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WWF-Brazil's Sustainable Power Sector Vision 2020

Supplying secure, affordable and clean energy is arguably one of Brazil's greatest challenges over the next few decades. The country faces the twofold challenge of energy and environmental security, due to growing power demand, dependency on foreign natural gas imports, climate vulnerability of hydropower production, and growing power-related CO_2 emissions.

To make sure that Brazil continues its leadership on clean energy sources, WWF-Brazil, in cooperation with a coalition of clean energy industries, environmental and consumers groups, has developed a vision for a Sustainable Power Sector in Brazil by 2020. Key elements of such vision include:

- Improving the efficiency of residential and commercial electrical appliances, buildings and industrial motors and processes
- Replacing electric water heaters with solar hot water systems
- Increasing the efficiency of existing power plants such as through refurbishment of old hydropower plants and combined heat and power (CHP)
- Expanding the role of new renewable energy technologies, such as biomass, wind power, small hydropower and solar power.

WWF calls on Brazil's government, power companies, appliances and motors manufactures and consumers to embrace this vision and take the following actions:

- The federal government should adopt urgently a smart energy plan, with time-bound targets and actions aiming at reducing the projected growth of power demand by 40% by 2020. The government should also set a target to increase the share of new renewable energy production to 20% by 2020.
- Local governments should mainstream energy efficiency in their public purchasing programmes and require the installation of solar hot water systems in new buildings.
- Power generators should invest urgently in the refurbishment of old hydropower plants, in the reduction of transmission and distribution grid losses, and the development of new renewable energy technologies.
- Power distributors should promote consumer's use of highly efficient residential and office appliances and industrial production equipment and processes.
- Financial institutions should require energy efficiency audits as a prerequisite for the lending activities and set up dedicated funds for energy efficiency and renewable energy systems.
- Energy consumers should opt for the most efficient appliances available on the market and, where possible, invest in new renewable energy sources.

FOREWORD

With oil and natural gas prices hitting record highs, and growing concerns about the future of power supply, energy security has come to the foreground in the political arena around the planet, including Brazil. There will be no real energy security, however, without a stable and safe environment, and this is particularly true when we consider the potentially disastrous effects of climate changes.

New and more robust scientific consensus shows that we will be faced with serious risks of global temperatures going 2ºC beyond pre-industrial levels. People around the globe are already feeling the effects, even with temperatures exceeded a mere 0.7ºC – stronger and more frequent storms, melting glaciers, heat waves, and dry spells. Such events may have huge impacts on the economy and security, including breakdown of crops in key areas of food production; cross-border natural resources conflicts; mass movements of "environmental" refugees; billions of dollars spent to tackle natural disasters; and reduced power supply from hydroelectric plants. In order to mitigate such risks, effective policies will be necessary to combat climate changes before carbon emissions reach a level that would make it very hard to be reversed.

Exceeding the 2ºC threshold is a dangerous. All countries must act to avoid this problem according to the principle of common but differentiated responsibilities set forth in the Kyoto Protocol. We all know that for industrialised countries (who are responsible for the most part of historical carbon emissions) this responsibility – and ultimately the obligation – is clear. For emerging countries, such as Brazil, it is paramount that actions geared towards reducing carbon emissions – or decarbonisation – do not jeopardise poverty reduction or development goals.

The state of São Paulo – whose area covers the equivalent to the French territory – has high urbanisation rates and is home to 40 million inhabitants. As we showed over the last decade, decoupling economic development –GDP grew by 5% per year – from greenhouse gas emissions not only was possible, but also economically and socially beneficial. This was the result of an array of initiatives, such as use of ethanol and incentives for public transport systems, with a number of non-climate related benefits.

This publication – the result of the commitment and hard work of an innovative coalition of environmental groups, consumers and industry lead by WWF-Brazil – is a major contribution to the discussion on energy and climate security in Brazil. This study shows that a more aggressive policy regarding efficiency and deployment of additional sources of renewable energy, such as biomass and wind energy will enable Brazil to enhance its energy security and create millions of jobs while contributing to global efforts against climate changes.

This report also tables a concrete proposal for sectoral emissions reductions that Brazil could consider in a context of the international climate change negotiations. This is the sort of proposal Brazil needs to reaffirm its leadership in the fight against climate change.

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1. INTRODUCTION

Brazil, South America's largest country and leading energy consumer, faces the twofold challenge of energy and environmental security. More than 80% of Brazil's installed generating capacity of about 70,000 MW is hydroelectric, generated by the nation's 450 dams. Such hydropower dependency not only has lead to significant negative impacts on Brazil's rivers and river-based communities, but also makes the country especially vulnerable to energy shortages from droughts, that are projected to increase due to climate change. For instance, since 2001, Southern Brazil is going through the worst drought in 20, perhaps in 50 years. This not only reduced the famous South America's Iguazu Falls to a trickle in March 2006, but also threatened hydropower production in the South of the country.

The rest of Brazil's electricity generation mix comes from natural gas (11%), oil (6%) coal (2%) nuclear power (3%), and new renewables such as biomass, small hydro and wind power (which combined account for less than 4%). Official estimates suggest that under a Business-As-Usual scenario (BAU), Brazil's electrical energy demand will growth by about 5% a year over the next fifteen years, as energy intensive industries develop and consumer demand increases, meaning that the country will need to more than double its existing capacity by 2020. At last power auction held in December 2005, Brazil started to increase its consumption of fossil fuels. On that occasion, coal, oil and natural gas-fired thermoelectric plants were contracted to supply 70% of the 3,286 megawatts (MW) of the auctioned electric power.

Such a trend towards a growing share of fossil fuels within the national power mix could prove risky from both an economic and security viewpoint, as it increases the country's dependency on foreign imported natural gas. It could also jeopardise the country's international leadership on climate change, particularly in the context of the international negotiations on the second phase of the Kyoto Protocol. For instance, once built the 2005 auctioned power plants will emit about 11 millions tons of CO_2 emissions per year –which represent a 11% growth compared to current energy-related emissions. This is more than four times the emissions planned to be saved by a large-scale national programme called PROINFA, that aims to install 3,300 MW of electricity generation from non-traditional renewable energy resources such as wind, sustainable biomass and small hydro.

The electric energy choices Brazil makes over the next fifteen years are critical for its energy security, economic development and global and local environmental protection. With this background, WWF Brazil commissioned the University of Campinas and the International Energy Initiative to investigate a scenario – called PowerSwitch (PSW) – for meeting Brazil's electric energy needs by 2020 in a sustainable way. The PSW scenario aims to minimise economic costs and socio-environmental impacts, while strengthening the country economic competitiveness and promoting job creation. To contrast what is likely to happen in the absence of new low carbon energy policy initiatives, the study also developed a 'Business-As-Usual' (BAU) scenario.

This document summarises the full study (which is available in Portuguese on www.wwf.org.br). It describes the methodology used (Section 2), presents the BAU and PSW scenarios (Section 3), identify the key energy efficiency and renewable energy options (Section 4), compares the two different scenarios (Section 5), discusses the costs of market transformation (Section 6), draws a number of conclusions (Section 7), and identifies the policies needed for realising the PSW scenario (Section 8).

2. METHODOLOGY

The methodology used for this study is based on the principles of the Integrated Resources Planning (IPR), and adopts a 'bottom-up' approach which essentially looks at the opportunities to reduce power demand by improving energy efficiency both on the supply and on the demand–side. It then investigates the feasibility to meet the projected electricity demand through the maximum share of non-conventional renewable energy, such as biomass, wind power, and small hydropower. It builds upon extensive data broken down into end-use sectors such as households, industry and services. Box 1 below summarizes the main options assessed.

Box 1: Key clean energy options analyzed

Supply-side reductions

- Efficiency increases of existing power plants (both hydropower and thermal)
- Increase the amount of distributed generation, particularly sugar-bagasse combined heat and electricity production
- Reduction of losses in the electricity transmission and distribution system
- Increased use of wind, small hydropower and biomass for electricity production

Demand-side options

- Introduction of energy efficient motors in industry
- Best practice appliances and cooling equipment in the household sector.
- Replacement of electricity water heaters with solar water heaters
- Energy efficiency office equipment, lighting and cooling.
- Appliances with low stand-by losses (< 1W) in the household sector.

A host of studies have also shown that the technical potential for energy efficiency improvements on the supply and demand side and the potential for developing renewable energy is very large. We live in an imperfect world however, and not all of the technical or economic options for energy conservation will necessarily be adopted. Hence the study makes a number of assumptions to produce what is termed a 'realistic' technical potential. While this is a subjective term, in this study it was assumed that:

- Power plants, appliances and other technologies would not be replaced earlier than their economic lifetime.
- The rate of introduction of more energy efficient appliances was based on 'real life' past experiences in progressive countries where a strong policy effort to stimulate the market for these appliances was made
- The rate of introduction of renewable energy sources was based again mainly on 'real life' experience in countries where progressive policies to stimulate the renewable energy market was used.

Overall, the assumptions of the study are challenging, but based on credible and realistic by mainly assuming the widespread adoption of rates of energy efficiency and renewable energy already achieved in the past and in a number of other countries.

3. BUILDING ENERGY SCENARIOS

The study presents two alternative scenarios of electricity demand by 2020. To contrast what is likely to happen in the absence of new policy initiatives, the study first developed a 'Business-As-Usual' (BAU) scenario. This utilized results from official estimates. These studies suggest that under a Business-As-Usual scenario (BAU), Brazil's power demand will grow by 4.8% a year over the next fifteen years. In absence of aggressive policies to overcome the wider adoption of efficient energy use technologies, many opportunities go unrealised and power consumption increases from 330,812 GWh in 2004 up to 702,726 GWh in 2020. This will require a total installed capacity of 125,000 MW, up from the current 92,000 MW (see Table 1).

These estimates are based on a continuation of the current patterns of energy use in Brazil, where energy-intensive industries, principally companies that process aluminium, metal alloys and cement consumed more than 50% of the total electricity production in 2004. The remaining power demand is roughly equally divided between the commercial and public services sectors and the residential sectors, accounting respectively for 80,171 GWh and 78,577 GWh. From this BAU scenario, realistic electricity reduction potentials were then assessed for the year 2020, the so-called 'Power Switch' scenario.

Table 1: Total power demand in 2004 and BAU projections for 2020 (GWh)

	Current	BAU	
Sectors/ Consumption	2004 (GWh)	2020 (GWh)	Annual growth rate (%) (2004-2020)
Residential	78.577	172.325	5,0%
Commercial and public sector	80.174	176.399	5,1%
Industrial	172.061	354.001	4,6%
Total power consumption	330.812	702.726	4,8%
Required power generation[1]	383.742	794.080	4,6%

Note: (1) includes transmission and distribution lossess of 13% by 2020; in 2004, losses were estimated at 16%.

4. KEY ENERGY EFFICIENCY AND RENEWABLES OPTIONS

The PSW scenario (see Figure 1) includes the following measures to increase energy efficiency both on the supply and demand-side (see Figure 2) and meet projected electricity demand with new and sustainable renewable energy sources (see Figure 3).

4.1 Supply-side Options

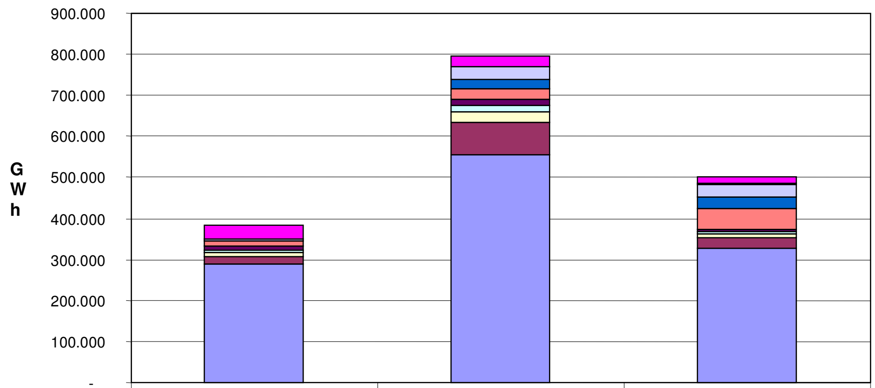
- *Retrofitting power plants*. It was assumed that retrofitting larger hydro plants could improve the supply by 15,000 MW – roughly equal to the capacity of one ITAPU hydropower plant– even though studies indicate a potential of up to 32,000 MW for a cost of BRL 250-600 per additional kW.
- *More efficient new thermoelectric power plants*. New combined cycle natural gas (CCNG) plant could reach efficiencies of 60-65%, compared to the current 35% efficiency rates of open cycle power plants. The PSW scenario assumes an average efficiency of 45% by 2020.
- *Reduction of power losses*. It is estimated that about 16% of the generated power is lost through the transmission and distribution system, compared with an international standard of about 6%. Through the introduction of more efficient power tranformers, the PSW scenario assumes to reduce losses to a 8% by 2020 – equal to the average loss rate of the United States in 2004.
- *Network management*. Efficiency gains achieved through new dispatch criteria for hydropower output, in coordination with thermoelectric production, and better power lines management are assumed to result in a 3% power generation increase.
- *Co-generation and distributed generation*. Significant energy savings can be obtained through distributed generation, such as natural gas-fired micro-turbine, and co-generation – the combined production of heat and electricity. It was assumed these energy systems will supply 4% of the 2020 generation, even though studies indicate a 10-15% potential.
- *Bioenergy*. Although a range of technologies including gasification and anaerobic digestion could be used in Brazil, bagasse co-generation is currently the most attractive option. Bioenergy production is a complementary to hydropower in the Southern and Southeastern regions, as the biomass feedstock harvest, such as sugar cane and rice waste, takes place during the dry season. With an assumed 20% cost reduction by 2020, installed capacity will increase by about 6000 MW.
- *Wind power*. The PSW scenario assumes wind power will supply 6% of the total electrical generation capacity by 2020, requiring an installed capacity of 8200 MW. That is only 11% of the technical potential estimated at 143,000 MW –double the country's current installed hydropower capacity. It is estimated a 15% reduction in wind power costs by 2020.
- *Hydropower*. With about 70,000 MW installed, Brazil is the third largest hydropower producer, following Canada and China. It was estimated an additional increase of about 6000 MW. For small-scale hydropower growth rates of 2-3% were assumed resulting in an installed capacity of 6900 MW by 2020, compared to an estimated potential of 2000 GW.

- *Solar photovoltaics*. High growth rates can be sustained for PV, but starting from a small base the technology will likely only make a significant impact by 2020 by supplying 1600 MW. Given the prohibitively high cost of extending the grid to rural communities, solar energy can play an important role in promoting rural development.
- *Coal*. Coal-fired generation will represent 1% of power generation by 2020. Improved coal-burning technologies that are currently coming onto the market, such as supercritical boilers and integrated gasification combined cycle systems, do not on their own reduce CO_2 emissions sufficiently. Capturing the CO_2 from fossil fuelled power stations and storing it underground –geosequestration – is neither a mature technology nor commercially available at this point and as a result has not been included in this study.
- *Nuclear power*. No new nuclear power capacity is assumed, though the scenario contains existing nuclear capacity which over the period to 2020, assuming a gradual phase out.

4.2 Demand side options

Figures 3 and 4 provide an overview of the potential for electricity generation, including the following options:

- *Efficient electric motor driven systems*. These use the largest amount of electricity in industry (about 60% of the total power consumed) and their energy performance can be increased through more efficient electric motors –which were assumed to be 20% more efficient by 2020– and the use of variable speed drivers. This could result in a power saving of over 55,000 GWh by 2020.
- *Appliances, consumers electronics and office equipment*. These devices account for a growing fraction of total electricity use in both households and workplaces. Energy saving options include more efficient appliances, efficient cooling (refrigerators, freezers and air-conditioning equipment) and efficient lighting. For instance, through the deployment of the best available technology, energy consumption of refrigerators – accounting for 30% of typical households consumption– could be cut by 40% on average, with a total power saving of 6,178 GWh by 2020. Stand-by and low-power mode use by consumer electronics is responsible for about 10% of residential and services power demand in Brazil. Current regulation to reduce stand-by option/energy use on appliances to 1-W is lacking implementation.
- *Electric shower heaters.* These systems consume 8% of all Brazil's electricity production and around 18% of the peak demand. Electrical showerheads are in themselves extremely cheap, costing USD 10 or less. However, given their high lifecycle electrical consumption, each shower head requires an investment of more than USD 1000 in new electricity-generation capacity to guarantee the peak power needed to fuel them. They can be replaced by domestic solar water heater systems, especially when it comes to new buildings or those with central heating systems that allow adaptations for solar thermal energy. The PSW scenario assumes a power-saving of over 27,000 GWh by 2020.



	2004	BAU 2020	PSW 2020
Imports	34.322	23.822	15.024
Solar PV	-	-	2.504
Small hydro	5.048	31.763	30.049
Wind power	56	23.822	30.049
Biomass	10.874	23.822	50.081
Nuclear	10.660	15.882	5.008
Coal	6.041	15.882	5.008
Oil	9.592	23.822	10.016
Natural gas	17.686	79.408	25.041
Hydro power	289.464	555.856	328.034

Figure 1: Electricity demand and fuel mix in 2004, and in 2020 under the BAU and PSW scenarios (GWh)

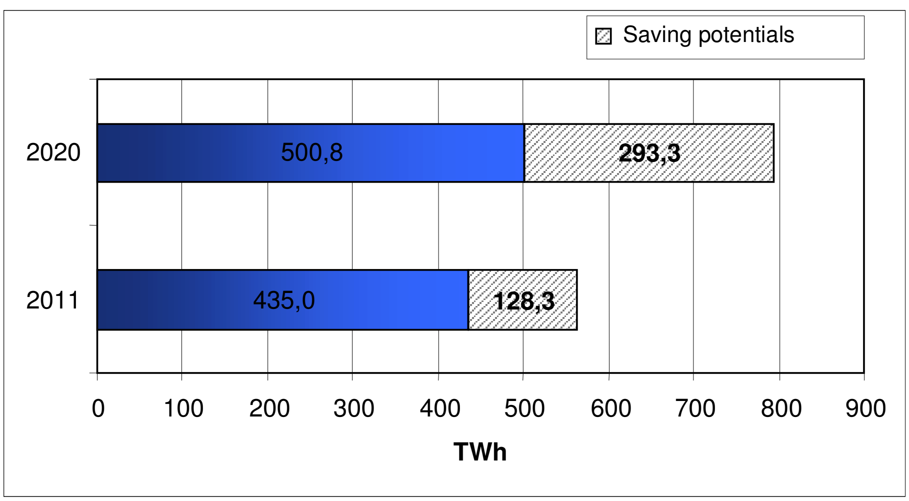


Figure 2: Total saving potential for electricity generation in 2011 and 2020 (TWh)

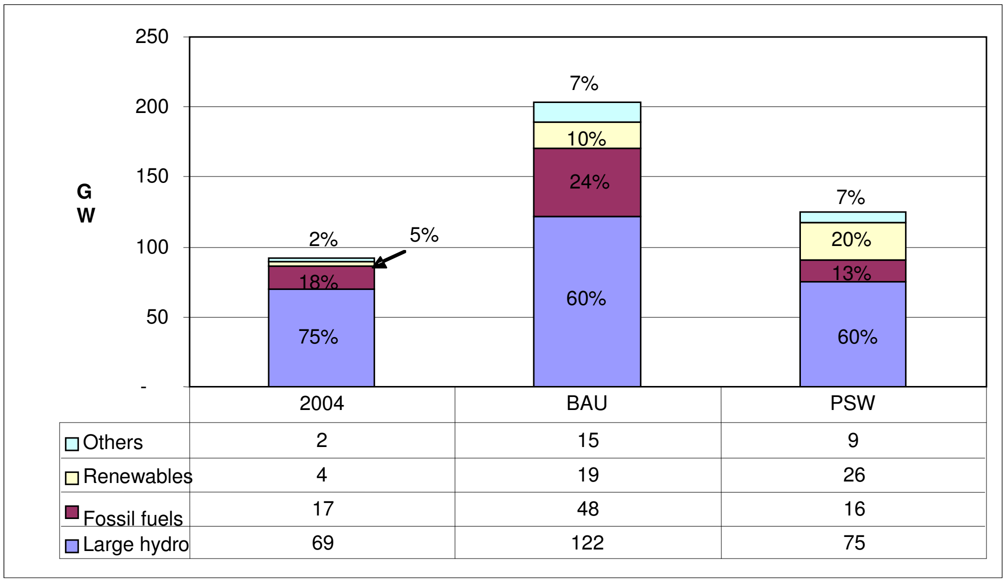


Figure 3: Installed capacity and fuel mix in 2004 and 2020 under the BAU and PSW scenarios (GW)

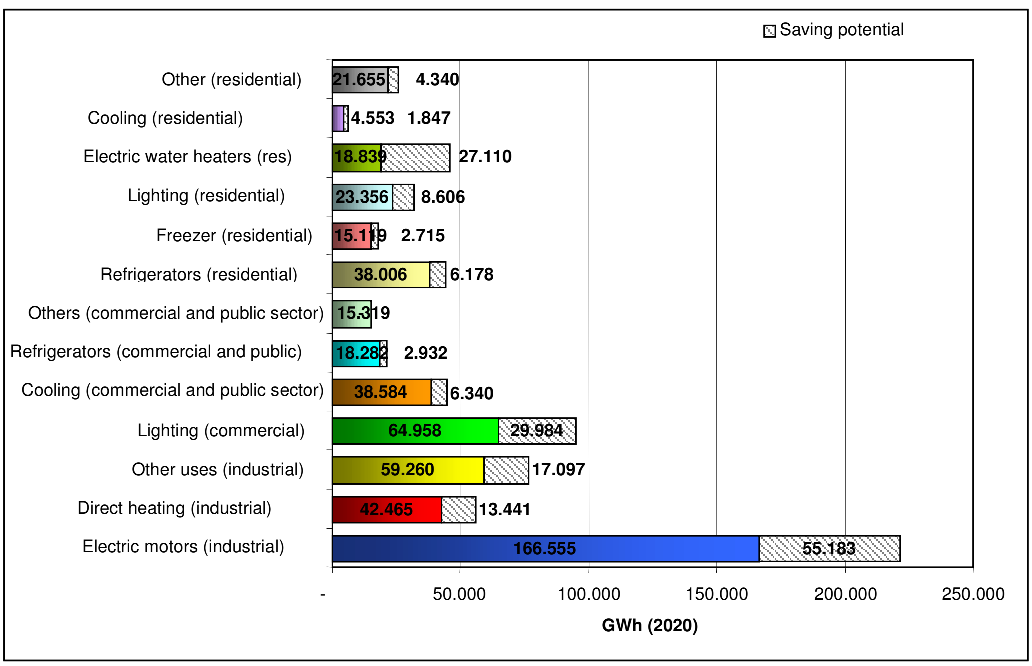


Figure 4: Energy efficiency potential for major end-uses by 2020

5. THE STUDY'S/RESEARCH FINDINGS

5.1 Business-As-Usual scenario

The main results for electricity demand under the BAU scenario are shown in Figure 1 and 2. These estimates are based on a continuation of the current patterns of energy use in Brazil, where energy-intensive industries still consume about half of the total electricity production in 2020. Highlights include:

- Under the BAU scenario, power consumption is projected to increase by 4.8% annually, from 330,812 GWh in 2004 up to 702,726 GWh in 2020, requiring a total installed generating capacity of 125,000 MW up from the current 92,000 MW.
- Generating capacity and output remains dominated by large-scale hydropower, though relatively decreasing, with an increasing share of fossil fuels, particularly natural gas. Also, 70% of the generating capacity will be based on hydropower in 2020, while fossil fuels and nuclear power will cover 15%, followed by new renewables with 10%.
- Natural gas consumption growth from roughly 17,000 GWh in 2004 to just below 80,000 GWh by 2020, equal to a 470% increase which will make the country mode dependent on unstable foreign supplies.

5.2 The 'Power Switch' scenario

- Energy savings are the key difference with the BAU scenario. The PSW scenario projects total electricity demand at roughly 500 TWh by 2020, with savings totaling 290 TWh - equivalent to 75% of the electricity consumption in 2004, that brings demand down by 38% by 2020.
- The need for expensive investments in new power infrastructure could be avoided, provide a net economic and social benefit to the Brazilian people. Specifically, the need to construct 78.000 MW of new energy generation plant by 2020 could be avoided – equivalent to the capacity of 6 large hydropower plants of the ITAPU-type or 60 nuclear power facilities of the Angra III;
- On the supply side, share of renewable energy, including large hydropower, in the fuel mix increases up to 80% of the installed capacity by 2020. New renewable energy options such as biomass –particularly sugar bagasse-fired co-generation– wind power, and small hydropower deliver the major supply increase, totaling about 26000 MW of installed capacity.
- Under the PSW, there will be no need to build new fossil fuels power plants. Natural gas consumption will stabilize at 2004 levels, reducing the country's dependency on unstable foreign energy resources.
- Under the high levels of energy efficiency and main renewable measures assumed, CO_2 emissions are stabilized at about 2004 levels. This is a 200% fall by 2020 compared to the BAU scenario. This will keep Brazil's leadership on low-carbon electric energy.
- Under the PSW scenario, inundated land will be reduced by a factor of seven compared to the BAU – that is from 142 square Km down to 955 square Km – leading to much lower socio-environmental impacts. Indeed, almost two-thirds of the country's hydro potential is in the rivers of the Amazon meaning that under a business as usual scenario the number

of rainforest, indigenous and riverbank communities affected by new dams infrastructure could rise significantly.

- The PSW scenario will create 10 million new and better jobs in the renewable energy sector – that is a 3.5 million additional to the BAU scenario. In reality, employment creation is likely to higher because the study does not account for the jobs created within the energy efficiency sector, for which there is a lack of data.

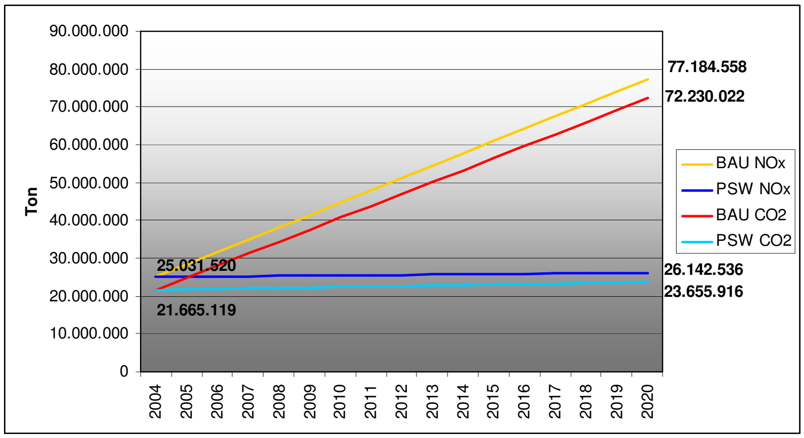


Figure 5: CO2 and NO_x emissions in 2004 and 2020 under the BAU and PSW scenarios (tCO_2)

6. COSTS OF MARKET TRANSFORMATION

The study has calculated the costs for implementing the BAU and PSW scenarios. The cost of the PSW scenario include the costs of investment, transmission and distribution of the increased generated power, as well as the costs associated with implementing energy efficiency programmes and deploying new renewable energy sources.

In comparing the cost effectiveness of energy efficiency vs supply side options, the study aims to minimizing consumers' costs of meeting a specific end-use service. For this, it assumes higher discount rates for investments compared to those applied by the power sector. The cost of supplying electric energy is assumed to correspond to the end-use power tariff, so that it is possible to compare it with the cost of energy savings measures. In 2004, the average electric tariff was BRL 197,25/MWh and this is assumed to increase to BRL 350/ MWh by 2020

While a fully detailed economic assessment has not been carried out, some initial conclusions on the costs have been made. These show that:

- The PSW scenario will be 12% less costly than the BAU scenario (see Figure 6). This is equivalent to USD 33 billion of savings by 2020, resources that can be used to meet urgent socioeconomic development needs in the area of health and education.
- As shown in Table 2, around half of the considered demand-side energy efficiency options can be implemented at a cost that is three-times lower than the retail cost of electricity by 2020 and one time cheaper than the current electricity tariffs.

- An important synergistic effect is that strong efforts to improve energy efficiency on the demand side will have a downward pressure on the electricity prices in Brazil.

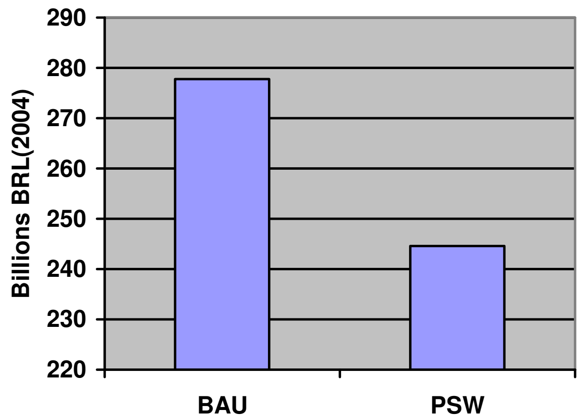


Figure 6: Total costs of the BAU e PSW scenarios (Billions BRL)

	Cost (BRL/MWh)	Saving potential (GWh)	Total cost of energy efficiency programme and policy (millions BRL)
Electric heating head (residential)	100	27.110	2.711
Lighting (commercial+public)	100	29.984	2.998
Other uses (industrial)	100	17.097	1.710
Lighting (residential)	110	8.606	947
Air conditioning (residential)	120	1.847	222
Air conditioning (commercial +public)	120	6.340	761
Direct heating (industrial)	120	13.441	1.613
Refrigerators (residential)	130	6.178	803
Freezers (residential)	130	2.715	353
Refrigeration (commercial +public)	130	2.932	381
Replacement of inefficient industrial motors (i)	130	55.183	7.174
		Total	19.672

Notas: r = residencial; i = industrial; c + p = comercial e público. Custo médio de fornecimento em 2020: R$ 350/MWh. Tarifa média nacional em 2004: R$ 197,35/MWh (ANEEL, 2005). Os custos foram estimados a partir de substituições de tecnologias convencionais por tecnologias mais eficientes disponíveis comercialmente hoje. Foram considerados custos anuais de investimentos amortizados ao longo da vida útil de cada equipamento, utilizando taxas de desconto entre 15-80%, dependendo de cada tipo de uso final e consumidor.

Table 2: Savings potentials and costs of energy efficiency measures

7. CONCLUSIONS

The study shows that with an effective electricity demand reduction programme and the aggressive adoption of policies stimulating renewable energy investment and efficient and retrofitted power facilities, Brazil will meet its 2020 electricity needs at low-cost and in a low impact way.

Only once supply-side and demand energy efficiency and conservation efforts have been fully implemented and if proven to be less successful than projected, would additional generation measures such more hydropower capacity considered, assuming that the outstanding issues regarding its socio-environmental impacts and acceptance have been adequately addressed, through for instance, the full and effective implementation of the Commission on Dams Guidelines.

The major challenge for policymakers will be in designing and stimulating an effective market and implementation programmes for energy efficiency and renewable energy technologies. Brazil has the potential for being one the first countries to have a low carbon power sector beyond 2020.

8. POLICY RECOMMENDATIONS

What then needs to be done for Brazil to realise its potential and make the transition to a more efficient, secure and sustainable power sector? As things now stand, Brazil's energy plans focuses mainly on expanding power generation facilities, principally large dams and fossil-fuels power plants. In order to realise the PowerSwitch Scenario by 2020, the government must approve and deploy a strategic plan to foster effective implementation of energy efficiency measures, as well as expanded use of renewable energy sources. This plan should include the following nine measures:

1. **Energy efficiency auctions.** Energy efficiency should be fully integrated into the energy planning process, through energy efficiency auctions, where a specific amount of energy consumption is saved through energy conservation measures. This is an alternative way of enabling implementation of energy-saving measures on the supply and demand sides through market agents. As far as end-use is concerned, this will make it possible to establish energy-efficient services companies (ESCOs) and, with regard to the supply side, it will boost the refurbishment of old large hydroelectric plants. These efficiency measures could deliver a potential of about 290 TWh by 2020 at a lower cost than that for the relevant year.

2. **Energy efficiency standards.** Implementation of the Energy Efficiency Law must become a priority by quickly approving more aggressive energy performance standards for appliances and motors. To complement this, it is also necessary to foster more efficient technologies and processes throughout the supply chain. Hence, the government should approve high energy efficiency standards for industrial processes, focusing on energy-intensive sectors and starting by the most inefficient segments with the largest potential for reductions. The implementation of such process standards must include financial and regulatory incentives, but also fines or penalties if the standard is not reached in a given time. In addition, mandatory technical standards and use of Research

& Development funds must be part of policies to reduce technical transmission and distribution costs.

3. **Technological bids.** The public sector accounts for approximately 10% of the total electricity consumption. Government agencies may set performance standards that will encourage manufacturers to develop and supply a given product to satisfy this demand. This sort of initiative is particularly important when associated to new technologies that have not yet been introduced at a significant scale into the market.

4. **Efficiency investment targets.** Mandatory investments of electricity companies in their energy efficiency and Research & Development programmes, in addition to the Sectoral Energy Fund (CTEnerg) that is estimated at about R$ 400 million/year, must be better managed so as to ensure maximisation of their effectiveness. Therefore, it is necessary to quantify the saving targets for such investment programmes, improve capabilities for monitoring, checking and evaluating the outcomes in terms of saved MWh and avoided MW that are obtained from these resources.

5. **National Distributed Generation Programme (PROGEDIS).** The government should implement a distributed generation programme at national level that includes stable and transparent incentives that make it possible to tap into the potential provided by these technologies, such as gas – and biomass–fired combined heat and power (CHP) and localised renewables. Considering the large co-generation potential from sugarcane bagasse use, valuation criteria and methods for auctions of new energies must be part of preliminary public hearing processes.

6. **Incentive Programme for Alternative Electric Energy Sources - phase two (PROINFA II).** The government should announce a phase two of the PROINFA scheme, with the goal of increasing the share of renewable electricity to 10% by 2010, and 20% by 2020. A more transparent programme that involves less red tape and is adjusted to the needs of renewable energy producers would be a substantial gain during the second phase.

7. **National Solar Thermal Energy Programme (PROSOLTER).** In order to effectively tap into the huge potential of solar thermal energy in Brazil, a national programme for this clean and cheap source of energy is required. This programme must include development targets, financing incentives for end consumers, and tax breaks, such as reduced taxes. Low-income populations may receive substantial benefits from such measures. It is fundamental to emphasise the need to require that proper devices be installed in new buildings. About 9% of total energy savings under the Sustainable Energy Scenario derive from implementation of a national programme for the coverage of nearly a third of households across the country by 2020.

8. **Reduction of subsidies to conventional energy sources.** Subsidies to fossil fuels spur wastage of electricity and make it difficult to introduce renewable sources of energy into the country's electricity generation mix. A reduction and eventual phase-out of such subsidies is necessary, such as the Fuel Consumption Account (CCC in Portuguese), which introduces biases into the market favouring fossil fuels such as coal and diesel. However, there must be differentiated treatment regarding use of CCC funds for the interconnected and the isolated electrical systems. For 2006, over R$ 4.5 billion will be

spent with CCC, i.e., 10 times more than the amount of mandatory investments to be made by electricity distribution companies under energy efficiency programmes.

9. **Awareness and education.** Although the country has developed energy conservation awareness programmes, be it through the National Electricity Conservation Programme - PROCEL, the National Programme to Rationalise the Use of Oil Products and Natural Gas - CONPET or the energy companies themselves, it is constantly necessary to follow up on the dissemination of up-to-date information on energy technologies and the most efficient ways of using the technologies and conserving energy. Significant barriers still exist, especially in terms of dissemination of technologies for thermal uses of solar energy in the household, industrial and office building sectors.

This study was supported by the following organizations:

- ABESCO –Brazilian Association for Energy Efficiency Companies
- ABRAVA – Brazilian Association of Refrigeration, Air Conditioning, Ventilation and Heating
- IDEC – Brazilian Consumers' Association
- INEE – National Institute for Energy Efficiency
- EOLICA – Brazilian Centre for Wind Energy
- FBOMS – Brazilian Forum of Social Movements and NGOS for Sustainable Development
- UNICA – São Paulo's Sugar Cane Agroindustry Union
- UK British Embassy

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