Part 1

Brazil's Energy Efficiency Program for Electricity Utilities:

Evaluation of the Program and Recommendations for Revising Current Regulations

World Bank/ESMAP Report

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Preface

This specific report (Part 1) is an adaptation of the original report prepared for ANEEL in Portuguese with ESMAP support, and is meant for a wider audience outside of Brazil. This version has been prepared given the considerable interest shown internationally in Brazil's Energy Efficiency Program, and in particular, its funding with a percentage of a electric distribution utility receipts.

As part of this study, the World Bank, at ANEEL's request, recommended improvements in the EEP in preparation for ANEEL's revision of the Program Manual by the end of 2007. The initial terms of reference were to: (i) evaluate the results of projects that have been developed under the EEP as a basis for identifying priority programs and evaluation criteria; (ii) identify strategic programs or priority projects and define criteria for the allocation of available resources; and (iii) define parameters and procedures to monitor and evaluate results. The Bank and its consultants worked closely with ANEEL staff between June and October 2007. The final report was delivered to ANEEL at the end of October 2007, in time for the recommendations to be considered for the revised Program Manual, which was promulgated and published by ANEEL in February 2008.

Nearly all of the recommendations of the report have been incorporated in the new Program Manual, and are detailed in Section 6. In addition, the report summarizes the innovative nature of Brazil's energy efficiency program and discusses the near-term challenges for the program.

Acronyms and Abbreviations

ANEEL	*Agência Nacional de Energia Elétrica* (Brazilian Power Sector Regulator)
BNDES	Brazil National Bank for Economic and Social Development
BREES	Brazil Energy Efficiency Study
CBR	Cost-Benefit Ratio
CCE	Cost of Conserving Electricity (used in calculations for Cost-Benefit Ratio)
CEMIG	Electricity distribution utility in Minas Gerais State
CEP	Cost of Reducing Peak Electricity Demand (used in calculations for Cost-Benefit Ratio)
CO_2	Carbon Dioxide
COPEL	Electricity distribution utility in Paraná State
CPFL	Electricity distribution utility in São Paulo State
EE	Energy Efficiency
EEP	Energy Efficiency Program of utilities regulated by ANEEL(aka public benefit wire charge)
Eletrobrás	Federal Holding Company for electricity sector
Eletropaulo	Electricity distribution utility in São Paulo State
EPC	Energy Performance Contract
EPE	Energy Research Company (planning agency for energy sector)
ESCO	Energy Service Company
ESMAP	Energy Sector Management Assistance Program
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
IDB	Inter-American Development Bank
INMETRO	Federal Agency Responsible for Physical Standards in General
IPMVP	International Performance Measurement and Verification Protocol
kWh	Kilowatt hour
M&V	Monitoring and Verification
MEEP	Manual for the Energy Efficiency Program
MME	Ministry of Mines and Energy
MWh	Mega-Watt Hour

NGO	Non-Governmental Organization
NOI	Net Operating Income
O&M	Operations and Maintenance
OECD	Organisation for Economic Co-Operation and Development
PROCEL	National Program for efficiency in electricity use
PROESCO	Credit line of the BNDES to finance energy efficiency projects
PL	Public Lighting
R&D	Research and Development
RELUZ	Program to promote energy efficiency in public lighting
SAG	Shared General Administration Costs (cost item allowed in the EEP)
SPE	*Superintendência de Pesquisa e Eficiência Energética* (Department of ANEEL responsible for regulating the EEP)
UNDP	United Nations Development Program
UNEP	United Nations Environment Program

Exchange Rate

1 US Dollar = 1.6490 Brazilian Real (May 21, 2008)
1 US Dollar = 0.6343 Euro (May 21, 2008)

Executive Summary

1. This report constitutes Part 1 of the three-part Brazil Energy Efficiency Study (BREES), which was prepared by the World Bank, with funding from the Energy Sector Management Assistance Program (ESMAP). The objective of BREES is to support the evaluation of energy efficiency (EE) programs and opportunities in Brazil based on good practices nationally and internationally. The topics included in the study were selected as a result of consultations with the Brazilian Government, academia, and the private sector in December 2006 and March 2007. As agreed by the Bank with the Government, the study would be organized around two major themes:

- Review of and recommendations for revising Brazil's Energy Efficiency Program (EEP), in support of ANEEL's recent decision to improve regulation of the program (Part 1); and

- Analysis of policy, institutional, and market issues related to realizing energy efficiency potential in public sector buildings (Part 2) and in the water and sanitation sector (Part 3).

2. **Energy Efficiency Program in Brazil.** Part 1, presented here, provides an analysis of Brazil's Energy Efficiency Program (EEP), which provides more than R$300 million a year for energy efficiency investment – by far the largest source of EE funds in most sectors. The study was designed to support ANEEL's efforts to improve the EEP by streamlining the application and approval process, improving the monitoring of program results, and making the program more market oriented.

3. **Energy efficiency is important for Brazil.** Improving energy efficiency is critical for Brazil for a number of reasons: to reduce energy demand in the short-term, to delay needed construction of new higher-cost electric generating capacity, to increase competitiveness by lowering production costs, and to reduce fossil-fuel consumption and the emission of local and global pollutants. Energy efficiency is particularly important for Brazil in the near-term as a means to reduce the growth in energy demand and the difficulties and time needed for planning, licensing, and constructing new generating capacity. Brazil is moving ahead to expand electricity supply through the construction of new thermal (gas) and hydro plants, but reducing demand through energy efficiency measures should be an integral part of the energy plan since they are typically more cost-effective and can be implemented more quickly than new electricity supply capacity.

4. **Energy efficiency can benefit utilities and the public sector.** In Brazil the EEP is the largest program in place for financing energy efficiency initiatives. Since 1998, about R$1.8 billion (US$1 billion) have been invested in energy efficiency programs through the program. A substantial portion of the total investments is concentrated in a small number of utilities that invest in large projects due to its cost-effectiveness. A considerable share of these investments is in the public sector, in areas such as public lighting, residential projects or electric motors. The Brazilian experience has revealed that indirect benefits are greater

when the energy efficiency project is implemented in conjunction with other measures and/or reforms financed by the client. Similarly, it has shown the relevance of performance contracts in their role of consolidating Brazil's energy service company (ESCO) industry.

5. **Shortcomings of the current regulatory framework.** Under Brazil's current regulatory conditions, however, electricity distribution companies may be facing limitations for expanding their energy efficiency programs due to inadequate incentives. The current system seems to be cumbersome resulting in delays in project implementation and high transaction costs for both the utilities and ANEEL. There has been some concern about whether these expenditures have significantly increased the efficiency of energy use or resulted in market transformation. In addition, there has also been concern for the lack of adequate and standardized monitoring and evaluation. The initial review identified the following shortcomings of the current regulatory framework:

- Too much time is spent on rules and procedures;
- Dependence on the prior approval by ANEEL of a set of projects only once a year;
- There is inadequate reporting on the results of projects;
- There is a lack of systematic monitoring and evaluation of the results achieved.

Recommendations of the Report

6. The analysis resulted in the following key recommendations, many of which have been incorporated in the new Program Manual governing the EEP.

- **Continuous flow of project proposals.** As a first step to seek ways to minimize bureaucratic hurdles and maximize the interest of the utilities in presenting and implementing sound energy efficiency programs we recommend a *continuous flow of project proposals for review and approval*, model. In this way, projects can be presented when they are ready, with a broader indicative plan presented annually.

- **Pre-approval of projects**. In order to simplify the proposal approval process it is recommended to *move to pre-approval of projects and simplify the overall approval process.* For standard and well-established projects, approval should be automatic. The preparation, approval, and adjustment process for all projects should be simpler and less bureaucratic.

- **Create an electronic system**. In addition, as a part of this new arrangement, the *creation of an electronic system* for proposing, registering, and monitoring projects is recommended.

- **Include education, training and marketing projects**. It is further recommended to *allow projects for education, training, and marketing,* which may not directly result in energy savings, but can be quite important for indirectly facilitating the success of energy efficiency projects. Similarly, marketing expenses to promote energy efficiency should also be permitted. Both measures would contribute to transforming the market for efficient goods and services, including attracting other investors to energy efficiency programs.

- **Create category for priority projects and programs**. A more operational kind of categorization is proposed through the *creation of a new category for priority projects and programs,* which would focus on national or regional objectives. Most priority projects and programs would not be managed by the utility.

- **Improve monitoring and evaluation**. Finally, it is recommended to *focus more on the evaluation of results* – both quantitative direct results, measured in kWh, and indirect results, such as the delivery of training programs.

7. **The road ahead**. In implementing the EEP reforms, one immediate challenge will be to establish more detailed guidelines and procedures for evaluating different types of projects, including those without direct energy saving results. Another is to establish procedures for the training and certification of energy efficiency professionals. Over the longer term, the option of designating priority projects creates a window within the EEP to support pilot energy efficiency programs to address priority issues.

Incorporation of Recommendations in the New Program Manual

8. **Incorporating recommendations**. Nearly all of the recommendations of the consulting report – including those outlined above –were incorporated in the new Program Manual. With the promulgation and publication of the new Manual by ANEEL in February 2008, it was possible to detail what changes were made based on the analysis of the World Bank consulting report. These changes, as well as others, are evaluated and future challenges outlined, in the final section.

I. Introduction

1. Since 1998, electricity distribution utilities in Brazil have been required to invest in energy efficiency. The model that was adopted for the Energy Efficiency Program (EEP) mandates that distribution companies propose and carry out energy efficiency projects. The program is under the regulation of ANEEL (the Federal regulator of the electricity sector), which is responsible for establishing the investment rules, project approval, and oversight of projects carried out under the EEP.

2. The resources for the EEP are defined as a percentage of the Net Operating Income (NOI) of the utility. The value allocated for energy efficiency has varied, and is currently at 0.50 percent of NOI.

3. The EEP is the largest source of resources for financing energy efficiency initiatives in Brazil. Since its inception in 1998, about R$1.8 billion (US$1 billion) has been invested in energy efficiency projects through the program

4. Why have an EEP overseen by ANEEL? It is recognized that within the country's current regulatory conditions, electricity distribution companies do not have adequate incentives to promote energy efficiency investments, nor to help consumers to become more energy efficient. The most fundamental disincentive is that quite often a reduction in electricity sales (kilowatt-hours, kWh) means a reduction in earnings.

5. There is no doubt that the mandatory investment in energy efficiency has led to much larger EE expenditures by distribution utilities than would otherwise have been the case. However, there has been some concern about whether these expenditures have sustainably increased the efficiency of energy use or resulted in market transformation. There has also been concern about the lack of adequate evaluation.[1]

6. This report begins by summarizing the objectives and key points which oriented the work. Chapter II describes the evolution of the EEP and summarizes recent patterns of investments and results, and offers observations on the quality of the available information. Chapter III discusses the categories of allowable projects, as well as the pre-existing rules regarding the submission process for proposals, prerequisites for approval, goals, and program procedures. Chapter IV considers issues in the development of an adequate process for monitoring and evaluating the results of the EEP program and its constituent projects. Chapter V summarizes the recommendations given to ANEEL for revising the Energy Efficiency Program Manual, as well as recommendations for action soon after its publication.

[1] See, in particular, G.M. Jannuzzi (2005), for a review of the program's development and impacts until several years ago. The report was prepared for the program, "Developing Financial Intermediation Mechanisms for Energy Efficiency Projects in Brazil, China and India," supported by the UN Foundation, ESMAP/World Bank, and UNEP.

A. Context, Objectives, and Strategy of the Review

7. We begin by considering the main objective of the Energy Efficiency Program (EEP) overseen by ANEEL, which is to maximize the public benefits resulting from energy efficiency savings in a manner aligned with the objectives of the National Energy Policy. Among these public benefits are:

- *Economic benefits:* Transform energy consumption markets so that energy efficiency is economically sustainable; increase the reserve margin of the electrical system.
- *Social benefits:* Reduce electricity prices for consumers and overall energy expenses in the economy.
- *Environmental benefits:* Reduce the rate of expansion of generation and transmission capacity, with its associated environmental impacts.

8. Ideally, the regulatory body should operate within a public policy framework that provides clear and consistent guidelines on the role of energy efficiency in the energy sector's strategic planning. As Brazil has no such guidelines, however, the regulatory agency needs to be clear and explicit about how its rules and regulations will benefit energy consumers, who ultimately finance EE investments.

9. For public policies to be successful, all stakeholders need to understand how to manage financial and institutional incentives. In addition, there should be an adequate regulatory environment that encourages the private sector to invest in energy efficiency programs.

10. The initial review identified the following difficulties with the current regulatory framework:

- Too much time is spent on rules and procedures;
- Dependence on the prior approval by ANEEL of a set of projects only once a year;
- There is inadequate reporting on the results of projects;
- There is a lack of systematic monitoring and evaluation of the results achieved.

11. *ANEEL's current system of analysis and approval is cumbersome and requires too much time for the evaluation of EE proposals, as well as for subsequent adjustments.* The many interactions between the Agency's technical staff and the distribution utility's professionals lead to delays in project implementation. Even during a project's execution phase, there are delays in obtaining the Agency's approval of the adjustments that are frequently required.

12. On the other hand, little attention given to evaluating the results of EE projects or their sustainability. Final reporting on the projects is frequently late and incomplete.

13. After the initial review, and discussions with the staff of *Superintendência de Pesquisa e Eficiência Energética* (SPE) of ANEEL, a strategy was adopted to orient the work. The key guidelines were to:

- Seek ways to minimize bureaucratic hurdles and maximize the interest of the utilities in presenting and implementing sound energy efficiency programs.
  - Simplify the proposal approval process and seek to give greater freedom of action to the utilities:
    - Investigate the possibility of creating "pre-approved" projects;
    - Avoid unnecessary ruptures and maintain, whenever possible, existing EEP terminologies and procedures that are already familiar to the professionals who design and execute the projects.
  - Introduce a new process for submitting proposals. Instead of presenting a set of projects at a fixed date once every year, utilities would be allowed to submit project proposals individually – a "continuous flow" model. The consequences of this new approach for other aspects of the regulatory framework should be considered.
  - Consider how the EEP can contribute to transforming the market for efficient goods and services, including attracting other investors to energy efficiency programs.
  - Promote innovation in the design and execution of projects for the EEP, seeking ways to maximize the amount of energy conserved at the lowest cost.
  - Consider how to strengthen the evaluation process for projects that have been implemented and the program as a whole, including evaluation of their social and environmental impacts. Also consider how to evaluate the training of the program's human resources.
  - Investigate the possibility of creating a category of national or regional EE projects that are not managed by the utilities and reflect the Government's priority concerns.

14. Preparation of the recommendations for ANEEL, which appear throughout the report and are summarized in Chapter V, had three primary objectives: (a) to serve as a reference for the preparation of the new Manual for the Energy Efficiency Program; (b) to provide a menu of suggestions that could be carried out in the short term, with minimal adjustments to the EEP; and (b) to suggest possible changes and complementary activities that could be implemented in the medium term, after the Manual's publication, and are consistent with the philosophy behind the near-term reforms.

II. Evolution of the Energy Efficiency Program

A. Establishing the Regulatory Framework and Coverage of the Program

15. Since its first annual cycle in 1998/1999, the EEP's rules and procedures have undergone significant changes. The EEP began as a clause in the contracts of newly privatized distribution concessions that required the utilities to invest one percent of their net operating income in energy efficiency projects, under the oversight of ANEEL. In 2000, the EEP was extended to all utilities by Law 9991, which established the basic regulatory framework for the EEP and significantly modified the allocation of resources, increasing the share for research and development (R&D).

16. After the utilities and the regulator gained experience with EE projects, changes were made in the allocations and other aspects of the regulatory framework: Law 10,848 of 2004, Decree 5879 of 2006, and Law 11,465 of 2007. The latter modified Law 9991/2000 by extending until 31 December 2010, the obligation of electricity distribution utilities to apply a minimum of 0.50 percent of their NOI to energy efficiency programs for consumers. Table 1 summarizes the changes in allocation of the total one percent resource since 1998.

Table 1. Allocation of Wire-Charge Revenue to Different Activities (1998-2007) (percent)

Annual Cycle	Energy Efficiency	R&D	MME/EPE [b]
1998-1999	0.90	0.10	----
2000-2003	0.50	0.50	----
2004-2005	0.50	0.40	0.10
2005-2006 [a]	0.25	0.60	0.15
2006-2007 [a]	0.25	0.60	0.15
From 2007 [a, c]	0.50	0.40	0.10

[a] Legislation of new allocation enacted during the EEP's annual cycle applies during part of the first year.
[b] Resources for operations of the Ministry of Mines & Energy and the EPE (Energy Planning Company).
[c] Law 11465 of 28/03/2007.
Sources: Authors' review of legislation.

17. In addition to this legislation, ANEEL has published a number of resolutions that have shaped the Energy Efficiency Program, including:

- Resolution nº. 242, of 24/07/1998;
- Resolution nº. 261, of 03/09/1999;
- Resolution nº. 271, of 19/07/2000;
- Resolution nº. 153, of 18/04/2001;
- Resolution nº. 186, of 23/05/2001;
- Resolution nº. 394, of 17/09/2001;
- Resolution nº. 185, of 21/05/2001;
- Resolution nº. 492, of 03/09/2002;
- Resolution nº. 176, of 28/11/2005;
- Resolution nº. 219, of 11/04/2006;
- Resolution nº. 233, of 24/10/2006.

18. Modifications made to the EEP over time have included changes to the acceptable categories of projects. For example:

- Law 9991/2000 prohibited the use of EEP resources in supply side projects involving investments in the utility's own infrastructure, such as new transformers. Prior to the

prohibition, more than 50 percent of wire-charge resources were used for such projects.

- Law 9991/2000 also created a category of projects implemented as "performance contracts," under which the beneficiary repays the investment. Up to 50 percent of the value of investments may, in principle, be in projects of this kind. Prior to this law, all projects were treated as grants and many remain in the system. However, in spite of many grant projects, performance contracts have played an important role in the consolidation of Brazil's energy service company (ESCO) industry, which has executed many of these projects for the utilities.

- Subsequently, ANEEL Resolution 176/2005 prohibited EEP investments in public lighting. Though public lighting accounts for about 3 percent of electricity consumption, it had been absorbing about 40 percent of total investments by the distribution utilities, despite the fact that public lighting also benefited from another large program in the power sector – RELUZ – administered by Eletrobrás.

- The same resolution also prohibited projects in the areas of marketing, education and training, and municipal energy management. This was due to various abuses which had occurred with projects of this kind, as well as to a reduction in resources for energy efficiency from 0.50% of NOI to 0.25% which was foreseen in legislation prevailing at the time. (This reduction did occur – see Table 1 – but was later reversed in new legislation).

- Resolution 176/2005 also created a new category of projects to benefit low-income residential consumers, with utilities required to spend at least 50 percent of their EEP resources in this category.

19. Other modifications have concerned the establishment of minimum and maximum shares of a utility's EEP program which must/may be allocated to different categories of project. The currently approved categories of projects, and limits on allocations, where relevant, are:

- Residential
- Commercial & services
- Government installations
- Rural – agricultural
- Residential low income (≥50%)
- Industrial
- Public services (except lighting)
- Solar water heating
- Performance contract – in any segment except low income (≤50%)

Note: Solar water heating to substitute wholly or partially for electric showerheads, which are very common in Brazil and have a disproportional impact on peak demand.

20. Criteria for approving projects within these categories are discussed in Chapter III.

B. Investment in the EEP

21. In the EEP, utilities present a set of projects together to be approved. Utilities are divided into groups which begin their annual cycle at different times. Hence the annual cycle used for reporting does not correspond to the calendar year. The history of investments of the EEP since its inception is shown in Table 2.

Table 2. Investments and Estimated impacts of the EEP, 1998-2006

Annual Cycle	No. of Utilities	Energy Savings (GWh/yr)	Avoided Demand (MW)	Investments Planned (10^6 R$)	Investments Made (10^6 R$)
98/99	17	672	167	200.9	214.8
99/00	42	672	169	322.7	173.3
00/01	63	630	167	169.6	109.2
01/02	61	90	23	165.9	44.8
02/03	61	222	54	154.0	NA
03/04	61	489	110	313.0	NA
04/05	61	925	275	175.0	NA
05/06	61	569	158	311.0	NA

Sources: ANEEL and authors' calculations.

22. Table 3 compares two periods: (a) the four annual cycles from 2000/01 through 2004/05; and (b) the cycles for 2005/06 and 2006/07. It shows the impact of Resolution 176/2005 on the allocation of planned investment resources, such as the elimination of investments in public lighting and the huge increase in the share of resources for residential projects.

Table 3. Planned Investments by Category during Two Periods*

Category	Planned Investment (10^6 R$)		Share of Investment (%)	
	2000/01 - 2004/05	2005/06-2006/07*	2000/01 - 2004/05	2005/06-2006/07*
Public lighting	374.6	0	39.9	0
Residential	133.5	304.9	14.2	63.7
Industrial	96.0	55.1	10.2	11.5
Public Services	91.3	26.4	9.7	5.5
Education	80.9	0	8.6	0
Commercial & services	59.5	22.9	6.3	4.8
Government	34.8	58.1	3.7	12.1
Solar heating	19.4	4.6	2.1	1.0
Rural	14.6	6.4	1.6	1.3
System losses	12.4	0	1.3	0
Municipal energy management	11.5	0	1.2	0
System load factor	11.3	0	1.2	0
Total	**939.6**		**100**	**100**

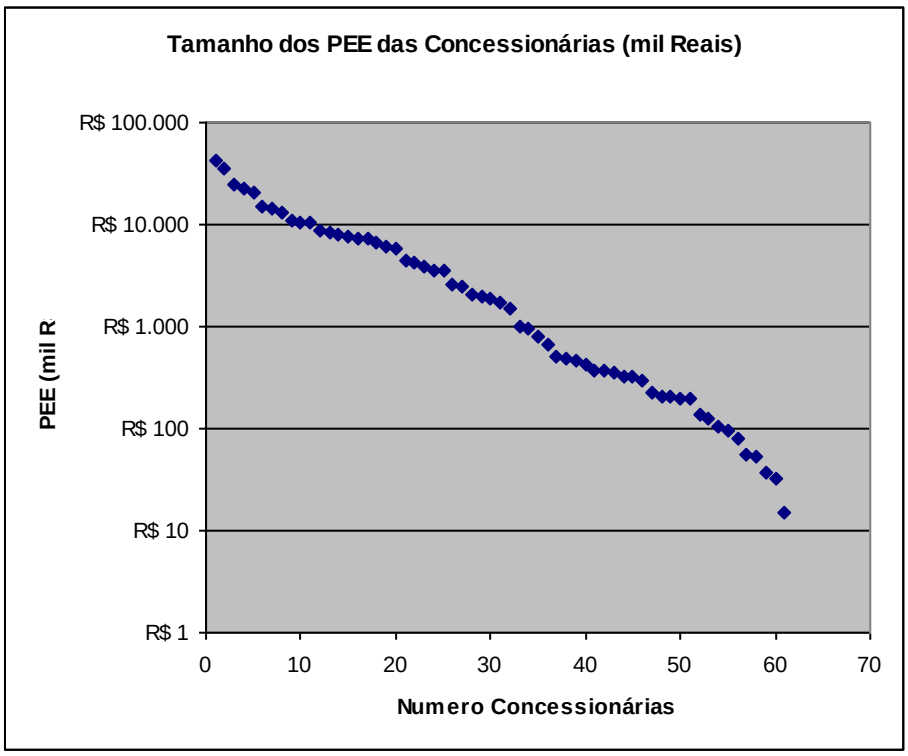
***** Estimates for the 2006/07 annual cycle are partial, due to incomplete data.

23. Great caution is needed when considering these results, however. In addition to the lack of systematic evaluation of EE projects, many final EEP reports contain incomplete data. As Table 2 shows, for example, at the time of writing it was still not possible to assemble coherent estimates of the total investments actually made and their impacts since the 2002/03 annual cycle. This is one reason for the focus on a sample of utilities – Eletropaulo, CEMIG, COPEL, Bandeirante, Light, and CPFL – in the more detailed analysis.

1. Differences in the scale of utilities' programs

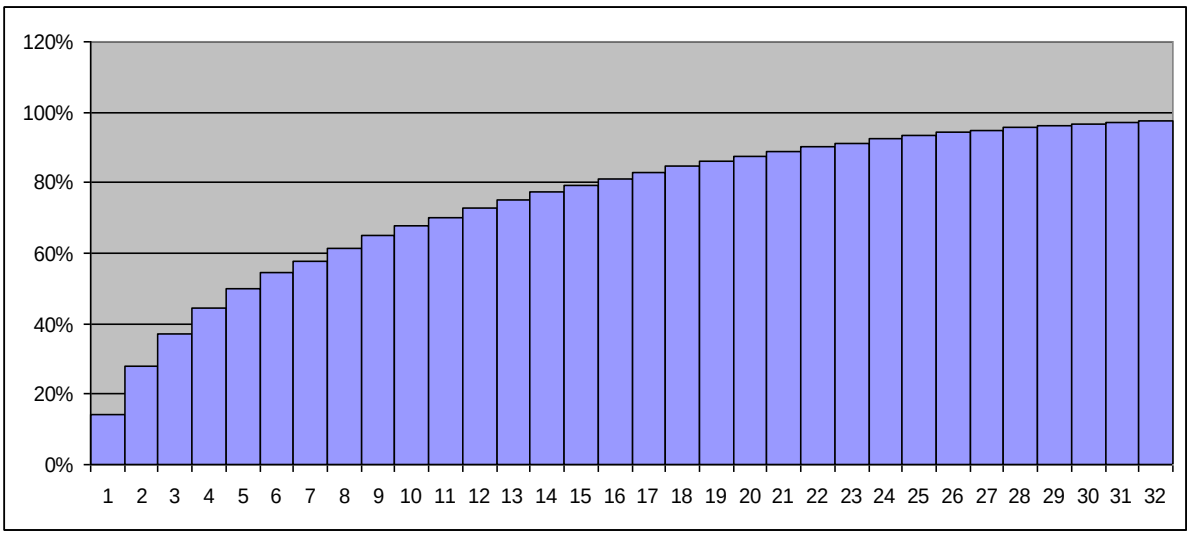
24. There are large differences in the size of different utilities' EE programs – more than 1,000 times between the largest and the smallest, as shown in Figure 1 for the 2005/2006 annual cycle. One of the consequences is that a large portion of the total investment is concentrated in a small number of utilities.

Figure 1. Resources for EE projects (1000 R$) by Utility, in Decreasing Order of Utility Size (2005/2006 annual cycle)



25. Figure 2 shows the accumulated percentage of total investment in energy efficiency, in decreasing order of the size of the utility. The 6 largest utilities invested 60 percent of the total, and the 15 largest utilities invested more than 80 percent of the total.

Figure 2. Accumulated Share of Total Resources for Energy Efficiency by Utility, in Decreasing Order of Program Size (2005/06 annual cycle)



26. The analysis presented below is based on information provided by the largest distribution utilities – Eletropaulo, CEMIG, COPEL, Bandeirante, Light, and CPFL – since there is a lack of data from many of the other utilities and also because the utilities selected represent more than half the total EEP investments.

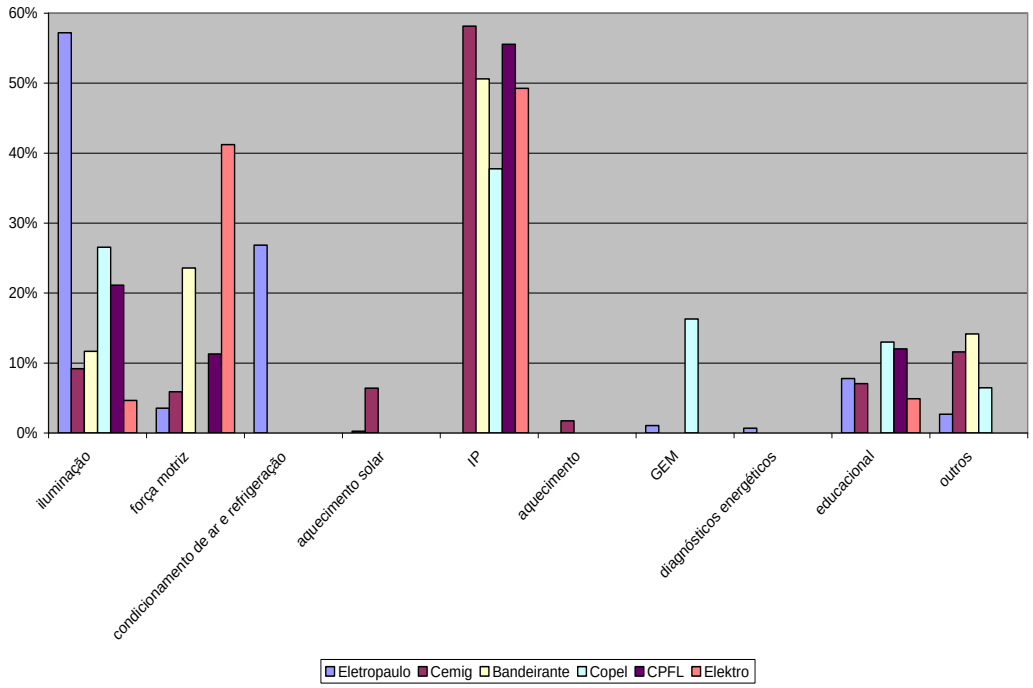
2. Investments by end-use

27.

28.

29. Figure 3 depicts the allocation of resources by utility and by type of project in two EEP annual cycles where complete data were available. As can been seen, there has been a high concentration of investments in lighting. Public Lighting (PL – in the figure the abbreviation is IP from the Portuguese), is by far the biggest end-use. Other lighting is the second largest, though not by a large margin.

Figure 3. Investments by End Use and Project Type

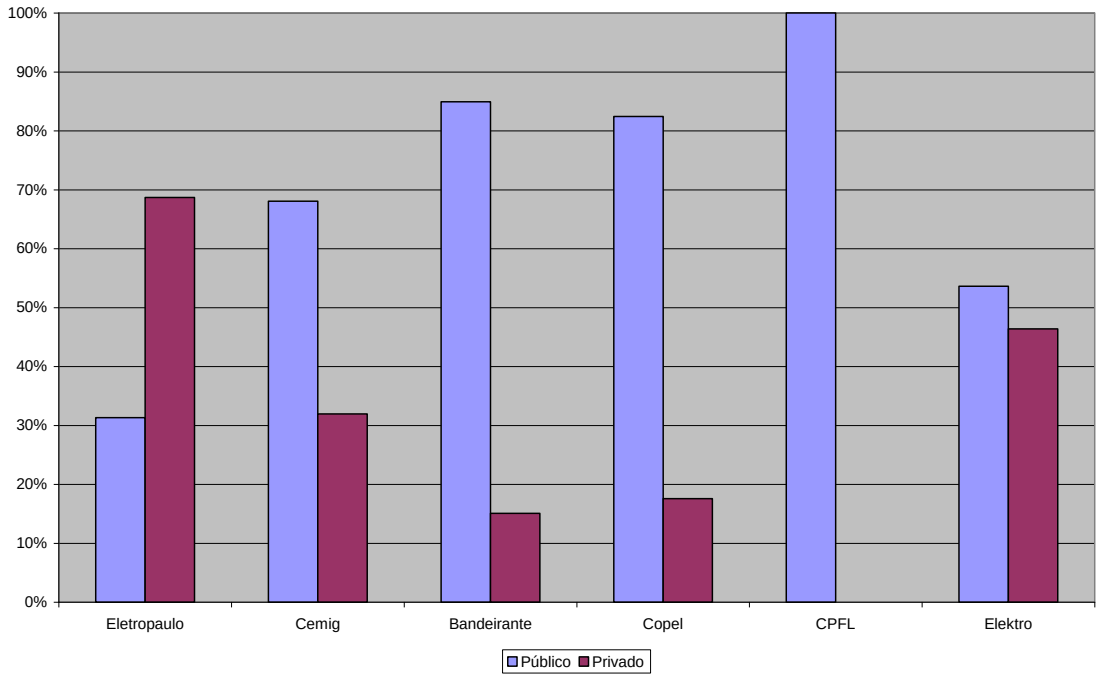


Note: Values refer to utility programs during the 2003/04 cycle. Since data from the Bandeirantes utility were not available for the 2003/04 cycle, the data used in this report are from 2004/05.

30. The investments made under the EEP do not point to any well-defined priorities by end-use, other than public lighting (until it was prohibited in 2005). There seems to be a preponderance of other lighting projects, though less so in terms of investment. This tendency has also been seen in the United States, according to Goldman et al (2005). It is caused by factors such as project standardization, ease of monitoring and verification (M&V), and the rapid return on investment.

31. In addition, utilities tend to invest in projects that are easily executed, considering the existing reality in their area. Public Lighting (PL), in which there has been massive investment, is one such area. Projects in the public sector, regardless of end use, also attract a large share of investments, as shown in Figure 4. The data also show that there are significant differences in the profiles of individual utilities' investments.

Figure 4. Shares of Investment in the Public and Private Sectors



32. Eletropaulo's investments during the 2003/04 annual cycle were focused on two end uses – lighting and air conditioning. A detailed analysis of the lighting projects shows that the great majority of such projects are based on substitution of 40W fluorescent lamps by 32W lamps; replacement of low-efficiency ballasts by more efficient and modern ones, and inefficient lamps by more efficient ones; substitution of incandescent lamps by compact and fluorescent bulbs; and sectioning circuits and automatic sensor controls.

33. Air conditioning projects, on the other hand, usually require specific project design that depends on the particularities of each site. Such projects can be grouped into two categories: (a) those that substitute individual window units; and (b) projects to upgrade central systems in large buildings.

34. The small number of investments by most utilities in solar water heating projects is notable – only one such project was developed by Eletropaulo, and several by CEMIG, during the 2003/04 cycle. In spite of the great potential and their impact on reducing peak energy demand, investments in solar water heating under the EEP are still quite limited.

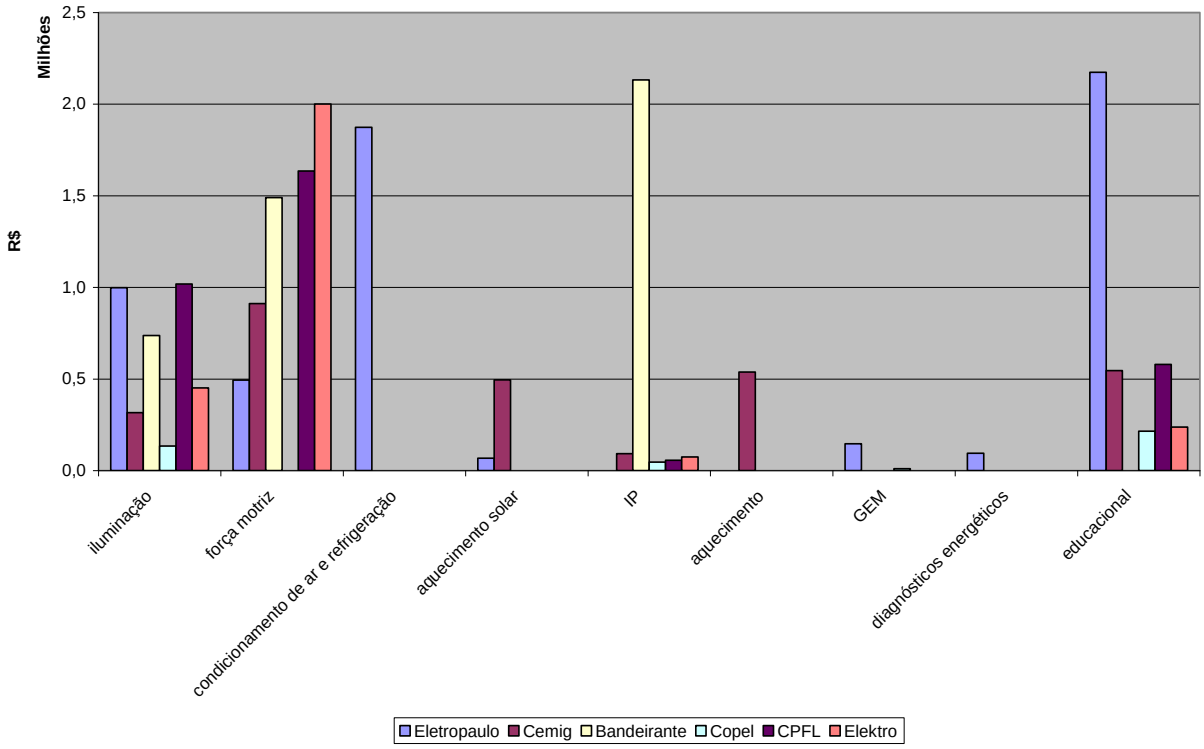
35. CEMIG also implemented several educational projects in primary and university education, as well as technical training for professionals in relevant areas. This type of initiative has not been common among other utilities. Another unique aspect of CEMIG's programs has been its participation in co-generation projects, which tend to be more complex in nature than those usually developed by the utilities.

3. Size of projects

36. In the analysis of these larger distribution utilities' programs, there was an attempt to identify patterns in the value of projects (Figures 5 and 6). The data indicate that there are

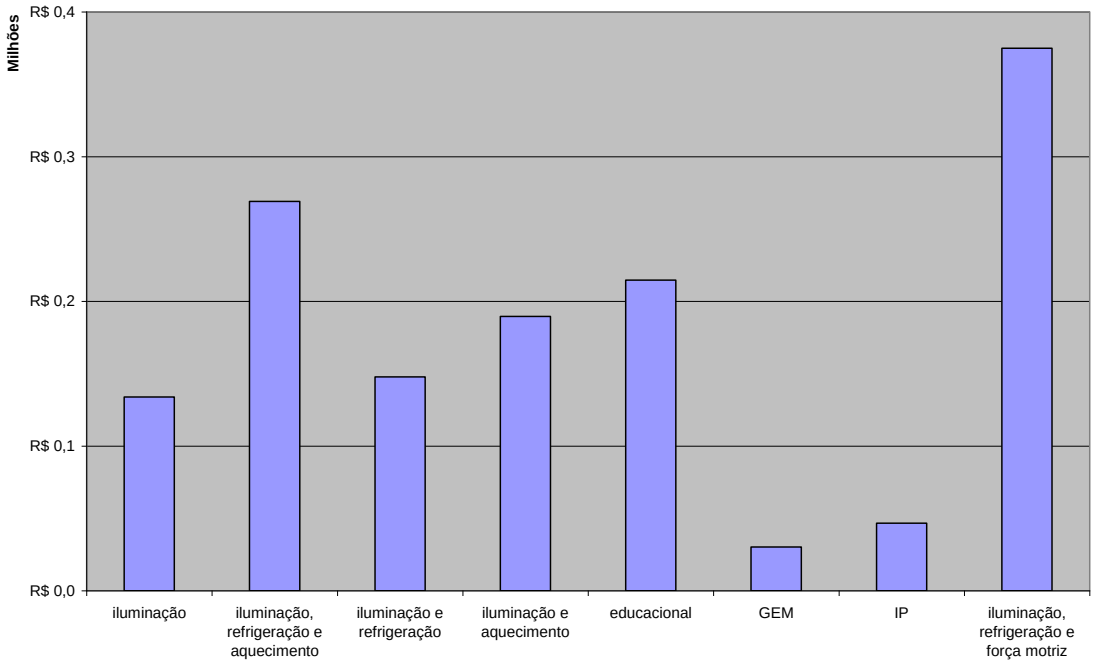
large variations in project values, with a tendency for utilities to invest in larger projects. The value of CEMIG's Public Lighting project was more than R$ 17 million because it encompassed several cities in a single project. (An observation, COPEL undertook several projects with multiple end uses, which do not appear in the graph.)

Figure 5. Average Value of Projects by End Use or Type



Note: Based on data from 2003/04 cycle (Eletropaulo, CEMIG & COPEL) and 2004/05 (Bandeirante).

Figure 6. Average Investment per Project – COPEL, Cycle 2003/04



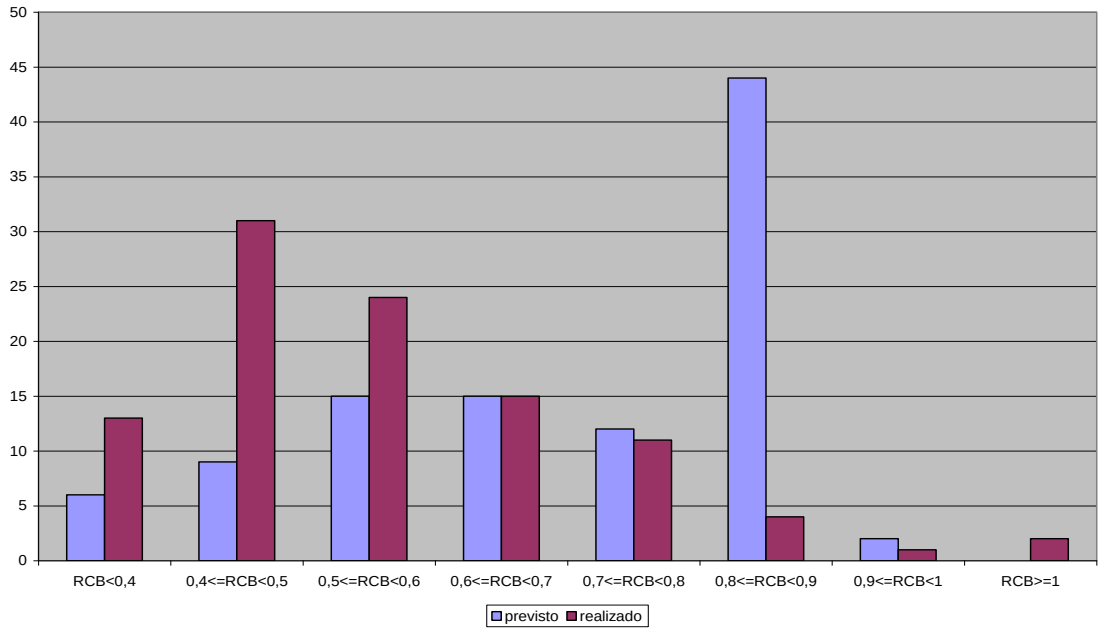
37. There is great variation in the systematization of project results due to the fact that many final reports have not been submitted. Many projects have only a partial report. Projects with the public sector tend to be larger, which can be justified by the size of such enterprises and the bureaucratic difficulties in dealing with government institutions, which makes smaller projects less cost effective.

C. Impacts

1. Cost-benefit ratio

38. An interesting result of the review is that the cost-benefit ratios (CBRs) of projects that have been implemented are often lower than the values projected in the project proposal, as shown in Figure 7. In the majority of cases, this may be due to conservative estimates during the diagnostic phase. This underscores the need for greater efforts in the measurement and verification (M&V) stages of the project, especially over longer periods of time, which would allow for more precise data on conserved energy and reduced energy demand, including the longevity of the gains.

Figure 7. Number of Projects Considered, by Value of the Cost-Benefit Ratio



39. Although the available data are insufficient to portray with precision the universe of projects that have been implemented, it appears that projects in the end-use segment of electric motors presented a higher return on investment (lower CBR) compared to other end-use segments (figures 8 and 9). A detailed analysis of successful projects shows that they were not limited to the substitution of obsolete equipment by more efficient motors, but also encompassed the restructuring of processes and rationalization of the use of the equipment.

Figure 8 Average Projected Values for Cost-Benefit Ratio, by End Use and Utility

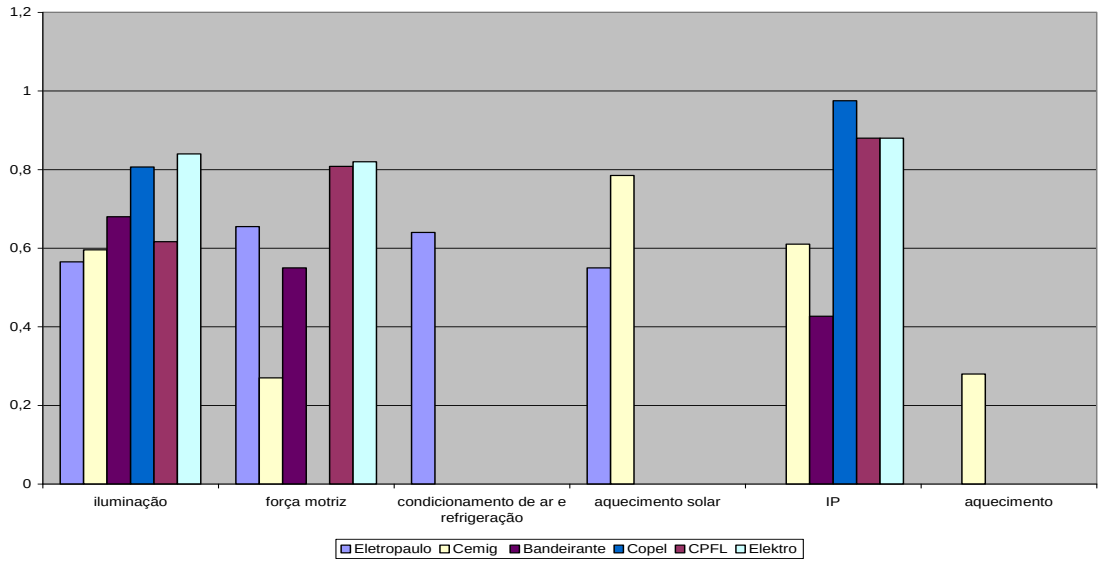
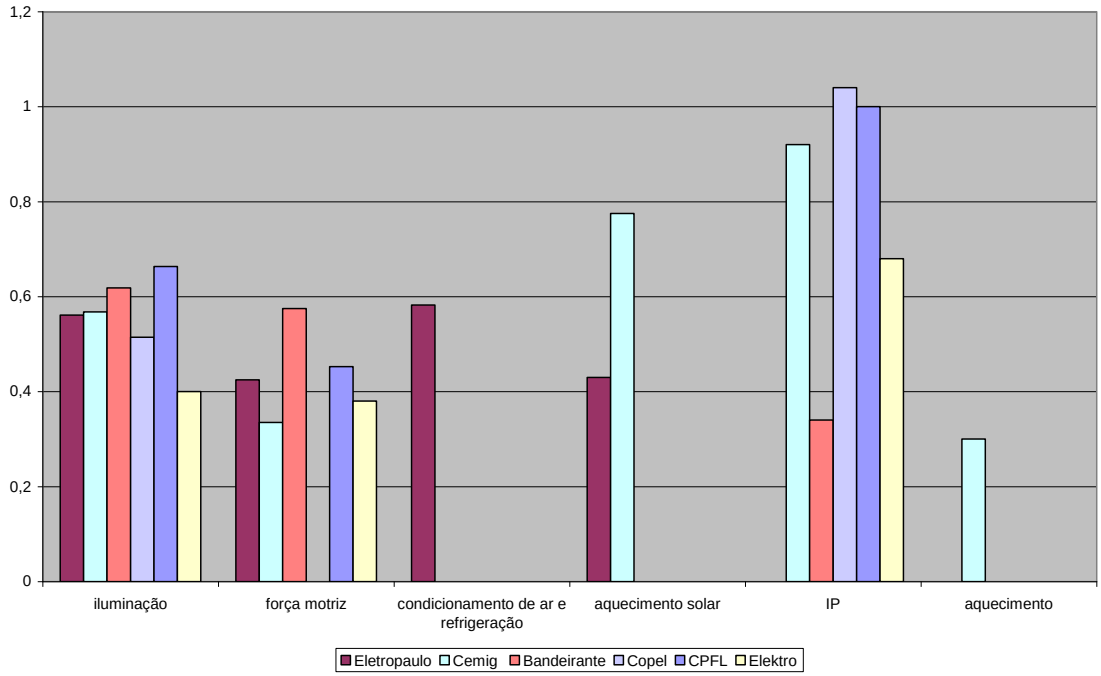


Figure 9. Average Achieved Values for Cost-Benefit Ratio, by End Use and Utility



40. Several successful projects increased the process efficiency, which allowed for considerable improvement not only in energy savings, but also in the quality of the final product. Examples include water and sanitation projects and central-pivot irrigation systems. These types of projects offer greater benefits to society than those dealing merely with equipment substitution. The gains in productivity tend to be larger and longer lasting, and can establish new standards of efficiency for the sector.

41. One should keep in mind, however, that such projects are quite specific in nature and require considerable knowledge about the company being benefited and the processes in question. It is evident that the combination of common interests and efforts between the

utility and the client/customer – going beyond simply energy conservation – contributes to the successful results of such a program. Hence, there is a need to consider mechanisms to further encourage such initiatives. Indirect project benefits are well received by clients. Such benefits are greater when the energy efficiency project is implemented in conjunction with other measures and /or reforms financed by the client.

2. Energy savings and demand reduction

42. In addition to the cost-benefit ratio, this report also sought to identify the relationship between investments that were effectively made and energy conservation. The correlation between investment and energy conserved for some utilities' programs, by end-use segment, are shown in Figures 10 through 13, below.

Figure 10. Correlation between Investments and Energy Savings – Lighting

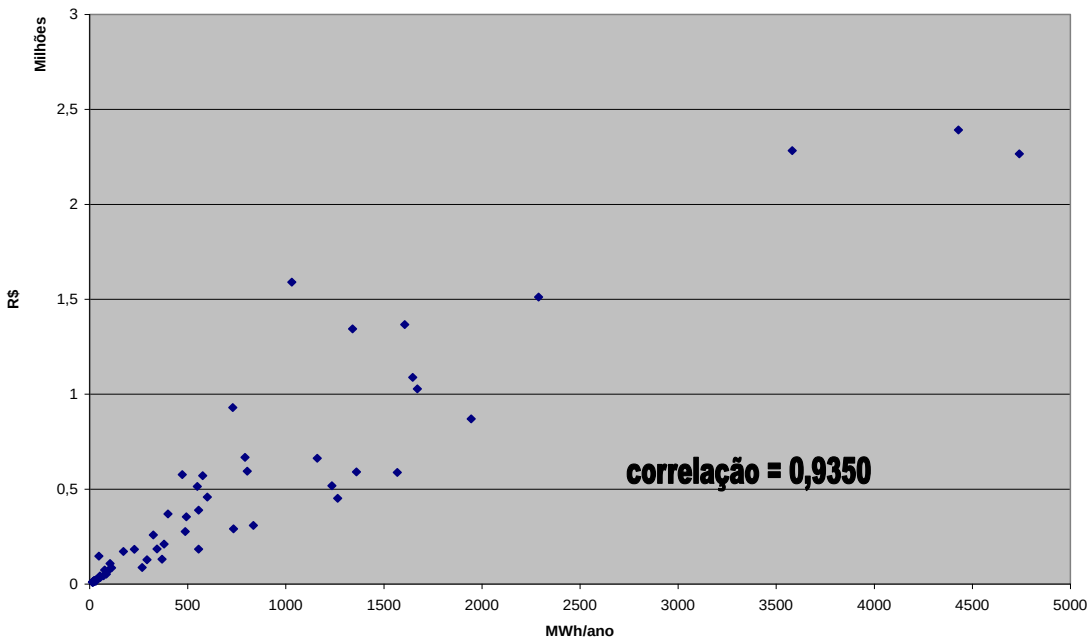


Figure 11. Correlation between Investments and Energy Savings – Electric Motors

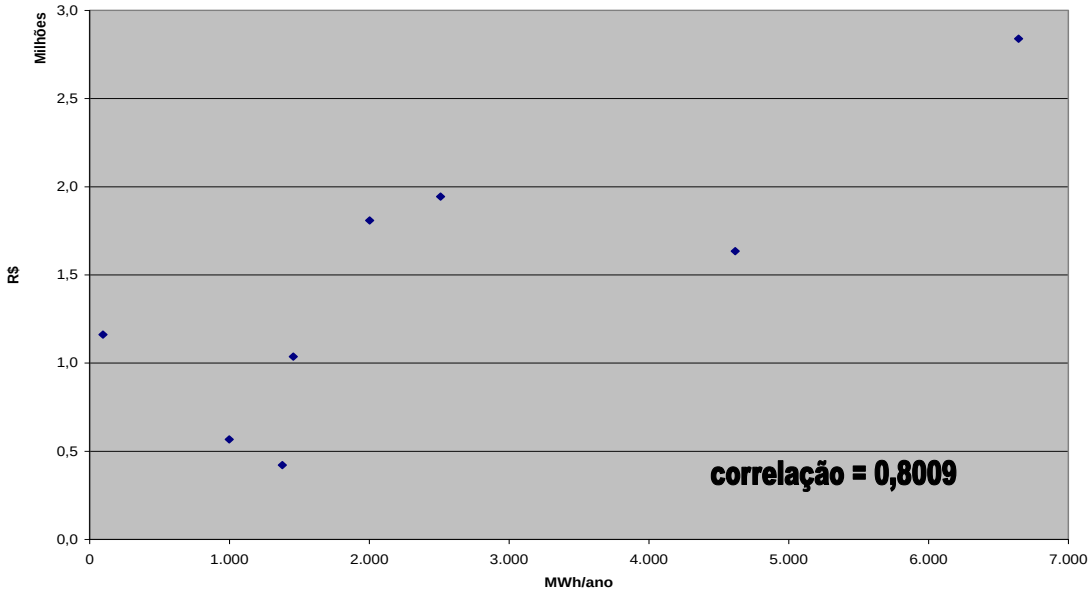


Figure 12. Correlation between Investments and Energy Savings – Public Lighting

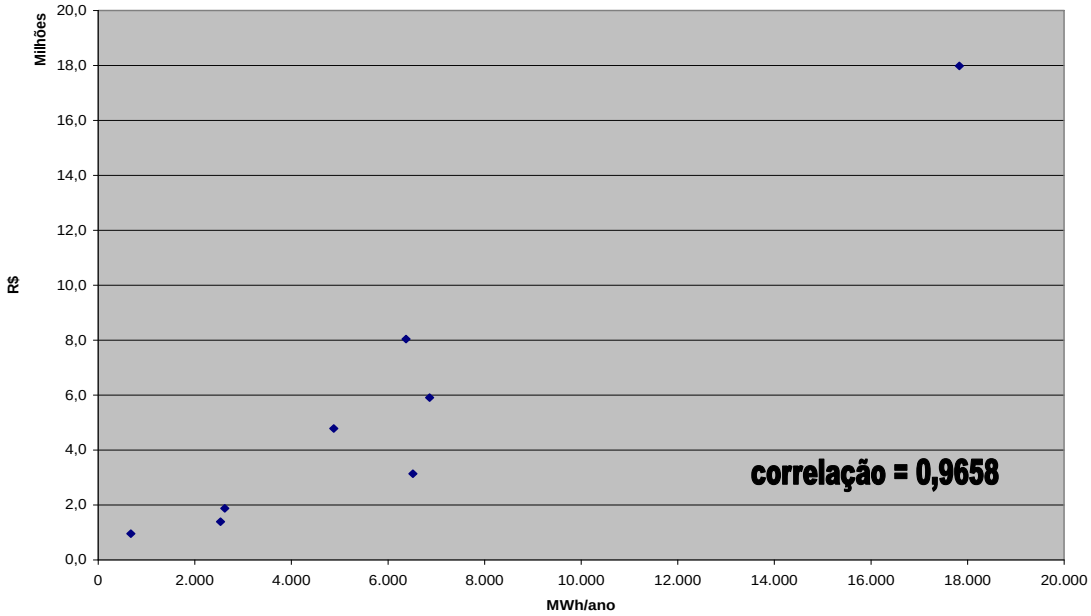
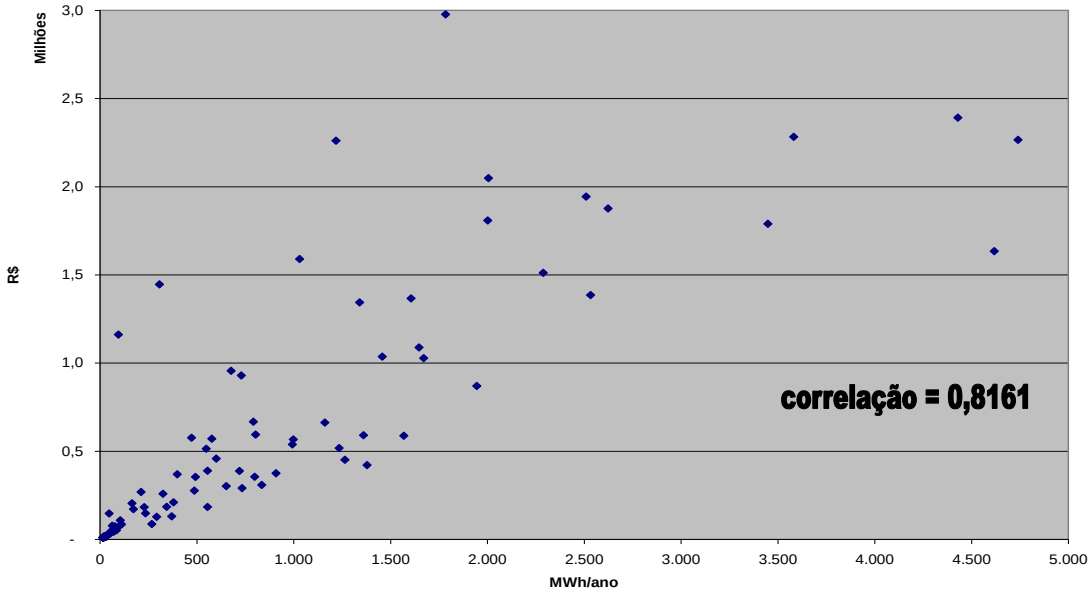


Figure 13. Correlation between Investments and Energy Savings – All End Uses



43. The maximum permitted CBR is 0.80 (see paragraph 81). This limit naturally conditions the relationship between investments and energy savings. Nevertheless, the high correlation observed, in particular for public lighting projects and lighting in general, suggests that projects in these areas tend to have similar characteristics and results profiles.

III. Criteria for EEP Regulation and Management

A. Introduction

44. As noted above, the Energy Efficiency Program's rules and procedures have been undergoing significant changes since its first annual cycle in 1998/1999. The guidelines in effect at the time this report was written are found in the Manual of the Energy Efficiency Program for 2005/2006 (MEEP-2005/06). That edition of the Manual and the contemporaneous Resolution 176/2005 are therefore the main references in the discussion here.

45. The succinct analysis below offers suggestions on how to improve the design of the regulatory framework, wherever appropriate, following the philosophy summarized in the Introduction.

46. The starting point should be (a) a fundamental change in the way projects are submitted. Following a presentation of this new project submission process, the report addresses: (b) program categories; (c) criteria for acceptable projects; (d) general program procedures; and (e) resource allocations.

1. New process for submitting projects

47. The current system of analysis and approval by ANEEL is too cumbersome and requires too much time for the evaluation of projects and subsequent adjustments. Too many interactions between the Agency's technical staff and the distribution utility's professionals lead to delays in project implementation. Even during its execution phase, there is still red tape in obtaining the Agency's approval of the changes and adjustments to the projects which are frequently required.

48. Under current regulations, each utility presents a set of projects to be carried out in a given year. The utilities are divided into groups: some present their EEP by September 30, others by November 30, etc. Once the utility's annual cycle has started, any modification to any project requires ANEEL's explicit authorization.

49. Changes and renegotiations do occur frequently, especially in the initial phases of EE projects, and they require time and attention from both the utility's professionals and ANEEL's staff. The current timeframe is excessively rigid, and does not reflect the dynamics of project implementation, especially when it involves negotiations with specific clients. As a result, the transaction costs for making the inevitable adjustments are very high for both the utility and for ANEEL. Another consequence of the current system is the delay in the submission of final reports for a set of projects, which should be prepared at the end of each cycle. In most cases, the delay is a year or longer.

50. Considering all the difficulties with the current system for submitting energy efficiency projects, it is proposed that it be replaced by a "continuous flow" system. Under the new arrangement, each project could be submitted independently for approval and subsequent monitoring. In this way, the distribution utilities would be able to design their

projects without the hindrances of a specific deadline, and also be able to implement and manage their projects with less red tape. The completion of one project's final report would no longer be tied-up by delays in another project.

51. As part of this new arrangement, it is recommended that ANEEL develop a computerized management system (the Management System for EE Projects or SGPEE in Portuguese) to register the data for each energy efficiency project which has been submitted and to track adjustments and the results.

52. At the same time, in order to avoid an excessive fragmentation in the planning and follow-up of EE projects, an "Indicative Plan" should be submitted periodically on the set of projects to be proposed. This plan would be sort of a "letter of intent" and should be quite simple. For example: the budgets of the anticipated projects would not contain many details and would be considered preliminary drafts; proposals in an initial phase of preparation would require fewer details than projects already in execution; etc. This "Indicative Plan" should also be used as a reference to allow the parties to monitor the flow of disbursements of the share of the annual NOI which is to be invested in energy efficiency. It is also recommended that adequate interest charges be applied to outstanding balances in order to encourage timeliness in the disbursement of mandated resources. The Plan could be presented at a public hearing or placed on the internet for public review and comment.

53. The initial idea to consider the implications of a "continuous flow" model came from ANEEL's Superintendent for Research and Energy Efficiency (*Superintendência de Pesquisa e Eficiência Energética,* SPE). It represents, in the authors' view, an important step toward simplifying procedures and reducing bureaucracy. It may also have important implications for other aspects of the program's regulation.

B. Categories of Projects

54. The following project categories are currently acceptable for EEP investments:

- Commercial/services
- Low-income communities
- Industrial
- Public sector buildings
- Residential
- Rural
- Public services
- Solar heating as a substitute for electric shower units

55. Within each project category, it is possible to submit a pilot project, which should be clearly identified as such. A pilot project should have the following characteristics:

- It should be innovative – the first of its kind in terms of technology or implementation process;
- It should emphasize evaluation of project results;
- It should be carried out on a small scale, and the methodology should be consistent

with the sample definition;

- It should not reflect additional research and development costs; rather, it should have practical applications.

56. It is also possible to submit projects for which the utility's investment is remunerated. Such projects can be implemented in any of the above categories except low-income communities (see below).

57. The evaluation conducted for each project approval always considers both technical and economic factors that influence the project's feasibility.

58. Since the beginning of the EEP, various project categories have been eliminated and others have been added. In 2005, for example, Public Lighting Systems, Education, and Municipal Energy Management were excluded with the justification that "Some types were identified as historically lacking effective levels of energy savings in their results and were consequently withdrawn from the program." However, the evaluations and monitoring of results that could justify the adoption of these changes have never been carried out.

59. In the authors' view, there is an important role for certain types of projects without directly verifiable impacts in terms of MWh or kW, such as education or support for efforts in municipal energy management (or in the public sector in general, including the state or federal levels).

60. It is therefore recommended that efforts should be made to reintroduce these types of projects in a new environment that encourages new ways of structuring projects and allows for better assessment of the results obtained.

61. As a part of this modification process, it is recommended that ANEEL consider making changes to the structure of project categories, as described in the next section.

1. Suggestions for new project categories

62. Besides the existing categorization of projects, essentially by market segment, a more operational kind of categorization is proposed, in which projects are divided into two major categories: (a) projects proposed by the utility; and (b) projects conceived and/or managed centrally – referred to as "priority programs."

63. Within the first category (proposed by the utility) there would be three subtypes:

- Pilot or innovative projects
- Pre-approved projects
- Other projects

64. The characteristics of and reasons for these categories are briefly described below.

Projects proposed by the utility

65. *Pilot or innovative projects.* This project category already exists within the current definitions. These projects should be submitted to ANEEL for evaluation and approval. This project category would require an evaluation, even if preliminary, of its technical and economic justifications in order to qualify for registration. It need not necessarily be linked to other types of projects. It is suggested that a pilot project have the following characteristics:

- Innovative in nature, or seen as a pioneer in terms of its technology or implementation process.
- If it is done on a smaller scale, then the sampling methodology should be explained.
- The pilot project may be aggregated to a specific research and development project for new technologies in energy efficiency.

66. *Pre-approved projects.* Projects of this type, based on experience, would be defined by ANEEL and would only need to be registered with the regulatory agency. In light of the EEP's framework for oversight and the utilities' acquired experience with some kinds of projects, the currently meticulous evaluation seems unnecessary for many proposals, especially for projects that have been pre-diagnosed. If such proposals are in conformity with existing norms and indexes, or those to be established in the Manual, this should be enough to lead to the project being pre-approved.

67. Lighting projects, as well as air conditioning and solar heating, appear most amenable to some standardization, in both the diagnostic and M&V phases, and therefore have the potential to have their initial approval process simplified.

68. Over time, this project category should expand and thus gradually reduce the need for ANEEL to conduct ex-ante assessments.

69. *Other projects.* Other types of project for which experience has not yet been consolidated should be submitted to ANEEL for ex-ante analysis of the technical and economic factors justifying the project's feasibility. Collaborative projects, where utilities work together, without necessarily being ordered to do so by the regulator, would also be included under this category.

Priority programs

70. Priority programs would be those to which utilities in a specific region or any part of the country can adhere. These programs would have a central management responsible for standardizing procedures, technologies, support mechanisms, etc. The central management would make it possible to provide utilities with the services of highly skilled professionals, including engineers and other specialists, staff trained in conducting field tests, or a communications office, that otherwise would not be justifiable costs in small-scale programs. Each utility would contribute a specified amount in exchange for the implementation of the

program.

2. Advantages of these new types of projects

71. These new types of projects have a number of advantages. They could:

- potentially attract smaller utilities that may not have the teams required to develop energy efficiency projects;
- provide economies of scale;
- ensure the implementation of actions associated with market transformation policies that are not necessarily in line with the interests of the utility;
- ensure the implementation of socially and environmentally significant initiatives that may not be financially competitive for the utility;
- make it easier to create standardized methodologies for the measurement of impacts and verification of results.

72. Possible candidates for developing priority projects include educational, training, and support programs for municipal or state energy initiatives. Programs for low-income communities could also be likely candidates, particularly if they were conceived within the context of social assistance policies. Another example would be a new program geared to providing public lighting systems, given the difficulties faced by the national program for public lighting (RELUZ).

73. Another interesting approach could be to create a fund to solicit EE projects through an open competitive bidding process. Projects that offer the lowest costs per kWh saved would be contracted. This "auction" should:

- reduce the cost of the EEP per MWh or kW saved and increase the impact;
- provide alternative uses for EEP resources;
- allow agents other than utilities to actively participate in developing and implementing projects;
- allow combining resources utilities to carry out priority actions in specific regions.

74. Projects financed through auctions must include a component for verifying their long-term sustainability and energy savings. Since all new electric power supply capacity in Brazil is contracted through auctions, an auction program within the EEP could conceivably serve as a pilot for more ambitious energy efficiency auctions, as part of the normal process of power system expansion.

3. Marketing

75. In 2005, ANEEL Resolution 176 established that the EEP should not "include marketing efforts." The current Energy Efficiency Program Manual (2005/2006 Manual) states that: "in order to ensure that most of the resources targeted for the EEP obtain practical results in terms of energy savings, no expenditures in "marketing" efforts should be included." (See item II.2.5.8 of the 2005/2006 Manual and Article 4, paragraph 5 of

Resolution 176/2005.)

76. In the past, there were indeed abuses in the use of marketing resources, which was one reason for their prohibition. However, we believe that efforts aimed at promoting the results of EE projects can help to disseminate information related to best practices associated with energy efficiency, and should not be prohibited. Appropriate requirements should, of course, be established to prevent abuses and to adequately evaluate marketing activities.

77. It is recommended that ANEEL should allow the inclusion of marketing coats as costs related to "Shared General Administrative Costs" (RAG in Portuguese), which are limited to 5 percent of the EEP costs.[2] These actions should, of course, be consistent with the projects implemented by the utilities.

4. Pre-diagnostic study requirements

78. Energy diagnostic studies were once considered a type of project, which was defined in the EEP Manual approved by ANEEL in 2001.[3] The 2005/2006 Manual does not define the Energy Diagnostic Study as a project, but does establish the condition that certain kinds of projects (commercial/services, industrial, public sector authorities, and public services) will only be accepted if they are subjected to a preliminary assessment, or pre-diagnostic study. It is recommended that this procedure be maintained.

C. Criteria for acceptable projects

79. According to existing rules, in order to be acceptable, projects should:

- be developed within the utility's concession area;[4]
- have a CBR that is less than 0.80;[5]
- use an annual discount rate of at least 12 percent;[6]
- use equipment that conforms to minimum technical standards set by PROCEL.[7]

80. *The prohibition of projects outside the utility's area of distribution* did not exist prior to 2005. Given that the consumer ends up paying this utility charge, it is reasonable to require that the energy benefits should, whenever possible, be provided within the distribution area

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[2] This item covers general administrative costs for the EEP which each utility may charge against the program, separately from the individual projects. It does not refer to sharing of costs between utilities.

[3] ANEEL Resolution 394, published on September 17, 2001, defines diagnostic studies as "projects aimed at identifying energy efficiency efforts for consumer units that can be implemented later. The project should consider preliminary goals aimed at reducing consumption and demand levels, cost estimates associated with the implementation of the measures/actions and a preliminary assessment of the CBR (Cost Benefit Ratio). All the aforementioned data should be compiled as a result of the preliminary assessment (pre-diagnostic study) carried out by the utility, and all the costs associated with this assessment should be included and clearly explained in the energy diagnostic study for the proposed project, even though these targets will not be appropriated to the overall results of the program."

[4] ANEEL Resolution 176/2005 Article 7, paragraph 2.

[5] ANEEL Resolution 176/2005 Article 4, paragraph 1.

[6] ANEEL Resolution 176/2005 Article 4, paragraph 2.

served by the utility.

81. Nevertheless, given that the electrical grid is inter-connected, it is possible that energy efficiency projects, even in areas that are not part of the utility's concession area, could, in some cases, benefit the utility's customers. This observation is especially relevant for the new category of priority projects that, by definition, are regional or national in nature. To insist that all resources from a given utility be entirely spent in its concession area could ossify such a program or simply make it lose viability.

82. It is therefore recommended that this requirement be maintained, but with exceptions made for priority projects or others involving cooperation among the various utilities. Specific requirements could be established for each program of this nature.

83. *The limit on the CBR was established in 2005.* Previously, the upper limit for most projects had been slightly higher – 0.85.[8] The methodology considers the energy costs saved (R$/MWh) and the avoided demand during peak periods (R$/kW), calculated according to the guidelines in the 2005/2006 Manual.

84. Table 4 shows the estimated average CBR values for implemented projects, as stated by the utilities in their final reports for the annual cycles from 2000/2001 to 2004/2005.

Table 4. Investments and Results by Project Category, 2000/2001 to 2004/2005

Project category	Investment (million R$)	Energy Savings (GWh/yr)	Avoided Demand (MW)	CBR
Public lighting	R$ 374.6	797	175	0.48
Residential	R$ 133.5	930	313	0.32
Industrial	R$ 96.0	376	59	0.32
Public services	R$ 91.3	312	118	0.45
Education	R$ 80.9	90	25	0.11
Commerce & services	R$ 59.5	130	30	0.21
Public buildings	R$ 34.8	57	14	0.67

Source: SPE/ANEEL.

85. The table shows that the average values are substantially below the stipulated ceilings at the time – 0.85 (or 1.00 for public lighting) – as well as the more recent limit of 0.80. In addition, as noted above, the achieved values of CBR were usually significantly lower than the projected values.

[7] ANEEL Resolution nº. 176/2005 Article four, paragraph III

[8] Resolution nº. 394/2001, Article one, paragraph II, stipulated a maximum CBR of 0.85 for projects in which energy savings can be verified. Projects related to Energy Diagnostic Studies, Education and Municipal Energy Management were exempt from this cap. Subsequently, with the approval of Resolution nº. 492/2002, ANEEL increased the maximum to 1.00 specifically for public lighting projects.

86. An issue to be addressed is the longer-term sustainability of the savings in energy and avoided peak demand. Over time, processes undergo modification and equipment suffers from wear and tear, the impact of which varies according to the type of project and the adequacy of the maintenance. Indicators of economic viability (such as the CBR) are very sensitive to performance that is lower than originally envisioned.

87. It is recommended that the current value for the maximum CBR be maintained, complemented by the development of more effective mechanisms for monitoring and evaluating results. Later, when the monitoring system is in place and is supported by the computerized management system recommended earlier in paragraph 49, it will be possible to conduct the following analyses, among others:

- For each distribution utility, follow up the evolution, in each project category, of the projected and achieved CBR.
- Follow up the evolution, in the same project category, of the projected and achieved CBR for all the distribution utilities.

88. *Annual discount rate equal to or higher than 12 percent.* The basis for this rate, according to the 2005/2006 Manual, is the Power Sector's Ten Year Expansion Plan for 1999/2008. This same value has been stipulated since at least 2001, though it could be reduced if requested and a justification was given.

89. Reducing the discount rate would make more kinds of energy efficiency action feasible. However, financial resources for investment are limited, and energy efficiency projects are competing for resources with supply expansion projects.

90. Regardless of the value stipulated for the discount rate, it is important to emphasize that the rate used during the project elaboration phase should be the same as the rate used during the results evaluation phase. It should also be the same as the value used in the electrical sector's expansion plans. Since the MME continues to apply the 12 percent rate in its Ten Year Expansion Plan 2006/2015, which is currently in effect, it is suggested that this discount rate remain the same for the EEP.

91. *PROCEL energy efficiency seal*. According to Resolução ANEEL 176/2005, "All electrical energy equipment whose end use is for these projects should bear the PROCEL seal of efficiency and/or the seal of performance issued by PROCEL and INMETRO." PROCEL is the national program for promoting electricity efficiency, which includes a substantial labeling program. INMETRO is the national agency responsible for physical standards.

92. These requirements should remain in effect. Nevertheless, a situation may arise where some equipment may not have yet received the PROCEL seal, despite it being deemed efficient. A modification to the wording to include "whenever possible" or "whenever it is relevant" is suggested. This phrasing was present in an earlier ANEEL Resolution (492/2002) on the subject.

D. General program criteria

93. Two subjects which are of relevance for the program as a whole are considered here: (a) the requirement that energy savings be equal to or greater than 0.10 percent of the utility's market; and (b) public hearings.

94. *Energy savings ≥ 0.10 percent of the market.* This goal was set by ANEEL in 2005 in Resolution 176. Nothing like it was contained in previous resolutions. At that time, the mandated resources for the EEP were reduced from 0.50 percent to 0.25 percent of NOI. Emphasis was therefore placed on the need to "update the current requirements in order to obtain the best possible results, with investment levels less than what had up to that point been the practice."9 This sense of pressure to obtain more effective results also led to the exclusion, at the same time, of certain kinds of projects, such as education or municipal energy management projects, as described above.

95. The authors believe that the objective of increasing results with the same resources is totally justifiable. However, in our opinion this criterion, as it is, could create difficulties for the proposed new process for submitting projects, for the following reasons:

96. A cost vs. benefit criterion (the CBR) already exists for projects subject to savings verification. This additional global market indicator is thus largely redundant and merely serves to eliminate abuses in projects whose results are not subject to quantitative verification, such as those related to education, a category that was prohibited in the same resolution. We believe that there are other ways to avoid abuses with this type of project.

97. Moreover, if the objective is to increase the level of productivity of the implementation of EEP resources, then the selected target value is not very challenging. According to 2006 data from ANEEL, the average cost that would have to be allowed to meet it is approximately R$630 per MWh saved with 0.25 percent of the NOI, and R$1265/MWh with the current value of 0.50 percent of the NOI. These permitted energy savings costs are much higher than electricity generation costs and, indeed, the electricity tariffs currently in effect nationwide.

98. Additionally, with the proposed change in the process, with projects to be submitted in a "continuous flow," it would be difficult if not impossible to carry out this calculation. We therefore recommend that ANEEL eliminate this rule.

99. *Public hearings.* These have been required of the utility since 2000, with the purposes of soliciting suggestions regarding the allocation of resources and disseminating the program to the public, prior to it being submitted to ANEEL.10

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[9] ANEEL Resolution176/2005. Article 4, paragraph 6.

[10] Resolution 271/2000, Article 7, stipulates that "prior to its submission to ANEEL, the concessionaires and

100. Despite the positive intention of the public hearings, they have, in general, not achieved the expected results. Similarly, according to 2005/06 Manual, "in the opinion of the utilities, the purpose of the public hearing process could just as easily be achieved through an exchange of documents without requiring a live event. The objective is merely to allow the parties to provide their opinions and suggestions for the EEP being considered in the hearing."

101. The authors believe it is important to maintain the practice of public hearings, but adapt them to fit the new model of a continuous flow of projects. For example, public hearings could be used as a forum for reviewing the results of ongoing projects, as well as presenting upcoming projects.

102. Once the procedure has been defined, ANEEL could consult with the utilities and establish a calendar of hearings. After this first date, the public hearing process could be repeated periodically, perhaps every 12 or 18 months, depending on the size of the utility's program.

E. Resource allocations

103. In the early years of the EEP, there were percentage floors for expenditures in diverse market segments. Since 2005 and the changes brought with Resolution 176, there are currently only one floor (for projects for low-income communities), and two caps (for projects with recovery of investment, and for administrative costs). The section briefly reviews these categories.

1. Projects for low-income communities

104. This project category arose as a result of Resolution 176 in 2005.[11] According to the 2005/06 Manual, these projects should target residential units, and consist of efforts aimed at:

- Disseminating information to the public about energy efficiency.
- Updating electrical installations inside the homes.
- Donating energy efficient equipment.
- Installing solar heating units to replace electric shower units.
- Installing solar energy panels as a back-up for electric shower units.
- Develop educational programs tailored to the needs of these communities.

105. Substantial resources (Table 5) have been targeted for these kinds of projects, well

licensees must hold a public hearing to formally introduce the respective programs to the both the consumers and society at large." The requirement was renewed in ANEEL Resolution176/2005, Article 6.

[11] Article 5, paragraph 7 stipulates that "a utility should allocate a minimum of 50 percent of the total amount of the program resources targeted to low-income community projects."

beyond the required minimum 50 percent level.

Table 5. Summary of Investments in 2005/2006 and 2006/2007

Item	2005/2006	2006/2007
Total investment (million R$)	R$ 296.4	R$ 182.7
Low income	63%	66%
Industrial	15%	6%
Others	22%	28%

Note: Partial data for 2006/2007.
Source: ANEEL/SPE.

106. Information on low-income residential projects during the 2005/2006 and 2006/2007 annual cycles are shown in Table 6.

Table 6. Resources Targeted to Low-Income Projects

Item	2005/2006	2006/2007
Investments (million R$)	R$ 184.7	R$ 107.8
Energy efficient lamps	2,938,677	1,761,201
Refrigerators	30,710	26,177
Internal wiring installations	130.025	n.a.
Solar water heaters	18,165	4,726
Connection standardized	94,20	n.a.

Note: Partial data for 2006/2007.
Source: ANEEL/SPE.

2. Projects with recovery of investment costs

107. The EEP has allowed utilities to recover their investment costs in a share of their projects since 2000. The current ceiling is 50 percent of total EEP investments. In this modality, the utility signs a performance contract or agreement with the consumer being benefited. In addition to complying with the general criteria stipulated in the 2005/2006 Manual, this type of project must also abide by the following procedures:

- The utility may receive 100 percent of the value of the investment, through payments made in installments whose value should be limited to that of the savings verified during the period;
- Recovery of investment costs is not allowed in residential projects, except for cases related to the common areas for horizontal residential condominiums;
- The utility must submit to ANEEL, as part of the project preliminary report, a copy of every signed performance contract;
- All revenues obtained through the performance contracts must be accounted for separately and will be reallocated for future energy efficiency projects, using the same (performance contract) mechanism in subsequent annual cycles.

108. The authors agree that it is important to develop mechanisms that foster sustainable markets for energy efficient services. In principle, the instrument of performance contracts, as adopted by ANEEL, could help to consolidate the energy efficiency services market. It was observed, however, that the requirement to reinvest the revenues exclusively in new

performance contracts in subsequent years has led to the opposite of was intended. Practically all of the distribution utilities desisted from this type of investment.

109. Given the importance of this tool for consolidating the energy efficiency market in Brazil, it is recommended that ANEEL cancel the requirement that the receipts from performance contracts be used solely for the purpose of funding new performance contracts, and allow them to be reused for any energy efficiency project in subsequent years.

110. It is also recommended that efforts be made to identify new incentives for taking out loans within these contract mechanisms, by using the EEP funds as "equity capital" for the project. In addition to leveraging the resources and the program's impact, this approach more closely resembles the conditions of a commercial market for energy efficiency services, and thus could facilitate the transition toward a market that is truly sustainable (Poole and Meyer, 2006).

3. Limitation of administrative costs to 5 percent of total investment

111. According to the 2005/2006 Manual, the total of Shared General Administration Costs (SAG; costs associated with managing the project) "is limited to 5 percent of the total EEP. The costs should be submitted in detail and with unit costs shown in such a way as to allow for an accurate evaluation of the program."

112. It is recommended that this procedure and the cost cap be maintained. In addition, ANEEL should also allow, if possible, expenditures devoted to disseminating and promoting energy efficiency initiatives.

IV. Evaluating the Energy Efficiency Program

113. Any new changes to the Manual should include the establishment of appropriate procedures for assessing results (ex-post assessment).

114. The following sections describe the most common ways to assess EEPs, through process and impact assessments; and consider how ANEEL might implement a program evaluation system.

A. Approaches to evaluating energy efficiency programs

1. Process evaluation

115. A process evaluation is ultimately aimed at providing information about the program's operations. In broad terms, this kind of evaluation involves feedback by the participants in a specific program, regarding the way the program was executed by the implementing agents, and whether it met their expectations. This type of evaluation has the potential to help program managers develop, review, and improve their methodologies, and thereby contributes to the operational efficiency of the EEP and future programs. A survey process is commonly used to interview business people, suppliers or manufactures, trainers, and consumers.

116. Efforts are also made to assess how the program’s methodologies influence:

- Levels of satisfaction of participating consumers;
- Obstacles that inhibit participation in the program;
- Differences between consumers who do and do not participate in the program.

2. Impact assessment

117. An impact assessment is ultimately aimed at examining a program's effect on total energy savings and demand reduction, as well as equipment sales volume (where concerns about a market transformation exist). It is mainly a quantitative assessment, although it can also address certain qualitative aspects more characteristic of specific initiatives, such as educational programs, energy efficiency marketing efforts, and municipal energy resources management.

118. An impact assessment implies an initial compilation of baseline data used to estimate the effects of the program in terms of the load curve and the electrical energy consumption patterns of the target population. The studies conducted for this purpose are called ex-ante, and are also focused on designing the program to the appropriate scale, selecting the right equipment, getting price estimates, etc. These studies are similar to market research, though they also need to include a detailed energy diagnostic study of the target region and its

consumers, including, for example, surveys of equipment/appliance ownership and consumption habits; and measurements of load curves at both the consumer and electrical grid levels

119. Energy savings programs must be properly dimensioned and their execution must be well planned. It is recommended that substantial amounts of data be gathered regarding the target audience, including their socio-economic characteristics; their consumption habits and what electrical appliances they own; and their preferred conditions for participating in the program (price of the technologies being promoted, appropriate forms of payment, etc.). This information is highly pertinent to the planning of various phases of a program.

120. This kind of information should be considered in the justifications for the priority programs, which were defined above. In particular, the baseline market survey and energy diagnostic study are crucial instruments for estimating the potential impacts of the program, and for determining the most appropriate ways to implement it.

121. Depending on the type of program, there may be a need to carry out individual measurements with a sample of consumers. With these measurements, it is possible to compile load curves of energy consumption by end users, before and after the program's implementation.

122. An ex-post impact assessment of EEP programs can be based on the following parameters:

- the level of participation in the program (including an evaluation of free riders and consumers outside the program) ;
- levels of acceptance by the consumers of the measures and practices recommended by the program;
- performance of the technologies promoted by the program, and their use by consumers;
- reduction in terms of energy use (kWh) and demand (kW);
- cost-benefit analysis of the program (per kWh saved and kW reduced);
- persistence in the use of the technology promoted and of the energy savings.

123. It is possible to establish adequate procedures for evaluating the programs when they are developed appropriately. An international protocol has been in existence for years to orient the monitoring and verification of results (M&V) obtained from energy efficiency projects. It is the International Performance Measurement and Verification Protocol for energy efficiency projects – also known by its acronym in English as the IPMVP.

3. Current status of the evaluation of utilities' programs

Ex-ante evaluations

124. The projects that comprise the annual energy efficiency programs follow specified requirements for formulating and submitting proposals for prior approval by the regulator and their subsequent implementation.

125. In the approval process, specific technical indices are used for each type of project or action. One of the indices is the ratio between the project's estimated implementation costs and the benefits, defined as the avoided costs of expanding supply being equivalent to the energy saved.

126. This cost-benefit ratio is the most important indicator for obtaining project approval. Under the formula R = C/B, the lower the value, the more beneficial the project is considered to be.

127. The criteria evaluated are essentially of an economic nature, reflected both in terms of savings achieved through reductions in energy demand during peak hours, and in terms of cost-benefit ratios. No social or environmental parameters are taken into consideration.

Ex-post evaluations

128. Until now, the utilities' EEPs have not received an ex-post evaluation to measure their real impact. The recent significant investments in programs for low-income consumers have not been accompanied by evaluations to verify their benefits. It can be asserted that the current procedures have not been sufficient to demonstrate with reasonable certainty the impacts and benefits over the years to the electrical power system or to the consumers that have financed these initiatives. The most significant type of ex-post evaluation is essentially economic in nature.

129. Nevertheless, there has been a concern over the years regarding the need to assess, monitor, and verify results. This has been clearly reflected in various ANEEL resolutions, although these procedures have not been implemented in practice.

130. Article 4, paragraph 4 of Resolution176/2005 establishes that "projects should contain methodologies for evaluating, monitoring and verifying results that can objectively prove assertions of energy savings and lower demand during peak hours." The 2005/2006 Manual states that "any measurement proposal should be based on the International Performance Measurement and Verification Protocol (IPMVP)." As described above, this protocol provides the basic guidelines required for verifying the results of energy efficiency projects.

131. Clearly, it is necessary to expand and reinforce procedures associated with the ex-post assessment component of the EEP programs. The models of report formats provided by the EEP should serve only as minimum parameters for drafting the reports that accompany each program. Some kinds of program may need to include additional parameters to produce an accurate assessment and follow-up.

132. In assessing EEP programs, consideration should be given to breaking up the evaluation into specific "process" and "impact"-related components. There is also a need to consider expanding the evaluation criteria of projects to avoid restricting them to purely economic aspects. Even though the CBR can serve as a basic indicator for obtaining a project approval from ANEEL, it is necessary to establish priorities given the limited resources. At the present time, social and environmental benefits that can be highly relevant are not given significant consideration. Adequate assessments should be given to educational, training, marketing, and municipal energy management programs that are patterned on criteria not considered in the current Manual. All of the programs should be subjected to evaluation processes in order to verify their envisioned benefits.

B. Proposed evaluation procedures and criteria

133. A set of criteria and indicators are proposed below, which can be useful for undertaking an ex-post evaluation of projects from a public interest perspective; i.e., reducing the need to expand electricity supply, with the ensuing social and environmental consequences. This effort should provide the opportunity for more comparative studies of programs offered by various utilities, and thus more easily identify best practices and opportunities for improving projects.

134. It is also necessary to consider cases where matching funds are available for investments. It is crucial that the EEP criteria stimulate the seeking of matching resources, while at the same time ensuring an adequate financial return. Whenever there are strong positive external factors, it is likely that there will be matching funds available, and this in turn justifies a more rigorous analysis of the projects funded with EEP resources.

135. Projects can be evaluated by taking into account:

- methods to quantify energy conservation results;
- comparison of the costs of energy savings ($/kWh saved energy; $/kW reduced peak demand);
- the project's impacts on the community;
- the sustainability of the project's impacts;
- the size of the distribution utility;
- impacts related to market transformation.

136. Below, we examine the ex-post evaluation process from each of these perspectives. This is a preliminary discussion, which aims to serve as a reference for an effort to develop more detailed guidelines to orient the agents after the publication of the new Manual.

1. Ways of quantifying the results

137. Projects are evaluated based on the types of results. Certain kinds of projects permit a verification process using accurate measurements, while others do not. Frequently, projects for which accurate measurements of energy savings are not possible, such as those related to education or marketing, are seen as having little significance. Both of these categories need to be evaluated, but they need to apply different procedures.

138. While educational and marketing projects cannot be measured accurately in terms of economic parameters and electricity savings, they do provide the opportunity to, for example, train thousands of children by disseminating information about energy efficiency practices. In this case, the discussion should focus on the kind of training model to be used, such as, for example, "PROCEL in the Schools," created by Eletrobrás with educational criteria that have been extensively evaluated by educators.

139. In order to accompany educational programs and compare utilities, we suggest that the parameter "Cost per Student Receiving Training" be used. ANEEL can develop indicative values for control purposes, based on the history of actions undertaken with different kinds of education projects. The ex-ante evaluation of actions geared to creating and disseminating knowledge (educational, marketing, and training programs, among others),[12] need specific criteria in addition to economic and energy efficiency indicators.

140. Some examples of these additional indicators include: (a) the number of students and teachers served; (b) the number of professionals trained, by profession and type of training received; (c) the rate of retention of skills and information taught; and (d) information on the behavior of persons directly benefited and their actions as multiplying agents. These indicators may be quantitative (percentage of the direct beneficiaries who show behavior of multipliers, or the ratio of indirect beneficiaries to direct beneficiaries), or qualitative (quality of the information which has been passed on, or the extent to which indirect beneficiaries have adopted energy efficient practices and behavior patterns.

141. For the remaining actions related to marketing, we suggest opening the option of

[12] These actions include such things as training of professionals and continuing education programs; adding components to academic curricula from the primary school level to universities; efforts geared to marketing energy efficiency and to organizing congresses, conferences, and workshops; and support for the Brazilian appliance labeling program.

applying a percentage of the resources for a project targeting segments of the EE market. In other words, within an industrial project, it would be possible to implement training and marketing actions up to a specific percentage of the total investment.

142. For projects that allow the verification of results based on measurements before and after energy efficiency measures have been implemented, we recommend creating standard criteria for reports of projects sharing the same characteristics and which represent a large share of EEP investments, such as the replacement of electric motors, refrigerators, public lighting fixtures, etc.

143. In these cases, it is recommended that the procedures adopted by the IPMVP be the reference. These reports could be filled out online and handled the electronic management system which was recommended in paragraph 49 of this report. Thus, while gathering data for the pre-analysis or energy diagnostic study, the measurements should be defined as being individualized (motor by motor, for example) or on a sample basis (replacing a refrigerator or donating lamps for low income consumers), in accordance with criteria that ensure the reliability of the results and of comparisons of actions undertaken by various distributors in different regions.

144. This action is aimed at reducing the current evaluations that are done empirically by ANEEL and by civil society (such as NGOs or academic institutions), which lack reliable tools and information for evaluation.

145. It is important to emphasize that all of the programs can and should be evaluated. The manner in which each category is evaluated should take into account its inherent nature.

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149. Table 7 below shows some indicators that could be used as elements in an evaluation. The evaluation proposed here goes beyond the assessment of quantitative indicators, as was discussed in the previous section.

Table 7. Examples of Evaluation, by Basis of Assessment and Project Segments

Basis of Assessment	Segment	Project	Indicators
Measurement	Industrial	Energy Management	kWh & kW saved
	Public facilities	Enhancing efficiencies in public facilities	kWh & kW saved
	Public lighting	Replacement of lighting fixtures	kWh & kW saved
	Residential	Efficient household appliances	kWh & kW saved
	Low income	Various	kWh & kW saved, Reduction of defaults
Estimate	Educational	Procel School Program	Cost/student, number of students, exam
	Training	Courses/Seminars	Cost/student, number of students, exam
	Marketing	Marketing Campaigns	Assessment of marketing campaigns

2. Comparison with the cost of expanding supply

150. It is important to conduct an economic evaluation of projects for which it is possible to make quantitative measurements of kWh saved and kW of avoided peak demand. Currently the energy savings calculations are carried out according to procedures established by ANEEL, using standard formulas for deriving the CBR.

151. An additional economic indicator (R$/kWh and R$/kW saved) is proposed here as another important element of the assessment. Economic indicators should be easy to compile and should serve as a useful reference for planning in the power sector.

152. It is recommended that the results of projects with measurable impacts (in terms of kWh and kW saved) should be presented in a form that is comparable with the marginal cost of expansion of electricity supply in the region where the project is implemented. As part of the calculation of the CBR, projects must already calculate the cost per kWh saved and/or per

kW of avoided peak demand, through the use of formulas such as:

CCE = (annualized project costs)/(kWh saved per year by project) R$/kWh

and

CEP = (annualized project costs)/(kW avoided peak demand by project) R$/kW

where CCE is the cost of conserving electricity and CEP is the cost of reducing peak electricity demand.

153. The annualization of costs includes the expected lifetime of the project and a discount rate of 12 percent – the same as that used in studies of the expansion of electricity supply.

154. The marginal cost of expansion is a much more familiar indicator in the electricity sector than is the CBR. It permits a direct comparison with the investments in reducing energy consumption, without the need for any additional calculations. This is a way to more easily transfer the results of the EEP to the agents responsible for expansion planning. The CCE can be compared to the marginal cost of expansion in terms of R$/kWh of firm energy. The CEP can be compared to the cost of installing new capacity for peak demand.

155. It is therefore recommended that these indicators be used to compare the results of the projects with the marginal costs of expansion of electricity supply. It should be emphasized that these cost calculations do not require any new data beyond those already used to calculate the CBR, and therefore would not place any additional burden of reporting on the utility.

156. Table 8 shows examples of some projects where it was possible to calculate the cost per kWh saved (CCE) and per kW of avoided peak (CEP), as well as reproducing the value of the CBR calculated by the utility.

Table 8. Comparison between the CBR and the Cost of Energy Savings (R$/MWh) and of Avoided Peak Demand (R$/kW) in Projects, 2003/04

CBR	Energy savings (CCE) R$/MWh	Peak Reduction (CEP) R$/kW	Sector	Utility
0.24	R$ 50	R$ 482	Commerce & services	CEMIG
0.25	R$ 64	R$ 215	Public facilities	COPEL
0.42	R$ 71	R$ 697	Industrial	CEMIG
0.44	R$ 146	R$ 395	Public facilities	COPEL
0.45	R$ 80	R$ 688	Industrial	CEMIG
0.47	R$ 76	R$ 980	Commerce & services	COPEL
0.49	R$ 95	R$ 597	Commerce & services	COPEL
0.51	R$ 102	R$ 453	Industrial	CEMIG
0.51	R$ 145	R$ 392	Public facilities	COPEL
0.60	R$ 160	R$ 489	Public facilities	COPEL
0.61	R$ 106	R$ 649	Industrial	CEMIG
0.67	R$ 133	R$ 608	Public service (water)	CEMIG
0.82	R$ 124	R$ 1126	Industrial	CEMIG
0.92	R$ 303	R$ 1327	Public lighting	CEMIG

157. One can see that similar values of the CBR can be associated with very different costs for energy efficiency gains and reduced peak demand. The advantage of presenting the CCE and CEP values is that they allow comparisons with the marginal costs of expansion (generation and transmission and distribution costs associated with the relevant class consumers), and provide a better understanding of the impacts of projects on the load curve of the system.

3. Scope of project benefits for the community

158. Projects can produce significant and interesting results when assessed by one type of criterion and have difficulties when assessed by another type. In this regard, it would be worthwhile to also evaluate projects in terms of their impacts on the community.

159. For example, the use of resources in hospitals and public facilities that serve a large part of the population of a given region could be important even if their costs surpass those of other projects.

160. Conversely, other projects might target resources to specific consumers and their benefits could be limited to only them. For example, an energy efficiency project in a private sector firm could show a significant reduction in the company's energy bill, which reflects the direct impact of the investments made with the resources of all consumers. For this reason we recommend that all projects with private consumers be done with performance contracts, where the consumer repays the investment. At the same time, reductions in consumption by one consumer do benefit other consumers as well.

161. It is therefore recommended that the projects should also be evaluated in terms of social benefits. These kinds of criteria are difficult to quantify, but an evaluation is possible in relative terms, taking into account the context of the projects implemented by the utility. It is recommended that the direct beneficiaries of the investments made in the EE programs be highlighted. Table 9 below illustrates the proposed evaluation. ANEEL could signal a preference for utilities to select projects with greater social impacts.

Table 9. Evaluation from the Perspective of Scope of Impacts on the Community (Who Benefits)

Type of EE Program	Individual	Partial	Total Community	Comments
Industrial efficiency	√			Serves isolated industrial units
Commercial efficiency	√			Serves large companies – hotels, supermarkets & shopping malls
Efficiency in public facilities		√		Serves healthcare facilities, social assistance entities
Replacing public lighting			√	Serves urban populations
Donate compact fluorescent lamps		√		Serves low-income communities in some municipalities.
Appliance rebate		√		Serves consumers with greater purchasing power
Institutional marketing		√		Disseminates material about

				energy efficiency practices
Industrial efficiency		√		Academic programs and donations of teaching materials

4. Sustainability of project impacts

162. When reviewing the history of implemented projects, it can be seen that their expected lifetimes vary greatly (from 1.5 to 25 years); and that the variation is related to the type of action or market segment and often has little to do with the equipment used. A compact fluorescent light, for example, can last up to 3,000 hours, but in most low-income homes, the operating conditions reduce its life cycle to between 1.5 and 3 years.

163. In contrast, in energy efficiency projects for public lighting, any technology modification is absorbed by the utility, which is (usually) responsible for the lighting system's maintenance, thus helping to ensure the sustainability of the savings.

164. It is therefore recommended that evaluations be conducted to determine the sustainability of the investment's impacts, considering not only the lifetime of the equipment and technology but also other relevant impacts of the project. For example, the success of efficiency measures may lead to an increase in demand, the so-called "boomerang effect" (Energy Policy, 2000). The values for the lifetime of each project should be used to calculate the economic indicators, including the CCE and CEP proposed above.

165. A main reason for this kind of evaluation is to increase the transparency of comparisons between types of programs as well as between utilities. This kind of evaluation implies accompanying programs over time in order to verify results. Consideration should also be given to using sampling techniques.

5. Market transformation

166. There are various definitions associated with the term "market transformation." Nevertheless there is a consensus that this transformation involves a continuous and durable change, such that the market in question does not later regress to lower levels of efficiency. This transformation is a process in which energy efficiency innovations are introduced in a given market segment, and over time occupy a large share of that market. This process implies a reduction in market barriers to the point where the use of efficient goods and services becomes a normal practice, and specific actions such as subsidies are no longer necessary to sustain progress.

167. In market transformation programs, new elements are introduced into the structure of the energy efficiency market (including for example, new terms of supply or conditions of access to products and services), and into the behavior patterns of market agents, to such an

extent that energy efficiency levels improve and changes become permanent after the program has concluded.

168. We believe that the activity of the distribution utilities is a highly significant factor in determining the success of energy efficiency policies in Brazil, given that they have the most familiarity with the market and the most administrative capability, and are most widely distributed throughout the nation.

169. One of the anticipated results of the ongoing investment of resources in the EEP is that they will lead toward leveraging more investments (beyond the minimum 0.5 percent of the utilities' NOI); and that they will prepare the market for initiatives to become economically attractive and to demonstrate economic sustainability over time.

170. It should also be noted that a market transformation program will only yield significant results after several years. It is expected that the conditions associated with the supply and demand of efficient goods and services gradually become more sustainable, until the program can be phased out. Besides distribution utilities, a market transformation program requires participation by manufacturers, wholesalers and retailers (to effectively distribute products), construction firms, engineering firms, and project developers.

171. Possible indicators to show the impacts of annual programs towards market transformation might include:

- For programs that disseminate more efficient technologies (retrofits, etc), annual sales of specific equipment in the utilities' franchise area.
- Trends in consumers' load curves.
- Follow-up assessments with local suppliers of energy efficient equipment and energy service providers (ESCOs) to show changes in the market.

172. It may be necessary to follow up data related to sales of equipment at the national level as well, depending on the technology and the size of the program.

V. Summary of Recommendations to ANEEL

173. The following recommendations were submitted to ANEEL in October 2007 for consideration in the revision of the Operational Manual. The changes to the Manual are detailed in the following section.

a. *Submission of project proposals.* The "continuous flow" model for submitting projects – currently being considered by ANEEL – would permit an increase in the quality of project proposals, maximize the possibility to exploit opportunities identified by the utilities, and allow them greater autonomy in developing the projects. The use of digital-electronic media for the utilities to submit pertinent EEP documents to ANEEL would enhance the efficiency of the EEP assessment and approval process, and should be undertaken.

   To supplement the submission of individual projects, it is recommended that an "indicative plan" be submitted annually that summarizes the overall set of projects being proposed and considered. This indicative plan should be quite simple: the budget proposal can be an estimate without detailed breakdowns; and it should not be necessary to identify the specific entity that would benefit from the project (only the sector). This procedure would allow ANEEL to review the intentions of the utility in a preliminary way before a significant amount of time has been invested in the preparation of projects. This would also allow projects to be "pre-approved" (see recommendation "d" below), and encourage the utility to think in terms of the whole set of measures being planned.

   It is also recommended that ways be sought to increase the speed of project implementation, to prevent resources destined for the EEP from accumulating and remaining idle for an excessive amount of time, as is often the case today.

b. *Aggregating projects*. Consistent with the idea of encouraging market transformation, it is recommended that incentives be created to aggregate projects, in order to increase the potential for market change. This aggregation could be attained by: (i) bringing together projects from various utilities, taking into consideration their areas of concession; or (ii) developing priority projects to which individual utilities can adhere (see recommendation "c"). Possible examples of the latter are incentives to encourage the use of energy efficient refrigerators; programs to serve low-income communities; and the promotion of solar energy for heating water. Some priority projects may only be effective in certain regions of the country due to the unique characteristics of each region.

c. *Include a new category of priority projects.* Creating the category of priority projects would increase the possibilities for promoting public policies in the area of energy efficiency. These projects could be periodically defined by ANEEL, with or without the participation of other institutions; and would be national or regional in scope to address specific objectives. This project category encompasses all of the envisioned

project types, including those related to education, marketing, and management. The priority project is characterized by its broad scope and strong potential for spurring market transformation. Diverse sectoral entities could show an interest in inserting themselves in a specific activity, and could become partners in priority projects. The regional coverage would encourage the consideration of projects that are inherently difficult if implemented in the concession area of only one utility.

d. *Create the category of pre-approved projects.* This new category would encompass all types of projects where there is accumulated experience in design and execution. Types of projects defined by ANEEL as pre-approved need only be registered with the regulatory agency. This category should grow over time and become more prevalent, helping in turn to simplify the project submission process.

e. *Other recommendations about project categories.* Proposals for pilot or innovative projects should be submitted by the utility to ANEEL for an ex-ante evaluation.

   Projects classified neither as pilot projects nor as pre-approved projects should be submitted for an ex-ante evaluation using a simplified methodology in an order to avoid delays in the approval process.

   It is recommended that co-generation and certain kinds of distributed generation be included as acceptable categories of projects. Both are important approaches to increasing energy efficiency.

f. *Re-authorize educational programs.* The current exclusion of educational projects limits the opportunities for expanding the impact of energy efficiency programs and should be reconsidered. Educational projects can be tailored to meet the needs of different target audiences and different training levels. Basic education is a key priority focus. However, technical training, advanced education, and skills and technology training for professionals involved in different areas related to energy efficiency – as well as for maintenance personnel in private or public sector companies, and for buyers in public sector enterprises – play a significant role in the market transformation process.

   The evaluation format for assessing educational and training projects cannot be the same as for projects focused on energy efficiency, due to the difficulties of measuring program benefits or their permanence. However, all successful energy efficiency programs in various countries include some educational components.

g. *Re-authorize marketing projects.* This item excludes publicity campaigns with commercial objectives, and focuses only on marketing activities that promote the use of energy efficient products and technologies and raise awareness among the general population and professionals involved in activities related to energy consumption. It is recommended that marketing activities be included as a component of all energy efficiency projects.

h. *Re-authorize public sector energy management projects.* It is recommended that municipal energy management projects be re-authorized, and that the scope of this

category be expanded so that such projects can also be implemented at the state or national level.

i. *Performance-based projects.* Any project with a private sector entity (except for those involving low-income residences) should be implemented through a performance contract, with payment made by the beneficiary. It is recommended that efforts be made to identify new incentives for taking loans by using the EEP funds as "equity capital" for the project. This could facilitate the transition towards a more sustainable commercial market for energy efficiency services.

   At the same time, the current requirement that the payments received from performance contracts be reinvested in this same class of projects should be eliminated. The impact of this requirement has had the opposite effect of what was originally intended – utilities have turned away from this kind of project.

j. *Greater flexibility in the allocation of resources.* Greater flexibility should be allowed in allocating resources among project categories, with consideration given to the big differences between utilities in terms of both their size and the characteristics of the market in their area of concession. In general, the use of quotas determined ex-ante for investments in different sectors (which was a strong characteristic of the EEP until changes made in 2005) should be kept to a minimum, because they will also complicate the implementation of the new continuous flow process for submitting projects.

k. *Importance of the evaluation process.* Establishing an evaluation process (including measurement and verification) for energy efficiency projects is essential for consolidating the new continuous flow model for submitting projects, and will be crucial for establishing the credibility of future proposals. It is therefore one of the pillars of the proposed changes.

l. *Every project should be evaluated.* Even projects whose results cannot be measured directly in economic or physical terms (kWh saved) need to be evaluated based on their specific merits so that their results can be weighed. This process is essential for building experience and lessons learned regarding both the content and the management of projects.

m. *Evaluate projects for low-income communities.* Given the large investments made in this area in recent years, it is recommended that efforts be made to assess the overall impact and specific results achieved through these programs. This assessment could serve as an exercise to demonstrate effective evaluation procedures for the programs. Based on the results of this assessment, it would be possible to propose modifications in this group of projects.

n. *Evaluation methodology.* This should accompany the project description documents and clearly specify the evaluation methodology to be used. In the case of projects with measurable results in terms of energy savings, the basic reference should be the IPMVP (International Performance Measurement and Verification Protocol).

o. *Allocating resources for evaluations.* In developing energy efficiency projects, resources need to be allocated for evaluation processes. It is recommended that a maximum of 5 percent of the total cost of the program be set aside for evaluation. In the case of pre-approved projects, a minimum value should be set in accordance with each category. For projects submitted for approval or in cases involving a pilot project, ANEEL could determine the maximum amount allocated to evaluation.

Consideration should also be given to conducting periodic evaluations that go beyond specific project evaluations, such as verifying the impacts on energy market transformation at the regional or national level. It is important for ANEEL to set aside a part of EEP resources to conduct evaluations of this sort.

p. *Who conducts the assessment.* It is highly recommended that the measuring and verification process be conducted by third parties not associated with either the utility promoting the project or with the client who is the direct beneficiary. To prevent an increase in the costs of the evaluation process, and given the difficulties involved in hiring third parties, it is recommended that the agent who executes the project be permitted to conduct the evaluation. At the same time, in the interest of maintaining transparency and credibility, it is recommended that ANEEL require, as a general rule, that all documents related to the measurement and verification process be made available for audits by third parties. In cases involving performance contracts, one option could be to let the client decide, given that the client has an interest in ensuring that an accurate assessment be carried out.

q. *Establishing goals.* Setting physical goals is important to establish benchmarks for evaluation and to monitor the progress of investments. An example would be to establish the goal of lowering electricity consumption by 6 percent in 10 years, at an average cost of less than R$200/MWh.

r. *Evaluation dimensions.* Given the diversity of program categories and the expected impacts, it is recommended that the evaluations should consist of the following elements:

- A method for quantifying the results obtained from energy savings (projects that can be measured in terms of kWh and kW saved, and other types of projects for which other indicators should be determined).

- A breakdown of cost comparisons associated with the energy savings ($/kWh saved or $/kW unused) together with the cost-benefit ratio.

- Indicators of the project's impacts on the community (e.g., analysis of the scope of benefits resulting from the program).

- Long-term sustainability of the project's impacts (assessment of the permanence of the benefits, in years).

- Impacts on the market transformation process (indicators of impacts of the projects on market transformation in determined segments).

s. *Present both the cost-benefit ratio and the unit cost of energy savings.* Project reports should include the cost of energy efficiency savings (R$/MWh) or avoided peak demand together with the CBR. The utilities should provide the information necessary for the calculations to be replicated by third parties.

t. *Provide training for conducting program evaluations.* To ensure an effective evaluation process, it is essential to have a training and certification process in place for professionals involved in measuring and verifying efficiency gains. A task force should also be created to clearly define procedures for evaluating projects that can be directly measured.

u. *Public hearings and ex-post assessments.* An ex-post assessment, especially in the context of public hearings, can also contribute to evaluating the allocation of resources selected by the utilities. It is recommended, in the model proposed here, that public hearings play a role in the ex-post assessment process, which would be a change from current practice.

v. *Long-term assessment.* Some projects may require new evaluations over time in order to verify the permanence of the results.

w. *Registry of evaluators.* ANEEL could create a national registry of evaluators, and provide detailed information on their procedures.

x. *Management system for following up proposals and projects.* It is recommended that ANEEL develop a computerized management system to track data and results of energy efficiency projects. This instrument could facilitate the project submission process and help define pre-approved projects or criteria for ex-ante evaluation.

y. *Leveraging EEP resources.* As a general goal over the coming years, it is recommended that ANEEL find ways to complement EEP resources with resources from other additional sources. In the case of performance contracts, "other resources" could come from national programs that finance energy efficiency, such as PROESCO (a credit line provided by the Brazil Development Bank, BNDES). Another way to leverage resources could be with matching funds provided by municipal governments that are, for example, following through on energy management studies. An increase in matching funds would have the immediate effect of increasing the amount of investment catalyzed by the program. It would also encourage the market transformation process.

VI. Summary of the Incorporation of Recommendations of the Report in the New ANEEL Manual

174. The new Manual for the Energy Efficiency Program (MPEE-2008) was promulgated by ANEEL on February 12, 2008.13 It was accompanied by a document giving detailed guidelines for registering the projects in the Program and making changes in them.14 From now on projects will be registered individually (the "continuous flow" model) into an electronic database – the Management System for EE Projects (SGPEE in Portuguese).

175. The Manual incorporates almost all of the changes proposed in the report, including the "continuous flow" model and the Management System for EE Projects cited above. Table 1, summarizes the recommendations and their treatment in the new Manual. As can be seen, almost all the recommendations pertaining to the Manual itself have been incorporated. The exceptions are partial and small.

176. Some of the recommendations in the World Bank report proposed actions to be developed after the publication of the Manual. This is especially true of the broad area of evaluation, where various actions are needed if the Manual's rules are to be effectively implemented. It was understood at the time of the Manual's preparation that detailing of procedures and putting training programs in place would be an urgent task afterwards.

177. In addition, there were several changes made in the new Manual which were not proposed in the World Bank report. The most significant are:

1. Utilities have until January of 2011 to reduce their accumulated delay in making mandatory EEP investments to the value of the past two years. For utilities with markets smaller than 1000 GWh/year the limit will be three years' value. Until then utilities face no penalties, so long as they spend at the rate of the average of their past 2 years' obligations. As a consequence, there will be little pressure to reduce the existing backlog of unspent resources for the EEP.

2. Utilities may use up to 5% (or R$ 250,000/year) of EEP resources for diverse activities related to management of the overall program. A "Management Plan" should be submitted at the same time as the indicative "Investment Plan". Resources may go for: training of utility's own personnel for management; participation in events, execution and measurement of the results. Marketing and dissemination of the program. Purchase of equipment for measurement and verification (M&V) of the savings and systems for information management. (item 1.20)

   The above use of management resources broadly follows recommendations made in the report, especially concerning marketing, but also resources for M&V. However, in addition, from February 2010 on, the utility's costs for the management of the EEP must come from the Performance Contracts' income (being no more than 20 percent of this

[13] Approved by Resolução Normativa nº 300, de 12 de fevereiro de 2008

[14] ANEEL/SPE - Superintendência de Superintendência de Pesquisa e Desenvolvimento e Eficiência Energética: Sistema de gestão de projetos de eficiência energética (SGPEE) - Instruções para geração e envio de dados de projetos de eficiência energética

income). This additional measure seems to be a way to stimulate utilities to undertake a minimum of projects of this kind (in principle, mostly in the private sector).

3. In the category of projects for low income communities (in which at least 50% of EEP resources must continue to be spent), there is room for projects outside the residential sector, including non-profit community services and private for-profit commerce located in the community. In the latter case, projects must recover at least 50% of the investment. (item 2.5)

4. The acceptance of "supply-side" projects. This proposal was made from within ANEEL after the WB report was delivered. Given the experience early in the history of the EEP (1998-2000), when utilities were allowed to make "supply-side" investments in energy efficiency, the incorporation of this new category is worrisome. A large chunk of resources went to investments on measures that any utility should undertake with normal market and regulatory conditions.

   Fortunately, the definition of permitted projects in this category is quite restrictive. Projects will only be allowed which "seek to improve the load factor of the electrical system via:
   - Reducing or shifting peak demand
   - Introduction of new types of electricity tariff which stimulate the consumer to change his/her habits.

   "Actions which are inherent to the activity of providing the public service of electricity distribution may not receive resources from the EEP, since such investments – when considered prudent – are already remunerated in the periodic review of the utility's tariffs." (item 2.10)

5. The discount rate for economic analysis was reduced from 12 percent to 8 percent, which substantially relaxes the threshold for viability, since the value of maximum cost-benefit ratio was maintained. The reason given is that this lower value is the parameter used in the National Energy Plan for 2030 (PNE-2030). The important thing is that the value be the same as that used in power sector expansion planning, which appears to be the case. Reporting requirements, if followed, will provide information to make calculations with different discount rates. (item 4.3.1.)

178. Some of these changes (such as 3 & 5) are entirely consistent with the reasoning of the World Bank report, even though they were not contemplated. The issue of arrears was largely outside of the report's scope. The others do not appear to seriously conflict with goals, though close attention is needed to how much gets spent on "supply side" projects and in what ways.

179. How will the utilities react? In principle we can know quite soon. The first round of indicative Investment Plans covering the next two years should be sent by the utilities within 180 days of the promulgation of the new Manual – that is by mid-August of 2008.

Table 10. Summary of recommendations of the World Bank report and their incorporation in the MPEE-2008

No.	Recommendation	Treatment of Recommendation
a	Submission of project proposals: (i) The "continuous flow" model for submitting projects. (ii) A simple "indicative plan" should be submitted annually that summarizes the overall set of projects being proposed and considered, in order to supplement the submission of individual projects. (iii) Ways be sought to stimulate greater agility in the utilities' project implementation, thus preventing that resources destined for the EEP from accumulating and remaining idle for an excessive amount of time, which is often the case today.	(i) incorporated and detailed. (ii) incorporated and detailed. First indicative plan within 180 days and must cover at least 2 years. (iii) besides making the process more agile there are penalties for utilities which let their arrears increase.
b	***Aggregating projects***: Incentives be created to aggregate projects from various utilities together.	"Cooperative Project" category created
c	***Include a new category of "priority projects"*** which would open possibilities for directly promoting public policies in the area of energy efficiency.	Category created
d	***Create the category of pre-approved projects:*** This new category would encompass all types of projects where there is accumulated experience in design and execution. Projects of types defined by ANEEL as pre-approved would need only to be registered with the regulatory agency.	Category created
e-h	***Other recommendations about project categories***: (i) Maintain and regulate pilot project proposals which should be submitted by the utility to ANEEL for an *ex-ante* evaluation. (ii) Projects classified as neither pilot projects and nor pre-approved projects should be submitted for an *ex-ante* evaluation using a simplified methodology. (iii) Co-generation and certain kinds of distributed generation be included. (iv) Re-authorize educational programs. (v) Re-authorize marketing activities to be included as a component of energy efficiency projects. (vi) Re-authorize public sector energy management projects.	All recommendations incorporated and detailed guidelines prepared for presentation, including new guidelines for iii, iv & vi.
i	***Performance based projects:*** (i) Any project with a private sector entity (except for those involving low income residences) should be implemented through performance contracts, with payment made by the beneficiary. (ii) The current requirement that the payments received from performance contracts be reinvested in this same class of projects should be eliminated.	Both recommendations incorporated.
j	***Greater flexibility in the allocation of resources*** with consideration given to the big differences between utilities in terms of both their size and the characteristics of the market in their area of concession. In general, the use of "quotas" determined *ex-ante* should be reduced to a minimum.	There appear to be no more "quotas" for sectors, except the 50% minimum for low income communities

No.	Recommendations	Treatment of Recommendation
k - n	***Importance of the evaluation process***: (i) Every project should be evaluated: Even projects whose results cannot be measured directly in economic or physical terms (kWh saved) need to be evaluated based on their specific merits. (ii) The evaluation methodology should accompany the project description documents and include the specific evaluation methodology to be used. In the case of projects with measurable results in terms of energy savings, the basic reference should be the IPMVP (International Performance Measurement and Verification Protocol). (iii) Efforts be made to assess the overall impact and specific results achieved through projects for low-income communities.	Recommendations (i) & (ii) included. Specific guidelines, including (but not only) for (iii) are still incipient.
o	***Allocating resources for evaluations***: (i) A maximum of 5 % of the total cost of the program be set aside for evaluation. In the case of pre-approved projects a minimum value should also be set in accordance with each category. (ii) For projects submitted for approval or in cases involving a pilot project, ANEEL could determine the maximum amount allocated to evaluation. (iii) Consideration should also be given to conducting periodic evaluations that are broader. ANEEL should set aside a part of the resources to conduct an overall evaluation of this sort at the national or regional level, beyond the specific project evaluations.	(i) & (ii) No explicit upper or lower limit is placed. (iii) As yet no provision for broader evaluation.
p	***Who conducts the assessment***: (i) The measuring and verification (M&V) process should be conducted by third parties not associated with either the utility promoting the project or with the client who is the direct beneficiary. To limit cost increases and given the difficulties in hiring third parties, it is recommended that the agent who executes the project be permitted to conduct the evaluation. (ii) At the same time, in the interest of maintaining transparency and credibility ANEEL should require that all documents related to the M&V process be made available for audits by third parties.	(i) no limitation made explicit. (ii) incorporated into the reporting requirements
q	***Establishing goals*** in order to establish benchmarks for evaluating and monitoring the progress of investments.	Only goals mentioned are those that each utility sets for its program.

r - s	***Evaluation dimensions.*** Evaluations should consist of the following elements: (i) Economic analysis: In addition to the currently presented the cost-benefit ratio (CBR) and project reports should include the cost of energy efficiency savings (R$/MWh) or reduced peak demand (R$/kW). (ii) Enough information should be provided for the calculations to be replicable by third parties. (iii)Indicators of the project impacts on the community (e.g. analysis of the scope of coverage of the benefits resulting from the program) (iv) Assessment of the permanence of the project's benefits. (v)Size of the distribution utility. (vi) Indicators of impacts on the market transformation process in determined segments.	(i) incorporated as part of the detailed reporting requirements of the Management System for EE Projects (SGPEE), section 4.B. (ii) & (v) incorporated into the reporting requirements (iii), (iv) & (vi) almost nothing defined

No.	Recommendations	Treatment of Recommendation
t - w	***Provide training for conducting program evaluations***: (i) It is urgent to have a training and certification process in place for professionals involved in measuring and verifying efficiency gains. (ii) A Task Force should be created to clearly define procedures for evaluating projects. (iii) ANEEL create a national registry of evaluators, defining the evaluator in terms of determined procedures.	These recommendations, by their nature are for acting on after the Manual is published. See the main text.
u	***Public hearings and ex-post assessments***: In the model proposed here, that public hearings play a role in the ***ex-post*** assessment process.	Recommendation incorporated and detailed.
v	***Long term assessment:*** Some projects may require new evaluations over time in order to verify the long term permanence of the results.	Partially included. Criteria should be established by Task Force cited above
x	***Computerized management system for following up proposals and projects***: This system would permit registering data for each project and its results.	The Management System for EE Projects (SGPEE) has been created.
y	***Leveraging EEP resources:*** Over the coming years, ANEEL should find ways to encourage the complementation of resources of the EEP with resources from other sources. An increase in matching funds would have the immediate effect of increasing the amount of investment catalyzed by the program. It would also encourage a market transformation process.	Recommendation by its nature is for action after the Manual is published. Achieving leverage probably linked to "priority projects". See main text.

A. Near Term Challenges

180. The new Manual represents a major change in the planning and implementation of projects under the EEP. The potential benefits of these changes could be large. However, there are many challenges for getting the reform off to a good start.

A) Many changes in relations with the utilities need to be made operational, including the registration of projects and from mid-year the review of dozens of indicative Investment Plans and Management Plans.

B) As already observed, the development of adequate evaluation processes, including M&V for projects with "directly measurable results", is an urgent priority and there are a number of actions needed soon. Perhaps the most difficult is to establish a training and certification process for professionals to validate energy savings. ANEEL is organizing a Workshop with EVO[15] to discuss the implementation of a certification process. This moment may represent an opportunity to also address some other issues concerning evaluation of the EEP.

C) The creation of the category of "priority projects" opens opportunities to implement a wider range of types of projects which respond directly to policy objectives. These projects can have a greater impact on market transformation and leverage more third party resources than traditional isolated utility projects have done (or are likely to do).

- The Manual gave examples of some kinds of projects that might be developed in this category, such as: public lighting; large scale substitution of refrigerators; substitution of electric showerheads by solar heating, water and sanitation.
- Many of the potential benefits of the reform depend on developing efficacious "priority projects". However to do this it is necessary to design new programs operating perhaps in unfamiliar ways. The Manual states that specific guidelines will be developed for the design, execution and evaluation of this type of project. The need for these guidelines is urgent.
- One point that deserves attention is how the development of "priority projects" will relate with first round of indicative Investment Plans (which will have a horizon of at least 2 years). Could proposals be developed in a very short time in order to be taken into account by the utilities during the preparation of the first round of plans? Where might resources be found if utilities have already planned other destinations? There is a "cushion" of sorts in the accumulated arrears cited above. These arrears are widespread – but would they be effectively available?

[15] EVO (Energy Valuation Organization) is the custodian of the IPMVP – International Performance and Measurement Protocol for energy efficiency projects and operates a certification program in M&V. The initial Workshop is scheduled for April.

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