# Moving Brazilian Markets Toward Greater Efficiency

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**ABSTRACT**

This paper discusses the authors' work with USAID to transfer specific information, techniques, and strategies to Brazil, designed/selected/based on field research and consultation with key USAID partners and other stakeholders. The paper will specifically describe: the Brazilian versus US energy markets; technical training/capacity building needs in Brazil for 2004; areas where Brazil and the US face similar challenges and a brief description of how they're addressing them; successes and lessons learned to date, including post-training results (where available); and preliminary plans/ideas for delivering additional capacity building support to Brazil in 2005.

## Brazil's Energy Supply: A Super Hydro Power

Most of Brazil's energy comes from renewable sources, particularly hydroelectricity. Oil, natural gas, and coal are the primary nonrenewable sources. With renewable resources produced domestically, Brazil imports about 10 percent of its total energy needs. This is dramatically different from the United States where hydroelectricity accounts for less than 6 percent of electricity production and more than 50 percent of crude oil, gasoline, and heating oil is imported. Table 1 provides a brief comparison of Brazil and the United States in terms of energy use and energy efficiency initiatives.

About half of Brazil's hydroelectric capacity is located on major rivers in the Southeast, in close proximity to the highest concentrations of people and industry. Improved transmission technology and the construction of industries, such as metal smelting, that use large amounts of electricity have begun to tap into the considerable hydroelectric resources of the Amazon region.

Lack of electricity makes it difficult to access ground water for improved community water supplies and irrigation. In the Northeast, 70 percent of the rural population lacks access to electrical services and more than 90 percent of the rural poor lack an adequate water supply. For this and other reasons, the Government of Brazil, USAID, and other partners are working to achieve the dual goals of reaching greater energy efficiency and developing new renewable sources of energy while simultaneously reducing poverty. Of particular concern are the remote and poor areas where the population is underserved.

**Table 1. Comparing Energy in Brazil and the United States**

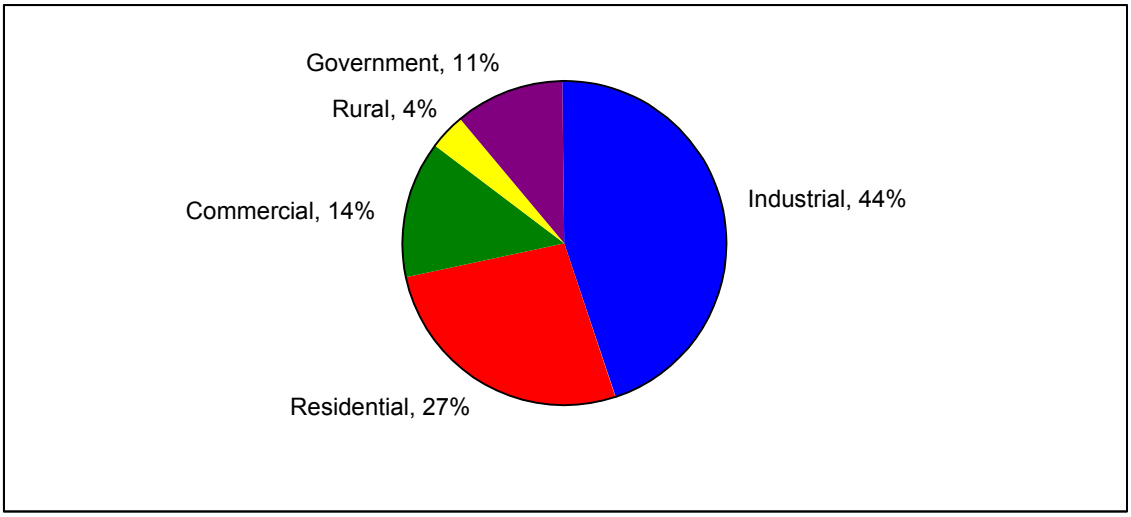
| | **Brazil** | **US** |
|---|---|---|
| **GDP per capita (US$; 2001)** | $2,920 | $35,280 |
| **Number of motor vehicles per 1,000 people (1997)** | 79 | 759 |
| **Electricity Production (2001 estimates)**<br>Hydroelectric:<br>Thermal:<br>Nuclear:<br>Geothermal, solar, wind: | <br>82.65%<br>8.28%<br>4.44%<br>4.62% | <br>5.61%<br>71.44%<br>20.67%<br>2.28% |
| **Per capita electricity consumption (2000)** | 1,878 kWh | 12,331 kWh |
| **Goals of Energy Efficiency** | Manage energy demand, stimulate economic growth, reduce poverty, address climate change | Environmental protection, economic prosperity |
| **Minimum Energy Performance Standards (MEPS)** | Law no. 10,295/2001, National Policy of Conservation and Rational Use of Energy – October 2001 | National Appliance Energy Conservation Act – 1975; Energy Policy Act - 1992 |
| **No. Products with MEPS** | 1 – electric motors | 22 |
| **Voluntary National Labeling** | Selo PROCEL - 1985 | ENERGY STAR - 1992 |

More than 40 percent of Brazil's electricity consumption is in the industrial sector, as indicated in Figure 1 below. Key industries include aluminum, steel, cement, paper and cellulose, and petrochemical. It is estimated that energy consumption could be cut by up to 15 percent by implementing energy conservation measures. Without conservation measures, the industrial sector is forecasted to grow to 410 TWh by 2010.

The second largest sector as noted in Figure 1 is residential with 27 percent. In Brazil, energy consumption tends to peak between the hours of 5 and 10 pm on weekdays. During the winter, much of this peak is due to the use of electric showers, widely used in Brazilian residences for water heating for baths. During the summer, increases in demand at the end of the workday are largely attributed to an increase in the use of air conditioning.

The tariff structure in Brazil for the industrial sector and portions of the commercial sector attempts to influence demand by varying the rate based on the hour in which the energy is consumed. For the residential sector, there is no differentiation on tariffs. Of note, some residential customers are subsidized, particularly within the less developed regions of Brazil.

**Figure 1. Consumption of Electrical Energy by Sector**




Source: Eletrobras

## Energy Efficiency in Brazil: A Snapshot

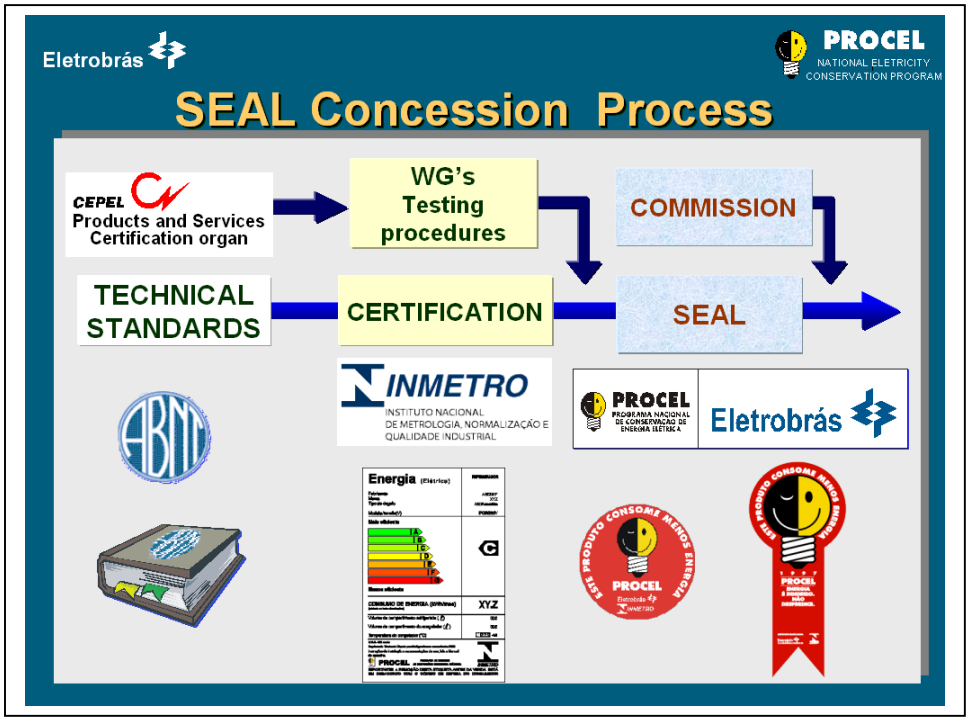
In 2000, parts of Brazil suffered from a major drought—a serious concern for an electricity system that depends on rainfall—while energy consumption reached record-breaking levels for several months. Ultimately, this led the Brazilian government to order consumers and businesses in May 2001 to cut electricity consumption by 20 percent through rationing that began on June 1, 2001. The Government also established an emergency chamber within the Ministry of Mines and Energy (MME), the Camara de Gestao de Crise. As a result of government policies, residential power use fell 35 percent in the first three months of the crisis. Household appliance sales fell 23 percent in May and 30 percent in June according to ELETROS, and microwave sales alone plummeted 70 percent. Rationing has since been discontinued (as of March 1, 2002), but concerns about power shortages remain as the electricity system is operating beyond its designed capacity limit. From December 31, 1960 to December 31, 2000, installed capacity grew from 5,000 MW to 70,000 MW, a rate of 7 percent per year.

Brazil's National Energy Efficiency Policy sets several goals, including "to stimulate the offer, to speed up the market penetration of efficient equipments and to foster industrial competitiveness." One key action step to achieve this goal is the development of minimum energy performance standards for energy-consuming equipment. The President of Brazil sanctioned Law number 10,295, which regulates the National Policy of Conservation and Rational Use of Energy, on October 17, 2001. This law directs MME to establish "the maximum levels of specific energy consumption, or minimum levels of energy efficiency for energy consuming machines and equipment that are manufactured and traded in the country." To date, a regulation for electric motors has been established, based on Presidential Decree 4,059 on December 11, 2002. Other short and medium-term priorities are air conditioners, lighting systems, refrigerators, transformers, DPM (electro-agricultural), gas stoves, electric heaters, gas heaters, and automotive vehicles.

In Brazil, there is an information labeling program and an endorsement labeling program. The voluntary information labeling program (Programa Brasileiro de Etiquetagem or PBE) is

coordinated by INMETRO, the National Institute for Metering, Standards Setting, and Industrial Quality. The program was originally established in 1984 to reduce the electricity consumption of white goods (i.e., large appliances such as refrigerators), but its objectives have been expanded to address safety requirements. The label follows the European design with seven color bands representing efficiency classes that range from low (letter G designation) to high (letter A designation) efficiency. The voluntary endorsement labeling program (Selo PROCEL) recognizes products that achieve a specified level of superior efficiency. The label[1] is awarded annually (i.e., manufacturers have to get recertified each year) and participation is voluntary. The Program is administered by Eletrobras, a holding company that includes the main generation companies, and closely coordinated with INMETRO and CEPEL (national test laboratory). Figure 2 depicts the process for both the PBE and PROCEL labels.

**Figure 2. PBE and PROCEL Label Development Process**

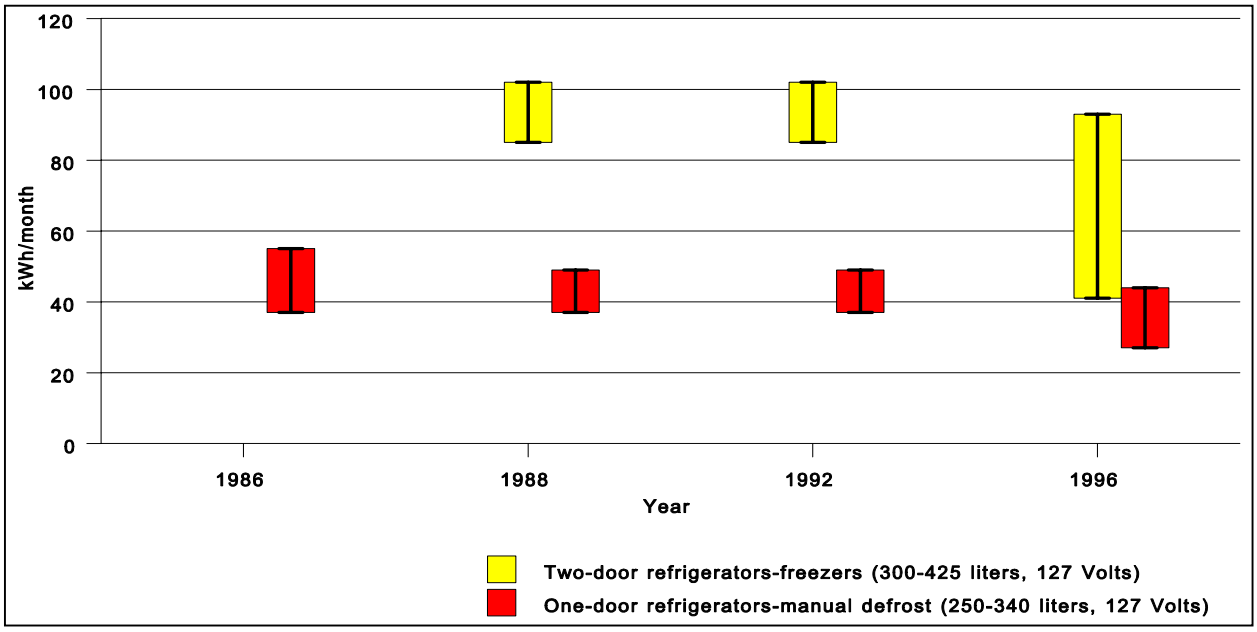



Source: Marcos Q. Lima, PROCEL/Eletrobras, April 2003

PROCEL, through its labeling program and other initiatives such as home lighting and municipal energy management, has been successful in reducing energy consumption. From 1995-1998, PROCEL invested $R 127 million in its programs, which generated 6,209 GWh/year of savings. Figure 3 specifically shows efficiency improvements in refrigerators over a ten-year period in Brazil.

[1] Actually, there are two PROCEL labels. The first looks like a winner's ribbon, focuses on energy efficiency, and covers a variety of appliances and other products. The second label is round, addresses product quality and energy efficiency, and covers only lighting products.

**Figure 3. PROCEL Label Leads to Refrigerator Efficiency Improvements**




Source: Eletrobras

Three additional examples of government programs designed to increase energy efficiency and access to electricity are:

- Luz no Campo (Light at the Rural Zone), which aims to provide electricity to 1 million properties and residences in rural areas within four years;
- PROINFA (Program of Incentive to the Alternatives Electrical Energy Sources), whose main objective is the diversification of the Brazilian energy matrix and the identification of regional renewable energy solutions; and
- RELUZ (National Program for Public Efficient Illumination), which is striving to make energy-efficiency upgrades or installations for over 12 million public lighting systems by 2010.

## USAID Energy Capacity Building Program

USAID's Energy Capacity Building Program is charged with increasing the capacity and ability of Brazilian counterparts to effectively promote sustainable energy generation and use through the provision of training and capacity building activities in the areas of Energy Efficiency Concepts and Technologies, Renewable Energy Project Development, Energy Sector Regulation, and Renewable Energy/Energy Efficiency Financing. The purpose of this program is to enable Brazilian energy sector key actors to learn concepts and methodologies that will contribute to the development of policies, identification of technology cooperation opportunities, and the development of a market for renewable energy.

To accomplish this goal, the first year of the program consists of four major activities:

- **Training.** Designing and implementing training activities focused on developing energy efficiency and renewable energy technologies and practices.

- **Travel and Exchange.** Coordinating international executive exchanges and other invitational travel, linked wherever possible to specific training priorities. For example, in May 2004, five representatives from the Brazilian Renewable Energy Congressional Delegation are expected to travel to the United States for approximately 10 days to visit the US EPA, USAID, US DOE, and the California Energy Commission and to perform field visits.
- **Information Technology (IT).** Developing an IT infrastructure to support the program, including the re-launch of an updated program website, ensuring online access to previous and forthcoming training resources, developing an online training course option for all newly-developed courses, and initiating work to design an "*online community*" to facilitate sustained communication and collaboration among USAID's alumni group.
- **Alumni Association.** Working with USAID to develop the Alumni Association, including refining an overall approach to developing the association, and making use of the *online community* as a principal organizing resource.

The key principles the program seeks to emphasize whenever possible include: 1) **Voluntary, market-based actions** to deploy clean energy technologies can be successfully encouraged based on targeted delivery of information, technical assistance, and promotion; 2) **Valuable "first actions"** can be successfully encouraged by focusing on low-cost or no-cost options, which can build increasing support over time for more costly and ambitious options; and 3) **Sustainability and replicability of outcomes** is best achieved not by focusing solely on technologies and their benefits, but by building support and capacities within organizations for long-term energy strategies.

## Capacity Building Priorities Identified for 2004

ICF's project team in Brazil worked with USAID in late 2003 to hold a series of discussions with key Brazilian agencies involved in energy efficiency and renewable energy policy promotion, to identify key priorities for capacity building activities in 2004. The team met with three key agencies, including:

- Ministry of Mines and Energy (MME)
- PROCEL/Eletrobras
- ANEEL (the national electricity regulation authority)

The outcome of these consultations was a set of broad priority areas for the USAID program, which was expected to inform the development of key training, international exchange, and other activities to be carried out in 2004. Table 2 below summarizes the **nine priority areas** for training and capacity building that emerged from this consultation process.

**Table 2. Training Priorities**

| Priority | Description |
|---|---|
| **Energy Efficiency Law Implementation** | Capacity building among key agency staff involved in developing and implementing policies and programs to support implementation of the Energy Efficiency Law, establishing minimum energy performance standards. |
| **Energy Efficiency in Buildings** | Focus on technologies and other practices that can promote efficiency among both public and commercial buildings, along with analysis of costs/payback for various approaches. |
| **Industrial Energy Efficiency** | Promoting actions among industry to make energy efficiency improvements, independent of public funding (i.e., on a voluntary basis), perhaps leveraging industry associations. |
| **Universal Electrification** | Given the prominence of this issue (approx. 20 million people in Brazil lack electricity), and the existence of the PRODEEM initiative (States and Municipalities Energy Development Program), hold a workshop with case studies to learn from South Africa's and Morocco's experience in this area. |
| **Energy Efficiency & Water Utilities** | Brazil has an active set of initiatives surrounding energy efficiency associated with water utilities, which USAID could leverage through supporting a joint, targeted workshop. |
| **Clean Energy Credits** | Organize a workshop on opportunities for Brazilian organizations to take advantage of international clean energy credits (e.g., CDM opportunities). |
| **Capacity Building for Energy Conservation Teams at Generation Companies** | Design targeted training workshops to build increased capacity among electric generation companies to design and implement energy conservation programs. |
| **Energy Efficiency Labeling** | Build increased capacity in Brazil to design and implement energy efficiency labeling programs (e.g., Selo PROCEL, and/or mandatory labeling programs). Target needs such as: 1) exploring opportunities to collect product and market data through independent, third-party sources, 2) developing strategies to promote more effective collaboration with utilities, which is critical to program success, and 3) developing an Integrated Marketing and Communications approach to make the Selo PROCEL "brand" more visible and valuable in the market. |
| **Renewable Energy Development** | There is a need to consider a variety of possible activities to support renewable energy. ICF has discussed one possible biodiesel generation project in the Amazon with Eletrobras. |

## 2004 Training Modules

From the priority list, five capacity building and training topics were selected as the most immediately relevant for USAID's mission and its principal stakeholders. Each is described briefly below. Trainings will be conducted in various locations in Brazil beginning in March through October.

### Support for Energy Efficiency Law Implementation

Brazil faces an exciting, but challenging time as it prepares to implement its relatively new Energy Efficiency Law. The scope of the Law is broad, as it addresses all energy-consuming equipment and considers energy efficiency throughout the manufacturing process and not simply in the final product. Given that other countries have already established methodologies for similar MEPS programs, a window of opportunity exists now to: 1) share the lessons learned and best practices from these international programs; 2) provide sector-by-sector overviews of energy efficiency opportunities; 3) discuss specific energy-efficient technologies and practices that might be implemented first for the greatest and quickest efficiency gains; and 4) solicit strategies for promoting energy efficiency in the marketplace. Finally, this topic is particularly time sensitive as ANEEL recently recruited 90 new employees who started at the Agency in January 2004 and will play a role in developing and implementing the Law.

### Industrial Energy Efficiency Promotion

As indicated on page 3 of this paper, 44 percent of Brazil's electricity consumption is accounted for by the industrial sector, making it an important target for improving energy efficiency. However, due to limited public funds, the Brazilian government wishes to pursue a voluntary energy efficiency improvement strategy that can be cost effectively implemented in facilities by interested industry groups. This strategy requires the "buy in" of senior management at industrial enterprises and an understanding of their overall business model. Management- and process-focused training for the industrial sector will concentrate on building management-level support for energy efficiency; creating internal management processes to support sustainable efficiency; identifying efficiency opportunities as well as their savings potential and costs; and engaging outside energy service expertise. Several successful programs will be presented as case studies, including the Cleaner Production for Industrial Efficiency Project in Samut Prakarn, Thailand.

### Energy Efficiency in Buildings

Two key lessons have emerged from the US EPA's ENERGY STAR Buildings Program and its many years of work with building owners, ESCOs, and other stakeholders. First, knowledge of what drives energy use and efficiency is critical to improving efficiency. This knowledge gives owners the information they need to prioritize investments, achieve early low-cost successes, and understand how to work more effectively with ESCOs downstream. Second, recent findings from ENERGY STAR Buildings show that high efficiency in buildings does not correlate to having the most efficient technologies. This suggests a need to focus on initial low-cost, high-impact measures such as operations and maintenance. As PROCEL is considering its

next steps for the public buildings initiative, training on these key lessons will allow staff to evaluate the merits of a potentially new approach.

**Sustainable Universal Electrification**

Universal access to electricity is a priority objective of the Government of Brazil, given that electrical services are not available to a significant portion of its rural population. Accordingly, programs such as PRODEEM (the Brazilian program for rural electrification using photovoltaics) and Luz no Campo have been initiated to achieve this important goal. A workshop that showcased similar programs from countries such as South Africa and Morocco would allow Brazilian government representatives to benchmark their progress and to consider new approaches to ensure the sustainability of their efforts over time.

**Water Utility Energy Efficiency**

There are currently several initiatives that have been completed or are in the implementation and planning phases to promote the efficient use of energy at water utilities, which consume 2.3 percent of Brazil's total electrical output (or over 7 billion kWh annually). Many of these initiatives have been conducted in association with the ***Watergy*** program, which is supported by USAID. While water utilities are significant electricity consumers, they also offer opportunities to reduce electricity use rapidly through efficiency. In addition, past efforts have demonstrated that water efficiency and energy efficiency are linked and the greatest benefits come from planning these two activities together. Based on initial discussions with Watergy representatives, there is interest in developing a training course that would complement ongoing or planned activities in Brazil in this area.

## Similar Challenges in Brazil and the United States

**Differentiating and coordinating between voluntary high efficiency specifications and minimum energy performance standards**. Much like the United States, Brazil is moving toward an energy-efficiency strategy that employs three tactics: minimum efficiency standards, mandatory information labels, and a voluntary endorsement label. Each plays an important role in reducing energy consumption:

- Minimum efficiency standards provide some level of savings on every product;
- Mandatory information labels help consumers understand how much energy each product uses; and
- Voluntary endorsement labels help consumers identify an "energy-efficient" product and challenge manufacturers to design more efficient products.

For maximum effectiveness, each of these tactics needs to be coordinated with the other (both in terms of levels and timeframes), so that changes in one area don't diminish the impact in another. For example, with motors in Brazil, the minimum efficiency standard was recently established at the same level as the voluntary PROCEL seal, failing to capture significant *new* energy savings and reducing the seal's value in the marketplace as a differentiator. Looking

forward, Brazil's methodology for establishing standards should include collaboration with voluntary labeling staff.

**Working effectively with manufacturers to push efficiency levels higher**. Energy efficiency programs must find the right balance between aggressive specification enforcement and fostering trusting partnerships with industry. It is critical that industry representatives not drive the process, but rather be important contributors to it. While industry often has access to key pieces of information, such as product energy use and unit shipments/sales, independent third party testing facilities and market research firms are able to provide some of this data, at a cost of course, and should be consulted when evaluating products and markets to confirm and supplement manufacturer data.

**Increasing the use of renewable energy technologies**. Although Brazil has significant hydro resources, it has faced difficulties similar to the United States in getting other renewable energy technologies to be more widely used (e.g., wind and solar power). The US push in wind power was substantially the result of direct policy measures and incentives such as the renewable energy production tax credit, and Renewable Portfolio Standards (RPS). Brazil is currently confronting how to increase wind, solar and other renewable energy technologies in the absence of such supporting policies.

## Successes and Lessons Learned to Date

By the end of April, about half of the 2004 trainings have been completed under the USAID Energy Capacity Building Program. Participant evaluations ranked both the training content and the US and Brazilian instructors as above average. The lowest scores were attributed to the training sites (specifically air conditioning problems) and the Training 2 materials (specifically presentation copies provided in black-and-white as opposed to color).

Two key insights on the Brazilian market have been gleamed from the trainings:

- **A Contradiction**. While there are many efforts to reduce energy consumption, subsidies continue to be provided to major industries. A more effective strategy might tie energy efficiency to the subsidy. In other words, the subsidy would only be granted to an industrial energy consumer as a reward for operating at a certain specified level of efficiency.
- **Energy Management**. The concept of energy management and long-term planning as a framework to drive energy efficiency improvements is not well established in Brazil. Many enterprises or industrial companies do not view energy management as being as important as labor and other issues. Industry's uncertainty about how to tackle energy issues may be a reflection, in part, of Brazil's regulatory framework, which has been undergoing changes. Ideally, operational excellence should be viewed as a no to low cost imperative for saving energy reliably into the future.

As with any new project, there are lessons learned along the way. First, a variety of programs are operating in Brazil with overlapping focus. To generate more interest in and attendance at the trainings, care must be taken to select new and/or unique topics. Second, highlighting demonstration projects may be one way to educate a more risk averse audience. Of course, explaining the failures as well as the successes is crucial, as the failures discussion can include pitfalls and how to avoid them. Third, trainings should encourage and allow for

significant participant engagement through practical sessions, problem solving exercises, or other efforts.

## Preliminary Plans for 2005

Based on the training evaluations and discussions with training participants during the breaks, our preliminary training plans for 2005 include the following:

- **More in depth focus on energy efficiency in public and commercial buildings**. PROCEL's mission and staffing are changing to include a greater focus on energy efficiency in buildings. ENERGY STAR and other international programs offer a wealth of experience that PROCEL can evaluate and incorporate into its program as appropriate. Future training sessions might have a more narrow and technical focus, such as benchmarking buildings or leveraging investors and financial media to provide incentive and recognition.
- **A more hands-on training environment**. Sitting through six to eight hours of lecture can be tiring no matter how interesting the topic is. While varying language skills may make this more challenging, future sessions will strive to increase the level of instructor to participant interaction as well as interaction among participants through role playing, brainstorming, and other exercises.
- **Better coordination with other training/capacity building programs in Brazil**. As noted in the Lessons Learned section, there are other programs operating in Brazil with similar missions. Coordination with them will continue to be key in 2005 and beyond. While much of this year's training topics have focused on energy efficiency, one way to differentiate may be by increasing the mix of renewable energy topics for the 2005 trainings.

Consistent with the approach for 2004, priority training areas for next year will be informed by discussions with key Brazilian agencies and stakeholders and finalized in late 2004/early 2005. The latest program information is available through USAID's Energy Capacity Building Program Website at www.brazilenergy.org.

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