

THE EMERGING ESCO INDUSTRY IN BRAZIL

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1. The Brazilian Context

A. Introduction

A significant number of companies providing energy efficiency services have begun to operate in Brazil. These firms are helping commercial and industrial consumers to identify energy conservation opportunities and implement energy savings projects, along with providing other energy-related services.

The purpose of this report is to provide an up-to-date portrait of this emerging industry in Brazil, including factors influencing its development, for both domestic and international organizations with interest in the subject.

The firms in this new industry are generally referred to as ESCOs in Brazil. The great majority still operate exclusively with traditional fixed fee contracts. While some have begun individually to develop elements of performance and risk contracts as a marketing tool - the adaptation of these concepts is incipient and broadly accepted standards have not yet been developed. Few, if any, firms would yet qualify as an ESCO in the strict definition of the term as a performance contractor.¹ There has been a strong and legitimate desire on the part of firms to distinguish their energy efficiency services from those of general engineering consultants, and the term ESCO helped to fill a void.

This report uses the term ESCO according to common Brazilian usage - that is, including fixed fee contracting.² When appropriate specific reference will be made to energy performance contracting (EPC). This distinction is important in terms of the service offered and since some firms in this broader ESCO pool have begun to or are planning to make the transition to EPC.

The remainder of this chapter reviews commercial and industrial energy use in Brazil, energy prices, and energy conservation potential specifically in the area of electricity use. Chapter II covers the status of ESCOs in Brazil, the types of services they are providing, the size of the ESCO market, market barriers, third party financing options, and support being provided to ESCOs by governmental, utility, and non-profit organizations. Chapter III presents some examples of projects that have been implemented by ESCOs in Brazil and the lessons that these projects teach. Chapter IV discusses opportunities for foreign ESCOs in Brazil. Chapter V draws some conclusions about the situation and near term needs of ESCOs in Brazil, and presents our recommended actions for building up this market. Appendix A contains brief profiles of 19 ESCOs, while Appendix B provides other useful contacts.

¹ See R.D. Cudahy & T.K. Dreessen, A Review of the Energy Service Company (ESCO) Industry in the United States, prepared for the Industry and Energy Department, The World Bank, Washington D.C., March 1996; INEE, Proceedings of the I Workshop on ESCOs in Brazil, Rio de Janeiro, May 1995.

² There is in fact no accepted term as yet in Brazilian Portuguese. In the Portuguese version of this report we use the term ESE, a literal translation which is also widely used, for Brazilian firms.

B. Energy Use in the Commercial and Industrial Sectors

The profile of energy use in Brazil is shown by sector in Table 1.1 for 1995, the last year for which complete data are available. The sectors of greatest interest are the industrial, commercial and public sectors.

The industrial sector accounts for 42% of total energy consumption and more than half electricity consumption (when self-generation is included). It is also the largest consumer of fuels. The large share of biomass fuels is a distinctive characteristic of Brazilian industry.³ The penetration of natural gas is still quite small, but is expected to increase rapidly in the late 1990s as domestic production expands and gas imports begin on a significant scale. A large share of industrial energy consumption is concentrated in a relatively small number of sectors.

In 1995, the top five industrial sectors accounted for 76% of total industrial energy use (79% of fuel use and 68% of electricity). These industries are: iron and steel (27.7%), food and beverages (22.6%), paper and pulp (9.4%), chemicals (9.2%), and aluminum and other non-ferrous metals (7.0%).

In the commercial and public sectors, fuel use is very small. This is due to the small need for space heating as well as the limited penetration of natural gas, which could compete in some functions. Electricity dominates in these sectors, accounting for 75% of total energy use.

Table 1.1
Final Energy Consumption - 1995
(Excludes the Energy Sector)

Sector	Thousand TOE ^a						Total
	Oil	Gas	Coal	Biomass ^b	Fuels	Electricity ^c	
Industrial	9798	1935	9042	18783	39558	10171	49729
Feedstock etc.	9069	1034	74	595	10772	0	10772
Commercial	442	42	0	143	627	2559	3186
Public	642	8	0	3	653	1819	2472
Agriculture	4237	0	0	7	4244	708	4952
Transport	32758	42	0	6686	39486	96	39582
Residential	5805	89	0	423	6317	5058	11375
Total	62751	3150	9116	26640	101657	20412	122069

Based on Balanço Energético Nacional, 1996.

^a A ton oil equivalent is equivalent to 10.8 Gcal, or 45.2 GJ.

^b Excludes residential and agricultural fuelwood consumption.

^c At 860 kcal/kWh or 0.08 TOE/MWh, which is the direct energy content only.

^d Alcohol for vehicles.

³ Sugarcane residues (used also in other agroindustries), metalurgical charcoal, and pulp industry residues are the principal inputs.

Electricity use increased at only 2.6%/yr on average during 1985-95. This low growth rate reflected the economic stagnation of the late 1980s and early 90s. However, with the beginning of greater macroeconomic economic stability in 1994, economic and electricity demand growth accelerated. The average annual growth rate of electricity demand from 1993 to 1996 was 5.1%.

Table 1.2 shows longer term changes in the profile of electricity demand. Industry's share has fallen since the early 1980s. The pattern of growth since 1993 strengthened this trend, with rising shares for residential and commercial consumption.

Table 1.2
Utility Sales by Consumer Class
(% of Sales Volume)

Sector	1980	1990	1995
Industry	54.0	49.8	45.8
Residential	20.3	23.9	26.1
Commercial	12.0	11.9	13.2
Government	12.0	11.2	11.2
Other/Rural	1.7	3.2	3.7
Total (TWh)	114	201	243

In fact, residential electricity use increased 30% and commercial/public sector use increased 31% during 1990-95, while industrial electricity use increased only 14% during this period. Like overall energy use, industrial electricity use is concentrated in relatively few sectors. As of 1995, the following industries consumed 68% of total industrial electricity use: aluminum and other non-ferrous metals (22.5%), iron and steel (16.1%), chemicals (11.6%), food and beverages (10.0%), and paper and pulp (7.8%).

Another perspective is to examine electricity going to end use energy “services” - such as lighting, refrigeration, etc. It intrinsically involves a greater degree of estimation, and calibrating surveys are still scarce. Table 1.3 shows estimates of electricity end use shares in the residential, commercial and public services, and industrial sectors in Brazil as of the late 1980s and early 1990s.

Table 1.3
Electricity Use by End Use Service (%)

End-Use	Residential	Comm & Public	Industry
Electronics/TV	8	-	-
Lighting	25	44	2
Other appliances	8	11	-
Refrigeration	32	17	-
Air conditioning	7	20	-
Water heating/boiling	20	-	10
Furnaces	-	-	32
Cooking	-	8	-
Electrochemistry	-	-	7
Motive Power	-	-	49

Sector Consumption 1995 (TWh)	63.5	54.9	127.7
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While these estimates are based on surveys and data that are 5-10 years old, end use shares are probably similar today. The national electricity conservation program - PROCEL - is conducting various surveys over the next two years to update these end-use breakdowns and better understand the changes in electricity use taking place in Brazil.

The estimates in Table 1.3 show the importance of: (1) motor systems in the industrial sector, and (2) lighting in the commercial and public buildings sectors. Also, air conditioning overall accounts for about 20% of electricity use in commercial buildings, but can be a higher share in buildings with central air conditioning.

C. The Electricity Market

Electricity pricing has long been a factor inhibiting adoption of conservation measures. Successive governments lowered electricity tariffs as part of short term policies to slow inflation. The average electricity price in Brazil dropped almost 50% from the early 1970s to 1993, when it fell to less than US\$ 35/MWh. However, the process was not continuous. At times a countervailing policy seeking tariff realism would predominate. This resulted in large oscillations in the average tariff. These oscillations, on top of high inflation, created additional planning problems for both energy suppliers and consumers.

A new direction in pricing policy began in 1993, as part of the beginning of the reform of the power sector. This reform has been gathering momentum and will be far-reaching regarding both the regulatory environment of the power sector and its ownership.

An early step was the decentralization of price setting and regulation. From 1974 to 1993, there was a single national rate schedule for each consumer category. Since 1993, rates have been differentiated at the utility level. Though the practical consequences so far have been small in terms of differences in tariffs among utilities, the tendency will be for the differences to grow.

The beginning of reform led to a rapid increase in the average tariff to consumers from its historic low-point in April, 1993 to the end of that year. Later prices plateaued and there was a freeze over the first 18 months of the *Plano Real*, beginning in mid-1994. In November, 1995, there were sweeping tariff increases, followed by another smaller round in March, 1996. The increases were concentrated on medium and low voltage business and residential consumers, especially the latter.

The national average has remained around US\$ 70/Mwh since December, 1995. There appears to have been a successful transition to a sustained tariff level that is adequate for most distribution

and verticalized utilities, though bulk generators continue to be in a difficult situation.⁴ Indeed, the average tariff is now above the U.S. level, though some care is needed with comparisons.

Various factors will contribute to the practice of more realistic and stable electricity prices than characterized the period 1980-1993. Chief among these are the privatization of many parts of the power sector⁵ and the decentralization of rate setting already referred to. There will also be an upward pressure on bulk supply tariffs for distribution utilities. This may squeeze the rather generous distribution margins which many now enjoy in preparation for or following privatization.

There are big differences in the prices paid by different classes of consumers, as shown in Table 1.4. Larger/higher voltage industrial consumers (classes A1 & A2) still pay a relatively low tariff of under \$35/MWh. However, many commercial consumers (B3 in the table) pay over \$100/MWh.

Table 1.4
Average Tariffs by Voltage and Consumer Class
(excludes ICMS ad valorem tax)

Subgroup	Voltage/Class	US\$/MWh (current) ¹	
		12/1995	09/1996
A1	230 kV or more	26.07	28.99
A2	88 - 138 kV	34.34	35.96
A3	69 kV	52.50	49.53
A3a	30 - 40 kV	58.89	56.21
A4	2.3 - 25 kV	67.76	69.33
AS	Subterranean	75.31	87.12
Total A	Medium & high voltage	48.30	49.91
B1	Residential	110.35	103.51
B2	Rural	69.37	68.83
B3	Other	109.92	111.35
B4	Public lighting	63.62	63.74
Total B	Low voltage	103.93	100.37
Total A & B	.....	70.93	70.07

¹ Official exchange rate in 12/95 was R\$ 0.96 per US\$; in 09/96 1.02.

The precise accompaniment of tariff structure has become more complex with the differentiation and decentralization of rate-setting. There are also differences between states in the application of the ICMS value added tax.⁶ In addition, higher voltage consumers (i.e. industries and commercial

⁴ Most power is produced by five bulk generators (plus Itaipú) and sold to consumers through more than 25 distribution utilities. About 1/3 of sales are by utilities with strong vertical integration.

⁵ Three distribution utilities with nearly 13% of total sales have already been privatized and others are scheduled to be privatized soon.

⁶ In addition to the basic electricity rate, most consumers pay the ad valorem ICMS tax, which varies from 15 to 20% depending on the State and the consumer category. The consumer thus sees a higher price than the basic rate usually

buildings) have the option of a time-of-use tariff, known as the “blue tariff” in Brazil. Table 1.5 displays this tariff for Eletropaulo, the largest distribution utility in Brazil. The tariff consists of an energy and a maximum demand charge, as well as a differentiation of peak and off-peak, and wet versus dry season power. The first factor varies far more than the second.

Table 1.5
Time-of-Use Rate Schedule of Eletropaulo, July 1996¹
(Blue Tariff)

A. Demand (US\$/MW)

Consumer Category		Wet Season		Dry Season	
Code	Characteristics	Peak	Off-Peak	Peak	Off-Peak
A-1	230 kV or more	6.83	1.43	6.83	1.43
A-2	88 - 138 kV	7.35	1.70	7.35	1.70
A-3	69 kV	9.85	2.68	9.85	2.68
A-4	2.3-25 kV - Blue Tariff	11.94	3.98	11.94	3.98
	- Green Tariff	3.98		3.98	

B. Consumption (US\$/MWh)

Consumer Category		Wet Season		Dry Season	
Code	Characteristics	Peak	Off-Peak	Peak	Off-Peak
A-1	230 kV or more	34.01	23.38	38.89	27.51
A-2	88 - 138 kV	38.45	27.09	41.21	29.53
A-3	69 kV	41.40	27.76	46.68	32.16
A-4	2.3-25 kV - Blue Tariff	72.45	32.89	78.29	37.23
	- Green Tariff	348.46	32.89	354.27	37.23

¹ Official exchange rate in 07/96 was R\$ 1.00/ US\$.

In addition to the blue tariff, A-4 consumers who receive power at 2.3-25 kV have the choice of a "green tariff" which features a much larger on-peak energy charge, but a lower demand charge than the blue tariff. This tariff gives consumers an even greater incentive to manage and reduce load during the peak demand period, which is typically about two hours long during the early evening. The wide use and availability of time-of-use rates presents opportunities for ESCOs to help consumers reduce their electricity bills through load management and in some cases changing rate schedules.

Including the ICMS tax where appropriate, most residential and commercial consumers pay electricity prices that are similar to or higher than the level in many industrialized countries. The commercial sector in particular presents an attractive market for ESCOs and energy efficiency prospects. Medium voltage (A4) industrial customers also have an incentive to conserve.

published. Most intermediaries can deduct the ICMS paid, though many fail to do this.

The reduction in the rate of investment of the power sector in 1990-95 has led to a situation of increasing possibility of generation supply shortages.⁷ Even the precarious balance in official plans depends on the timely completion of several problematic large projects. Before shortages in generation occur - with consequent rationing - the transmission system will be a bottleneck, provoking periodic blackouts and voltage oscillations. It is already seriously stressed. These prospects are influencing both public policy and business postures towards energy optimization.

At the level of public policy, urgency has been added to the already vigorously expanding national program to reduce losses of electricity - PROCEL. An increasing number of utilities are developing programs to limit load growth. Some of these measures will have impacts on the market for ESCO services, as described in Section II.D. However, it is important to emphasize that public policy is not driven primarily by the risk of rationing.

At the level of business and consumers, the rationing threat may have an ambiguous impact on behavior. On the one hand it captures firms' attention regarding doing something about energy waste. This is useful because the priority given the subject is usually very low. Unfortunately, it presents a disincentive as well. As long as rationing is applied equally across the board, the current rule, businesses that invest in efficiency before rationing could be hurt more severely by it than those who continue to waste energy (i.e. businesses may be motivated to maintain "fat" so that they are better able to adapt to a cut in power consumption, should this be necessary).

D. Fuels

Strategic concerns with supply adequacy together with the profile of energy use, especially in the buildings sector (which is likely to be the biggest near term market for ESCOs), mean that electricity end-use will be the main target for ESCOs in the coming years. However, the rapid expansion of natural gas availability may lead to a general wave of energy re-optimizations, opening additional market opportunities for ESCOs in both industry and commerce.

Industrial natural gas use increased by 47% between 1990 and 1995, but still accounted for just 2.5% of total industrial energy use as of 1995. As of that year, industrial consumption of petroleum products was five times greater than natural gas use. However, gas use is expected to increase substantially in the next few years due primarily to the construction of a natural gas pipeline from Bolivia. One study estimates that natural gas availability in the South-Southeast regions of Brazil will more than double once this pipeline is completed in the late 1990s.⁸ It is expected that there will be considerable competition for this gas among consumers, including utilities, independent power producers, and industries interested in cogeneration or fuel substitution.

There is considerable scope for cogeneration in Brazil over a wide range of scales. Besides the increased availability of gas, changes in the regulatory framework provide a stimulus for cogeneration. These changes have introduced competition for most new generation capacity and

⁷ Given the fact that Brazil's grid is ~98% hydro, potential supply deficits should always be viewed as a probability.

⁸ S.V. Bajay and M.G. Rodrigues, "Diagnóstico e Perspectivas do Setor de Gás Natural no Brasil", *Revista Brasileira de Energia* 5 (1), 1996, pp. 24-47.

much competition for providing power to larger consumers.⁹ Cogeneration systems may be an important entry point for ESCOs in the Brazilian efficiency market. Once inside the plant or building, it is natural to do a general energy optimization.

The price trends for important fuels are shown in Table 1.6. It can be seen that the price of key fuels (fuel oil and natural gas) fell by more than two-thirds between 1985 and 1995. Also the price of coal fell in the late 1980s. Of course the decline in fuel prices reduces the cost effectiveness of, as well as consumer interest in energy efficiency improvements.

In addition to fossil fuels, the industrial use of biomass is large and generally even less efficient. This can open some niche markets for ESCOs, either in improving the efficiency of fuel use or for fuel switching projects.

Table 1.6
Prices of Important Fuels

Fuel	Average Price (US\$ of 1995 per barrel equiv of oil)			
	1980	1985	1990	1995
Imported oil	56.1	41.5	26.7	15.9
LPG	140.8	132.9	66.9	51.2
Diesel	196.5	211.9	96.4	63.2
Fuel oil	77.1	96.8	49.5	27.9
Natural gas (fuel)	129.7	123.0	50.2	23.0
Steam coal	25.1	27.8	18.5	19.1

E. Conservation Potential

The potential for energy savings can be viewed in a number of ways. One way is the "technical potential", assuming that energy efficiency measures are used wherever technically feasible. Another way is the "economic potential", assuming that energy efficiency measures are used wherever cost effective, with some particular methodology used to determine cost effectiveness. Yet a third way is to consider "achievable potential", where market barriers and limits to adoption are considered in estimating savings potential. Whichever way is used to estimate savings potential, there are many opportunities to use energy more efficiently in Brazil, and the overall savings potential is large.

With regard to electricity, one national study completed in 1991 estimates a total cost-effective savings potential of 111 TWh (24%) by 2010.¹⁰ This study only considers end-use efficiency

⁹ The figure of the Independent Power Producer (IPP) was created in 1995, with an important rule-making in 1996. Distribution utilities must tender competitive bids for outside power. At the same time, IPPs have direct access, in principle, to all existing loads above 10 MW served at 69 kV or higher. The market is 80 TWh/yr, though existing tariffs in the highest voltage categories are unrealistically low for competition.

¹⁰ See H.S. Geller, Efficient Electricity Use: A Development Strategy for Brazil, American Council for an Energy Efficient Economy, Washington DC, 1991.

improvements, and the efficiency measures taken together have an estimated average cost of saved energy of only \$24/MWh (based on a 10% real discount rate). The most important measures in terms of savings potential are low-cost industrial efficiency improvements, more efficient refrigerators, lighting efficiency improvements in commercial buildings, and industrial motor speed controls.

In commercial and public buildings, lighting is the largest end use and often the largest energy savings "resource". Electricity savings of 60% or more are technically and often economically feasible through use of more efficient lamps, ballasts, light fixtures, and controls. A wide range of energy-efficient lighting technologies are now available and sold in Brazil including compact fluorescent lamps, T8 triphospher fluorescent lamps, sodium vapor lamps, metal halide lamps, electronic ballasts, occupancy sensors, and specular reflectors for fluorescent fixtures. Sales of compact fluorescent lamps, for example, have reached the level of 3 million units per year and are growing about 25% per year. The vast majority of these lamps are used in the commercial sector. Use of electronic ballasts and specular reflectors is more limited, with about 1.2 million of the former and 300,000 of the latter sold in 1996.¹¹ But sales and use of these products is increasing rapidly.

Existing fluorescent lighting in Brazil is often inefficient and of poor quality, with fixtures that lack reflectors, that are highly enclosed thereby limiting light output, are very dirty, are poorly located, etc. This means that the savings potential using a combination of improved technologies and improved lighting design can be even greater than that typically found in industrialized countries. To cite one example, a lighting retrofit of a bank building in Sao Paulo, including new fixtures, electronic ballasts, T8 lamps, and an improved lighting design, resulted in 78% electricity savings with greater useful light output and improved visual comfort at the same time. The payback period for this project was only 11 months.¹²

In commercial buildings with air conditioning, large savings are possible through a combination of reducing thermal gains, use of more efficient cooling technologies, and improved system control. For example, a retrofit of a seven story Banco do Brasil office building in Varginha, MG, including measures to reduce thermal entry, improvements in the air conditioning system, installation of more efficient lamps, and more efficient building operation, resulted in a 38% reduction in electricity use.¹³ Furthermore, the centrifugal chillers typically used in large air conditioned buildings in Brazil are relatively inefficient, consuming 30-50% more electricity per unit of output compared to more efficient equipment available today.¹⁴ Thermal storage systems can be cost-effective in larger

According to this study, achieving 111 TWh of savings by 2010 would cut the average growth in electricity demand during 1990-2010 from about 4.5%/yr to 2.6%/yr.

¹¹ See H.S. Geller, P.A. Leonelli, R. Monteiro, and I. Araujo, "Energy-Efficient Lighting in Brazil: Market Evolution, Electricity Savings, and Public Policies", PROCEL/Eletrobras, 1997.

¹² "O Banco BNL e a Racionalização de Energia", Boletim Informação sobre o Uso Racional de Energia, Agência para Aplicação de Energia, São Paulo, julho/agosto, 1995.

¹³ See "Conservação de Energia - Um Bom Negócio", pamphlet published by PROCEL, CEMIG, and Banco do Brasil, no date.

¹⁴ Personal communication with José Carlos Felamingo, Union RHAC, São Paulo, November 1995.

commercial buildings with central air conditioning, given the time-of-use tariffs with separate energy and demand charges.

Energy waste can be especially large in public buildings. Audits of six state buildings in Bahia showed an average electricity savings potential of 28% from efficiency measures with an average payback of 2.4 years.¹⁵ A retrofit of the Ministry of Mines and Energy building in Brasilia has been completed and demonstrated a 60% reduction in lighting electricity use through delamping (the building was previously overlit) and installation of distributed light switches. This project, implemented by an ESCO hired by the local utility in Brasilia, had a payback period of less than 12 months.

There is a large market for installation of building control and automation systems, both in new and existing buildings. The market has been driven so far by non-energy factors, but building owners are discovering that the main tangible and predictable cash flow benefit is energy savings.

In the industrial sector, motors systems account for about half of electricity use. Their efficiency can be improved in a number of ways, including use of high efficiency motors, variable speed motor drives, replacing and downsizing greatly oversized motors, and making power supply improvements in situations with improper voltage, phase unbalance, etc. Field studies have found that around 24% of industrial motors in Brazil are operating at loads under 50% of their nominal capacity and are excellent targets for downsizing.¹⁶ Replacing oversized motors can be very cost effective.

In applications with highly varying motor load, electronic adjustable speed drives (ASDs) can be cost effective, with typical payback periods of one to four years.¹⁷ State-of-the-art ASDs are manufactured by one Brazilian company (Weg Acionamentos) as well as imported by major multinational companies such as Siemens, ABB, Reliance, and Toshiba.

In addition, there is a market for power factor improvement projects. Beginning in 1993, medium and high voltage consumers in Brazil were required to achieve a minimum power factor of 0.92. Penalties are charged if consumers fail to meet this minimum level.

PROCEL has set long-term energy savings goals which have been incorporated in the latest strategic plan for Brazil's electricity sector- the Plan 2015.¹⁸ It calls for about 75 TWh of end-use electricity savings in 2015, which is about an 11% reduction of the projected demand that year without the implementation of conservation measures.

¹⁵ See L.C.A. Alves and R.S. David, "Eficiência Energética em Edifícios Públicos: Experiência na Bahia", Secretaria de Energia, Transportes, and Comunicações, Estado da Bahia, 1996.

¹⁶ R.P. Tabosa and G.A. Soares, "Ações tecnológicas de conservação de energia em motores e acionamentos", Eletricidade Moderna, No. 263, fevereiro 1996, pag. 36-48.

¹⁷ "Electric Energy Conservation with Adjustable Speed Drives in the Petrochemical Industry", CEPEL, Rio de Janeiro, 1995. An ASD demonstration project at a Petrobrás refinery resulted in 90-95% electricity savings in two pumps, with a simple payback period of about seven months.

¹⁸ An other goal of PROCEL is to reduce transmission and distribution losses from 17% to 10% of generation by 2015.

A recent evaluation shows that PROCEL stimulated about 800 GWh/yr of electricity savings due to actions taken in 1996 alone. Based on cumulative actions, PROCEL stimulated energy savings of about 2.45 TWh/yr as of 1996, equivalent to energy typically supplied by about 550 MW of hydro capacity or nearly 1% of the actual electricity use in 1996.¹⁹

Less is known about fuel conservation potential, though it is undoubtedly large. This uncertainty includes the potential for cogeneration. This is conservatively estimated to be equivalent to at least 10% of today's generation nationwide, or more than 25 TWh/yr.

Information on potential is still fragmentary. According to a study completed in 1995 for the State of Rio de Janeiro, the cogeneration potential is 2.0-10.2 TWh/yr depending on the type of technology used.²⁰ This is equivalent to 7.5 -38% of the total electricity use in the State of Rio. The study pointed out that the realization of this cogeneration potential was discouraged by: 1) relatively low industrial electricity prices and relatively high natural gas prices; and 2) unwillingness on the part of distribution utilities to provide adequate contracts for purchasing excess electricity or providing back-up power. Legislation, rule-making and price trends since that time have reduced but not eliminated these problems.²¹ The Ministry of Mines and Energy has organized a Task Force to address public policy elements in the remaining barriers. The logic of the reform of the power sector underway points to an opening of this market.

In the early 1980s, a program known as CONSERVE was started to encourage conservation of petroleum products and fuel substitution in Brazil. The program sponsored audits, reached accords for oil savings targets with major sectors, and offered low-interest loans for project implementation through the BNDES. This program was relatively successful, although substitution predominated over efficiency improvements. Some sectors, such as iron/steel and pulp/paper, reduced their oil consumption by more than 30% between 1979 and 1985.

The nearly 600 industrial audits sponsored by CONSERVE estimated an average oil products conservation potential of 16.5% with a payback period of only 8 months on average. Follow-up studies show that while many housekeeping measures and simple retrofits were implemented, very few industries adopted major process.²² Considerable potential still exists for increasing the efficiency of fuel use in industry. One recent study estimates a cost-effective savings potential of 15-21% in four fuel-intensive sectors: steel, chemicals, pulp/paper, and cement.²³ The main energy

¹⁹ PROCEL, "Economia de Energia e Redução de Demanda na Ponta em 1996 e Revisão dos Resultados Obtidos Entre 1993-1995", Eletrobrás, Rio de Janeiro, 1997.

²⁰ A. Oliveira, "Cogeração no Estado do Rio de Janeiro: Oportunidades e Desafios", IEI/UFRJ, Rio de Janeiro, April 1995. The study involved research in 61 companies.

²¹ INEE accompanies these changes closely and has organized various workshops on the subject of competitive power generation, whose proceedings are published. New materials specific to cogeneration will soon be available.

²² J.L. Araújo, A. Oliveira, M. Piccinini, and L. Navegantes, "Rational Energy Use in Brazil: Policies, Programs, Results", COPPE and IEI/UFRJ, Rio de Janeiro, 1993.

²³ M.F. Henriques Jr., "Melhoria da Eficiência Energética e Potencial de Economia de Energia na Indústria Energo-Intensiva Brasileira", Anais do VII Congresso Brasileiro de Energia, COPPE/UFRJ, Rio de Janeiro, 1996, pp. 2427-2439.

efficiency measures considered were combustion control, heat recovery, and better thermal insulation.

While fuel conservation potential is substantial, the recent stability of fuel prices at a relatively low level makes it of limited priority to most industries. The national program to promote conservation of oil and gas derivatives - CONPET - is also much less active in addressing the market barriers to efficiency in industry than is PROCEL. Nevertheless, the process of switching to natural gas, which many manufacturing and service industries will experience over the next few years, can open a window of opportunity for rationalizing fuel use.

II. The Emerging ESCO Market

A. The Situation of ESCOs in Brazil

An explicit market for energy efficiency services began to appear in the late 1970s and early 80s in the wake of the second oil shock and subsequent government measures. The emphasis was on industrial use of oil derivatives and frequently involved fuel substitution more than efficiency. The fall of oil prices in the mid-1980s shrunk this market, though a new impetus appeared for a time with the beginning of the PROCEL program in 1986. This stimulated many audits of electricity use but fewer investments in actual retrofits.

The macro-economic turbulence in the early 90s and the decline of PROCEL and related utility programs at that time brought the market for energy efficiency services to a low ebb. Over this period numerous firms moved into other consulting services. Anecdotal evidence suggests that some went into areas such as environmental engineering and building controls. Many left consulting altogether or drastically reduced their scale of operations. The past decade in Brazil has been a difficult period for engineering services in general.

Over the past couple of years the situation has become more favorable, including low inflation, higher and more stable energy prices, and the reactivation of support programs (see below). The concern with the possibility of rationing is also stimulating some interest among potential clients. As a result, the number and activity of firms in the energy efficiency services market has been rising.

The estimate of the size and scope of ESCOs in Brazil today depends on the definition of an ESCO. Employing the broad definition made in the Introduction, there are something like 30 active "emerging ESCOs" in Brazil as of 1995-96.²⁴ Most are relatively small, independent engineering or consulting firms. Larger domestic engineering firms have so far shown little interest, perhaps because of the small scale of many projects. However, at least one larger firm of this type is now entering the market.

Some multinational equipment manufacturers already present in Brazil which have ESCO subsidiaries abroad (e.g. Honeywell, Johnson Controls and Landis & Gyr), are beginning to develop domestic ESCO capability. Johnson Controls Inc, in particular, has started a small ESCO within its Brazilian subsidiary. Others (such as Phillips) are exploring the use ESCOs and performance contracting as a marketing channel for their products, but so far with limited results.

There has been no systematic survey until now on emerging ESCOs in the market today.²⁵ In order to begin filling this gap, a questionnaire was circulated at the *II International ESCO Workshop* held in São Paulo in November 1996, and subsequently sent to other firms who could

²⁴ Estimate made by Isac Roizenblatt, Philips do Brasil Ltda., São Paulo, Nov. 1995.

²⁵ A first limited attempt was carried out in 1994 by INEE, ABCE & SEBRAE. It involved almost 500 firms. However, targeting problems and the incipient nature of the industry at the time make it of limited value today.

not attend or did not respond at the time. Annex A presents short profiles of firms responding to date. While the survey is still far from complete, we believe it to be representative of the more active firms. It will be expanded and updated on an ongoing basis, with the results available on a website.

Despite the limits of existing survey data, the information we have collected along with extensive contacts with firms in or entering the market permit some generalizations. First, the emerging ESCOs in Brazil tend to be specialized based on the expertise of the key individuals in each firm. For example, we are aware of one or more ESCOs specializing in the following areas:

- 1) lighting fixture retrofits;
- 2) commercial air conditioning systems;
- 3) building control systems;
- 4) water and sanitation systems;
- 5) public sector building audits and retrofits.
- 6) small-scale cogeneration

Also, some Brazilian ESCOs are developing relationships with foreign manufacturers of energy-efficient products including a number of U.S. companies. For example, Negawatt has obtained the rights to import and distribute silver film specular reflectors from both Prefinish Metals and Alcoa Bright in Brazil. This specialization has helped the ESCOs to develop market niches, but also has limited the growth potential for individual companies.

Second, Brazilian ESCOs often sell and provide a wide range of services for their clients in addition to the implementation of energy efficiency projects. These services include:

- 1) renegotiation of power supply contracts;
- 2) energy auditing;
- 3) peak demand reduction;
- 4) power factor correction;
- 5) building control systems;
- 6) HVAC systems;
- 7) improved power quality;
- 8) voltage upgrading;
- 9) industrial process improvement;
- 10) staff training;
- 11) operations and maintenance programs;
- 12) monitoring and data bases.

While most emerging ESCOs are specializing in one or a few of these areas, some are offering a wide range of these services (e.g., see the Teknergia case study in Chapter III).

Third, the emerging ESCOs in Brazil generally lack capital for project financing or working capital for expansion. Given the lack of functioning third party financing in Brazil (see financing section below), the ESCOs usually depend on clients providing their own project financing. A few Brazilian ESCOs have reached the stage where they can self-finance some smaller projects

(R\$50,000 or less) for clients, with payment provided over time on a fixed fee or shared savings basis.

Fourth, regarding contracts, most energy efficiency projects in Brazil are done on a fixed fee basis. However, some firms (see Annex A) have experience in negotiating and implementing shared savings contracts (also known as performance or risk contracts). In this case, the ESCO will spend a modest amount of its own money on low-cost measures and O&M improvements, with payment based on a fraction of the resulting energy bill savings. One of these companies reports that its shared savings projects have been problematic, with clients in some cases disputing the energy savings results or refusing to honor the contract terms.²⁶

The related concept of a guaranteed minimum level of savings is new in Brazil and is rarely included as part of contracts and projects. Likewise, performance monitoring and verification is at a very early stage of development and use. This can contribute to the kind of problem just cited. Some Brazilian ESCOs are keenly interested in advancing in these areas, in part by developing closer ties to or joint ventures with foreign ESCOs. It is uncertain how long it will take to test these concepts and adapt them to the realities of the business environment in Brazil.

The current level of ESCO activity is somewhat uncertain. Only a relatively small share of energy-efficient equipment sales to industry and commerce pass through ESCOs. Indications are, however, that the ESCO market is growing quite rapidly. Many ESCO projects tend to involve O&M improvements or relatively low-cost, limited retrofits, with the total project costing US\$ 50,000 or less. ESCO projects in excess of \$200,000 are still scarce, but a few multi-million dollar projects have been implemented. Based on the survey results in Annex A, we estimate that in 1996 all ESCOs implemented about 125 projects with a total value of roughly US\$ 16-17 million.²⁷

Our survey indicates that there are six leading ESCOs, each having implemented projects whose value totaled over one million dollars. Two of these ESCOs report projects totalling more than U.S.\$ 20 million. The ESCO market appears to be growing rapidly, with about 25% of all projects in the data base implemented in 1996²⁸.

B. Market Barriers

The marketing of energy efficiency measures and services in Brazil has not been easy. Firms seeking to sell energy efficiency services have confronted a series of reasons why the potential client is often not interested. This litany usually boils down to a few basic problems:

1. The lack of **priority** for energy in most businesses relative to other activities. Energy is generally a small part of the cost of doing business and often treated as a fixed cost.
2. The related lack of **awareness** of consumers regarding their energy losses and what can be done, as well as the limitations of in-house capability.

²⁶ Personal communicatin with Ricardo da Silva David, Ecoluz Consultores, Salvador, Bahia Nov. 1995.

²⁷ These estimates are based on the assumption that 80% of all projects in 1996 were implemented by the companies included in Annex A.

²⁸ Anecdotal reports suggest that growth is continuing in 1997.

3. The lack of **credibility** of energy consulting - the quality of consulting has been uneven. Firms with few projects and references (as many still are) are often viewed with skepticism. Sometimes there are also issues of **confidentiality** of information gained about the client's processes.
4. The lack of third party **financing**, if the consumer can't finance the investment with internal resources. There has been essentially no long-term private bank project financing. Shorter-term financing is very expensive. Public development bank financing, while available in theory, has not reached ESCOs or ESCO projects yet in practice (see below).

If these barriers are overcome, other problems can appear. There can be difficulty in getting customers to take decisions. There are often multiple decision-makers, leading to high transaction costs. Another problem has been the renegotiation of energy supply contracts between the customer and distribution utility once the investment has been made.²⁹

Some problems are common to establishing a new industry, others have their roots in more specific conditions of the country and its history, such as the remnants of the inflation culture, which lead to short time horizons on the part of most businesses and consumers, and the lack of competition which previously existed in many sectors. Major changes are occurring throughout the economy and in public institutions - including those of the energy sector. But time is required for new outlooks to take hold on a wide scale.

On the other hand, this is a promising moment for ESCOs wishing to expand their operations or enter this market. Many barriers are being reduced. Stabilization is favorably changing various factors influencing consumers' awareness and decisions in many sectors. The opening of the economy promotes competition which is forcing businesses to be more attentive to cost and quality. This both increases interest in investments of this kind and reduces their cost. In addition, the differential between energy efficient and "standard" equipment is diminishing though in some cases it is still greater than in the industrialized countries.

Another favorable development is the set of initiatives to significantly improve access to both project and working capital, as discussed in the next section. Other measures, described in Section II-D, are being undertaken to help overcome the barriers discussed above and build up this market.

C. Third Party Financing Options for ESCO Projects

There is little experience so far with third party financing for energy efficiency and other projects implemented through ESCOs in Brazil. In effect, nearly all projects are being implemented using either: a) financing provided by the client, or b) financing provided by the ESCO, who is paid over time by the client. However, a few projects have been implemented already using third party financing, and a number of steps are being taken to increase the availability and amount of third

²⁹ Regulations in recent years state that the adjustment should be timely - both between the consumer and distributor and the latter and the bulk supplier. However, the rate of reduction allowed at present can be a problem.

party financing available for ESCO projects in Brazil. Interest rates have been falling, which is increasing consumers' willingness to borrow money.

Utility Financing

PROCEL, working through local distribution utilities, is trying to make utility sector capital available for financing ESCO projects. Two pilot projects have been implemented, and more are planned. The pilot projects involve either RGR funding (i.e., a low-interest loan from Eletrobras to local utilities) or PROCEL core funding. The local utility then contracts for an ESCO to perform a specific retrofit project. The ESCO is hired through an open bidding process. The ESCO is paid by the utility on completion of the project, and the client repays the local utility over time based on the energy bill savings. The local utility then uses this money to repay its loan from the RGR fund.

One pilot project of this type has been implemented by PROCEL to retrofit the Ministry of Mines and Energy building in Brasilia, and a second project has been implemented to retrofit two metro stations in São Paulo. Both were lighting retrofit projects implemented by Johnson Controls of Brazil. This financing concept has proven to be viable and can be replicated. In fact, funding has been approved and efforts have begun to retrofit all of the ministry buildings in Brasilia using this type of financing scheme. In this case, RGR funding is being used by the local utility in Brasília (CEB) to hire ESCOs for auditing and retrofits. In addition, RGR funding (\$1.4 million) has been approved for a retrofit of the water and sanitation utility in Recife, with funding passed through the local utility (CELPE). An ESCO will be hired to implement this project.

Furthermore, a recently approved law allows states and municipalities to receive RGR funding. Some states or cities are interested in obtaining an RGR loan for financing retrofits of public buildings, schools, hospitals, etc. States or cities would hire ESCOs to do the actual work. The first use of RGR funds in this way was approved for a public lighting project in the city of Salvador at the end of 1996.

Utility sector financing for ESCO projects should increase significantly if a proposed loan from the World Bank to Eletrobrás is approved. This loan would be for \$150 million over a four-year period, and would be matched 1:1 by RGR financing, PROCEL core funds, and local counterpart funding. Most of the loan funds would be passed on by Eletrobras to local utilities and states for implementing energy efficiency projects in both distribution systems and end use. Some of the utilities and states are expected to use their funds to hire ESCOs for implementing end-use efficiency projects. The World Bank loan is expected to be approved by late 1997 or early 1998.

Bank Financing

Efforts are underway to make available low-interest financing from national development banks (BNDES and FINEP) for ESCO projects. Financing from these banks has not yet occurred due to a number of issues including the relatively small size of most energy efficiency projects, the sizable amount of paperwork involved in applying for loans from these sources, the need to present smaller projects to BNDES through a local private bank, and heavy collateral requirements. However, a presidential decree (Decree 1040) issued in 1994 directed these institutions to give priority to financing energy efficiency projects.

BNDES and FINEP have indicated a willingness to try to overcome the barriers listed above, and PROCEL is helping by encouraging ESCOs to present specific projects to the banks for financing. Four energy efficiency projects have been presented to FINEP which would be implemented by ESCOs if financing is obtained. Also, a number of other ESCO projects have been presented to BNDES. As of January, 1997, these projects were still being evaluated. One project, a US\$ 800,000 retrofit of a major hospital in Salvador, Bahia, is close to receiving financing from the BNDES.³⁰ If these projects are approved and go smoothly, they could serve as models for other projects and/or lead to the banks contributing to a dedicated fund for efficiency projects.

In principal, BNDES and FINEP could be excellent sources of financing for ESCO projects. BNDES has a credit line called "BNDES Automatico" for projects under \$5 million in size. The annual interest rate is 3.5-4,5% plus the official long-term interest rate (as of January, 1997, the latter was on the order of 11% per year and falling). The loan term is usually 8 years, with a two year grace period. BNDES will fund up to 65-90% of the total project cost depending on region of the country. Financing at these terms could be very attractive for ESCOs and their clients, assuming the transaction costs and time delays can be kept to a reasonable level.

BNDES also has begun a special program with SEBRAE for financing projects up to \$90,000 in size in small businesses. SEBRAE guarantees up to half the project cost, limiting the collateral requirements for borrowers. The interest rate is 5% per year plus long-term inflation, and projects can be presented to BNDES through a number of local banks. This loan program is not targeted, but it could be used to fund smaller size energy efficiency projects. However, as far as we know, no energy efficiency projects have been financed so far.

In addition to the national development banks, two private banks, Credibanco and Unibanco, have expressed some interest in financing individual energy efficiency projects and/or administering an energy efficiency fund. Such a fund might possibly be set up with international sources of capital (e.g., from the International Finance Corporation) or a combination of local and international capital. But these banks have not made any energy efficiency loans so far. Furthermore, private banks in general are most interested in larger projects and prefer to lend to their regular clients. Thus, it is not yet clear if they will become a practical source of financing for ESCO projects.

Vendor Financing

Some equipment suppliers such as manufacturers of lighting products, air conditioning systems, or building/process controls may be willing to finance ESCO projects. Of course, the ESCO must purchase equipment from the supplier, and the supplier may not be willing to finance other components of the project. Some suppliers of energy-efficient lighting products in Brazil are working closely with ESCOs including providing training, software and assistance with project design. These manufacturers have expressed an interest in providing longer term financing for ESCO projects, but this has not occurred yet.

³⁰ Personal communication with Ricardo David, Ecoluz Consultores Associados, Salvador, January 1997.

In addition to direct vendor financing, an effort is being led by the International Energy Initiative (IEI) to establish a low-interest loan fund for which ESCOs could use for projects involving installation of efficient lighting technologies. IEI is developing this initiative together with ABILUX (the lighting industry association in Brazil) and BNDES. BNDES would provide the capital for the fund and a major national bank (Unibanco) would serve as the intermediary. The details regarding the size of the fund, the loan terms, and when it will begin were still being worked out as of January, 1997.

Other Funds

Other organizations besides IEI/ABILUX/BNDES have expressed an interest in establishing Revolving Loan Funds to finance ESCO projects in Brazil. These organizations include PROCEL and the Agency for the Application of Energy in Sao Paulo. Both intend to investigate the feasibility of establishing a fund over the next year. Also, Hagler Bailly, Inc., a consultant to U.S. AID, is attempting to interest foreign investors in establishing a loan fund for energy efficiency projects in Brazil. However, these efforts are in the early stages of development and will not lead to financing becoming available until 1998 at the earliest.

Another possibility is to establish a Guarantee Fund to facilitate access to credit by ESCOs and their clients. This would help to overcome the lack of interest lenders have for ESCO projects and/or high collateral requirements that they demand of borrowers. The idea of creating a Guarantee Fund to guarantee loans for ESCO projects is at an early stage of discussion.

D. Support from Government, Utility and Non-Profit Groups

A number of public sector and non-profit organizations are trying to help the ESCO industry get established and thrive in Brazil. Efforts related to project financing were discussed above. Government, utility sector, and non-profit group support for ESCOs is reviewed in a more comprehensive manner in this section.

PROCEL

PROCEL is engaged in a number of activities to support the growth and maturation of the ESCO industry in Brazil. First, PROCEL is encouraging BNDES and FINEP to provide financing for ESCO projects. In addition to talking directly to the banks, PROCEL is facilitating presentation of specific ESCO projects that need funding. Second, PROCEL is encouraging local utilities to fund and contract with ESCOs as part of their own energy efficiency programs. Two pilot projects, one in Brasilia and one in Sao Paulo, have been implemented (see above) and others are in the works. These projects are funded with either RGR or PROCEL core funds. Third, PROCEL is contracting ESCOs to help evaluate and develop energy efficiency projects for its overall effort (e.g., in public buildings and in water and sanitation companies). This effort should lead to additional projects that ESCOs could implement in the future. Fourth, it is funding training, seminars, software, and other activities that publicize and support the efforts of ESCOs. Finally, PROCEL is helping to coordinate the activities of different organizations that are supporting the development of the ESCO

industry in Brazil. As part of this, a Working Group was established at the end of 1996 and is preparing a manual for ESCOs.

Agency for the Application of Energy of the State of São Paulo (AAE-SP)

This Agency of the State of Sao Paulo is trying to support ESCOs through a number of activities. First, the Agency co-sponsored the ESCO pilot project in the Sao Paulo metro station and is planning a similar pilot project in the state water and sanitation utility. Second, it is contributing to the manual for ESCOs as part of the Working Group cited above. Third, it is interested in forming a revolving loan fund to finance energy efficiency projects in the state, including projects developed and presented by ESCOs. Also, the Agency has hosted Workshops on ESCOs in Brazil, as well as meetings leading to the formation of an ESCO association.

State of Bahia

The Secretary of Energy, Transport and Communications (SETC) in Bahia state has started an energy efficiency program focussed on public buildings. In the first phase, ESCOs have been hired to audit selected state buildings. The SETC is now trying to obtain financing to implement these projects from BNDES, RGR and the World Bank through the major Brazil energy efficiency loan. In particular, SETC is seeking \$6.8 million in order to retrofit 28 state buildings and 12 public hospitals in the state of Bahia. It is estimated that the retrofits of the 40 buildings would save 13.6 GWh/yr, 27% of the electricity use in these buildings, with an average simple payback period of about five years.³¹ If financing is obtained, the SETC would hire ESCOs to implement these building retrofits. The SETC has also organized seminars to encourage the formation of and train ESCOs in the Northeast region.

INEE

The National Institute for Energy Efficiency (INEE), a non-governmental organization, is also actively supporting ESCOs in Brazil, with emphasis on strengthening performance contracting. It has organized several Workshops and seminars, both to develop business tools and introduce concepts to consumers. As part of the “ESCO Manual” mentioned above, INEE is preparing a draft performance monitoring and verification protocol and supporting materials - taking as a reference the protocol now used in the United States and Canada. In order to make information more accessible, it is developing a website which will bring together information of interest to ESCOs and their potential clients. Finally, INEE is exploring possibilities for the certification of energy efficiency professionals and the credenciation of firms for performance contracting.

IEI

The International Energy Initiative (IEI) is supporting ESCOs in Brazil through activities sponsored by its Latin American office in São Paulo. IEI has sponsored training courses and seminars to help stimulate and advance ESCOs here. It is participating in the Working Group which is preparing the “ESCO Manual”. IEI is also attempting to establish a revolving loan fund

³¹ See Proposal from PROCEL/Eletrobrás to the World Bank, Project Report, October, 1996.

with money coming from the BNDES, which would be available for lighting efficiency projects and accessed through a commercial bank.

The formation of an Association to represent and mobilize ESCOs is regarded as desirable by most firms in the business, as well as by all of the organizations described above. The first steps to this end were taken in the aftermath of the *II International Workshop on ESCOs*, held November 4-6, 1996. Representatives of half-a-dozen firms established a Task Force to develop a detailed proposal with draft by-laws for the Association. A version for wider comment should be available by April, 1997.³²

The intention is to create a structure which is adequate for the geographic size of the country, with decentralized Chapters. Much thought is being given to criteria for screening associates. It is already clear that the Association will include firms that do not engage in performance contracting qualifications. In that sense it will be quite different from NAESCO or CAESCO in North America.

III. Examples of Projects

The examination of real world experience is useful for better understanding how ESCOs are operating in Brazil and the challenges they confront. Below we present a sampling of projects that have been implemented by ESCOs in Brazil, illustrating a range of types of clients, types of actions, and contract terms. These case studies support the general observations made above, as well as the issues identified in the next section.

A. Teknergia - Mesbla

Teknergia has had a contract with the Mesbla department store chain, a major chain with 45 stores in Brazil. The objective is to help Mesbla reduce its overall energy bill through a wide range of actions including but not limited to upgrading energy efficiency. The contract is on a fixed fee basis, and does not include hardware purchases which are done separately by Mesbla as needed.

Teknergia is assisting Mesbla take a wide range of actions including:

- energy auditing (using the Mark IV model developed by PROCEL)
- establish an internal energy commission and goals for each store
- training technical staff of each store to implement measures and for more efficient operation
- adoption of alternative tariffs (14 stores)

³² Those interested should contact the executive secretary of the Task Force, José Carlos Felamingo, of União RHAC. His phone is (011) 531 5901; fax is (011) 531 6351. In addition, the draft and follow-up will be available on the INEE website - see Annex B.

- control of peak demand in stores with separate demand and energy charges
- modification or replacement of oversized air conditioning systems and motors
- replacement of incandescent lamps with compact fluorescent lamps
- use of T8 fluorescent lamps and specular reflectors in fluorescent light fixtures
- adjustment of meters and voltage supply
- disconnect unnecessary transformers
- better maintenance of air conditioning and lighting equipment
- implementation of a systematic monitoring program, data base, and a program for exchanging experiences among stores

In 1994 prior to implementing these measures, Mesbla was spending R\$500,000 per month on energy. By late 1996 after working with Teknergia for two years, Mesbla's monthly energy bill had been reduced to \$360,000 even though average electricity tariffs were increased 22% during this period.³³ This suggests an energy bill reduction of 41%, correcting for the tariff increase. Total electricity use was reduced by a similar percentage.

This case study shows that a great deal can be accomplished in a relatively short time in a large, decentralized company through a comprehensive, well-organized effort. Energy savings are certainly possible, but other actions can also be valuable for lowering the customer's energy bill. Moreover, this case study demonstrates the benefits of a longer-term, intensive relationship between the ESCO and client, as opposed to a short-term relationship focussed on one particular end use or action. In effect, the more Teknergia worked with Mesbla, the more cost-effective actions it found and the more Mesbla's energy bill fell. Furthermore, this successful project was implemented through a simple fixed fee contract without a savings guarantee or shared savings provision. In order to maintain its contract, Teknergia had an incentive to provide results and keep its client happy.

B. DHB - Itapira, SP, Water and Sanitation

DHB Servicos Eletricos S/C Ltda. is an ESCO based in Sao Paulo. DHB specializes in energy efficiency projects in water and sanitation utilities. DHB has implemented an energy efficiency and load management project with the municipal water utility in the small city of Itapira (population 70,000) in the interior of Sao Paulo state. This project is representative of DHB's approach as well as the savings potential in water and sanitation utilities in Brazil.

DHB approached the water utility, offering to perform a free audit and to assist the utility make no cost or very low cost operational improvements. DHB also offered to identify other attractive energy efficiency improvements that require a significant capital investment. For this service, DHB proposed and received a simple shared savings contract, with DHB receiving half the value of electricity savings realized by the utility due to the operational improvements over a one year period. DHB assumed all of the risk as the utility is only obligated to pay DHB based on realized energy savings. DHB claims that obtaining this project was relatively easy, in large part because the superintendent of the utility is an engineer who is easy to work with.

³³ Personal communication with Gerson Sampaio Filho, Teknergia, Salvador, Bahia, October 1996.

With DHB's help, the utility has shifted to a time-of-use tariff and is reducing electricity use during the peak demand period. It is also operating its pumping and aeration systems more efficiently, leading to electricity as well as peak load savings. These actions, which were begun in July, 1996, are leading to around 500 MWh/yr of electricity and 720 kW of peak demand savings (20-30% reductions).

In addition to the no-cost operational improvements, DHB recommended that the utility invest about \$500,000 to build reservoirs to store water and enable the utility to further reduce its electricity use during the peak load period. The reservoir would also allow better motor/pump utilization, thereby providing energy as well as peak demand savings. Funding for this action has not been obtained yet, and will likely require third party financing of some sort.

This project, the third of its kind implemented by DHB, demonstrates that relatively straightforward, short-term shared savings contracts are possible in Brazil. It also demonstrates the substantial energy savings potential in the public sector in general and water and sanitation utilities in particular. According to DHB, Itapira is typical of smaller cities throughout Sao Paulo and nearby states - utility staff have inadequate technical training and expertise, and significant energy savings are possible through improved operation at virtually no cost.³⁴

C. Johnson Controles - São Paulo Subway Stations

After winning a public bidding sponsored by PROCEL, Johnson Controles Ltda. received a contract to retrofit the lighting fixtures in two subway stations in São Paulo. Johnson installed polished aluminum specular reflectors in 200 light fixtures which previously contained two 110W high output fluorescent lamps. One lamp was removed from each fixture, with the level of illumination increasing about 4% after the reflector was installed. In addition, electronic ballasts were installed on a demonstration basis in five light fixtures.

The retrofit of the two subway stations, including installation, cost R\$18,400 and resulted in about 175 MWh/yr of electricity savings. With the high cost of electricity in the commercial sector in Brazil, the simple payback period was around 16 months. The project was contracted on a fixed fee basis by PROCEL/Eletróbras.

This project was meant to demonstrate utility sector bidding and contracting with ESCOs for energy efficiency projects, and stimulate other similar projects. At the inauguration of the project in mid-1996, PROCEL/Eletróbras offered to pay half the cost of subsequent lighting retrofit projects in other stations in the São Paulo subway system. In spite of this generous offer and the quick return demonstrated by the pilot project, the Metro system had not indicated any interest in proceeding with similar projects in other subway stations as of January, 1997. However, Johnson Controles or other ESCOs have not tried to convince the subway system to make this investment either. This experience demonstrates the importance of active marketing of ESCO services and selling energy

³⁴ Personal communication with Djamil de Holanda Barbosa, DHB Serviços Elétricos S/A Ltda, São Paulo, October 1996.

efficiency projects, especially to the public sector in Brazil -- where demonstrations alone may not be enough to overcome the difficult barriers discussed above.

D. Negawatt - White Martins

Negawatt is a small ESCO specializing in lighting efficiency improvements using high quality specular reflectors. It imports silver film from the United States for this purpose. One of Negawatt's largest projects was in the office building of White Martins in Rio de Janeiro. This 27-story office building contains about 100 fluorescent light fixtures per floor, most of which had two 40W lamps and one conventional 2x40 W ballast. Negawatt first installed one light fixture containing a specular reflector and only one lamp, demonstrating 31% more light output with half the electricity use (the old fixtures were of poor quality and design). White Martins was impressed, and approved a contract to replace all 2700 light fixtures in its building.

Negawatt installed new fixtures containing silver film specular reflectors and half the lamps and ballasts (i.e., the fixtures were converted to one lamp, with each ballast serving two fixtures). The cost for the project (material and installation) was about R\$102,000, or R\$38 per fixture. The lighting electricity savings was estimated to be 52 W per fixture, 140 kW for the entire building, or 454 MWh/yr. Including savings in air conditioning, the total electricity savings was 186 kW or 605 MWh/yr. The value of this electricity savings, given White Martins time-of-use tariff, is R\$73,400/yr. In addition, there will be additional savings from reuse of the lamps and ballasts that were removed and fewer purchases of new lamps and ballasts, bringing the total savings to R\$76,300/yr. Thus, the project had a 16 month simple payback period.

Negawatt spent over two years developing this project. Much time was spent trying to negotiate a shared savings contract, but in the end a standard fixed fee for service contract was signed. Also, the project moved forward because there was an interested and supportive person in the Rio de Janeiro office of White Martins. When Negawatt proposed a similar project for the São Paulo office building of White Martins after successfully completing the project in Rio, it got nowhere due to lack of interest in the Sao Paulo office.

This project demonstrates that a targeted, single technology project can yield substantial energy savings and fairly rapid economic payback. It also shows that project development and contract negotiations can take a number of years, even for a fairly straightforward project like installation of specular reflectors in fluorescent light fixtures, and that shared savings schemes can be difficult to arrange in Brazil under current circumstances. Also, the ability of an ESCO to implement this type of project depends a great deal on the receptivity of key individuals in the client's facility.

IV. Opportunities for Foreign ESCOs in Brazil

As described above, the market for energy efficiency services is at an early stage of development, but has favorable prospects for rapid growth. The economy has stabilized, the energy savings potential is great, and energy prices are relatively high in certain market segments. While the hurdles to a thriving ESCO market here are high, so also are the possible rewards.

The emergence of this market presents opportunities for experienced international ESCOs that are expanding into developing country markets. With their technical expertise, project implementation experience, and access to outside financing, international ESCOs could gain significant share and realize sizable profits over the long run in Brazil. Furthermore, international ESCOs could benefit from "getting in" at the early stage before the market starts taking off.

The potential for foreign ESCO participation in Brazil is briefly discussed below, both in terms of direct entry and partnership options.

Direct Entry

Setting up a local subsidiary would be one way for foreign ESCOs to enter the energy services market in Brazil. In fact, one multinational with an ESCO abroad, Johnson Controls, has already started an energy services division in Brazil.³⁵ So far, the Brazilian ESCO has operated with minimal support from the Johnson Controls ESCO in the U.S., but more support is expected in the near future, including help with implementation of performance contracting in Brazil. Furthermore, another major multinational ESCO is actively seeking large projects in Brazil.

Direct entry of foreign ESCOs via a subsidiary will require a significant commitment and considerable patience in order to be successful. There are risks. The attempt of a major German performance contractor to establish a subsidiary in Brazil failed after three years. Projects can take many months if not years to develop, negotiate, finance, and get off the ground. Also, foreign ESCO subsidiaries will need to learn how business is done in Brazil. This can be facilitated by hiring local staff. In this regard, there are quite a few energy efficiency experts in Brazil, some of whom are already trying to operate as small ESCOs, who would be very interested in leading or working in local subsidiaries of international ESCOs.

Joint Ventures

Another logical way for international ESCOs to enter the Brazilian market would be through joint ventures with local ESCOs. A number of Brazilian ESCOs are seeking foreign partners in order to increase their technical and marketing expertise, access to capital, and overall prestige. Some of these companies have numerous projects in the works and wide contacts, as well as an understanding of how the business world works in Brazil. Thus, it is likely that international ESCOs could obtain projects more quickly and at less risk through joint ventures rather than by entering the market on their own. One international ESCO, Soreib S.A. from France, has entered

³⁵ Johnson Controls Ltda do Brasil is actually half owned by Johnson Controls International and half owned by a national company in Brazil.

into a joint venture with Ecoluz, which is one of the major Brazilian ESCOs based in Salvador, Bahia.

The specialization that has already started among Brazilian ESCOs presents obvious partnering opportunities. For example, North American or European ESCOs specializing in projects for public buildings or for water and sanitation companies would be logical joint venture partners for Brazilian ESCOs with similar specializations. Alternatively, international ESCOs might want to enter into looser partnerships with a number of Brazilian ESCOs and/or equipment vendors, in order to offer a fuller range of services and access a broader market.

V. Conclusions and Recommendations

In spite of many difficulties, energy efficiency service firms are beginning to establish themselves in Brazil. Some important historic barriers are being reduced as the economy stabilizes, energy pricing becomes more realistic, and public policies to promote energy efficiency are put in place. The recent growth of the industry should continue, especially in electricity markets. There is potential for the current estimated project volume of U.S.\$ 16-17 million per year to grow by an order of magnitude over the next decade - representing a 25%/yr average growth rate.

Nevertheless, many problems remain for the realization of the full potential of the ESCO market. These problems include limited capacity, lack of certification, lack of functioning third party financing, limited experience with performance contracting, and lack of credibility. To address these problems an "ESCO Working Group" was formed at the end of 1996 under the coordination of PROCEL and AAE - S.P, while steps began within the industry to create an association for ESCOs. Besides coordinating previously fragmented initiatives, these groups will define lines of action and help mobilize a critical mass to achieve necessary changes. We summarize some of these activities and suggest other potentially helpful options below.

Capacity building and certification

In general, the emerging ESCOs in Brazil seem fairly strong on the technical side, but relatively weak on the business and sales side. Many of these companies could benefit from training on how to develop projects and market their services in an efficient manner, close sales, etc., with practical information presented by international and Brazilian marketing and business experts. A particular set of training needs revolves around energy performance contracting (see below).

Working capital is a major restriction on the development of almost all ESCOs. Arrangements are being considered to provide funding for relatively small amounts of venture capital (either through debt or equity mechanisms) to qualifying ESCOs - enabling them to hire additional staff, purchase equipment, increase marketing, etc. The BNDES has a general program of this nature, but has not yet applied it in this area. In order to implement this type of initiative, it will be necessary to develop criteria for evaluating the credit worthiness and growth potential of ESCOs.

The lack of experience and credibility is a serious problem that ESCOs in Brazil face. Without a strong track record, potential clients are suspicious of claims made by ESCOs concerning savings potential, payback, etc. Certification of either ESCOs as a whole or individuals who work for ESCOs could be one way of helping to build credibility. To be useful, certification would need to be done by an unbiased third party that is well-recognized and respected. Potential sponsors of ESCO certification in Brazil could be an official government agency like PROCEL, an industry association such as the "BRAESCO" now in formation, or an NGO like INEE. However, ESCO certification is still at an early stage of discussion in Brazil.

Performance contracting

By providing a guaranteed minimum level of energy savings, energy performance contracting (EPC) can increase confidence in and the market for projects implemented by ESCOs in Brazil. The assumption of project risk and the verification of results in the EPC approach are potentially attractive to consumers, financial agents and utilities. However, the basic tools of performance contracting are just beginning to be assimilated by some firms. The process of adaptation to the business realities of Brazil is incipient and there are no accepted protocols or other reference materials. All this makes the task of marketing a new concept much more difficult for individual emerging EPCs.

The development of EPC protocols and orientation materials for EPCs and consumers is thus urgent. Two key areas are: (1) the measurement and verification of savings; (2) the preparation of contracts and key contract clauses. The preparation of these materials has begun³⁶ and a Workshop focussing on them is planned for mid-1997.

It is also important to demonstrate the value of performance monitoring and verification (M&V) in Brazil, with the implementation of M&V measures in real facilities. M&V is of value not only as a necessary part of implementing performance contracting, but for increasing the energy savings from retrofits in general.

Once protocols and model EPC contracts are developed and proven, support is needed for the transfer and adaptation of these tools to ESCOs as a whole. While much of the transfer of know how will occur in private ventures between firms, broader information dissemination and training will be valuable to expand the use of EPCs as rapidly as possible.

Third party financing

Mechanisms for public sector and utility financing already exist in principle, but the flow of third party financing for projects has been small. In particular the BNDES and FINEP had not reached closure on any efficiency projects as of January 1997.³⁷ The immediate priority is to turn financing by the development banks from a hope to a reality. PROCEL is helping to “shepard” legitimate ESCO projects through to financing. At the same time, ESCOs and other parties need to work to address the historic lack of “bankable projects”.

Private sector financing is likely to play a very small role in the short term - the market is new and projects tend to be small. Public and utility financing, on the otherhand could play a major role in “priming the pump”. In this regard, more utilities, states or municipalities should pursue low interest loans from the RGR fund. These funds in turn could then be used to finance ESCO projects at attractive terms, with the customer directly reimbursing the utility using the monthly electric bill.

³⁶ Within the Working Group, INEE is preparing M&V materials, while the Agency for the Application of Energy of São Paulo is coordinating work on contracts.

³⁷ However, as observed in the text, several projects are near financing.

The heavy collateral requirements often required by banks (including local banks who serve as intermediaries for the national development banks) is a major deterrent to third party financing. An important initiative would be to establish a Guarantee Fund for ESCOs for energy efficiency projects financed by BNDES or private banks. The fund could guarantee a portion of a project (say 50%), thus reducing the risk for banks and the collateral requirements placed on borrowers. Capital for the Guarantee Fund might be raised from public sources, multilateral development banks, or the power sector. It should earn a return from investments, fees and money market management. The Fund could also evaluate project viability - an expensive capability for private banks to develop at the outset (this is true also of their role as intermediaries in BNDES financing).

In fact, as observed earlier, there is a pilot Guarantee Fund being administered by SEBRAE for small loans made by the BNDES through some local banks. The use of this fund as a resource for the smaller ESCO projects, which are the most common type today, needs to be developed. Also, PROCEL is exploring starting a revolving loan and/or Guarantee Fund in order to stimulate third party financing of ESCO projects.

Power sector reform

Utilities can play an important role in expanding the market for ESCOs. PROCEL's programs have helped to strengthen the interest of some utilities in demand-oriented approaches in general and the use of ESCO services in particular. At the same time, the power sector is in the midst of a major transformation which is changing utilities' incentives and will have repercussions for their approach to their consumers' use of electricity. While there are necessarily uncertainties, two areas are emerging with regard to utility/ESCO relations: (1) utilities' development of ESCO subsidiaries; (2) utilities' use of ESCOs for executing their demand-side strategies.

Some Brazilian utilities are starting to become interested in establishing ESCO subsidiaries. Their entry could greatly increase capabilities in the industry, and for the utilities would be consistent with the trend towards privatization, increasing competition and greater marketing of services. However, it also raises various competition issues such as the equal access of other ESCOs to key market information in the utility-owner's service area, or whether an ESCO subsidiary can develop projects outside its utility-owner's service area. These issues should be addressed as part of new regulations governing the utility sector.

As for the broader use of ESCOs, the first need is for utilities and the regulations governing them not to create obstructions to energy efficiency projects - as they have at times in the past. Absolutely crucial is the guarantee of timely re-adjustment of energy supply contracts for consumers. This may have important consequences for the institutional/regulatory model being developed for Brazil's power sector, since distribution utilities will need some flexibility to adjust their electricity purchase levels from generators as a consequence of energy efficiency programs or verified efficiency investments by consumers. There are also implications for power purchase agreements that industries enter into with IPPs, with respect to adjusting purchase levels in the future.

For consumers, the situation in this respect has been improving, but the limits imposed on the rate of reduction for contracts below 69 kV can still create problems for some projects, especially if

cogeneration is involved. There is a clear demand on consumers` part for prompt adjustment to important investments - whether these increase or decrease their energy use.

In terms of positive promotion, utilities should be encouraged to support and contract ESCOs. An example is the PROCEL auditing program, which has stimulated utilities to use ESCOs to conduct the audits. This practice should be reinforced, since ESCOs have an obvious interest in working on project implementation, not just auditing. Another example is financing of ESCO projects using RGR funds or payment through electricity bills, mentioned previously

The regulatory environment will strongly influence the scope and priorities of utility demand side action. Two examples of emerging rulemaking challenges are: (1) the possibility of load reduction projects participating in the grid`s bidding process, assuming that new regulations lead to one or more independent system operator(s) who acquire resources at least in part through a bidding process; (2) the protection of consumers who have invested in energy efficiency projects in case there is rationing of power or natural gas. In other words, it would be helpful if consumers who have achieved a high level of energy efficiency (either through contracting with ESCOs or implementing measures on their own) receive less of a power cut (or no cut at all) in case rationing is required.³⁸

General

An underlying goal of many of the above activities is to increase consumers` awareness and confidence in ESCO services, be they fixed price, shared savings or performance contracts. Yet another way of advancing this goal would be to hold a series of workshops involving ESCOs and specific industrial and commercial sectors (e.g. in the steel, paper/pulp, textiles, transport equipment industries or banking, hotel or health services sectors). These workshops could include project case studies, and opportunities for use of ESCOs within the targeted sector. It is hoped that the workshops would lead eventually to additional business for ESCOs and additional energy savings in Brazil.

³⁸ This may require some form of verification procedure.

Annex A: Profiles of Emerging ESCOs in Brazil

This register presents short profiles of Brazilian firms (shown in alphabetical order) which are active in providing energy efficiency project services. The profiles summarize information provided by each firm. The firms appearing in this register are divided between those who have executed or are implementing energy efficiency projects, and those who have only performed audits so far. Auditing has been an important part of the work of most ESCOs active in Brazil. The register is not complete, though we believe it covers most of the more active firms in this emerging business.

Each profile includes contact information and addresses.³⁹ It briefly describes the firm's specialties in energy efficiency and other areas. It indicates the scale of the firm and of its operations in ESCO services. It also shows the number and value of the energy efficiency projects implemented, and whether there was any project in the period which had a risk component, instead of being a traditional fixed price contract. A basic criterion for inclusion of projects is that they involve the implementation of concrete energy efficiency measures for the client, be they hardware, software or training. Feasibility studies and audits alone are not included.

For all firms that have implemented energy efficiency projects, the total number and value of projects is shown in the table below. In this summary we do not include projects implemented by Cogerar, which is implementing cogeneration projects exclusively. Including these large projects would distort the overall totals.

Firms in Database with Projects	Number of Projects Implemented ⁴⁰		Value of Projects ⁴¹ (Million R\$)	
	Before 1996	1996	Before 1996	1996
14	303	104	42.9	13.3

The information shown is based on a questionnaire circulated by the organizers of the *II International Workshop on ESCOs*, held in São Paulo on November 4-6, 1996 - as well as subsequent contacts. This register will be continuously expanded, updated and upgraded by INEE on its website (<http://www.ibase.org.br/~inee>) when the register comes on-line in early April. Firms wishing to register for the first time will find a questionnaire at the site, while others are encouraged to update their information

³⁹ An observation on telephone/fax numbers: these are shown in the internal Brazilian format. When calling from abroad, remove the first zero in the domestic code and add Brazil's country code - 55.

⁴⁰ For dating projects, the criterion is when financing was approved. As a necessary simplification for this kind of survey, the total value of the project is attributed to the year of financial approval.

⁴¹ To convert to U.S.\$, the approximate exchange rate in 1996 was one:one.

COGERAR Sistemas de Energia

Contact person(s): Edison Tito Guimarães
Address (headquarters): Praia de Flamengo, 278 - Conj 81
 22210.030 - Rio de Janeiro - RJ
Phone/Fax: 021-552 4882 (tel); 552 9568 (fax)
E-mail: cogerar@ibm.net
Homepage:
Branches: São Paulo, SP
Year Company founded: 1990
Specialties in energy efficiency: Cogeneration in industries and commercial buildings.
Specialties in other areas: Analyses of energy use in processes and facilities to determine possible substitution with cogeneration.

Implemented projects reported:

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	2	Not applicable	25,000,000
1996	1	Not applicable	3,500,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

CONERG Comércio e Assessoria Ltda

Contact person(s): Reginaldo Vinha
Address (headquarters): Rua Guararapes, 531
 04561.000 - São Paulo, SP
Phone/Fax: 011-533 1106 (tel); 535 2111 (fax)
E-mail: conerg@stbnet.com.br
Homepage: http:// www.conerg.com.br
Branches: Santos, SP
Year Company founded: 1988
Specialties in energy efficiency: Principally active in industrial sector; some cases in commerce (banks and shopping centers) and services; cogeneration.
Specialties in other areas:; Diverse electrical services; inspection of boilers and pressure vessels; spatial planning; lighting design.

Implemented projects reported

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	20	n/a	1,500,000
1996	8	Yes	600,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

Datum Consultores e Projetos Ltda

Contact person(s): Edison Tito Guimarães,
Address (headquarters): Praia de Flamengo, 278 - Conj 51
 22210.030 - Rio de Janeiro - RJ
Phone/Fax: 021-552 6399 (tel); 552 5299 (fax)
E-mail: datum@ibm.net
Homepage:
Branches: São Paulo, SP
Year Company founded: 1978
Specialties in energy efficiency: Design and execution of projects in commercial buildings and industries for: air conditioning and refrigeration; thermal processes and cogeneration; control systems.
Specialties in other areas: Strategies for purchase of electricity. Conversion to natural gas. Peak modulation using thermal accumulation.

Implemented projects reported:

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	30	No	20,000,000
1996	2	No	750,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

DHB - Serviços Elétricos Ltda

Contact person(s): Djamil de Holanda Barbosa
Address (headquarters): Rua Batatais, 159 - Cj 292
 01423.010 - São Paulo, SP
Phone/Fax: 011-255 7641 (telefax)
E-mail: djamil@mandic.com.br
Homepage:
Branches: Rio de Janeiro, Recife, Manaus
Year Company founded: 1994
Specialties in energy efficiency: Water and sewage treatment; small and medium industries; hotels and hospitals.
Specialties in other areas:

Implemented projects reported

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	2	Yes (all)	500,000
1996	2	Yes (all)	1,000,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

Ecoluz Consultores Associados s/c Ltda

Contact person(s): Ricardo da Silva David
Address (headquarters): Av Tancredo Neves, 274-A,
 Centro Empresarial Iguatemi - suite 306
 41.820.020 - Salvador, BA
Phone/Fax: 071-351 8526 (telefax)
E-mail:
Homepage:
Branches: São Paulo, SP; Porto Alegre, RS
Year Company founded: 1988

Specialties in energy efficiency: Energy audits and implementation of measures in industry and commercial buildings; cogeneration and alternative energy sources; automation in buildings and industry; energy policy, municipal energy management; development of courses and training; efficiency in the architecture and conception of buildings.

Specialties in other areas: Electrical installations.

Implemented projects reported

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	112	Yes (43)	2,240,000
1996	28	Yes (10)	1,200,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

Enerenge Engenharia e Informática Ltda

Contact person(s): Julian Villelia
Address (headquarters): Rua Deputado João Sussumu Hirata, 382 - sala 1
 05715.010 - São Paulo, SP
Phone/Fax: 011-844 7853 (tel); 844 2227, 844 7853 (fax)
E-mail: enerenge@br.homeshopping.com.br
Homepage:
Branches:
Year Company founded: 1995

Specialties in energy efficiency: Rationalization of electricity use: lighting, motors, drives, thermal insulation.

Specialties in other areas: Software development for electricity use.

Implemented projects reported

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	2	No	100,000
1996	1	No	50,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

Information Liner Ltda

Contact person(s): Gregório Bittar Ivanoff; Dimitri Ivanoff
Address (headquarters): Rua Corinto, 543/113C - Jardim Rizzo
 05586.060 - São Paulo, SP
Phone/Fax: 011-813 1707 (tel/fax)
E-mail: gregorio.ivanoff@mandic.com.br
Homepage:
Branches:
Year Company founded: 1994

Specialties in energy efficiency: Lighting systems; distributed control systems / process controls.

Specialties in other areas: Protection of power systems. Systems and services based on understanding of processes, informatics and management.

Implemented projects reported

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	0	....	0
1996	2	No	20,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

Johnson Controles Ltda

Contact person(s): Luiz Alberto Almeida Reis
Address (headquarters): SHIS Q1 13, Bloco A - sala 22
 71635.013 - Brasília, DF
Phone/Fax: 061-364 1222 (tel); 364 1221 (fax)
E-mail: luis_alberto.reis@jcibr.jci.com.br
Homepage:
Branches: São Paulo, SP; Rio de Janeiro, RJ
Year Company founded: 1995 (ESCO division)

Specialties in energy efficiency: Control and automation of lighting, air conditioning, and other energy systems in buildings - design and installation.

Specialties in other areas: Building automation.

Implemented projects reported

Projects Implemented	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	2	No	150,000
1996	4	No	400,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm: ¹

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

¹ Overall energy management within firm.

Leme Engenharia

Contact person(s): Adalberto Carvalho de Rezende
Address (headquarters): Rua Guajajaras, 43
 30180.909 - Belo Horizonte, MG
Phone/Fax: 031-249 7682 (tel); 273 3602, 273 2527 (fax)
E-mail: negocios@leme.com.br
Homepage: http://www.leme.com.br
Branches:
Year Company founded: 1965
Specialties in energy efficiency: Industrial uses of electricity, lighting, compressed air. Water consumption. Thermal processes, fuel use and cogeneration.
Specialties in other areas: General mechanical, electrical and civil engineering services. Automation. Environmental, waste and sanitation control

Implemented projects reported

Projects Implemented	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	2	Yes (2)	27,000
1996	14	Yes (14)	236,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

MSE Engenharia de Eletricidade Ltda

Contact person(s): Luiz Moacyr Spagnuolo
Address (headquarters): Rua Guilherme da Mota Correia, 3571
 86070.480 - Londrina, Paraná
Phone/Fax: 043- 348 0502 (tel/fax)
E-mail:
Homepage:
Branches:
Year Company founded: 1979
Specialties in energy efficiency: Lighting; redimensioning of motors; air conditioning and refrigeration in commercial buildings and industry.
Specialties in other areas: Design and installation of electrical systems in buildings and industries.

Implemented projects reported

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	6	No	240,000
1996	5	No	400,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

Negawatt Projetos, Engenharia e Comércio Ltda

Contact person(s): José Roberto Moreira
Address (headquarters): Rua Francisco Dias Velho, 814
 04581.001 - São Paulo, SP
Phone/Fax: 011-531 5901 (tel); 531 6351 (fax)
E-mail: bun@eu.ansp.br
Homepage:
Branches:
Year Company founded: 1992
Specialties in energy efficiency: Design and installation of lighting systems; cogeneration systems.
Specialties in other areas: Strategies for purchase of electricity.

Implemented projects reported

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	6	Yes (1)	140,000
1996	3	No	100,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

Optimum Engenharia do Conforto e Meio Ambiente Ltda

Contact person(s): Alessandro Gil Catto
Address (headquarters): Rodoviária SC 401, km 01 - Parque Tecnológico ALFA
 CELTA - Centro Empresarial para Laboração de Tecnologias
 Avançadas
 88030.000 - Florianópolis, Santa Catarina
Phone/Fax: 048-234 5144 ramal 205 (tel); 234 1547 (fax)
E-mail:
Homepage:
Branches:
Year Company founded: 1995
Specialties in energy efficiency: Diagnostics, project execution and verification for commercial and residential buildings, emphasizing lighting and air conditioning. Retrofits and design of new buildings.
Specialties in other areas: Diagnostics and projects to enhance comfort (thermal, acoustic, lighting, ergonomic and air quality) in residential, commercial and industrial buildings.

Implemented projects reported

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	0	.....	0
1996	3	Yes (1)	57,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

SGAM - Serviços de Consultoria Energética Ltda

Contact person(s): Sérgio Alves Novo
Address (headquarters): Rua da Quitanda, 194; sala 702
 20091.000 - Rio de Janeiro, RJ
Phone/Fax: 021-253 9975 (tel/fax)
E-mail: sgam@ibpinet.com.br

Homepage:

Branches:

Year Company founded: 1993

Specialties in energy efficiency: Diagnostics and installation of projects in lighting, air conditioning and vertical transport. Energy efficiency in industrial processes; cogeneration.

Specialties in other areas: Security, automation and control systems. Design and installation of thermal generating plant.

Implemented projects reported

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	1	No	28,000
1996	0	....	0

Size of the Firm (n° employees):

5 or less

6 to 14

15 to 49

50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%)

Dominant (50-79%)

Important (15-49%)

Small (<15%)

Teknergia

Contact person(s): Gerson Sampaio Filho
Address (headquarters): Rua Ismar R. Prates, Lote 55
 - Lauro de Freitas, Bahia
Phone/Fax: 071-359 3050 (telefax)
E-mail: teknergia@energia.com.br

Homepage:

Branches: Rio de Janeiro, RJ; São Paulo, SP; Cuiabá, MT; Maceió, AL

Year Company founded: 1985

Specialties in energy efficiency: Lighting, motor systems, air conditioning, other electrical systems.

Specialties in other areas: Tariff analysis; automation and control systems; fuel switching.

Implemented projects reported

Projects Implemented	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	120	No	18,000,000
1996	30	No	4,500,000

Size of the Firm (n° employees):

5 or less

6 to 14

15 to 49

50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%)

Dominant (50-79%)

Important (15-49%)

Small (<15%)

Union RHAC Tecnologia e Comércio Ltda

Contact person(s): José Carlos Felamingo
Address (headquarters): Rua Francisco Dias Velho, 814
 04581.001-São Paulo-SP
Phone/Fax: 011-531 5901(tel); 531 6351 (fax)
E-mail:
Homepage:
Branches:
Year Company founded: 1992
Specialties in energy efficiency: Air conditioning, refrigeration, lighting, automation; steam, industrial heating and cooling; cogeneration.
Specialties in other areas:

Implemented projects reported

Projects	Number	Risk assumed?	Value of Projects (R\$)
Before 1996	0	.....	0
1996	2	No	4,000,000

Size of the Firm (n° employees):

5 or less 6 to 14 15 to 49 50 or more

Weight of energy efficiency services within income of firm:

Almost all (>80%) Dominant (50-79%) Important (15-49%) Small (<15%)

FIRMS WITHOUT IMPLEMENTED PROJECTS

The firms registered below did not report projects with implemented efficiency measures, but are active at the level of diagnostic work. All are small firms with less than five full time employees

Ecologus Engenharia Consultiva Ltda

Contact person(s): Juarez dos Santos Barros; Cláudia Barros Silva
Address (headquarters): Rua 1° de Março, 7 - sala 1007-9
20010.000 - Rio de Janeiro, RJ
Phone/Fax: 021-221 8133 (tel/fax)

Energel Engenharia Elétrica Ltda

Contact person(s): Antônio Lima de Souza
Address (headquarters): Rua Major José Inácio, 1849
13560.160 - São Carlos, SP
Phone/Fax: 016-271 2583 (t); 274 2968 fax
Year Company founded: 1994
Specialties in energy efficiency: Diagnostics of industrial energy use; supervision of project installation.
Specialties in other areas: Management consulting at factory floor level on quality and productivity.

Maxieletro Automação Ltda

Contact person(s): Edmilson Benedet
Address (headquarters): Rua Vitório Serafim, 174
88810.010 - Criciúma, SC
Phone/Fax: 048-437 1600 (tel); 437 2854 (fax)
Specialties in energy efficiency: Control systems
Specialties in other areas: Electric installations

Nortrafo Engenharia de Eletricidade Ltda

Contact person(s): Wagner Xavier de Moraes
Address (headquarters): Rua Martins Fontes, 6-48
17054.310 - Bauru, SP
Phone/Fax: 014-236 1155 (tel/fax)
E-mail: nortrafo@adoptanet.com.br
Year Company founded: 1987
Specialties in energy efficiency: Management of electricity in industry and commercial buildings.
Specialties in other areas: Correction of power factor. Installation of electricity control panels. Sale and installation of electrical equipment in industry.

Annex B: Other Useful Contacts in Brazil

ABRAVA - Associação Brasileira de Ar Condicionado, Ventilação e Aquecimento

Contact person(s): Fernando Martins de Souza
Address: Av. Rio Branco, 1492
01206.001 - São Paulo, SP
Phone/Fax: 011-221 5777 (tel); 222 4418 (fax)

Agência para Aplicação de Energia do Estado de São Paulo

Contact person(s): Maurício Fernandes
Address: Rua Bela Cintra, 847 - 13° andar
01415.000 - São Paulo, SP
Phone/Fax: 011-824 7792 (tel); 257 9599 (fax)

BNDES

Contact person(s): Eduardo Bandeira de Mello
Address: Av. Chile, 100 - sala 1417
20139.900 - Rio de Janeiro, RJ
Phone/Fax: 021-277 7354/64 (tel); 220 7461
E-mail: emello@bndes.gov.br

FINEP

Contact person(s): Laércio de Siqueira
Address: Praia de Flamengo, 200 - 13° andar
22210.030 - Rio de Janeiro, RJ
Phone/Fax: 021-276 0454 (tel); 276 0402 (fax)
E-mail: laercio@finep.gov.br
Homepage: <http://www.finep.gov.br>

Instituto Nacional de Eficiência Energética

Contact person(s): Alan Poole, Fernando Milanez
Address: Rua Uruguaiana, 55 - sala 903
20050.094 - Rio de Janeiro, RJ
Phone/Fax: 021-252 2540 (telfax); 232 5752 (tel)
E-mail: inee@ax.ibase.org.br
Homepage: <http://www.ibase.org.br/~inee>

International Energy Initiative

Contact person(s): Otávio Mielnik
Address: Instituto de Eletrotécnica e Energia,
Avenida Professor Almeida Prado, 925
Cidade Universitária
05508.900 - São Paulo, SP
Phone/Fax: 011-211 4250 (tel); 535 3077
E-mail: iei@iee.usp.br

PROCEL

Contact person(s): Luiz Carlos Magalhães, Maria Christina Cerviño
Address: Rua da Quitanda, 196 - 10º andar
20091.000 - Rio de Janeiro, RJ
Phone/Fax: 021-211.5187 (tel); 263 9776 (fax)
E-mail: eletro1@embratel.net.br

SEBRAE - Rio de Janeiro

Contact person(s): Ricardo Wargas
Address: Av. Calógeras, 15 - 7º andar
20030.070 - Rio de Janeiro, RJ
Phone/Fax: 021-533 1846 (telefax)
E-mail: wargas@rio.sebraesat.com.br

Secretaria de Energia, Transportes e Comunicações do Estado da Bahia

Contact person(s): Sérgio Catão Aguiar
Address: Centro Administrativo da Bahia,
Av. Luiz Viana Filho s/n ("*without number*")
41750.300 - Salvador, Bahia
Phone/Fax: 071-371 2480 (tel); 371 3466 (fax)
E-mail: aguiar@svn.com.br

SMACNA - Sheet Metal Air Conditioning National Association/ Brazil Chapter

Contact person(s): Osmar G. Silva
Address: Av. Rio Branco, 1492
01206.001 - São Paulo, SP
Phone/Fax: 011-221 5366 (telefax);