

Contribution of energy services

to the Millennium Development Goals and to poverty
alleviation in Latin America and the Caribbean



UNITED NATIONS



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Bundesministerium für
wirtschaftliche Zusammenarbeit
und Entwicklung



Contribution of energy services to the Millennium Development Goals and to poverty alleviation in Latin America and the Caribbean



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This document was published with funding from *Deutsche Gesellschaft für Technische Zusammenarbeit* (GTZ).

The views expressed in this document are those of the author and do not necessarily reflect those of the organizations which supported the project. This document has been produced without formal editing.

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Foreword

The energy debate has one dimension that is often sidelined: its relationship with poverty and development. This document attempts to shed some light on this aspect, unnoticed when public policies are being formulated.

The document describes the results of the joint effort of the Economic Commission for Latin America and the Caribbean (ECLAC), the United Nations Development Programme (UNDP) and the Club de Madrid, which highlight the crucial role of access to energy services¹ in the attainment of the Millennium Development Goals.

Access to energy services, as a basic factor for poverty reduction and improvement of the environmental conditions of the socially most vulnerable groups, is a topic that is usually not featured prominently in official government policies. In the national development plans, poverty reduction strategies and energy plans and strategies of a large number of countries in Latin America and the Caribbean, the relationship between energy and poverty is not mentioned and, when it is, it is not dealt with in any depth.

There has been little research in Latin America and the Caribbean on the linkage between access to energy services and attainment of national goals for development, poverty reduction and environmental protection. This document shows that, despite the high rates of urbanization in Latin America and the Caribbean, almost 30 million people still do not have electricity, of whom 21.4 million (73 per cent) are poor. The lack of electrical services is directly related to poverty: it is estimated that, of the total poor in the region (200 million), about 10 per cent have no electrical services and this figure rises to 30 per cent in the case of the absolute poor.

¹ The term “energy services” is used to describe the benefits provided by energy use. For households, these benefits include lighting, cooking, refrigeration, telecommunications, education, transport and mechanical power. Energy services are the last link in a chain which starts with primary energy sources and continues with their transformation into energy carriers suitable for final use as fuels and electricity. From the viewpoint of the consumer, what is important is the availability and coverage of energy services. (UNDP 2005).

A large number of households still do not have access to modern fuels for cooking; when they do, this accounts for a disproportionate share of their income, which exacerbates social inequity in the region. In addition, areas which have the largest per capita consumption of firewood generally have low human development indices. The largest number of families using firewood, in all the cases analysed, is usually found among the poorest inhabitants. Consequently, although access to energy for the poor sectors is not one of the Millennium Development Goals, it is undoubtedly a vital prerequisite for their attainment.

If the Millennium Development Goals are to be attained, the energy policy of States must give priority to the goal of providing access to energy services for the poor, at prices they can afford. For this reason, the energy policies of States cannot be viewed solely from the macroeconomic viewpoint or from the viewpoint of the major energy industries – oil, gas, nuclear or hydroelectric energy – and cannot be subsumed under the major topics such as energy security, geopolitical interests connected with these resources, or effects on climate change.

Increased access by poor sectors to energy services provides an opportunity for incorporating low-carbon and energy-efficient technologies, as well as renewable and decentralized energy sources in remote rural areas. In comparison with the contribution of the higher-income sectors to greenhouse gas emissions, elimination of energy poverty would have a marginal effect on national emissions, in view of the low participation of these sectors in total energy consumption.

All this presupposes a major change from the current view of this issue as being irrelevant: there must be a shift from neglect to active awareness, and particularly towards the expression of a clear political will to eliminate energy poverty as an integral part of the attainment of the Millennium Development Goals. There must be plans with clearly defined goals and quantitative and qualitative resource commitment, with implementation monitoring and evaluation. This will require better coordination between the various ministries, services and government agencies responsible for executing these policies; it will also require definition of areas of action and collaboration between the public and private sectors and between national efforts and international cooperation.

The State must carry on a proactive role in the energy sector. This role must come together with that of the private sector in a joint effort to achieve the goals of a sustainable and equitable energy policy. Specific goals should therefore be included regarding access to energy for sectors currently without access, and possible and desirable sources geared to the availability of resources and to economic, social and environmental conditions must be identified in each case. Similarly, regulatory frameworks should be established to protect poor consumers in order to guarantee access to clean, efficient and modern energy sources at affordable prices.

The design of policies for qualitative and quantitative access to energy, at prices suited to income levels, may have to include subsidies, both to facilitate access to energy sources and to purchase modern and efficient equipment so as to reduce families' total energy costs and help to alleviate climate change.

In the case of policies for rural areas, it will be necessary: (i) to identify mechanisms to guarantee the continuity and expansion of supply to households; (ii) to move towards programmes that ensure the provision of sufficient energy to improve the productivity of the economic activities of rural communities in order by this means to achieve poverty reduction; (iii) to promote replacement of firewood as an energy source wherever possible and, where this is not possible, use must be made sustainable by means of efficient equipment; (iv) to set thresholds for access to electricity so that sufficient power is provided for productive uses. On the other hand, in the case of urban areas, there will be a need: (i) to set basic consumption standards; (ii) to introduce reduced rates; (iii) to give consideration to cross subsidies; (iv) to adopt energy efficiency policies. Since programmes of this kind can have a considerable impact on total energy consumption, long-term overall and sectoral planning is needed in order for energy consumption to be sustainable.

Efficient and effective access to energy services is a vital requirement for attainment of the Millennium Development Goals, which in turn are intrinsically linked to the enhancement of human rights and of democracy. The countries of the region must therefore rise to the challenge of energy access in order to promote a decent quality of life and protect the rights of their citizens. To this end, it will be essential to formulate national, regional and international agendas that have a clear focus on this subject and that represent effective tools in efforts to combat poverty and inequity.

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1. Introduction

Even though the international community acknowledges the linkage between energy, poverty and the environment, the operational implications of this consensus are not made clear either in development policies or in planning and monitoring documents for attainment of the Millennium Development Goals (MDG) in Latin America and the Caribbean.

Traditionally, energy continues to be considered as a sector apart and few links are made between access to energy services and attainment of national goals for development, environmental protection and poverty reduction.

In spite of the high urbanization rates in Latin America and the Caribbean compared with regions like Asia and Africa, around 28 million people are still without electricity and a significant number have no access to modern fuels for cooking. When they do, it accounts for a considerable proportion of their income, exacerbating social inequity in the region.

Energy shortages limit people's opportunities and their quality of life as regards their economic productivity and their ability to enjoy education, food, health and gender equality.

This document, which stems from a joint initiative by the Economic Commission for Latin America and the Caribbean (ECLAC), the United Nations Development Programme (UNDP) and the Club de Madrid, stresses the importance of incorporating the energy-environment-poverty linkage into national planning frameworks as a key contribution to attaining the Millennium Development Goals.

In this connection, it is essential to understand that, although access to energy by the least protected strata of the population is not in itself one of the Goals, it is undoubtedly a prerequisite for the attainment of all of them.

The energy approach proposed in this document encompasses a series of interrelated aspects each addressed in a separate section.

- First, it makes an exhaustive analysis of the documentation relating to national development plans, poverty reduction strategies and energy plans and strategies, as well as of national reports on progress towards the Millennium Development Goals (MDG reports). The aim is to evaluate and characterize the way in which Latin American and Caribbean public policies link the energy issue with attainment of the Millennium Development Goals in general, and with poverty reduction and environmental sustainability in particular.

- Second, it analyses regional poverty trends, highlighting the differing poverty dynamics between urban and rural areas. This makes it possible to identify patterns specific to the Latin American and Caribbean region, differences among the various countries and differences in the type of energy access problems between one geographic area and another.
- It goes on to analyse the energy sources used by poor households compared with middle- and upper-class households. This is examined from the standpoint of differences between poor and non-poor households with regard to equipment and income-energy expenditure ratios, as well as in terms of the relationship between energy-access indicators and human development indices (HDI).
- The study also explores the use of firewood and analyses recent trends, making it possible to identify specific and general situations relating to the problem and its solutions.
- It also makes a generic evaluation of the use of renewable energy sources as part of strategies for alleviating energy poverty.
- A specific chapter has been devoted to identifying, insofar as possible, the social and environmental impact of energy sector reforms in South America and Central America.
- Lastly, on the basis of this analysis, it puts forward a preliminary proposal on the need to make problems with the energy-poverty-environment linkage an explicit part of national planning frameworks, in order to progress towards inclusion of the matter among the priorities of Governments in the region.

The following conclusions have been drawn from the analysis:

- The examination of numerous national planning and energy documents has shown that energy access for the poor is not made an explicit priority of either policies or specific goals.
- The study has determined that energy access and environmental protection problems still impact most heavily on poor people living in rural areas. Despite a larger increase in the number of urban poor compared to rural poor, this has been one of the most notable features of the region in the past three decades.
- In many cases, the approach to rural electrification, access to clean and renewable energy sources and the substitution of firewood with modern and efficient fuels has been muddled. No distinction is made between the different types of energy problems faced by poor urban people compared with the rural poor; nor have strategies been formulated to address the different electricity uses (such as lighting and communication) and heating uses (such as cooking) in an integrated fashion.
- In all the cases analysed, the poorest sectors of the population were found to spend a larger proportion of their monthly income on energy than the middle and upper classes. This has led to marked inequity in the energy expenditure-income ratio between the poor and non-poor strata.
- The poorest users tend to pay more than others for each caloric unit consumed, owing as much to socially and environmentally retrograde models of pricing and tariff policies as to lack of access to cheaper and more efficient energy sources. In some cases, energy sector reforms, especially in South America, have undermined equity by increasing the tariffs for low consumption more steeply than for higher consumption rates.
- An analysis of the decline in total firewood consumption in Latin America and the Caribbean reveals that this is mainly the result of rural-urban migration and that there has been a relative rise in firewood consumption per rural inhabitant. Furthermore, there has been a further upsurge in firewood consumption since the fuel price rises in 2003, which is a clear indicator of the vulnerability of poor social sectors to increases in international oil prices.

- An examination of access to equipment by poor households compared with non-poor households reveals gaps and inequities that are difficult to reconcile with a democratic and egalitarian society. It calls for integrated energy planning that includes goals for coverage of basic needs, efficient use of energy, increasing the supply of energy from clean and renewable sources, and access to equipment for households and other types of energy consumers in both poor and non-poor sectors.

Following more than a decade of energy sector reforms in the region, it has become clear that the State must carry on a proactive role in the energy sector. This role must be made compatible with that of the private sector in a joint effort to achieve energy policy objectives. Preliminary recommendations are that these objectives should include:

- Specific goals regarding access to energy for sectors currently without access, and possible and desirable sources geared to the availability of resources and to economic, social and environmental conditions must be identified in each case.
- Regulatory frameworks should be established to protect poor consumers in order to guarantee access to clean, efficient and modern energy sources at affordable prices.
- Financing mechanisms should be clearly identified, as well as the sources and specific allocation of financing.
- The scope of energy consumption and investment subsidies in both rural and urban areas should be defined clearly, specifying financing mechanisms.
- Energy consumption projections for the poor should be included in an integrated framework of energy projections.
- Reasonable supply horizons should be guaranteed by means of callable investment plans.

To achieve these objectives it will be necessary to enhance the capacity of institutions and technical personnel in the sectors responsible for designing, implementing and monitoring energy policy programmes, as well as to build social and political consensus among the various stakeholders. In other words, the importance of energy access needs to be seen in a context of strengthening democratic societies in the region.

The current deficiency of information needed to address the energy-poverty-environment linkage effectively is a serious obstacle not only to policy formulation but also to a clearer characterization of the problems.

2. Energy access in the region's national planning frameworks: analysis of explicit priorities

2.1 Approach adopted

National energy plans tend to focus on aspects of macroeconomic growth, such as expanding power generating capacity and large-scale electricity distribution in the country. The plans give little importance to such issues as how to provide access to energy services for the poorest sectors of the population that have insufficient energy services to meet their basic needs, such as for cooking or to support productive activities.

In order to ascertain precisely how the various Latin American and Caribbean countries have taken energy issues into account, the following types of document were analysed:

- National poverty reduction strategy papers which present a structured view of medium- and long-term development and determine the type of policies and investments required to reduce poverty and hunger and to promote health, education, gender equality and environmental sustainability up to the year 2015.
- National development plans, which fulfill the same function as national poverty reduction strategies but take a national approach focusing less on the specific problems of the poor.
- National reports on progress towards the Millennium Development Goals, which to an extent reflect national priorities and provide information on the development models chosen by Governments to attain the Millennium Development Goal targets. As none of the Goals refers directly to energy, it is even more interesting to discover how these documents present the connections between energy and poverty reduction or the environment and whether they demonstrate the country's concern for such connections (see table 1).

TABLE 1
ENERGY AND THE MILLENNIUM DEVELOPMENT GOALS: ALTHOUGH ACCESS TO ENERGY IS NOT ONE OF THE GOALS, IT IS COMMON TO ALL OF THEM

Energy and the Millennium Development Goals		
ENERGY	1	Eradicate extreme poverty and hunger
	2	Achieve universal primary education
	3	Promote gender equality
	4	Reduce child mortality
	5	Improve maternal health
	6	Combat HIV/AIDS, malaria and other diseases
	7	Ensure environmental sustainability
	8	Develop a global partnership for development

Source: Leila Mercado, *Papel de la energía en el logro de los Objetivos de Desarrollo del Milenio*, Panama, United Nations Development Programme (UNDP), June 2008.

National and subregional energy strategies were analysed to ascertain the degree to which Governments link energy with the fight against poverty or with environmental protection, and whether they have set goals or targets for access to energy services, particularly for the poor and/or for the development of renewable energies, as well as whether they have allocated a budget to them.

In 2007, the UNDP published two reports presenting the results of a worldwide review of how national poverty reduction strategies and national reports on progress towards the Millennium Development Goals address energy-related issues.² This project document updates and expands upon the UNDP review, focusing specifically on the Latin America and Caribbean region.³

The following table summarizes the documents analysed.

² See UNDP (2007a), which analyses the extent to which energy-poverty dynamics are reflected in national poverty reduction strategy papers worldwide. See also UNDP (2007b), which makes a worldwide review of how the energy issue is tackled in national Millennium Development Goal reports.

³ This study examines the latest available versions of national poverty reduction strategy papers and Millennium Development Goal reports adopting a similar methodology to that used for the UNDP review. It reveals how far the treatment of energy issues has evolved between the two analysis periods and identifies the main trends. In addition, this study includes national development plans. A point of note is that few Latin American countries prepare national poverty reduction strategy papers (which is why the UNDP worldwide review included only four Latin American countries). As most countries publish national development plans in the form of medium- and long-term national planning framework documents, this study includes an analysis of the latter to gain a better understanding of how the region's national planning frameworks address the energy issue. In addition, this study reviews national energy strategy documents, which were not analysed in the 2007 worldwide review.

TABLE 2
DOCUMENTS ANALYSED TO ASCERTAIN WHETHER AND HOW MUCH IMPORTANCE IS
ASSIGNED TO ENERGY-POVERTY-ENVIRONMENT LINKAGES

Country	National poverty reduction strategies	National development plan or equivalent	Millennium Development Goal report version	Energy plan ^a
Argentina		Argentina 2016: National Policy and Strategy on Development and Land-use Planning	2007	National Energy Plan 2004-2008
Bolivia (Plur. State of)		National Development Plan : a dignified, sovereign, productive and democratic Bolivia for living well 2006-2010*	2008	
Brazil			2004*	Ten-Year Energy Expansion Plan (PDE 2007/2016)*
Chile		Government programme: Presidential Message to the Nation of 21 May 2008	2005*	
Colombia		National Development Plan 2006-2010	2005*	National Energy Plan 2006-2025
Costa Rica		National Development Plan 2006-2010*	2004*	
Cuba			2005*	
Ecuador		National Development Plan 2007-2010*	2005*	
El Salvador			2007*	National Energy Policy (May 2007)
Guatemala	National Poverty Reduction Strategy 2006		2002*	
Haiti	National Growth and Poverty Reduction Strategy Paper (DSNCRP) 2008-2010		2004	
Honduras	ENRRP (PRSP) Progress report 2004		2003*	
Mexico		National Development Plan 2007-2012*	2006*	
Nicaragua		National Human Development Plan 2008-2010, draft 0*	Version 2003*	
Panama		Government programme: 'New Homeland' Plan; agreements of the National Consultation for Development 2007	Version 2005*	
Paraguay	National Poverty and Inequality Reduction Strategy 2002*		2003*	
Peru		National report on attainment of the Millennium Development Goals (<i>Hacia el cumplimiento de los objetivos de desarrollo del milenio en el Perú</i>)	2004*	
Dominican Republic			2004*	Indicative Plan for Electricity Generation (PIEGE) 2006- 2006
Uruguay			2003*	Energy Strategy Guidelines for Uruguay (2006) Energy Policy 2005-2030
Venezuela (Bol. Rep. of)		Simon Bolívar National Project for the Economic and Social Development of the Nation, 2007-2013	2004*	

Source: Prepared by the author on the basis of information from the United Nations Development Programme (UNDP).

^a Where national energy plans are not available, the information appearing on the websites of the respective ministries was analysed.

The following steps were taken to rank the degree of importance assigned to each of the energy-related issues examined in this study:

- The rating scale was standardized in order to evaluate national poverty reduction strategy papers, national development plans and MDG reports uniformly. Below is a breakdown of the scale used to evaluate the depth in which the energy issue is addressed in the various documents:

Evaluation of the amount of energy-related content in the documents studied:

0. No data; no reference to energy; no energy keywords⁴ appear.
 1. Little mention: energy is discussed very superficially, providing only one or two anecdotal references or energy statistics.
 2. Moderate information: a few lines or one paragraph devoted exclusively to energy issues.
 3. Detailed information covering two paragraphs (half a page) or more of detailed information on energy issues.
- The matrix used in the 2007 documents to analyse national poverty reduction strategies has been adopted without modification to analyse the content of national development plans. A specific table was drawn up to examine how national energy strategies have addressed poverty reduction and environmental protection issues.

Figure 1 provides an overview of the scores that have emerged from analysing the abovementioned documents.

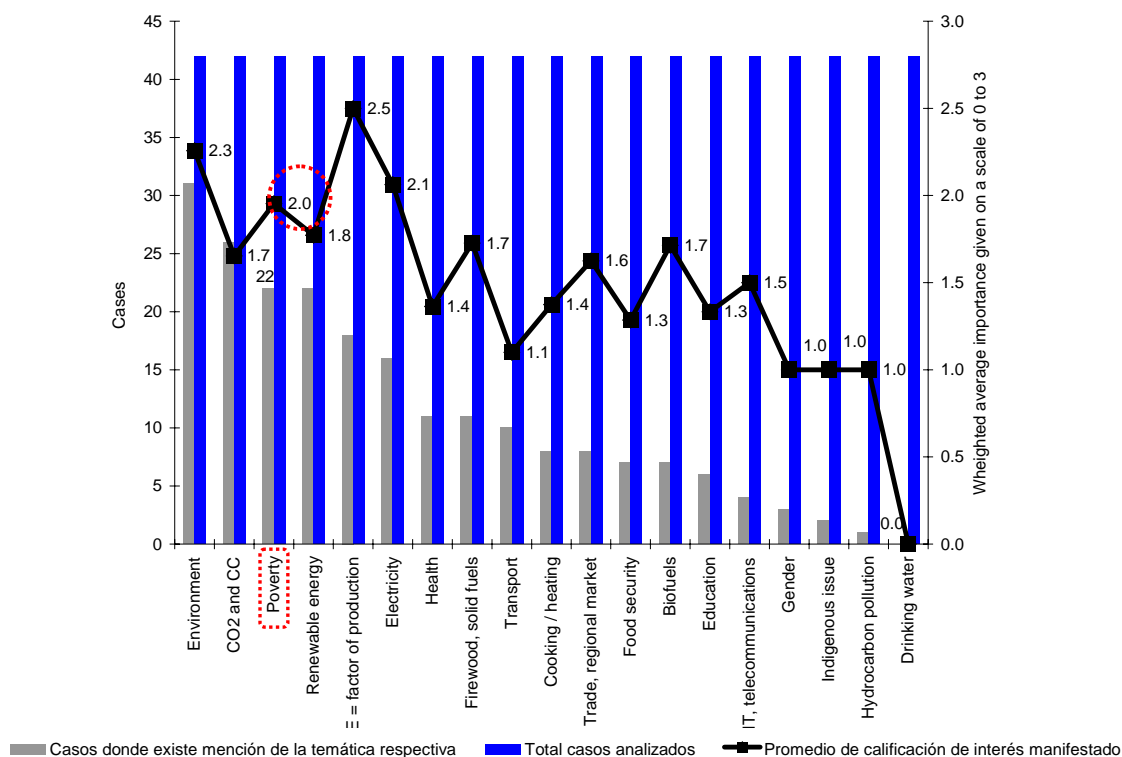
An initial conclusion from the analysis is that the energy-poverty linkage features in a little more than half of the documents. However, the average score for the importance assigned to the relationship between energy and poverty is 2 (moderate information: a few lines or one paragraph devoted exclusively to energy considerations). Furthermore, the average score is subject to 40% variability, one of the widest after firewood use and renewable energies (48% variability in the score for depth of treatment of problems and linkages).

By contrast, other issues, such as the linkages between energy and productive sectors, or the environmental impacts of energy, are dealt with in greater depth and present less variability (around 28%).

This is confirmed below when describing in detail the extent to which the different national documents establish links between energy and the various cross-cutting issues deemed to be important.

⁴ For MDG reports and national development plans, the keywords used were: energy, energy-related, electricity, electric, electrical, fuel, transport, oil, hydrocarbon, solar, wind, biomass, hydro, renewable, firewood, fuelwood, CO₂ and carbon dioxide. For energy strategies, the keywords used were: poor/poverty, development, rural, urban, environment, pollution, contamination, CO₂, carbon dioxide, transport, electricity, electric, electrical, solar, wind, biomass, hydro, renewable, firewood, charcoal, wood.

FIGURE 1
TOTAL NUMBER OF DOCUMENTS ANALYSED, NUMBER OF DOCUMENTS CONTAINING ENERGY-RELATED REFERENCES TO THE VARIOUS ISSUES AND AVERAGE OVERALL SCORE FOR THE DEGREE OF IMPORTANCE ASSIGNED TO THE LINKAGE BETWEEN ENERGY AND THE ISSUES ADDRESSED



Source: Prepared by the author.

2.2 Energy and the Millennium Development Goals: results of the documents analysis

2.2.1 Energy in relation to MDG 1: Eradicate extreme poverty and hunger

All the national development plans, national poverty reduction strategies and national energy strategies were found to take two predominant approaches to the energy-poverty nexus. The first emphasizes the key role of energy in economic development, which in turn constitutes the basic requirement for stimulating production, creating jobs and hence combating poverty. One paragraph in Colombia's national energy strategy illustrates this approach well. It states that only an expanding economy will make it possible to rectify the persistent problems of Colombian society, which result in high poverty rates and a growing number of people with unsatisfied basic needs (Colombia, 2007).

Haiti's national growth and poverty reduction strategy paper acknowledges clearly that the supply of productive energy is a Government priority for boosting economic growth, whilst at all times seeking to reduce monetary poverty and promote pro-poor growth.

The second predominant approach is to improve poor people's quality of life by providing access to suitable energy services (such as electricity and modern fuels for cooking) as a prerequisite

for social equity. Regarding this issue, Uruguay's energy strategy guidelines state that coverage of basic energy requirements, in terms of both quantity and quality, is essential for securing an acceptable quality of life for all its people and greater social equity (...).

The national development plan of the Plurinational State of Bolivia states that access to electricity is a necessity for achieving the goal of its national programme 'Living Well' (*Vivir Bien*), on the same footing as decent work, sufficient income, water and sanitation.

Mexico's national development plan acknowledges access to cheap electricity to be a form of poverty alleviation.

All the national poverty reduction strategies and national development plans recognize the relationship between energy, poverty and economic development, either directly or indirectly. The issue that is dealt with in most depth is access to electricity for the poor. Some poverty reduction strategies, such as Paraguay's national poverty and inequality reduction strategy, provide data on access to energy services to explain the causes of poverty and inequality. However, even though they acknowledge the links between poverty, inequality and access to energy services, only a few poverty reduction strategies prioritize energy for promoting development.

Poverty-related energy issues tend to be discussed at more length in national policy documents (national development plans and poverty reduction strategies) than in MDG reports. Nicaragua's national human development plan pays much attention to the energy issue, recognizes that one of the needs of the poor is energy security at affordable prices, and classifies projects for rural electrification and modernizing the energy sector as investment in poverty reduction in order to build the capacity of the poor and increase their income.

The content of the MDG reports is structured around the different Millennium Development Goals targets and around pre-established indicators for monitoring these targets. So, as none of the Goals refers specifically to access to energy services, any energy considerations in the reports refer chiefly to Millennium Development Goal 7 on environmental sustainability, which includes an indicator for carbon dioxide (CO₂) emissions.

MDG reports from countries facing severe energy challenges, like Haiti and the Plurinational State of Bolivia, barely touch upon the energy issue.

In the majority of national energy strategies analysed, little mention is made of poverty issues. Instead the discussion tends to focus mainly on security of supply, increasing energy supply (power generation and distribution infrastructure) and the transition towards a more autonomous and sustainable system. Very few strategies break down demand and specific actions into socio-economic groups, urban and rural areas or on- and off-grid areas. Of all the energy strategies studied, the most complete were those of Colombia, Brazil and Uruguay, all of which address issues specific to the poor. For example, Colombia's national energy plan acknowledges the need to set tariffs in relation to the ability of the poor to pay for electricity access, and to continue with the successful policy of natural gas expansion to extend coverage to the lowest population strata and to rural areas. The plan recognizes that liquefied petroleum gas (LPG) meets the needs of households whose opportunities and alternatives for improving their quality of life are limited by their purchasing power. Another example is provided by Uruguay's energy strategy guidelines, which plan to increase the access of the absolute poor to energy for a variety of uses.

A useful means of clarifying the approaches taken in the documents studied is to analyse each of the thematic sub-areas relating to Millennium Development Goal 1. Below are the findings of this analysis:

(a) Electricity

In most of the documents studied, including national development plans, poverty reduction strategies, MDG reports and energy strategies, access to electricity is the most commonly acknowledged aspect of all the energy service deficits suffered by the poorest sectors. The national

development plans of Haiti, the Plurinational State of Bolivia, Colombia, Brazil and Mexico mention specifically that renewable energies are an important option for the electrification of remote areas.

Similarly, 25% of the MDG reports studied highlight the importance of electricity in improving the living conditions of slum dwellers as part of their MDG reports (target 11, Millennium Development Goal 7). Access to electricity is the issue for which the largest number of statistics and goals are found in the various types of document. Another specific example, found in the MDG reports of Panama, El Salvador, Honduras and Cuba, is that access to electricity is considered to be a parameter for characterizing poverty or people's standard of living.

Energy strategies also make the connection between electricity and poverty. For instance, El Salvador's national energy policy acknowledges access to electricity as a means for reducing poverty, together with drinking water and sanitation services and road infrastructure. This is why it has invested in electricity via a 'Solidarity Network' programme to subsidize connection costs, which enabled it to increase access to electricity from 70% to almost 88% of all households in the country between 1999 and 2005.

(b) Modern sources of energy for cooking and heating

The use of domestic natural gas and liquefied petroleum gas for cooking and heating appears in only 25% of the national development plans and poverty reduction strategies. The Plurinational State of Bolivia's national development plan seeks to expand the use of natural gas for cooking and heating. Colombia has a national gas expansion plan to supply natural gas mainly to urban areas and LPG to rural areas to replace firewood.

This subject also comes up in the MDG reports, in connection with indicator 29 (target 9, Millennium Development Goal 7) on the use of solid fuels. For example, El Salvador's MDG report refers to its programme of improved wood stoves and the promotion of LPG as strategies for reducing high firewood consumption; Mexico's report mentions its policy for promoting domestic gas use; and the Dominican Republic's report disaggregates the indicator for 'main source of cooking fuel' into rural and urban households and types of energy source: firewood, charcoal, propane gas and other.

El Salvador's national energy policy stipulates that poverty alleviation strategies should centre on cooking-gas subsidies to reduce the consumption of solid fuels and on the use of more efficient stoves to lessen firewood consumption.

(c) Food security

According with the countries analysed, only Haiti, Mexico, Nicaragua and the Plurinational State of Bolivia make the connection between energy, hunger reduction and food security, and present mechanical energy as a key factor of rural development. These linkages are made explicit in Haiti's national growth and poverty reduction strategy paper and in Nicaragua's national human development plan, and feature indirectly in the plans of Mexico and the Plurinational State of Bolivia.

The case of Haiti deserves special attention in view of the key role given to energy in agricultural production, especially in a context of rising food prices when priority is given to boosting food sovereignty. Undoubtedly this has to do with the fact that Haiti's national growth and poverty reduction strategy paper dates from 2008 when the food price crisis was already in evidence (it is the most recent document of all those analysed).

Nicaragua's national human development plan aims to guarantee food security by means of a variety of programmes, including one for low-price stoves and bottled gas for poor families.

The Plurinational State of Bolivia and Mexico's national development plans make indirect mention of this link between energy and food security. The Plurinational State of Bolivia's states briefly that access to energy is important for increasing agricultural productivity and making irrigation viable. Mexico's national development plan is interesting in that it gives examples of how certain

energy-related poverty reduction policies are damaging the environment. It explains that half of the electricity subsidy for the poor is earmarked for subsidizing cheap electricity for pumping irrigation water to boost agricultural production. This has increased groundwater extraction in Mexico at a time when 100 of the country's 188 largest aquifers are already over-exploited.

(d) Transport

Colombia, Honduras, Mexico and Uruguay are the only countries that refer directly to the issue of access to transport by poor sectors of the population, especially in a context of fuel price rises.

For instance, the national development plans of Honduras and Mexico mention that, in some regions, the urban population spends up to 50% of household income on transport alone. To address this problem, the two plans propose to use specific transport subsidies. Colombia mentions the importance of providing access to transport services for residents of recent, poor and remote neighbourhoods.

When MDG reports refer to transport, they tend to do so in relation to its role in air pollution (50% of the South American MDG reports mention the transport sector's contribution to air pollution). A number of reports refer to the need to introduce mass public transport systems to counteract this.

(e) Indigenous issue

Several of the documents analysed discuss the linkage between energy and the indigenous issue in connection with poverty and economic development. As regards energy access, Mexico and Panama, and to a lesser extent Guatemala and Nicaragua, discuss differences between indigenous people and the rest of the population other than urban/rural differences.

In this respect, Panama's final agreement under the national consultation for development stipulates that one of the Government's objectives will be to define and implement an energy policy designed to deliver maximum social benefit (including for indigenous peoples), as well as environmental benefit. The goal of Panama's 'Patria Nueva' Plan is to reduce poverty among indigenous communities by between 98% and 80%, and its MDG report uses the criterion of 'indigenism' to characterize poverty. Similarly, Mexico's national development plan gives priority to indigenous peoples, which constitute the poorest sector. That is why no specific information is given for urban areas in relation to rural areas, but instead for the total population in relation to the indigenous population. In spite of this differentiation, the plan does not seek to promote the access of indigenous communities to energy services. In the South American documents studied, this differentiation is practically not mentioned, except in Brazil's ten-year energy expansion plan, which makes no connections between energy access and poverty, although it does discuss the indigenous issue, especially in relation to the location of energy resources in indigenous lands. However, this is a separate issue usually linked with cultural resistance or obstruction of modernization projects.

2.2.2 Energy in relation to MDG 2: Achieve universal primary education

In the documents analysed, either there is no explicit reference to the energy-education linkage or it is addressed superficially. Only the following countries mention it:

- Mexico's national development plan aims to develop renewable energies as a necessity and sets a number of goals, including the expansion of a system of housing and electricity subsidies to promote education projects. Its MDG report also uses family access to electricity as a weighting variable in calculating a schooling indicator.

- The Plurinational State of Bolivia's national development plan mentions that access to electric lighting enables children to study and learn at home in the evenings.
- Cuba's MDG report mentions, in connection with Millennium Development Goal 8, that solar energy has brought electricity to rural schools to enable children to learn computing.
- Panama's MDG report refers to implementation of the Social Investment Fund, which includes rural electrification and the incorporation of new electrification technologies for education and health.
- El Salvador's national energy policy mentions that access to electricity enables families to improve their incomes, diversify their productive activities, increase their productivity and improve their levels of education.

2.2.3 Energy in relation to MDG 3: Promote gender equality and empower women

The only two countries that make the connection between energy and gender equality are the Plurinational State of Bolivia, in its national development plan, and the Dominican Republic in its MDG report. Both documents highlight the fact that women tend to have differential access to energy services and that, in many cases, their human and productive development (as well as that of their children) depends on access to energy.

The Dominican Republic's MDG report also mentions workload, which for rural women means time spent searching for and carrying firewood. Regrettably, neither country makes a more in-depth analysis, nor do they mention policies or projects for resolving the problem.

2.2.4 Energy in relation to MDGs 4 and 5: Reduce child mortality and improve maternal health

For the most part, MDG reports mention the link between energy and health in connection with CO₂ air pollution. However, no more than one third of the countries refer to this link and it is acknowledged more in South America than in Central America (MDG reports of Mexico, Honduras and El Salvador) or the Caribbean. For instance, Peru's MDG report states that air pollution affects public health, especially the health of children and slum dwellers. Chile's MDG report highlights not only outdoor air pollution but also indoor air pollution from the use of traditional woodfuel or charcoal stoves. In its MDG report, El Salvador is also planning to introduce new rural electrification technologies for health, and cites a World Bank's Wang report of 2001, which states that the factors affecting infant mortality rates differ between urban and rural areas. In urban areas, access to electricity has been identified as one of a number of key factors determining the state of health of children and infants.

Out of this context of air pollution in MDG reports, the only countries that refer to the energy-health linkage are Mexico, El Salvador and Panama, which make very brief mention of the relationship between child health and electricity access, chiefly to improve and facilitate the operation of health centres. The only development plans to make this connection between energy and health are that of Mexico, which stresses the key role of access to electricity and water in the development of health centres in remote areas, and those of Chile, Colombia and Ecuador. Colombia's is the only energy strategy studied that makes the energy-health connection, and it does so in relation to air pollution, and not directly to maternal or child health.

Colombia's national energy plan acknowledges that there is awareness of the need to change the way in which we use and consume energy, owing to the health problems caused by poor air quality in the country's leading cities, such as Bogotá, where it has had a serious impact on public health in terms of acute respiratory disease, especially among children and the elderly.

2.2.5 Energy in relation to MDG 7: Ensure environmental sustainability

(a) Renewable energies

All the development plans analysed for South America, Central America and the Caribbean mention renewable energies. In most cases, renewable energies are referred to in the context of: (i) energy efficiency policies; (ii) switching the country's energy matrix to a more sustainable and autonomous system; and (iii) the environmental impact.

This applies to Nicaragua, which proposes to invest in renewable energies to balance its energy matrix, and to Costa Rica, which aims to make technological improvements and to restore the reliability, quality and security of energy supplies. By reducing the use of hydrocarbons in electricity production, Costa Rica is laying the foundations to become, by the year 2021, the first country in the world to produce 100% of the electricity it consumes from renewable energy sources.

In other cases, such as in the national development plans of the Plurinational State of Bolivia, Colombia and Brazil, and in Haiti's national growth and poverty reduction strategy paper, renewable energy is referred to as the primary option for rural electrification.

For example, Brazil's law No 10438 of 2002 sets up a Programme of Incentives for Alternative Electricity Sources (PROINFA), designed to increase the share of electricity produced by wind, small hydroelectric and biomass power plants, although it fails to set targets for increasing the contribution of these sources to the national energy matrix. In its Government Programme, Chile's aim is for 15% of the increase in electricity generation by the 2010 Bicentenary of the country's independence to come from non-conventional renewable energies, such as wind, biomass or small hydropower.

Most of the Latin American and Caribbean MDG reports (100% of Central America's reports and 50% of South America's reports) discuss the development of renewable energies, and the promotion of energy saving and efficiency policies. Indeed, all the MDG reports mention the need to change regulations, legal structures or policies to improve the use of natural resources, including energy, either by means of plans to improve production and distribution or by making more efficient use of them. For example, the goal set in the MDG report of the Bolivarian Republic of Venezuela is for 100% of the nation's territory to be covered by updated land-use plans by the year 2015. These plans take into account energy-related factors such as the development of renewable energies and energy efficiency. In its MDG report, Argentina's target is for the share of renewable sources as a percentage of the total primary energy supply to reach 10% by 2011.

Some MDG reports establish a direct link between renewable energies and poverty, such as that of Argentina, which states that renewable energies are being promoted not only to achieve a significant reduction in CO₂ and other greenhouse gas (GHG) emissions, but also, from a local standpoint, to cut the cost of the energy services used, so helping to improve the access of the poorest sectors to energy services.

Brazil's ten-year energy expansion plan states that the country's energy matrix is clean, with 87% of its electricity produced in a renewable manner. It also states that in 2006, renewable sources were used to generate 37% of the energy consumed in Brazil. However, it makes no link between renewable energies and poverty, possibly because the vast majority of Brazil's electricity is produced by large-scale hydropower plants. El Salvador's national energy policy states that renewable energies represent half the national energy matrix, and mentions that a law has been formulated to grant tax incentives for the development of renewable energies. The Dominican Republic's Indicative Plan for Electricity Generation (PIEGE) presents a preliminary draft law on incentives for renewable energies and gives clear priority to renewable options, including hydroelectric and wind power plants, to expand its electricity production capacity. By contrast, the Energy Strategy Guidelines for Uruguay (2006) mention renewable energies for mitigating the inevitable environmental impact of economic

production and consumption activities and for altering the energy matrix, as well as for guaranteeing energy supplies and price stability.

The types of renewable energy most favourably considered in all the documents studied are, in order of importance: hydropower, biofuels, geothermal power, modern bioenergy and, lastly, solar and wind power. In Central America, much emphasis is placed on biofuels, unlike in South America, where they are scarcely mentioned. Geothermal power is also referred to by several Central American countries, which view it as a very important alternative. By contrast, solar energy receives virtually no mention in Central America, unlike in South America, where it is one of the most commonly cited renewable energies. Wind power and biogas tend to be referred to much less often.

(b) Firewood and solid fuels

The firewood issue is not treated uniformly in each subregion, nor amongst the documents studied. From the various documents it emerges clearly that, throughout Central America and the Caribbean, forest degradation and the contribution of firewood use to this dynamic is a severe problem that calls much attention. For example, it features in the development plans of El Salvador and Costa Rica and in all the Central American MDG reports, although not all countries' reports explore solutions for tackling the problem.

However, despite the scale of forest degradation in a number of South American countries, they cite and discuss the issue of firewood use comparatively less often than in Central America and the Caribbean. The fact that many South American countries continue to be very heavy firewood users and the subregion's forest resources are much more extensive than those of Central America, may explain why they do not necessarily make a connection between the use of firewood as an energy source and environmental degradation. One exception is Brazil, where there is a fairly serious problem of firewood extraction, which states in its MDG report that the Government is supporting the sustainable use of biomass by means of reforestation and agro-forestry programmes. However, a number of Central American countries propose solutions for reducing the use of firewood for energy: the national development plans of Costa Rica and Nicaragua, the MDG reports of Costa Rica, Mexico and Panama, El Salvador's national energy policy and the national poverty reduction strategy of Honduras.

Haiti's national growth and poverty reduction strategy paper devotes much attention to the use of firewood and charcoal for generating energy, and the problems this raises in terms of natural resource degradation. It includes an extensive discussion of the environmental vulnerability of Haiti's poor, largely as a result of felling trees for firewood. Tackling this situation is one of the basic priorities identified in the paper. The issue of firewood use is virtually absent from all the national development plans studied, with the exception of those of Colombia and the Plurinational State of Bolivia, which mention it briefly.

The MDG reports of Brazil, Chile and Peru provide details on solid-fuel consumption patterns, whereas that of Colombia makes only very brief reference to it. In its MDG report, Peru takes the percentage of the population using traditional fuels as an indicator of quality of life and the incidence of poverty in the country. Chile's MDG report uses its own indicator to characterize its population, which is the percentage of the population using solid fuels (disaggregating the indicator by socioeconomic level), and Peru's report takes the percentage of the population using solid fuels as an indicator of quality of life and the incidence of poverty in the country.

Brazil's ten-year energy expansion plan (PDE) limits itself to stating the percentage share of firewood in Brazil's total energy consumption as compared with final consumption by households. Colombia's national energy plan focuses more on the subject of firewood in relation to health, and proposes to assess mechanisms for waste disposal and combustion gas removal to safeguard public health in the home, especially in rural areas.

El Salvador's national energy policy states that poverty alleviation strategies should centre on cooking-gas subsidies to reduce the use of solid fuels and on the use of more efficient stoves to cut firewood consumption and protect sources of drinking water.

(c) Biofuels

Biofuels are discussed at length in the various documents analysed. In Central America, much emphasis is placed on biofuels, unlike in South America, where they are scarcely mentioned. This is surprising in view of the fact that South America has some major biofuel producers.

In their reports, all the Central American countries, with the exception of Honduras, state that they are seeking to develop biofuel production. This tends to be related to considerations about the price of oil. For example, Costa Rica's development plan states that the Government has a project to promote the use of biofuels, whereas Nicaragua's national human development plan is seeking to regulate the biofuel sector. The national energy policy of the Government of El Salvador considers a requirement to mix ethanol with petrol to reduce the country's petrol imports.

Few South American countries make an in-depth analysis of biofuels in their poverty reduction strategies, development plans or MDG reports. Colombia's MDG report cites the strategic plan for the transport sector 2003–2006, which expresses interest in continuing to promote and provide incentives for the use of alternative fuels, such as natural gas for vehicles and biofuels. Both Brazil's ten-year energy expansion plan and Colombia's national energy plan consider biofuel development as a solution for reducing the environmental impact of energy consumption, especially in urban areas.

The repercussions of world food price rises are not yet reflected in the documents available for this study, with the exception of Haiti's, and surprisingly, none of the documents contain a critical analysis of their impact and of their link with biofuel production.

(d) Pollution from hydrocarbon production

The Latin American documents contain little information on the links between hydrocarbon exploitation, the environment and poverty. The national development plans of Ecuador and the Bolivarian Republic of Venezuela refer to the environmental impact of hydrocarbon production and Brazil's ten-year energy expansion plan mentions environmental aspects with regard to exploration, production, refining and the fuel transport network.

(e) Carbon emissions and climate change

The emission of greenhouse gases, especially CO₂, is one of the most frequently discussed energy-related environmental issues in all the countries' MDG reports. Obviously this is influenced by the fact that there is a specific indicator for CO₂ emissions in the Millennium Development Goals.

The transport and the energy sectors stand out as the main sources of CO₂ emissions and most of the documents of the South American countries and Mexico discuss them at length, but not so much those of Central America. The size of cities in the South American subregion may, in part, explain this difference in treatment. Mexico is an interesting case because of the extent to which the issue is analysed in its national development plan: for instance, it acknowledges a direct link between the economic development achieved in recent years and neglect of the environmental issue, which has led to high levels of pollution (including soil pollution, air pollution from CO₂ emissions and aquifer pollution).

To reduce the impact of fossil energy consumption on the environment, the climate and health, the proposed alternatives in the various documents are:

- To develop non-conventional energy sources: Colombia's national energy plan, Argentina's MDG report.
- Energy saving and efficiency policies: Mexico's national development plan; the MDG reports of Brazil, Chile, Cuba and Argentina (which mentions the creation of the Argentine Carbon Fund); the Bolivarian Republic of Venezuela's national project for the

economic and social development of the nation; the goals and targets of the National Government of Panama for the period 2005-2009.

- To implement a strategy of mitigating greenhouse gases in the energy sector, and to regulate and reduce CO₂ emissions in the energy and transport sectors: Nicaragua's human development plan; Chile's Government programme.
- To implement mass public transportation systems: Mexico's national development plan; the MDG reports of Honduras, Panama and Costa Rica.
- To promote projects under the Clean Development Mechanism (CDM), associated with reducing CO₂ emissions, which is discussed in one third of the documents studied, including the MDG reports of Nicaragua, Costa Rica, Panama, Argentina, Brazil and Colombia; El Salvador's national energy policy and the Plurinational State of Bolivia's national development plan, which proposes that receipts from the Clean Development Mechanism should contribute to the development of rural communities. This is an innovative proposal because it ties potential profits from the carbon market to the generation of income to fight poverty.

Colombia provides a good example of this debate. In the policies and strategies section of its MDG report it explains that, in addition to the efforts made since 1994 to convert vehicles to gas, control vehicle emissions, impose traffic restrictions and implement mass public transportation systems in large urban centres, the recent strategic plan for the transport sector 2003–2006 expresses interest in continuing to promote and provide incentives for the use of alternative fuels, such as natural gas for vehicles and biofuels. In addition, the Colombia's Environmental Management Plan 2001–2009 defines guidelines in accordance with national policy for consolidating mass public transport systems, reducing polluting emissions from urban transport and promoting the use of cleaner and more efficient forms of energy in the sector.

By contrast, none of the Caribbean or Haitian documents studied (Haiti's national growth and poverty reduction strategy paper; the MDG reports of Haiti, the Dominican Republic and Cuba and the Dominican Republic's Indicative Plan for Electricity Generation) make any reference to the impacts of energy on carbon emissions and climate change.

(f) Drinking water

Despite being an issue of great importance in many Latin American countries, none of the documents analysed mentions energy as an essential means of providing access to drinking water. The Plurinational State of Bolivia and Mexico are the only two countries in Latin America to make indirect reference to the link between energy and access to water in their national development plans, but only with regard to irrigation.

2.3. Conclusions from the analysis of the energy-poverty-environment linkages by type of document analysed

(a) Development plans

In all the national development plans studied (10/10), the energy issue is discussed in relation to increasing production and distribution capacity to support economic development and, to a lesser extent, to environmental considerations, chiefly CO₂ emissions (6/10). The issues of poor people's access to electricity and their access to energy for heating purposes (cooking) feature in approximately half of the

plans studied (5/10 and 4/10 respectively). The development plans make very little reference to the relationship between energy and social aspects such as education, health and gender equality.

(b) Millennium Development Goal reports

All the Latin American MDG reports mention the energy issue to a greater or lesser extent. The MDG reports of Mexico (2006) and Honduras (2003) attribute great importance to energy, whereas those of Paraguay (2003), Haiti (2004) and the Plurinational State of Bolivia (2008) pay it less attention.⁵

In the MDG reports, energy considerations tend to be concentrated in the chapters relating to Millennium Goal 7 (MDG7), and are associated with the three target 9 energy indicators (indicator 27 on energy efficiency, indicator 28 on CO₂ emissions and indicator 29 on the use of solid fuels). There is little discussion of the energy issue apart from in these sections.

Virtually all the energy information provided in the MDG reports relates to environmental considerations, chiefly air pollution and the promotion of renewable energies and energy efficiency. Some reports mention access to energy services in relation to the indicator for the proportion of the population using improved sanitation services (target 9), or to the indicator for improving the lives of slum dwellers (target 11).

Several South American countries have developed additional energy indicators in their MDG reports, unlike the Central American countries. Peru and Chile's MDG reports take the percentage of the population using traditional fuels (firewood) as an indicator of the incidence of poverty in the country.

(c) National poverty reduction strategies

All four national poverty reduction strategies studied acknowledge energy access as a prerequisite for overcoming poverty, very explicitly in the strategies of Haiti and Honduras, and more indirectly in those of Guatemala and Paraguay. Access to electricity continues to be the most commonly cited priority in relation to poverty.

The poverty-reduction strategies of Haiti and Honduras also refer to environmental issues such as: renewable energies; firewood and solid fuels; CO₂ emissions and the impact of the energy sector on climate change. Only Guatemala's strategy mentions the link between energy access and telecommunications, which refers directly to Millennium Goal 8 (MDG 8).

Unlike in national development plans, far fewer linkages are made between energy and social considerations (education, health, gender equality, food security) in poverty reduction strategies. The only exception is Haiti's strategy 2008-2010, which makes clear mention of the link between energy and food security.

(d) Energy strategies

Of the six energy strategies studied, four make a direct connection between energy and the environment: Colombia (2006-2025), Brazil (2007-2016), Uruguay (2005-2030) and El Salvador (2007). The remaining two do so indirectly: Argentina (2004-2008) and the Dominican Republic (2006-2020). The focus is on renewable energies, to reduce pressure on the environment, as well as to diversify the national energy matrix and ensure the sustainable and economical use of energy. The issues of firewood, solid fuels and biofuels are discussed in three strategies (those of Colombia, Brazil and El Salvador), while the problems of air pollution and CO₂ emissions are discussed in the strategies of Colombia, El Salvador and Uruguay.

⁵ Countries whose MDG reports were included in the earlier study (UNDP, 2007b) but for which there is now a new MDG report were found to have provided more energy-related information in the later report. The only country to have provided less is the Plurinational State of Bolivia.

Whereas the energy strategies of Colombia, El Salvador and Uruguay refer to the need for energy services and electricity for the poor, those of Argentina and the Dominican Republic make less mention of the subject. In comparison with the other types of document studied, national energy strategies make scarce mention of the relationship between energy and poverty. The energy strategies discuss other social issues, such as food security, energy for cooking, transport, education, gender equality and health, only very briefly.

(e) General conclusions

Below are a number of qualitative conclusions:

- Nearly all the Latin American documents mention access to electricity, the impact of energy on economic development and the resulting creation of opportunities for the poor in general.
- Virtually none of the reports details the specific productive energy needs of the rural and urban poor (mechanical power for agriculture, irrigation, small industry, transport, telecommunications and drinking water).
- The relationship between energy and hunger reduction or food security is barely acknowledged.
- Access to electricity as part of the basic bundle of services provided to households is the most common issue referred to by countries in general, although the MDG reports scarcely mention it.
- Despite being common to practically all the countries, the problem of inefficient cooking fuels (usually traditional biomass) is touched upon briefly by fewer than half the countries.
- The role of energy in the provision of basic services, such as access to water, is practically never mentioned. Energy is referred to solely in relation to irrigation, while the link with access to drinking water is never made, in spite of it being one of the Millennium Development Goal targets.
- The greatest weakness in the documents studied is that, in practically all cases, they fail to make connections between energy and the various social aspects (mainly education, health and gender equality).
- The gender equality issue is addressed in only two documents, education in five documents and health in three documents, if air pollution problems are excluded. The key role of energy in facilitating home study and especially in the operation of schools and health centres is scarcely mentioned.
- Little attention is paid to the specific needs of rural or remote areas, which is precisely where access to energy is vital, not only for productive development, but also to make viable access to other social services like health, telecommunications and education.
- The fundamental role of electricity in access to computing and new information technologies is emphasized in only two documents.
- By contrast, environmental considerations are fairly well covered by all the different types of document analysed. In these documents, countries attribute the highest importance to the various renewable energies. Thereafter, the documents mention air pollution and climate change, proposing solutions for energy saving, the Clean Development Mechanism and renewable energies.

The foregoing analysis, based on a detailed study of a series of documents, reveals that the linkage between energy, poverty and the environment is recognized, but only in a fairly superficial

manner, with little consistency in the way the different countries address this linkage. It tends to be dealt with in a fragmented and unsystematic manner, with a superficial approach that sounds more like rhetoric than a real interest in solving a clearly identified problem situation.

If consideration of the issue had been a focus of the political agendas of the countries of the region, the documents would have been expected to include satisfactory indicators of the lack of energy services for the poor, a clear description of the problem situation, identifying diagnostic studies, strategic approaches to overcome it, instruments defined for each strategic approach and actions relating to each approach. Nothing of the kind is found to such a systematic degree.

The reasons identified as possible causes of this state of affairs include:

- Frequent lack of coordination between the different departments of ministries of energy, or energy and mining, and between these ministries and the agencies responsible for poverty-alleviation and environmental policies. Added to this are differing attitudes to the energy-poverty issue among other leading players, including ministries of economy and finance, service providers, municipalities and other government entities, such as regulators when systems have undergone far-reaching institutional reform.
- Weakening or inefficiency of the institutions responsible for energy planning and of State-owned energy utilities after of the sectoral structural reforms in countries where such utilities still exist.
- Lack of statistics, information, indicators and studies that would allow formulation of public policies focused on the poor sectors of the population in both rural and urban areas.
- Incorrect identification of rural electrification goals with rural energization and failure to acknowledge the problems of access, for both the rural and urban poor.
- Lack of trained middle-level technicians in the respective government ministries and/or departments.
- The lack of knowledge of the energy needs of the poor in various geographical areas, both rural and urban.
- Reluctance to use subsidies to solve the problem of energy access and to guarantee affordability for the poor sectors, both for budgetary reasons and for other reasons based on ideological bias that may unfortunately gain acceptance.

The analysis confirms the need for an explicit framework of strategies and policies to eradicate energy poverty in the region.

The strategies must take into account the diversity of actual situations in poor sectors in each country. The political will to find a response to this problem must be considered as a global priority in the fight against poverty, particularly in its extreme manifestations that undoubtedly occur when modern forms of energy are unavailable. When this is not feasible in the short term, the sustainable use of firewood should be actively promoted and transition deadlines should be set for the poor to gain access to modern, clean and efficient energy sources.

The quantification of energy requirements to meet basic needs should also be given priority.

Simultaneous attainment of the Millennium Development Goals globally depends on correct evaluation of the resources that will have to be mobilized in the light of energy supply and demand scenarios in order to ensure future quality of life.

In view of this situation, it is recommended that short-term and medium-term initiatives should be adopted in order to:

- Strengthen government planning agencies with highly specialized technicians who view planning as a process requiring institutional flexibility, inter-agency coordination and

dialogue with public and private actors for implementation and ongoing monitoring of the policies set.

- Implement programmes for compilation of adequate statistics to allow comprehensive monitoring of the energy sector and identify unmet basic energy needs in poor sectors, including their specific geographical location. Continuous household surveys are a good instrument for this, provided that they include specific relevant questions, that they are extended to include representative geographical areas of each country (in particular poor urban and rural areas already identified and yet to be identified) and that there is a move to standardize the methodology among all the countries of the region.
- Include in the national budget items for investment and subsidies to achieve energy access and affordability for poor sectors, after definition of specific coverage goals and technologies to be used for this purpose.
- Identify sources of financing for programmes (for example, international cooperation, Government and/or cross subsidies).
- Analyze, using simulated scenarios, the expected impacts of greater energy consumption through inclusion and raising of the consumption threshold of the poor, with the formulation of comprehensive policies for efficient energy use in other consumption sectors.
- Define explicitly the expected scope of the contribution of renewable energies to meet the energy needs of both the poor and the other sectors.
- Define indicators for monitoring and quantification of the progress achieved, by periods.

3. Energy policy, access to energy services and poverty

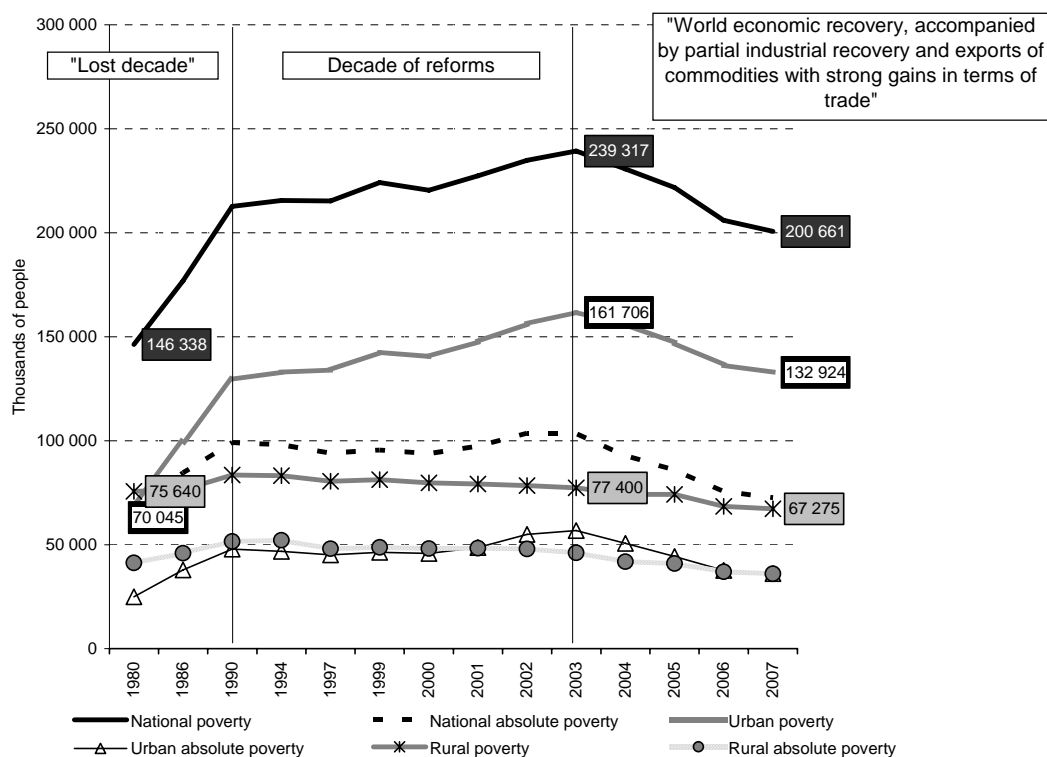
3.1 Characterization and quantification of poverty in Latin America and the Caribbean

Not only is poverty a multifaceted problem but it can also stem from a multitude of different causal factors, making any uniform or simplified analysis difficult. Although indicators tend to standardize poverty as an economic and sociological category, situations of poverty vary widely among the different countries in the region and even among different geographical locations within the same country.

One aspect that needs to be borne in mind regarding the alleviation of energy poverty is that, over the past 20 years, urban poverty has increased at a higher rate than rural poverty (figure 2), both in South America and in Central America and the Dominican Republic.

Although high economic growth rates in the region between 2002 and 2007 made it possible to reduce the number of poor and absolute poor in the region, this figure is still higher overall than in 1980. In Latin America and the Caribbean, the number of people classed as poor grew by around 54 million between 1980 and 2007, while the number of urban poor grew by nearly 69 million during the same period. This means that, while the processes of rural-urban migration were continuing, urban productive systems were unable to absorb and include this immigrant population completely and in accordance with modern standards. As a result, rural poverty has been displaced and become urban poverty and exclusion.

FIGURE 2
TRENDS IN THE NUMBER OF URBAN POOR, RURAL POOR AND TOTAL POOR
IN THE LATIN AMERICA AND THE CARIBBEAN
(Thousands of people)



Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC), Social Indicators and Statistics Database (BADEINSO), [online] www.eclac.cl/badeinso/Badeinso.asp; and United Nations "World Urbanization Prospects: the 2005 revision" [online database] <http://esa.un.org/unpp>.

With annual economic growth rates of less than 4%, in recent decades the region has been unable to find the means for reducing the absolute number of poor. This is all the more serious since it is unclear how deep the world economic crisis unleashed in late 2008 will be or how long it will last.

There are an estimated 200 million people living below the poverty line, of whom around 133 million live in urban areas and 67 million in rural areas. However, the absolute poverty figures are lower. There are about 72 million absolute poor, 50% of whom live in urban and 50% in rural areas. When the increases are analysed in absolute values, though, it turns out that the number of absolute poor living in urban areas was 11.2 million higher in 2007 than it was 1980, whereas, in absolute values, the number of rural absolute poor fell by a little over 5 million.

As table 3 shows, the distribution of urban and rural poverty varies widely among the Latin American and Caribbean countries. In South America, around 70% of poor people live in urban areas, whereas in Central America the figure is only 48%. In South America, Brazil alone accounts for around 50% of the region's urban poverty and 40% of its rural poverty. In Central America, more than 70% of urban poverty and more than 81% of rural poverty are concentrated in El Salvador, Guatemala, Honduras and Nicaragua.

TABLE 3
ESTIMATES OF THE APPROXIMATE NUMBER OF POOR IN SOUTH AMERICA
AND CENTRAL AMERICA IN AROUND 2006
(Millions of people and percentages)

Country	Urban poverty	%	Rural poverty	%	Total poverty (partial)	%	% Urban	% Rural
Argentina	7.4	7.9%	ND		7.4	6%	100%	0%
Bolivia (Plur. State of)	5.1	5.4%	2.7	6.9%	7.8	6%	65%	35%
Brazil	46.8	49.8%	15.6	39.4%	62.4	47%	75%	25%
Chile	2.0	2.1%	0.3	0.7%	2.2	2%	88%	12%
Colombia	10.0	10.7%	11.5	29.1%	21.5	16%	47%	53%
Chile	2.0	2.1%	0.3	0.7%	2.2	2%	88%	12%
Ecuador	3.3	3.5%	2.4	6.1%	5.7	4%	58%	42%
Paraguay	1.9	2.0%	1.7	4.2%	3.6	3%	53%	47%
Peru	6.2	6.6%	5.2	13.0%	11.3	8%	54%	46%
Uruguay	0.6	0.6%	ND		0.6	0%	100%	0%
Venezuela (Bol. Rep. of)	8.6	9.2%	ND		8.6	6%	100%	0%
Total South America	93.9	100.0%	39.6	100.0%	133.5	100%	70%	30%
Costa Rica	0.5	4.1%	0.3	2.5%	0.8	3%	60%	40%
El Salvador	1.6	13.6%	1.6	12.5%	3.3	13%	50%	50%
Guatemala	2.9	23.9%	4.3	32.8%	7.2	29%	40%	60%
Honduras	2.0	16.3%	2.9	22.3%	4.9	19%	40%	60%
Nicaragua	2.0	16.5%	1.8	13.7%	3.8	15%	52%	48%
Panama	0.5	3.9%	0.5	3.9%	1.0	4%	48%	52%
Dominican Republic	2.6	21.6%	1.6	12.3%	4.2	17%	62%	38%
Total Central America	12.0	100.0%	13.2	100.0%	25.2	100.0%	48%	52%

Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC) and Caribbean Demographic Centre (CELADE) - Population Division of ECLAC.

Note: As the estimates were made using urban and rural poverty percentages reported in the latest household survey available for each country, the figures should not be considered as anything more than approximations.

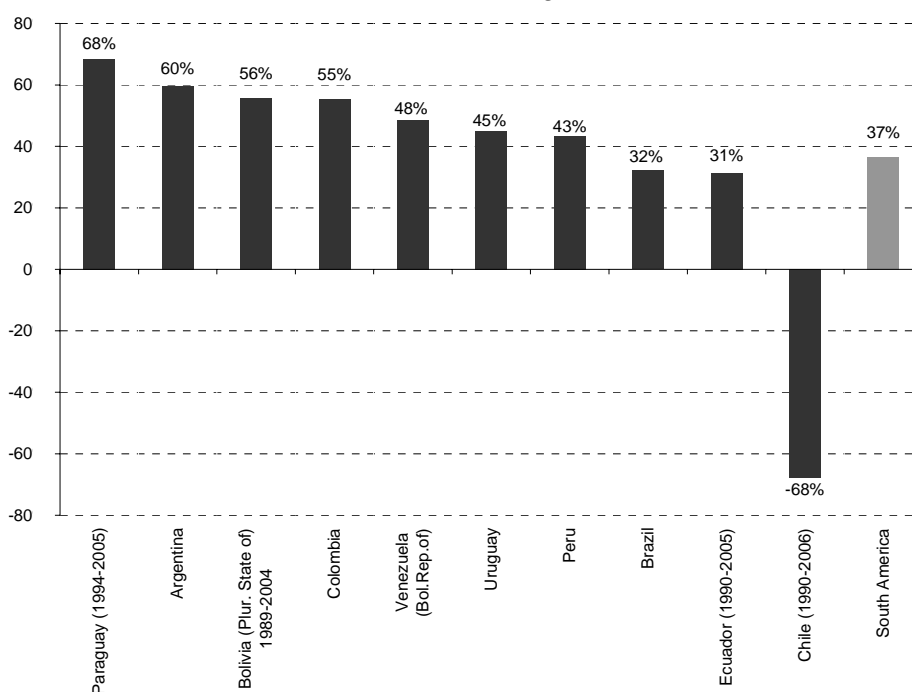
The geographical and climatic diversity in the poverty map is huge both within the region and within each country. One must therefore exercise great care when considering aspects of energy access by the poor.

Even though there tend to have been significant reductions in poverty percentages in most countries, except in cases like Chile there is no uniform downward trend in the absolute number of poor. Vulnerability to variations in the price of the basic food basket that determines the absolute poverty rate –and indirectly the poverty rate– can suddenly plunge people into poverty. In some countries, such as Argentina after the 2002 devaluation, the poverty rate worsened suddenly because

of the impact of the devaluation on the price of the basic food bundle, but then improved up until 2006 as a result of high economic growth rates and lower unemployment rates.

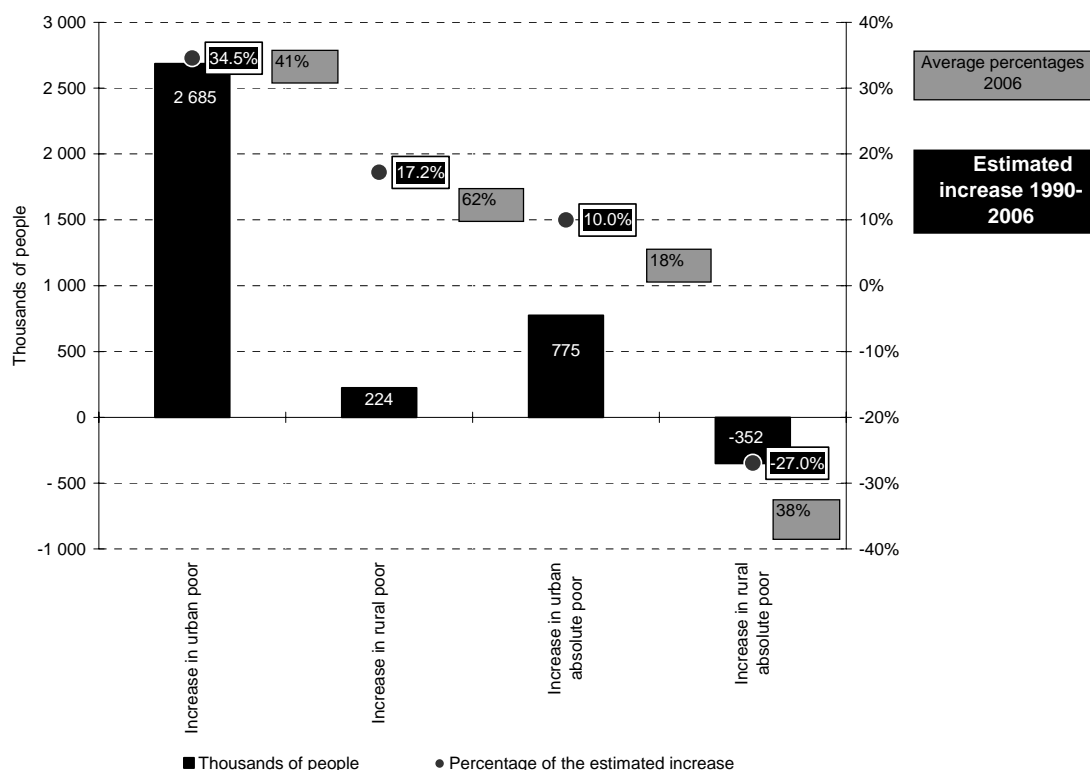
In many Central American countries there is a noticeable lack of continuity in poverty measurements and, even in South America, countries like the Bolivarian Republic of Venezuela, Argentina and Uruguay have no measurements of rural poverty. Countries such as Colombia, Paraguay, the Plurinational State of Bolivia, Ecuador and Peru still have very high percentages of rural poverty. In South America, the increase in the share of urban poor as a percentage of the total increase in the urban population ranged between 30% and 60% in the countries analysed (figure 3).

FIGURE 3
INCREASE IN THE SHARE OF URBAN POOR IN SOUTH AMERICA AS A PERCENTAGE OF
THE TOTAL INCREASE IN THE URBAN POPULATION - APPROXIMATE ESTIMATES FOR
THE PERIOD 1990–2006 OR NEAREST DATA AVAILABLE
(Percentages)



Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC) and Latin American and Caribbean Demographic Centre (CELADE) - Population Division of ECLAC.

FIGURE 4
ESTIMATED INCREASE IN URBAN AND RURAL POVERTY IN
CENTRAL AMERICA 1990–2006



Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC) and Latin American and Caribbean Demographic Centre (CELADE) - Population Division of ECLAC.

The pattern was similar in Central America. Even though there are insufficient data to conduct a country-by-country analysis, during the period 1990–2006 there was an estimated 34.5% increase in the share of urban poor as a percentage of the total increase in the urban population. The shares of urban poor and absolute poor as percentages of the estimated overall increase during the period 1990–2006 are lower than the average percentages in 2006, which points to a relative improvement. Nevertheless, at present many Central American countries rely heavily on foreign remittances from family members working abroad, but the situation is changing and will continue to change further in the coming years as a result of the 2008-2009 world crisis. As figure 4 shows, the increases in rural poverty are by contrast insignificant, although the number of absolute poor has fallen in absolute terms only. These trends may well represent more the process of rural-urban migration (displacement of rural poverty to urban areas with variable prospects for climbing out of poverty) than the targeted efforts of explicit poverty reduction policies.

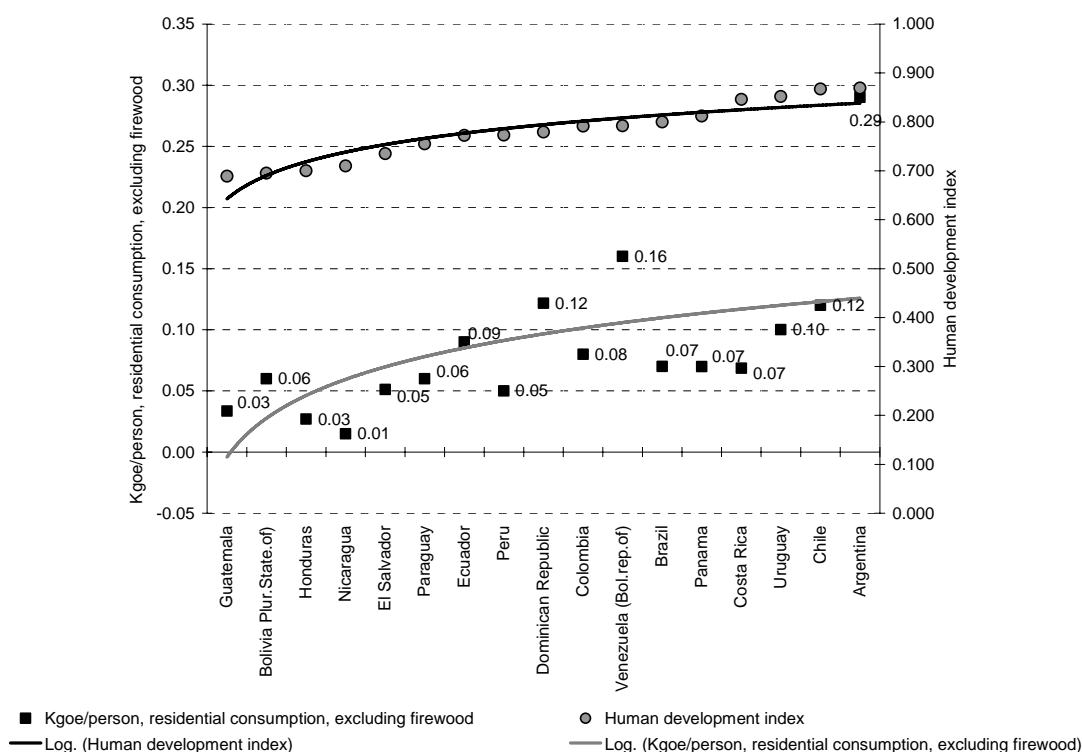
3.2 Energy consumption and human development

The lowest energy consumption rates from modern sources are invariably accompanied by the lowest HDIs. Figure 5 shows the results of ordering Latin American and Caribbean countries according to their HDI and their respective per capita energy consumption in the residential sector, excluding firewood. At the bottom of the scale we find nearly all the Central American countries and the poorest Latin American countries, including the Plurinational State of Bolivia, Paraguay, Ecuador

and Peru. These correlations between access to modern energy sources, per capita energy consumption and HDI, are not exclusive to the region. Previous studies have shown similar indicators worldwide (UNDP, 2005).

For energy-exporting countries like Argentina, the Plurinational State of Bolivia, Ecuador and the Bolivarian Republic of Venezuela, the consumption rates appear either on the trend line or close to it. However, not all exporting countries share this profile. For instance, the Bolivarian Republic of Venezuela has per capita consumption rates far higher than its HDI. The reason is that, as a country with abundant energy resources, historically energy has been sold cheaply on the domestic market, usually at unsubsidized prices. Argentina's high per capita consumption rate stems as much from its high HDI as from its high urbanization rate, but now its status as an energy exporter is almost a thing of the past. Some energy importers like the Dominican Republic and Guatemala also have consumption rates above the trend line.

FIGURE 5
PER CAPITA RESIDENTIAL ENERGY CONSUMPTION
(EXCLUDING FIREWOOD) AND HUMAN DEVELOPMENT INDEX

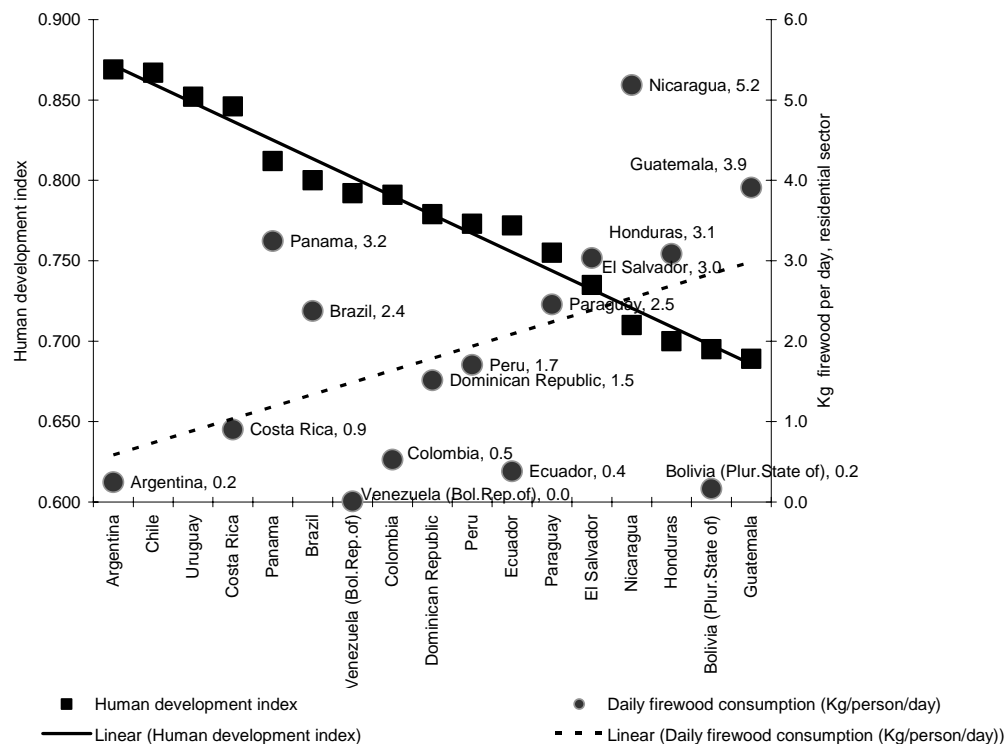


Source: Prepared by the author on the basis of information from Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE), National energy balances, Economic Commission for Latin America and the Caribbean (ECLAC), Latin American and Caribbean Demographic Centre – Population Division of ECLAC and United Nations Development Programme (UNDP).

As figure 6 shows, greater per capita firewood consumption also generally corresponds to low HDIs, as is the case for the poorest Central American countries. However, the amount of firewood consumption may reflect other factors such as the availability of affordable replacement energies, income level of rural inhabitants, types of firewood consumption and ownership, abundant availability of the resource and lack of satisfactory energy alternatives. High firewood consumption may also be associated with cultural preferences and the existence of clusters of poverty within countries that have a high HDI.

A high firewood consumption rate can therefore stem from a wide variety of situations. Countries such as Chile and Uruguay have both a high firewood consumption rate and a high HDI. However, as a general rule, in cases such as Nicaragua, Guatemala, Honduras, El Salvador, Paraguay and Peru, low or intermediate HDIs coexist with high rates of rural poverty and per capita firewood consumption. Although Brazil has a fairly high HDI, it has a high firewood consumption rate owing to its still high rural poverty rates.

FIGURE 6
RESIDENTIAL FIREWOOD CONSUMPTION PER RURAL INHABITANT
AND HUMAN DEVELOPMENT INDEX



Source: Prepared by the author on the basis of information from Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE), National energy balances, Economic Commission for Latin America and the Caribbean (ECLAC), Latin American and Caribbean Demographic Centre – Population Division of ECLAC and United Nations Development Programme (UNDP).

So, from the standpoint of energy policy, as well as that of poverty in general, it is important to realize that there are huge qualitative differences between urban and rural poverty.

Lack of sufficient monetary income may sometimes be more of a deprivation in urban than in rural areas. In rural areas, access to energy through use of firewood may be partially guaranteed, but in ways that are highly undesirable because of the effect on health and on the work of women and children, and because of the environmental consequences when firewood collection is unsustainable.

In urban areas, failure to satisfy sufficiently the energy needs of the poor has a detrimental impact in terms of health, gender equality, child labour and access to education. Added to this is the legal insecurity that often arises from illegal occupation of land, illegal connections to the grid and lack of proper access to fuels for cooking and heating water.

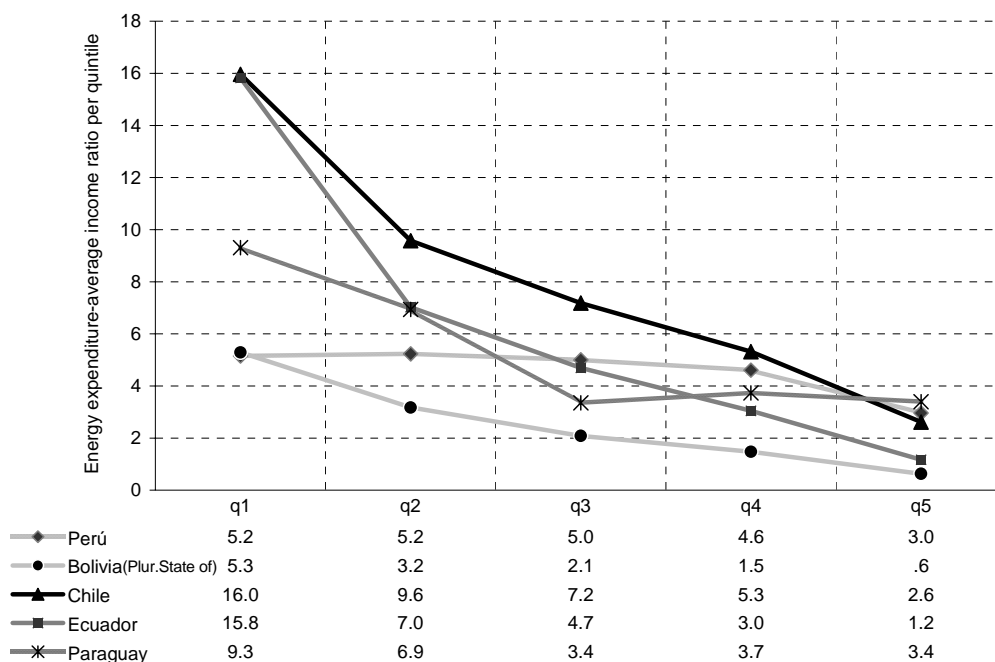
3.3 Energy and inequitable distribution

In all the countries analysed, the poor strata consume less energy than the other social strata. However, they spend more of their income on energy than do the non-poor strata and, in many cases, the price per calorie equivalent unit is higher, basically because of difficulty in accessing grid services for electricity and/or natural gas. When this is not the case, it is because the firewood is used as a basic fuel or because people are illegally connected to the grid and do not pay for the electricity they use. Figure 7 and table 4 illustrate the inequity that can be inferred from the energy expenditure-average income ratio per quintile in a number of Latin American and Caribbean countries.

Lower energy consumption by poor families reflects the differing levels of access to equipment between income quintiles of the population. However, paradoxical cases can be found of poor families with high consumption rates, especially where they use second-hand or cheaper, less efficient equipment. The illegal connection of these users to the grid can require additional investment in the electricity sector, particularly if they are using electricity for heating purposes, such as cooking, water heating and air conditioning.

It is therefore essential to encompass energy access policies within integrated programmes for the rational use of energy (RUE) that promote closer coordination with utility companies, as well as to analyse the possibility of involving utility companies in financing efficient equipment and scrapping inefficient equipment. In many programmes, equipment replacement is central to energy access and rational use policies, and is sometimes combined with environmental considerations (such as Colombia and Argentina's proposed energy-efficiency labelling and scrapping schemes for refrigerators and freezers and Cuba's recent highly ambitious RUE programme (Fourth International Symposium on Energy and the Technological Frontier in the Rural Sector, held by IPSE (Colombia's institute of power planning for areas not connected to the national grid) in Medellín, Colombia, in July 2008)).

FIGURE 7
ENERGY EXPENDITURE-AVERAGE INCOME RATIOS PER QUINTILE
IN SOME SOUTH AMERICAN COUNTRIES



Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC).

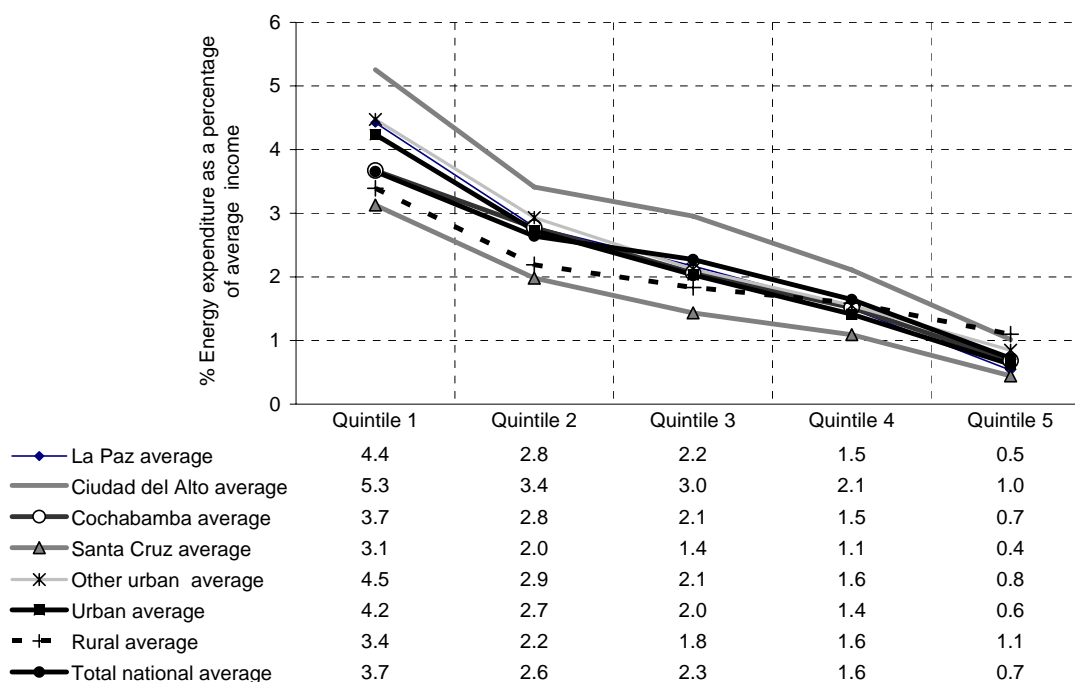
TABLE 4
ESTIMATED DIFFERENCE IN AVERAGE INCOME AND ENERGY EXPENDITURE
BETWEEN QUINTILES 1 AND 5

Country/Location	Average income ratio Quintile 5 to Quintile 1			Energy expenditure ratio Quintile 5 to Quintile 1		
	National	Urban	Rural	National	Urban	Rural
Costa Rica	12.1	14.2	13.5	-	-	-
El Salvador	13.5	10.3	13.1	2.7	6.87	2.21
Guatemala	17.7	13.5	15	5.72	21	1.5
Honduras	29.6	15.3	38	2.53	2.96	1.64
Nicaragua	19.6	16.6	24.1	-	-	-
Dominican Republic	17.2	17.8	12	-	-	-

Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC).

While differences between countries are evident from comparing average national aggregates, the disparities become even wider if one extends the comparison to regions of a single country, or even within those regions, as figure 8 below shows in the case of the Plurinational State of Bolivia.

FIGURE 8
EXAMPLE OF DISPARITIES IN THE ENERGY EXPENDITURE-AVERAGE INCOME RATIO
WITHIN COUNTRIES: THE CASE OF THE PLURINATIONAL STATE OF BOLIVIA, 2003



Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC).

4. Poverty, access to basic services and equipment: an approximation for identifying unsatisfied basic needs

The degree of access to services and equipment varies widely according to the different income quintiles of the population, with additional disparities between urban and rural areas and between people living in large conurbations and in smaller towns or cities, depending on income levels.

Systematizing this information and identifying similar energy consumption patterns among different income strata in different countries according to type, allows the diversity – and similarity – of situations to be fully characterized in terms of the energy-poverty linkage. This chapter endeavours to characterize the links between energy access, poverty and equity.

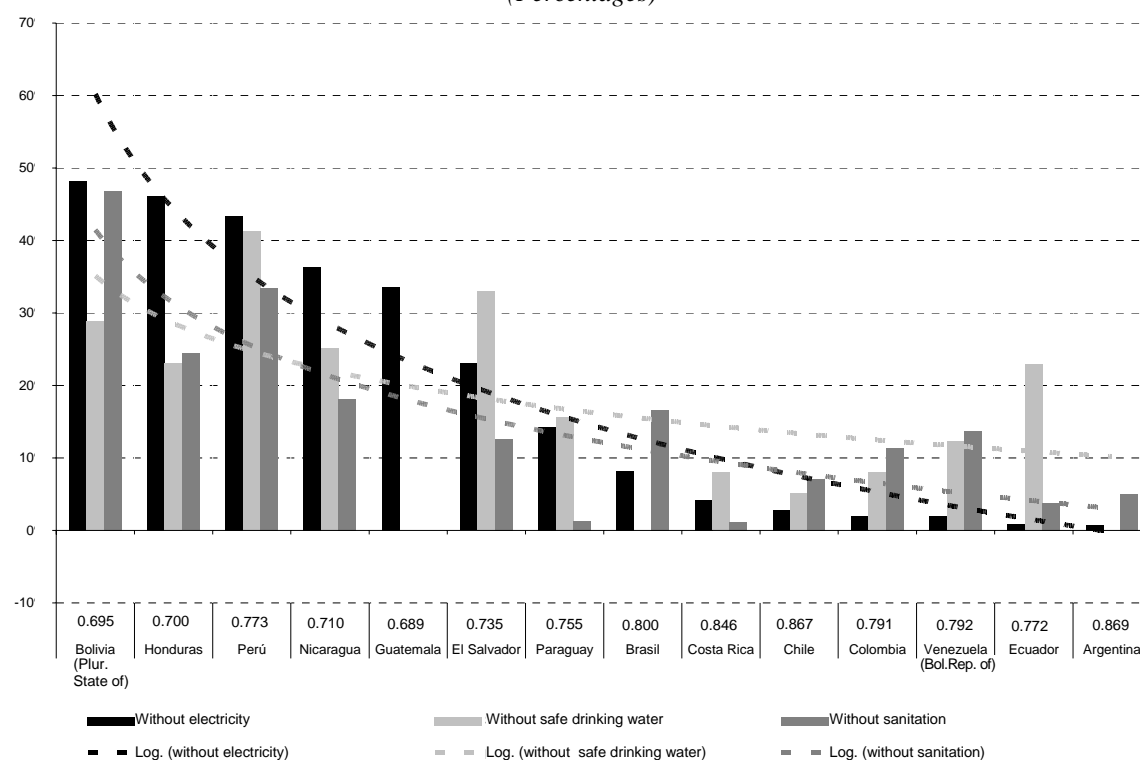
Figure 9 orders a representative group of Latin American and Caribbean countries on the basis of lack of basic services among the poor. These data, coupled with the estimated percentages of poverty in each country, provide an approximate estimate of the number of people with no electricity (table 5). As figure 9 and table 5 show, the countries with the lowest HDI are usually those with the greatest relative deficit of services, especially electricity. Lack of services for non-poor sectors tends to be more of an indicator of coverage problems owing to geographical location rather than of lack of income.

Brazil, Peru and the Plurinational State of Bolivia in South America and Guatemala, Honduras and Nicaragua in Central America would appear to have the largest deficit in electricity coverage, although the problem also seems to affect the other countries to widely varying degrees. The lack of explicit data in energy documents concerning electricity coverage is yet another indicator that little real attention is paid to the matter.

Moreover, in many cases, access to cheaper and cleaner services, such as natural gas, is distributed very inequitably among the various social strata.

For instance, even in Argentina, which is a highly urbanized country with one of the highest gas penetration rates in the national energy matrix and a high HDI, there are noticeable inequalities among the various social strata in terms of access to natural gas as opposed to substitute fuels like LPG.

FIGURE 9
PERCENTAGE OF THE POOR WITHOUT BASIC SERVICES
BY COUNTRY AND HUMAN DEVELOPMENT INDEX
(Percentages)



Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC).

Note: the HDI values are shown on the horizontal axis above the name of the respective country. The vertical axis shows the percentage of people classified as below the poverty line who lack access to the respective services.

TABLE 5
APPROXIMATION OF THE NUMBER OF PEOPLE WITHOUT ELECTRICITY IN SOME
COUNTRIES OF LATIN AMERICA AND THE CARIBBEAN

Country/Status	Poor people without electricity	Non-poor people without electricity	Total number of people without electricity	Poor people as a percentage of the total number without electricity in each country	Each country's share of the cumulative total number of people without electricity
Argentina	57	91	148	38%	0.5%
Bolivia (Plur. State of)	2 904	708	3 611	80%	12.2%
Brazil	5 123	2 753	7 875	65%	26.7%
Chile	62	168	231	27%	0.8%
Colombia	420	956	1 376	31%	4.7%
Costa Rica	34	18	52	66%	0.2%

(Continues)

Table 5 (Concluded)

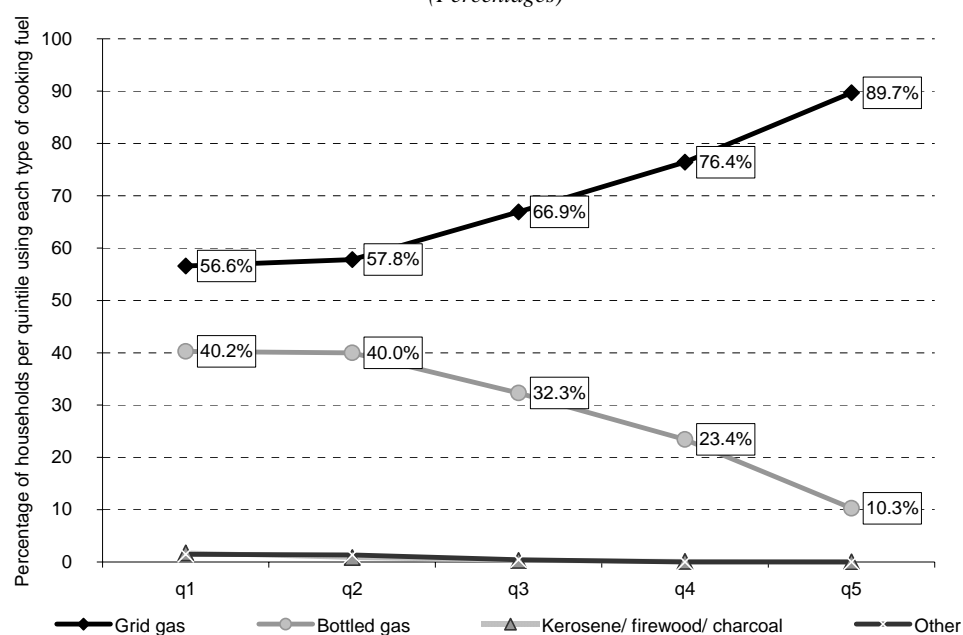
Ecuador	51	15	66	77%	0.2%
El Salvador	751	191	942	80%	3.2%
Guatemala	2 569	687	3 256	79%	11.0%
Honduras	2 272	210	2 482	92%	8.4%
Nicaragua	1 377	219	1 596	86%	5.4%
Paraguay	510	75	585	87%	2.0%
Peru	5 264	1 982	7 245	73%	24.6%
Venezuela (Bol. Rep. of)	16	19	35	46%	0.1%
Estimated total	21 410	8 092	29 501	73%	100.0%

Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC).

Note: the estimate is based on the latest poverty records for Latin America and the Caribbean, and was weighted to the total population of each country for which information is available. In turn, the estimated number of households without electricity was applied to this figure.

Even though grid gas is eight times cheaper in Argentina than LPG, despite specific subsidies for the poor through the 'Garrafa Social' programme (to subsidise the purchase of 10-kilogramme bottles of LPG), around 40% of households in quintiles 1 and 2 had no access to the gas grid in 2006. In contrast, coverage in quintiles 4 and 5 averaged 76.4% and 89.7% respectively in urban areas (figure 10). This shows the slight importance attributed to equity in Argentina's energy policies.

FIGURE 10
ENERGY SOURCES USED FOR COOKING ACCORDING TO INCOME QUINTILES:
THE CASE OF ARGENTINA (AVERAGES FOR ALL URBAN AREAS)
(Percentages)



Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC).

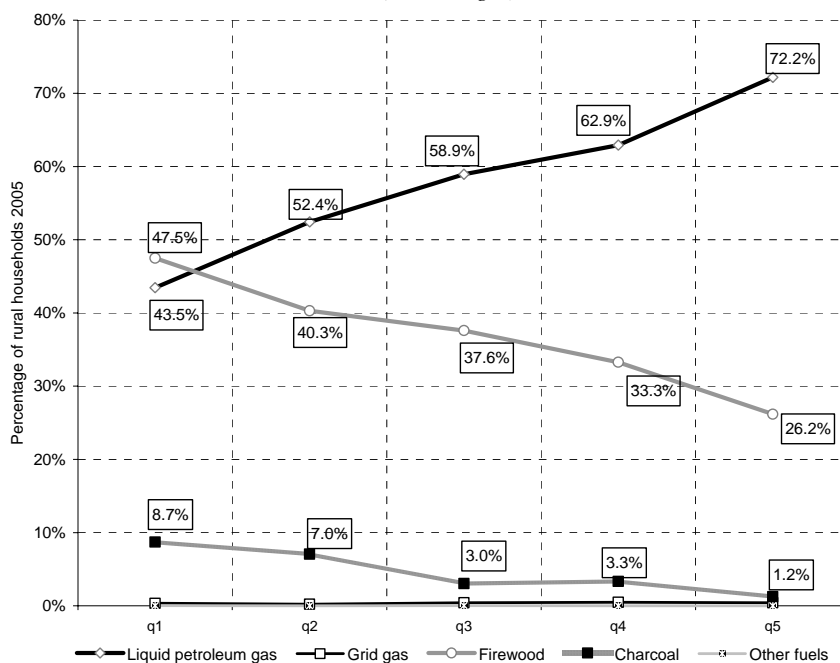
The same type of inequity is apparent in other countries in the region too. For instance, in the case of rural inhabitants in Brazil, we find that only 43% of people in quintile 1 have access to clean, better-quality fuels like LPG, as opposed to more than 72% of those in quintile 5. The asymmetry is clear when one examines the distribution of firewood use for cooking by income quintile (figure 11).

This shows that there is a strong link between poverty and lack of access to clean and more environmentally friendly energy sources. In all the cases analysed, the highest percentage of families using firewood tends to correspond to the poorest sectors.

It is common knowledge that when poor people are consigned to using firewood as their sole means of heating it causes health and gender-related problems. Women and children are usually responsible for collecting firewood and, as it is an extremely time-consuming task, it reduces children's educational opportunities and women's ability to participate in productive work, which would boost the rural poor's monetary income and improve their quality of life. If, in addition, firewood is used inefficiently as a result of cultural practices or conditions of absolute poverty, the problem is compounded by indoor air pollution in slum dwellings, causing pulmonary disease and reducing life expectancy. It is also a well known fact that, in certain regions, firewood consumption is unsustainable in the long term without reforestation programmes. All this should suffice to convey the importance of defining the scope of programmes for promoting the sustainable use of firewood and the use of LPG or other modern fuels in rural and urban areas where firewood consumption rates among the poor can still be significant. There is far too little data available to draw up a regional inventory of firewood consumption classified by sustainable and unsustainable uses, or to analyse the real possibilities for replacing firewood with cleaner and more efficient fuels.

As the information compiled in this project document is mainly descriptive, it is useful in demonstrating the scope and magnitude of the problem but is insufficient as a basis for moving to eradicate energy poverty.

FIGURE 11
ENERGY SOURCES USED FOR COOKING ACCORDING TO INCOME QUINTILES:
THE CASE OF BRAZIL (AVERAGES FOR ALL RURAL AREAS)
(Percentages)



Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC).

Apart from the examples shown above (figure 10 depicting the average urban population in Argentina with access to a clean and less expensive fuel like natural gas compared with other more expensive substitutes such as LPG, and figure 11 depicting access to modern sources in rural areas of Brazil), the pattern of inequity is evident in many of the other countries analysed, including the Plurinational State of Bolivia and Chile, for which the same type of information is available.

The only clearly counterexample found regarding this widespread trend is Colombia, which passed Law 142 on public utilities in 1994 adopting a scheme of social stratification by type of housing (strata 1 to 6) and cross subsidies as a way of mitigating inequality both via the energy policy and by providing access to non-energy public utilities (strata 1 and 2 are subsidized by strata 5 and 6, by other user sectors and by the national budget).

Colombia's Natural Gas Expansion Plan, formulated as a core concept in 1991 (CONPES, 1991) and introduced gradually between 1993 and 1997, has resulted in the connection of more than 3.6 million households to the gas grid. Of these households, 53% are in the lowest two strata, the poorest, and receive subsidies. Another successful outcome of the Plan was that, by 2007, a total of 415 municipalities had been connected to the gas grid, as compared with only 191 in 2000. This means that the organically implemented policy has tended to equalize geographical access to natural gas, benefiting the poor sectors in many of Colombia's diverse urban areas. Another point of interest is that the Plan has not ruled out the participation of private actors or the principle of full payment for services. The existence of strong public and public/private actors has undoubtedly facilitated the Plan's implementation and enabled it to withstand policy changes, which confirms the importance of developing long-term institutional arrangements even in highly-conflicted societies. However, no data are available for Colombia on the energy expenditure and income ratio per quintile, nor any average ratios of energy expenditure as a percentage of average national income in order to draw comparisons with other countries and to make a more in-depth assessment of the real scope of the Plan. Clearly, though, the Plan has considered inequality explicitly in policy design and makes some interesting proposals for abolishing inequity and reducing poverty by facilitating access to and the affordability of energy services in particular and public utilities in general.

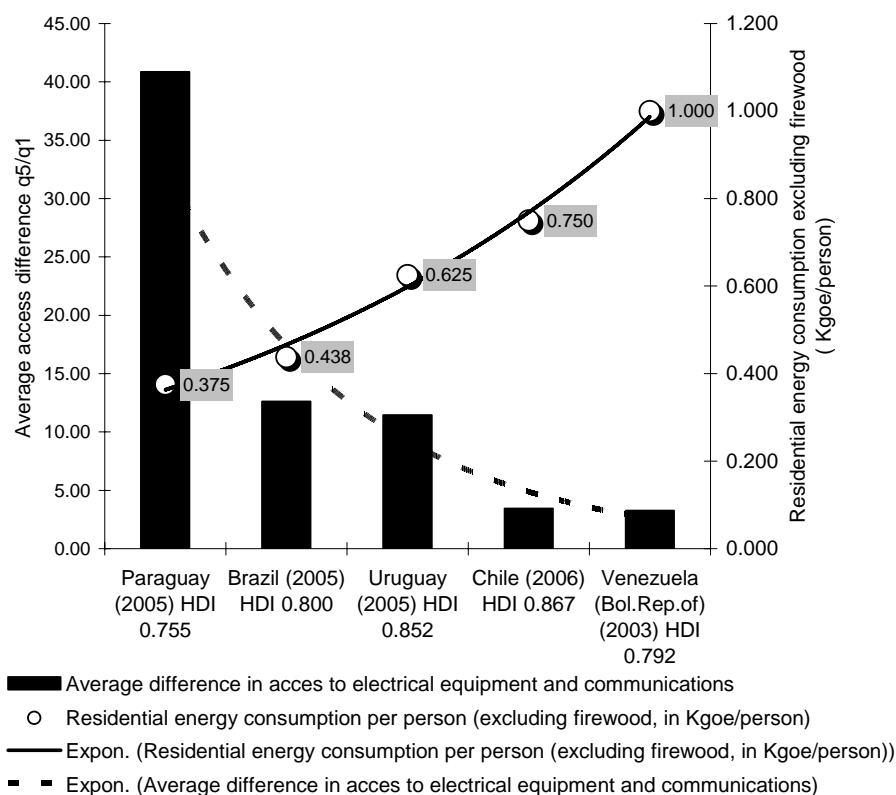
As regards inequitable access to equipment by the various social strata, both from one country to another and within regions of a single country, the information available shows the magnitude of the problem from another angle: access by the poor to household appliances and equipment required by the knowledge society.

While it is hard to interpret the mass of information provided in table 6, there is an interesting correlation between the equipment, social status, HDI and average consumption rate of households. The most important factor in explaining differences in average energy consumption from one country to another is access not only to electricity but also to equipment. Invariably, smaller differences in access to electricity and equipment among social sectors are associated with higher energy consumption rates and higher human development indices (figure 12).

Processes of urbanization drive up energy consumption rates as access to services and equipment increase, which means that the energy policy agenda should include requirements to:

- 1. Increase total energy supply to enable a larger share of the population to fulfill modern living standards.*
- 2. Define policies for covering unsatisfied basic energy needs and for providing access to energy services and equipment.*
- 3. Quantify the broadening of energy services to poor sectors in terms of the financing required and of price and subsidy policies compatible with such goals, together with guaranteed supply.*
- 4. Take an integrated approach to energy sector planning in order to promote the application of measures for energy saving, the rational use of energy and the dissemination of clean energy sources for all user sectors and social strata in order to achieve sustainable social inclusion.*

FIGURE 12
DIFFERENCES IN AVERAGE ACCESS TO EQUIPMENT, AVERAGE PER CAPITA CONSUMPTION OF ENERGY FROM MODERN SOURCES AND HUMAN DEVELOPMENT INDEX

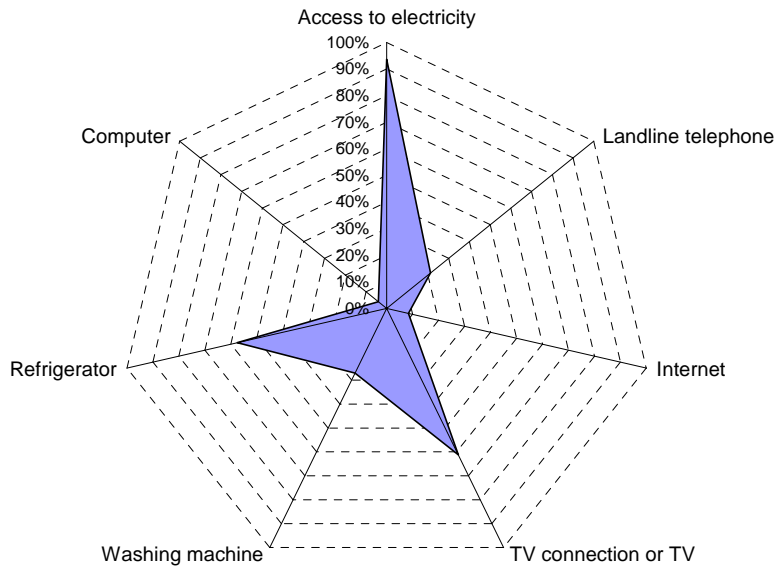


Source: Prepared by the author.

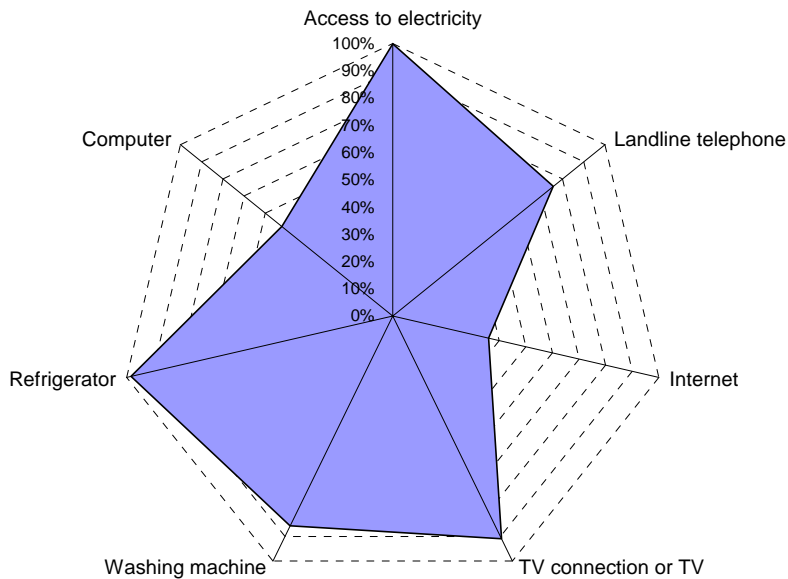
As figure 13 shows, access to a variety of equipment and appliances, in terms of simple averages for a few countries for which information was available, differs widely between quintiles 1 and 5. This gives a general indication of the gap that exists between the social strata in a subregion, in this case South America. The data in table 6 below allow a more in-depth comparison of equipment to be made for individual countries and, in some cases where information is available they even make it possible to differentiate the situation in various areas of a single country. Even so, it is lacking for many of the cases studied in this project document. This is yet another indication of the scant attention paid to issues of access for the poor, all the more so if one considers that accurate information is a prerequisite for the design of energy and poverty alleviation policies.

FIGURE 13
AVERAGE INEQUITY IN ACCESS TO EQUIPMENT ACCORDING
TO POPULATION QUINTILES

Simple average of five South American countries
 Equipment quintile 1



Simple average of five South American countries
 Equipment quintile 5



Source: Prepared by the author.

TABLE 6
ESTIMATED ACCESS TO MODERN SERVICES ACCORDING TO INCOME STRATUM AND COUNTRY
(Country averages)

Data for quintile 1-Lowest incomes										
Equipment	Electricity	Landline telephone	Internet	TV	Washing machine	Refrigerator	Computer	Per capita residential energy consumption, excluding firewood (Kgoe/person)	Urbanization (%)	HDI
Chile (2006)	98%	23%	39%	9%	42%	75%	10%	0.120	87%	0.867
Uruguay (2005)	98%	47%	1%	80%	28%	89%	3%	0.100	92%	0.852
Brazil (2005)	93%	18%	1%	79%	10%	5%	2%	0.070	83%	0.800
Venezuela (Bol. Rep. of) (2003)	93%	15%	1%	81%	39%	72%	4%	0.160	93%	0.792
Paraguay (2005)	86%	3%	0%	57%	16%	46%	1%	0.060	59%	0.755
Data for quintile 5- Highest incomes										
Equipment	Access to electricity	Landline telephone	Internet	TV connection or TV	Washing machine	Refrigerator	Computer	Per capita residential energy consumption, excluding firewood (Kgoe/person)	Urbanization (%)	HDI
Chile (2006)	100%	79%	75%	61%	92%	98%	73%	0.750	87%	0.867
Uruguay (2005)	100%	97%	46%	99%	90%	100%	63%	0.625	92%	0.852
Brazil (2005)	100%	88%	40%	99%	78%	99%	60%	0.438	83%	0.800
Venezuela (Bol. Rep. of) (2003)	99%	57%	8%	99%	84%	97%	29%	1.000	93%	0.792
Paraguay (2005)	100%	57%	11%	96%	84%	97%	36%	0.375	59%	0.755
Ratio between the highest and lowest quintiles in terms of percentage of people with access (q5/q1)										
	Access to electricity	Landline telephone	Internet	TV connection or TV	Washing machine	Refrigerator	Computer	Per capita residential energy consumption, excluding firewood (Kgoe/person)	Urbanization (%)	HDI
Chile (2006)	1.02	3.43	1.91	7.05	2.17	1.31	7.21	0.750	87%	0.867
Uruguay (2005)	1.02	2.07	48.40	1.23	3.16	1.13	23.17	0.625	92%	0.852
Brazil (2005)	1.08	4.95	29.33	1.26	7.51	19.93	24.22	0.438	83%	0.800
Venezuela (Bol. Rep. of) (2003)	1.07	3.86	6.55	1.22	2.14	1.35	6.77	1.000	93%	0.792
Paraguay (2005)	1.16	16.92	208.81	1.68	5.18	2.11	50.13	0.375	59%	0.755

Source: Prepared by the author on the basis of information from ECLAC and UNDP.

5. Social and environmental impact of reforms in Latin America

This section explores the principal social and environmental impacts of energy reforms in South America and Central America to ascertain how far some countries in the region took social and environmental factors into consideration when developing their reforms.

5.1 Reforms and their impacts in South America

The process of energy reforms undertaken in South America was far from uniform in terms of scope and results. In some cases, the changes involved the extensive restructuring of markets – as occurred in Argentina and the Plurinational State of Bolivia⁶ during the 1990s, when State-owned utilities were split up and privatized and others, such as in Peru, Brazil and Colombia, introduced a wide range of interim reforms.

Nor were the reforms of the hydrocarbon sector identical, even though almost all countries increased the role of the private sector by means of privatization (Argentina and Peru), capitalization (Brazil and Colombia), restructuring of State-owned utilities, or involving the private sector in a variety of contracts with State-owned oil companies (Peru, Colombia, Brazil, Ecuador, the Plurinational State of Bolivia).

However, a common feature of virtually all the reforms was that no explicit mention was made of a policy to address either energy poverty or environmental issues. The only exception was Colombia, which enacted the 1994 Public Utilities Act classifying services into social groups and establishing an official system of cross-subsidies between them for all utilities (electricity, gas, water, sewage, sanitation and rural telephony). Other countries placed the priority on seeking to introduce competition mechanisms (electricity generation) and, ultimately, on consolidating market rules and regulations to guarantee a high return on investment, on the assumption that proper price signals would suffice to resolve the issue of the expanding energy supply and efficient resource allocation.

Almost a decade and a half after the reforms, the State has been forced to intervene in some countries in order to ensure expansion of the energy supply, either by means of new regulations, by

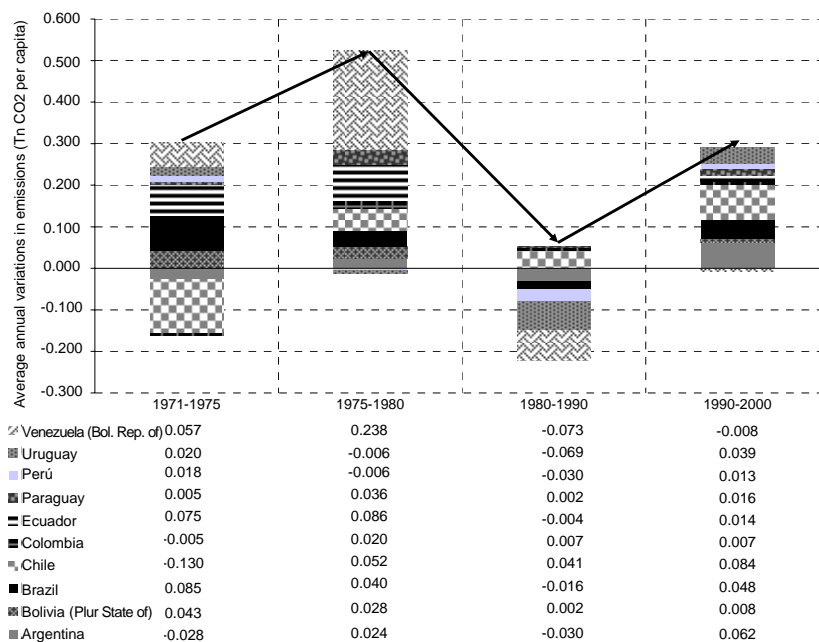
⁶ The current trend in the Plurinational State of Bolivia is towards the renationalization of formerly privatized companies.

compensating private actors or by returning to State investment schemes. This is what has happened in Argentina and, to a greater extent, in the Bolivarian Republic of Venezuela, the Plurinational State of Bolivia and Ecuador. In Brazil too, the reforms were revised following the 2001 crisis and moves were made towards greater State intervention by changing some of the previous rules of the game.

However, apart from the fact that the reforms gave no explicit consideration to access to energy services by the poor, they had a number of negative social and environmental impacts.

Throughout the region, the process of disintegration of electricity chains and the new interactions between electricity generating sectors and gas producers, resulting from the increasing use of combined cycle and gas turbine power plants, altered the previous balance between hydroelectric and nuclear generation with respect to generation from conventional heat sources. So, between 1980 and 1990, of the 62 743 MW increase in installed capacity in the electricity generating system for public utilities in the region, 70% was from hydropower plants, 25% was from conventional heat sources and the remaining 5% was from other sources, including nuclear. However, between 1990 and 2000, only 50% of the total 63 029 MW of new installed capacity came from hydropower plants, compared with 46% from new conventional thermal power plants and the remaining 4% from other sources.⁷ In South America, if we consider only hydropower plants, gas turbine power plants and steam turbine power plants, hydropower plants accounted for 87% of the increase in installed hydropower capacity during the 1980s, whereas in the 1990s the share fell to 63% and between 2000 and 2006, it fell again to 57%, with conventional thermal power stations taking up the slack in each case. This rising trend in fossil fuel consumption in the electricity generating sector, together with other factors, led to an increase in total emissions.

FIGURE 14
AVERAGE ANNUAL RATE OF CHANGE IN PER CAPITA CO₂ EMISSIONS BY PERIOD

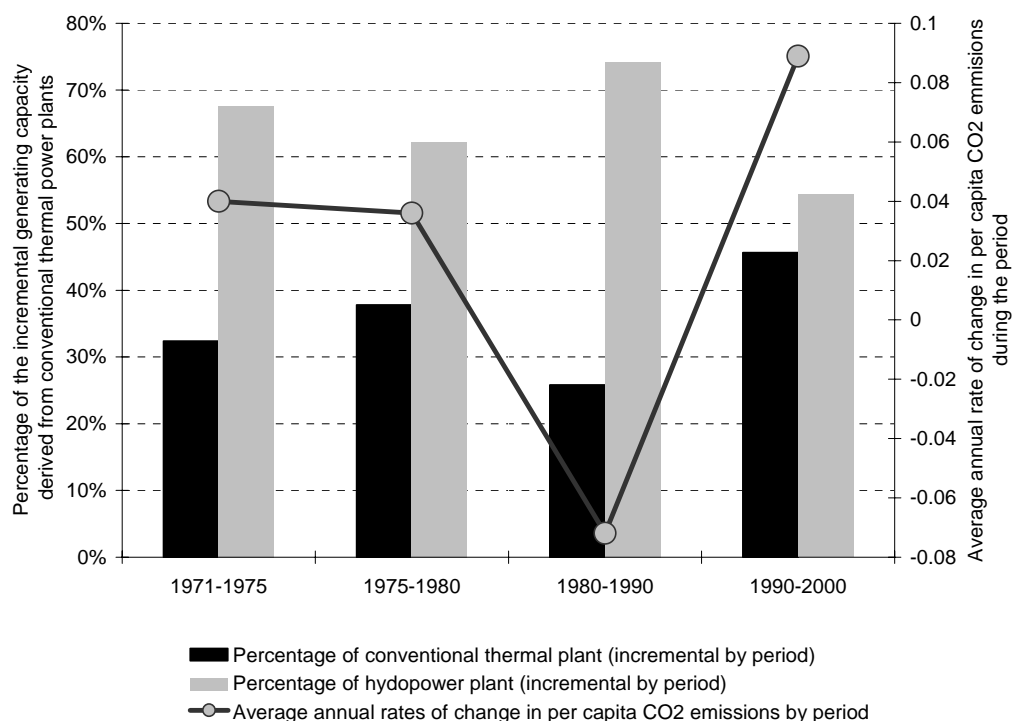


Source: Prepared by the author on the basis of International Energy Agency (IEA), *CO₂ Emissions from Fuel Combustion, Highlights 1971-2002*, Paris, Organization for Economic Co-operation and Development (OECD), 2004..

⁷ Estimated on the basis of data from the Energy-Economic Information System (SIEE) of Latin American Energy Organization (OLADE), 2008.

Even though it is difficult to pin down the sector responsible for this increase in emissions, they undoubtedly coincide with the changes in electricity generating capacity that took place in the region following the reforms (figure 15).

FIGURE 15
CHANGES IN TOTAL ELECTRICITY GENERATING CAPACITY AND AVERAGE ANNUAL RATES OF CHANGE IN CO₂ EMISSIONS



Source: Prepared by the author on the basis of International Energy Agency (IEA), *CO₂ Emissions from Fuel Combustion, Highlights 1971-2002*, Paris, Organisation for Economic Co-operation and Development (OECD), 2004 and Latin American Energy Organization (OLADE), *Energy-Economic Information System (SIEE)*, 2008

However, the introduction of combined cycles reduced the region's investment cost for electricity generation, which is an especially sensitive variable given that, prior to the reforms, much of the funding for hydropower plants fell to the public sector, causing high levels of external indebtedness. Some countries, such as Argentina, included new indebtedness requirements into their sector reforms that were not dissimilar to the new systems for providing public utilities or to the macro-economic policy frameworks that accompanied them.

One way of measuring the social impact of the reforms is to analyse variations in tariffs by user category, which is feasible using the available data. With the exception of Paraguay and Ecuador, residential tariffs increased considerably during the 1990s despite the prior assumption that the introduction of competition rules in electricity generation and of combined cycle power plants would drive down generating costs. Although this did in fact happen in a number of countries, the cost reduction was not passed on to the consumer. Moreover, with few exceptions, the ratio between residential and industrial tariffs grew. As no data are available on real costs before and after the reforms, and assuming that the bulk of the reforms took place in the 1990s, it is impossible to ascertain whether or not this tariff increase corrected a prior situation of blanket subsidies and cross subsidies between user categories.

TABLE 7
CHANGES IN AVERAGE TARIFFS BY USER CATEGORY ACCORDING TO COUNTRY AND TYPE OF REFORM

Country and type of reform	Variations in average prices 1990-2000 compared with the 1980-1990 average			Ratio of industrial tariffs/residential tariffs		Direction of variation
	Residential	Commercial	Industrial	1980-1990	1990-2000	
Argentina	52%	71%	91%	64%	80%	-25%
Bolivia (Plur. State of)	120%	124%	83%	129%	107%	17%
Brazil	119%	64%	41%	79%	50%	36%
Chile	29%	17%	39%	53%	57%	-8%
Colombia	49%	37%	29%	182%	157%	13%
Ecuador	-7%	7%	17%	113%	141%	-26%
Paraguay	-25%	-25%	-32%	76%	69%	9%
Peru	252%	-7%	19%	184%	62%	66%
Uruguay	88%	37%	49%	73%	58%	21%
Venezuela (Bol. Rep. of)	-9%	27%	133%	53%	137%	-156%

Source: Prepared by the author on the basis of Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE).

Nevertheless, in order to analyse the impact of the reforms on social equity and on energy distribution equity, as well as their indirect impact on poverty, first we need a comparison of tariffs before and after the reforms, by consumption rate in the residential sector, on the general assumption that their lesser equipment levels would lead the most disadvantaged sectors to have the lowest consumption rates in the residential sector. Unfortunately the data are insufficient to make a country-by-country comparison. For instance, the data available for Argentina reveal that the tariff increase was higher for poor groups than for higher-income groups (Arza, 2002). The same happened in Brazil following the reforms after 1993-1996 (Sauer, 2003).

Indeed, as figure 16 reveals, in Argentina the lowest-income groups connected to the gas and electricity grids suffered the widest tariff variations (figure 16). This was the result of applying a calculation methodology, following the restructuring of the energy sector, whereby the unit tariff would decrease as consumption increased, also encouraging misuse of energy by the better-equipped and higher-income sectors. To compound this, there was a decline in the number of connections to the gas grid among the lowest-income groups compared with the preceding period, forcing them to resort to a high-price fuel such as LPG, making access to energy even more inequitable and costly for the poor.

In the case of Brazil, the reforms undertaken since 1993, implemented in 1996 in a rather disorderly fashion (Ariztía Correa, 2002; Sauer, 2003), led to high tariff rises in all user sectors, particularly for residential users. Those hardest hit were users with the lowest consumption rates and those who lost the status of low-income users (table 8).

TABLE 8
CHANGES IN ELECTRICITY TARIFFS FOR RESIDENTIAL USERS
IN RIO DE JANEIRO AND SAO PABLO

Residential electricity rises – Eletropaulo power distribution company – June 1994 to July 2002		
Consumption level	For consumers who remain in the 'low-income' category (%)	For consumers who cease to belong to the 'low-income' category (%)
Up to 30 kWh	332.6	1 171.8
Between 31 and 100 kWh	194.2	404.5
Between 101 and 200 kWh	144.7	179.8
Residential electricity rises – Light power distribution company – June 1994 to November 2002		
Consumption level	For consumers who remain in the 'low-income' category (%)	For consumers who cease to belong to the 'low-income' category (%)
Up to 30 kWh	378.2	1 306.0
Between 31 and 100 kWh	244.1	490.1
Between 101 and 200 kWh	204.1	247.7

Source: I.L. Sauer, *A reconstrução do setor elétrico brasileiro*, vol.1, São Paulo, Paz e Terra, 2003.

Note: during the period, consumer prices (Greater Sao Paulo Consumer Price Index (ICP/FIPE)) rose by 110.9%.

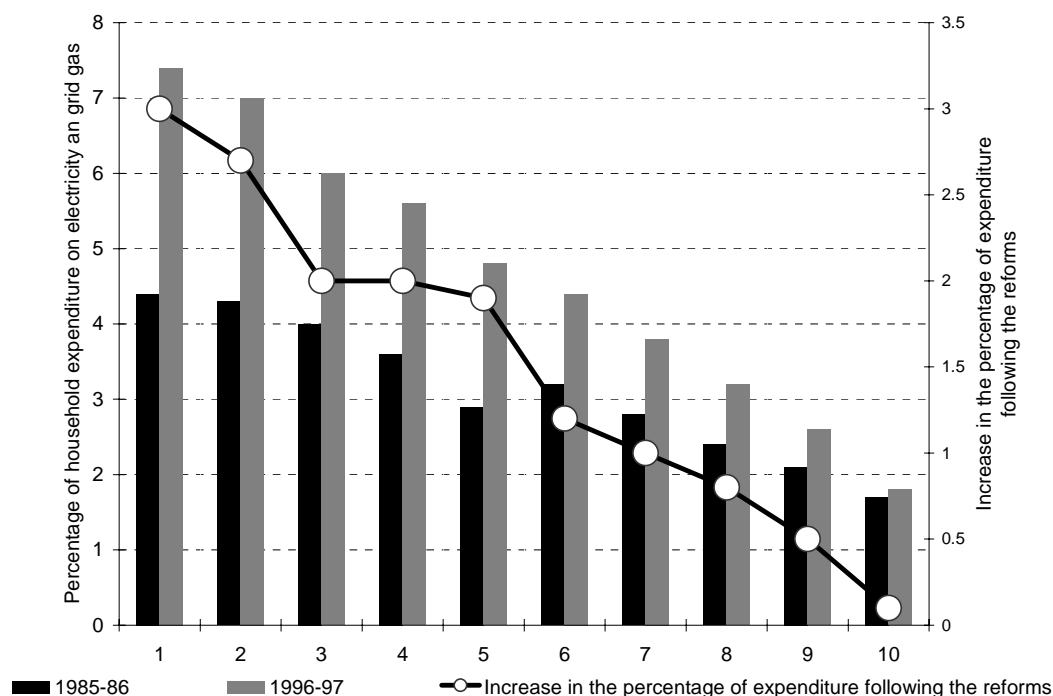
The Law lays down a number of explicit criteria for social equity and environmental protection, including:

- Ongoing expansion of coverage by means of systems to offset insufficient payment capacity by users.
- Proportional tariff system for low-income sectors in accordance with the precepts of equity and solidarity.
- Protection of natural resources.
- Granting of subsidies to lower-income people.
- Stratification of residential buildings in accordance with methodologies devised by the National Government.
- Establishment of a specific alphanumeric nomenclature in each municipality to individually identify all premises to be provided with public utilities.
- Support by means of investment and other instruments described in Law 142 for public utility companies promoted by the departments and the National Government.

The Law is explicit on the issue of social solidarity and redistribution. It states that what it means by solidarity and redistribution is that, when implementing the tariff system, measures will be adopted to assign resources to 'solidarity and redistribution funds', whereby high-strata users and commercial and industrial users help the lowest-strata users to pay the tariffs for utilities to meet their basic needs.⁸

⁸ Argentina's official journal, *Diario oficial*, No 41.433, Bogotá, 11 July 1994.

FIGURE 16
AVERAGE EXPENDITURE ON ELECTRICITY AND GRID GAS BY INCOME DECILE IN ARGENTINA BEFORE AND AFTER THE REFORMS



Source: Prepared by the author on the basis of Camila Arza, "El impacto social de las privatizaciones. El caso de los servicios públicos domiciliarios", *Working Paper*, No. 3, Privatisation and Regulation in the Argentine Economy project (BID1201/OC-AR PICT99-02-07523), Buenos Aires, Latin American Faculty of Social Sciences (FLACSO), March 2002.⁹

One case that bucks this trend, mentioned earlier in this document, is Colombia, as a result of its enactment of Law 142 of 11 July 1994 establishing a system of residential public utilities.

⁹ This declining trend was the result not only of the tariff increase but also of falling relative incomes among the poor, as the following table shows:

Decile of total household income	Income distribution		Percentage of income spent on electricity		Percentage of income spent on natural gas	
	1985	1997	1985-86	1996-97	1985-86	1996-97
1	2.0	1.5	2.7	4.2	1.7	3.2
2	3.1	2.8	2.5	3.8	1.8	3.2
3	4.4	4.0	2.2	3.1	1.8	2.9
4	5.7	5.2	2.1	2.9	1.5	2.7
5	7.0	6.4	1.6	2.5	1.3	2.3
6	8.5	7.9	1.8	2.3	1.4	2.1
7	10.2	9.8	1.6	2.0	1.2	1.8
8	13.0	12.4	1.3	1.7	1.1	1.5
9	16.6	16.9	1.3	1.4	0.8	1.2
10	29.4	33.1	1.0	0.9	0.6	0.9
Total	100.0	100.0	1.6	2.0	1.0	1.6

Source: Prepared by the author on the basis of Camila Arza, "El impacto social de las privatizaciones. El caso de los servicios públicos domiciliarios", *Working Paper*, No. 3, Privatisation and Regulation in the Argentine Economy project (BID1201/OC-AR PICT99-02-07523), Buenos Aires, Latin American Faculty of Social Sciences (FLACSO), March 2002.

In practical terms, social stratification means that middle-strata users (strata 3 and 4) pay the full cost defined in the regulation, while high-strata users (strata 5 and 6) pay extra, making it possible to subsidize the lowest-strata users (strata 1 and 2). Moreover the legislation has adopted the principle of the industrial and commercial sector cross-subsidizing the residential sector, with the industrial tariff set up to 20% higher than the residential average. That is to say, the legislation has favoured the principle of cross subsidies within the residential category and between user sectors, in order to expand energy access to urban and rural residents. Indeed, when Colombia's Natural Gas Expansion Plan, mentioned earlier in this document, started connecting lower-income users to the grid, the result was not only to reduce subsidies in the electricity sector but also to replace electricity with natural gas for household heating purposes, whilst simultaneously abolishing the use of cocinol, a highly flammable cooking fuel that had caused many accidents in poor households.

Even though the differences between the tariffs paid by strata 1 and 2 and the other strata have diminished over time, they are still large enough to facilitate coverage of a minimum electricity and gas consumption threshold for the poorest sectors, in addition to access to other services such as water, sewage and sanitation. The mechanism provides for the possibility of government subsidies to supplement insufficient funds. In practice, this guarantees the companies' profitability, as it favours the principle of efficiency as a minimum cost but sufficient to render for the provision and expansion of services.

Colombia's Law 142 was compatible with a system of utility provision by both private and public enterprises within a context of new rules for unbundling regulated activities. However, in 2001 a programme was introduced for dismantling subsidies on petrol and other derivatives for transport purposes, with subsidies being considered as the difference between domestic and international prices. So Colombia's energy pricing policy and regulations have evolved in line with energy, macroeconomic and social policy goals, with different degrees of emphasis placed on each type of goal in the various policy guidelines issued between the early 1990s and now. Even so, users in strata 1 and 2 represent a large proportion of total gas and electricity users and, although they have seen their energy costs rise gradually in recent years, they still benefit from the system of cross subsidies established in the mid-1990s.

A point of note is that 62% of the gas invoiced is for residential users and total consumption rates average only 27 m³ per month (20 m³ per month for residential users). However, the average tariff is not subsidized, unless the fact that the wellhead gas price is somewhat below the assumed opportunity cost can be considered a subsidy.¹⁰

While it is difficult to quantify the bulk of the government input for implementing the natural gas expansion plan in Colombia, it is well known that the highest cost came not from subsidies to the poor, but from a transfer of income from the State-owned enterprise Ecopetrol to another State-owned enterprise (the natural gas transporter, Ecogas), which was eventually privatized in 2007. It is difficult to evaluate the feasibility of replicating this model for use in other countries because it depends on the institutional framework placed in each country and on the policy guidelines of Governments. What it does illustrate, however, is that, when the political will exists, it is possible to find effective and dynamic formulas for resolving serious problems by means of highly beneficial solutions.

Peru is another example of the viability of according greater consideration to the problem of the urban poor's ability to afford utilities. In 2001 it was decided to mitigate the impact of the reforms on electricity tariffs by introducing a cross subsidy between residential consumers. This allowed lower-income users – considered as those who consume less than 100 Kwh/month – to receive a subsidy funded by receipts from other residential consumers.

However, in addition to the impacts described above there are others that should not to be overlooked. One aspect of the reforms and their social impacts that is difficult to evaluate is the macroeconomic frameworks that tend to form an integral part of such reforms. While it is not possible to expand on this point here, in cases where energy sector reforms have been accompanied by largely

¹⁰ In July 2007 the average tariff for grid gas was around US\$ 9/MBTU.

unsustainable macro-economic frameworks, they have resulted in a widespread increase in poverty (Kozulj, 2003, 2008). In such cases, the indirect impact of reforms on the poor has been much heavier than the direct impact (Kozulj, GNESD, 2003). To be more specific, in some countries' energy sectors, market mechanisms have not served as signals for the long-term expansion of the system. The crises in Brazil in 2001, in Argentina since 2004 and a few recent problems in Colombia and Peru all indicate that, while the social cost of energy shortages affects not only the poorest sectors, it is they who are ultimately the most vulnerable.

For example, there has been a downturn in a number of rising trends in the consumption of modern fuels in rural, deprived urban and peri-urban areas as a consequence of the liberalization of fuel prices in a context of rising world fuel prices. This has happened in Peru, where firewood consumption has been increasing steadily since 2003 (Ministry of Energy and Mines of Peru, 2006).

Nevertheless, progress has been made with the regularization of illegal electricity users. In the case of Argentina, as well as Brazil, Peru and the Bolivarian Republic of Venezuela, service providers (with varying degrees of State cooperation) have tackled the problem of 'non-technical losses' (or energy theft) attributable mainly to illegal users living in deprived urban areas.

Argentina's 'Framework Agreement' was designed to regularize more than 700,000 users by means of an ingenious system of cooperation among municipalities, provincial governments and the State. This agreement consists of tax offsetting and arrangements with electricity distribution companies to install meters in exchange for a State-funded indemnity. Even though the framework agreement has been renewed for three successive four-year periods since 1994, some of the results achieved are far from consolidated, chiefly owing to the 2002 crisis, which brought new problems in terms of users' inability to pay and, for companies, a freeze on tariffs between 2001 and 2008 (table 9).

TABLE 9
TREND IN ELECTRICITY CUT-OFFS FOR ARREARS IN ARGENTINA
FOLLOWING THE REFORMS

Year	Framework Agreement	Users with more than two cut-offs			Percentage of users with more than two cut-offs under the Framework Agreement		
		1999	2000	2001	1999	2000	2001
Total EDESUR	331 930	44 793	47 834	90 085	13%	14%	27%
Total EDENOR	369 745	121 393	171 168	207.604	33%	46%	56%
Grand total	701 675	166 186	219 002	297 689	24%	31%	42%

Source: Prepared by the author on the basis of information from distribution companies.

Some countries have introduced schemes in the worst slums by installing collective meters and collecting tariffs through the intermediary of neighbourhood leaders. A good example of this are the initiatives of service provider Light in the Brazilian city of Rio de Janeiro (WEC, 2006). One of the lessons learned for resolving the problem of illegal electricity use is to maintain close contacts with leaders of local residents' committees in slums, which calls for special measures and the design of communication strategies, education programmes and the granting of benefits. Failure to do so can elicit violent reactions and increase slum residents' feeling of social segregation and exclusion from full citizenship.

BOX 1
BRINGING LIGHT TO BRAZIL'S IMPOVERISHED AREAS

“For the residents of Rocinha, one of Latin America’s largest and oldest slums, the struggle to find work and have access to basic social services is exacerbated by the threat of fire, electrocution and power outages. These additional risks stem from the often desperate steps residents take to bring electricity to their meager homes, which are often connected illegally and with extreme risk to the power network.

Part of the solution is to find ways to deal with infrastructural inadequacies to provide essential services at a low cost and to educate residents about proper power usage, in Rocinha and in other slums in Rio de Janeiro.

Such an effort is being undertaken by Light Serviços de Eletricidade, Rio’s main power provider, as part of an ongoing program to upgrade the city’s electricity transmission and distribution systems. The latest initiative is made possible by a US\$ 200 million loan, a portion which is insured against non-commercial risks by a guarantee from the World Bank’s Multilateral Investment Guarantee Agency (MIGA).

Under the Program for Normalization of Informal Areas, Light is working in the city’s low-income communities to establish and upgrade power networks, install transformers and meters and educate local residents about safe, cost-effective power usage. The company is working closely with local NGOs to make sure residents understand the program and to address their concerns. For favela residents, the programme does not just provide a steady, safe source of power; it also documents proof of residence, necessary for getting a phone and establishing credit, in addition to other benefits.

Brazil’s recent power crunch has added a new urgency to the program, which in 2000 reached out to about 150,000 new low-income clients. By 2005, Light expects to be present in 728 slums and 594 low-income communities and “irregular” areas - those with unregistered connections or “doctored” meters – adding some 176,000 new clients.

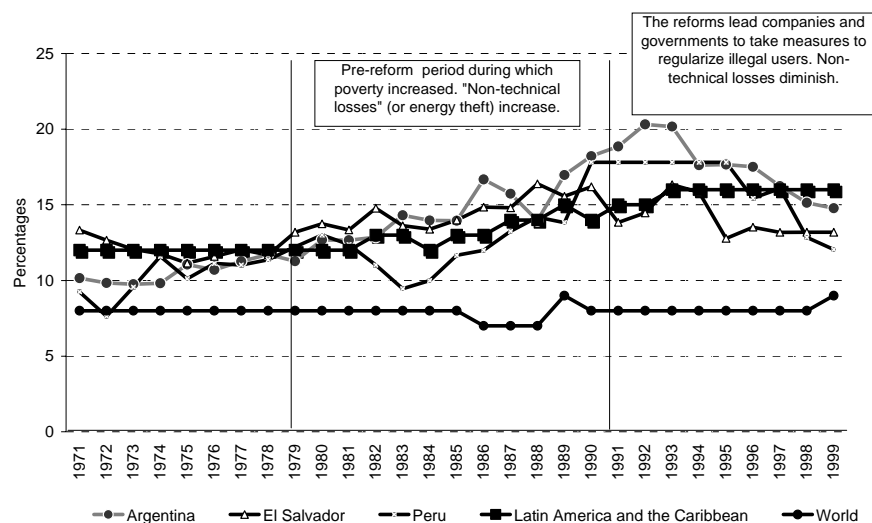
Source: World Bank, “Bringing light to slums of Brazil” [online] <http://go.worldbank.org/8XIQ6YD500>.

Losses from energy theft grew during the 1980s as the number of urban poor increased. The reforms faced private companies with the challenge of regularizing illegal users in order to reduce their own economic losses (figure 17).

This led to the inclusion in the discussion agenda of the most appropriate means for legalizing access to electricity. The companies of several countries started to propose prepayment meters as a valid option for supplying electricity to the poor in line with their ability to pay (Bravo, Kozulj and Landaveri, 2008). Even though some companies’ studies commend this system, it undoubtedly poses a number of serious operational problems, ranging from the availability of sales outlets to equitable distribution and quality of service. Indeed, not only can a system of prepaid cards for the use of a certain amount of energy be more costly to the user in terms of the Kwh consumed, it may also interrupt supply to such appliances as refrigerators, with detrimental consequences if the food cold chain is broken.

In conclusion, with few exceptions, the agenda of reforms in South America during the 1990s failed to give priority to social and environmental aspects. It was only after electricity providers themselves realized the practical importance of these aspects that there was a demand for more attention and research in this area.

FIGURE 17
TREND IN NON-TECHNICAL LOSSES IN ELECTRICITY DISTRIBUTION SYSTEMS
BEFORE AND AFTER THE REFORMS
(Percentages)



Source: R. Kozulj, N. Di Sbroiavacca and D. Bouille, "Energy access. Assessment of energy reforms case studies for Latin America and the Caribbean", document prepared for the Energy Access Working Group, Bariloche, Global Network on Energy for Sustainable Development (GNESD), August 2003.

5.2 Reforms and their impacts in Central America

In the nineties, a series of structural changes were also initiated in Central America's energy sector. As part of these institutional changes, a number of State-owned utilities were transferred to the private sector and market liberalization processes were set in motion.

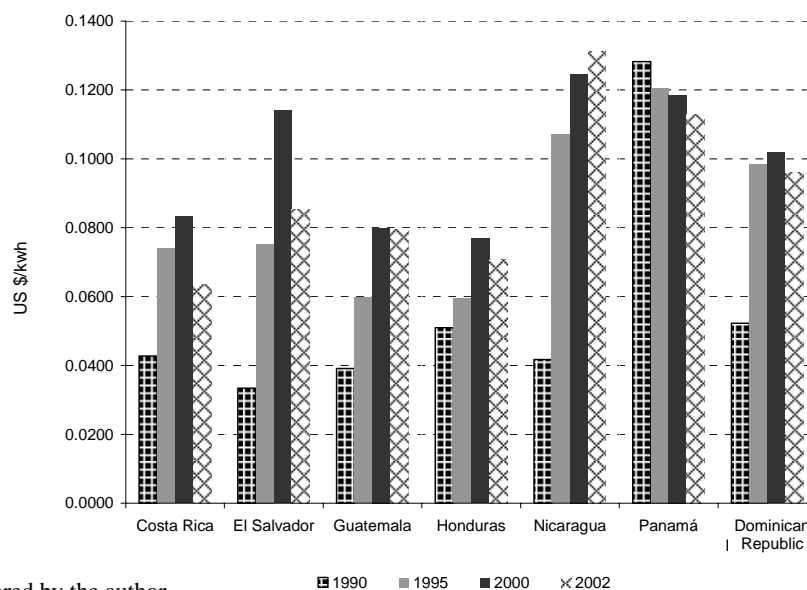
This led to the creation of institutions that helped to standardize and regulate the energy market. However, these institutions were not given the required technical, financial and human resources to carry out their task effectively, with the result that, to a certain extent, private companies succeeded in imposing their own market criteria, usually to the detriment of the lowest-income population sectors.

An important point to be borne in mind is that, as the provision of services to deprived urban and poor rural areas is not generally attractive to the managements of private companies from an earnings standpoint, given the high financial risk of poor people's inability to pay, it is the job of Governments to guarantee poor families' access to electricity.

Despite this, there is no evidence that energy market liberalization processes in Central America were accompanied by targeted policies and strategies for providing good quality, modern energy services to lower-income families at an affordable price, and no evidence of rural electrification or energization programmes or of environmental protection programmes. In other words, Central America's energy sector reforms failed to consider either the poverty issue or the environmental issue.

While there is not enough information to ascertain the social impact of the reforms on poor sectors, there was a general increase in the average tariff rate between 1990 and 2000 (figure 18).

FIGURE 18
TREND IN AVERAGE TARIFFS IN THE RESIDENTIAL SECTOR 1990-2002



Source: Prepared by the author.

Unlike the well-known cases in South America, in Central American countries the unit price for residential electricity either decreases very slightly as the consumption rate rises or does not increase in most cases, which would indicate that the reforms did not lead to negative discrimination against lower-consumption users who, when they are regularized, are usually the poorest people (table 10).

TABLE 10
CENTRAL AMERICA: AVERAGE REAL PRICE OF ELECTRICITY
IN THE RESIDENTIAL SECTOR - 2007
(US cents/Kwh)

	Monthly consumption (Kwh)			
	20-100	100-150	150-200	200-300
Costa Rica	8.24	7.97	7.83	7.97
El Salvador	8.11	10.27	11.27	12.20
Guatemala	12.85	12.92	13.30	14.06
Honduras	3.57	3.96	4.26	4.70
Nicaragua	12.68	13.81	14.77	15.84
Panama	11.57	13.29	14.15	15.01

Source: Economic Commission for Latin America and the Caribbean (ECLAC) 2007 b.

However, one fact that emerges clearly from a simultaneous analysis of differences in the average incomes of the social strata per population quintile in relation to their average energy expenditure is that the poor spend a much larger share of their income on energy than do the non-poor.

TABLE 11
CENTRAL AMERICA: DIFFERENCES BETWEEN AVERAGE MONTHLY INCOME
AND ENERGY EXPENDITURE ACCORDING TO POPULATION QUINTILE

Country/Location	Average income ratio Quintile 5 to Quintile 1			Energy expenditure ratio Quintile 5 to Quintile 1		
	National	Urban	Rural	National	Urban	Rural
Costa Rica	12.1	14.2	13.5			
El Salvador	13.5	10.3	13.1	2.7	6.87	2.21
Guatemala	17.7	13.5	15	5.72	21	1.5
Honduras	29.6	15.3	38	2.53	2.96	1.64
Nicaragua	19.6	16.6	24.1			
Dominican Republic	17.2	17.8	12			

Source: Prepared by the author on the basis of information from Economic Commission for Latin America and the Caribbean (ECLAC), 2007.

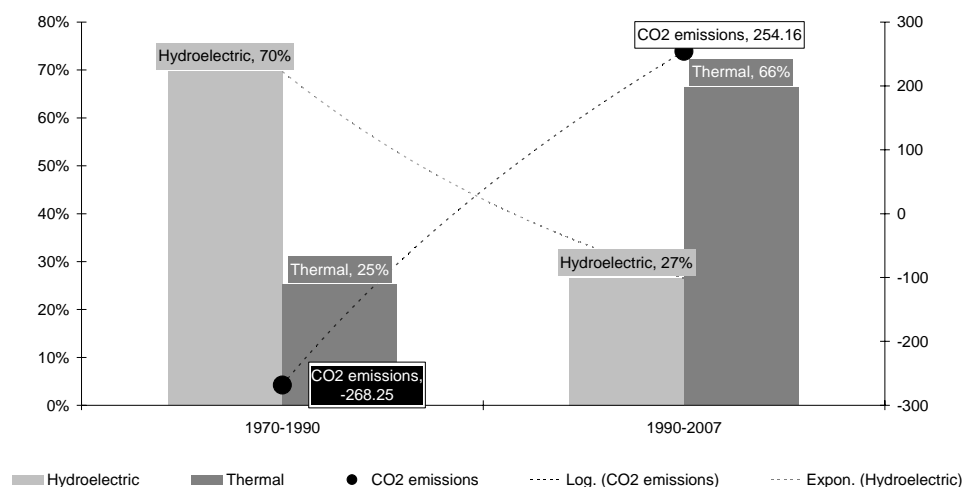
It is very clear to see that, with the exception of urban consumers in Guatemala, the average income ratios of the social strata far exceed energy expenditure ratios. Implicitly this means that energy expenditure as a proportion of average income per quintile is greater for the poor than for the non-poor. While it is not feasible to deduce the precise impact of the reforms from this, there is little doubt that Central American reforms also failed to address or resolve the problem. In most cases, the tariff differentiation by user bracket is lower than the average increase in tariffs, which would indicate a worsening energy cost for the poor, all the more so for LPG and electricity following the price increases for oil and liquefied natural gas after 2004.

Just as in South America, the trend in Central America after the 1990s was towards an increase in thermal power plants compared with hydropower plants, which reversed the decline in CO₂ emissions achieved between 1970 and 1990, as can be seen from figure 19 below, showing the increase that occurred between 1990 and 2007.

So it can be concluded that the reforms in Central America also failed to consider the environmental impact. Indeed, even though there has been much talk of the need to increase the share of renewables as a means of linking the environment-energy-poverty issue, the figures betray a serious lack of concern for implementing policies compatible with such a goal.

Indeed, from an analysis of various data relating to international cooperation in the region, it can be concluded that: (a) the funding has been scarce, fragmented and not properly targeted at reducing energy poverty and improving the trend in greenhouse gas emissions, and (b) there has been a huge bias towards financing small hydropower plants and biofuels rather than disseminating other renewable technologies or promoting the sustainable use of firewood. Moreover, a significant share of international cooperation funding has been earmarked for institution-building programmes in the energy sector, the results of which are difficult to evaluate.

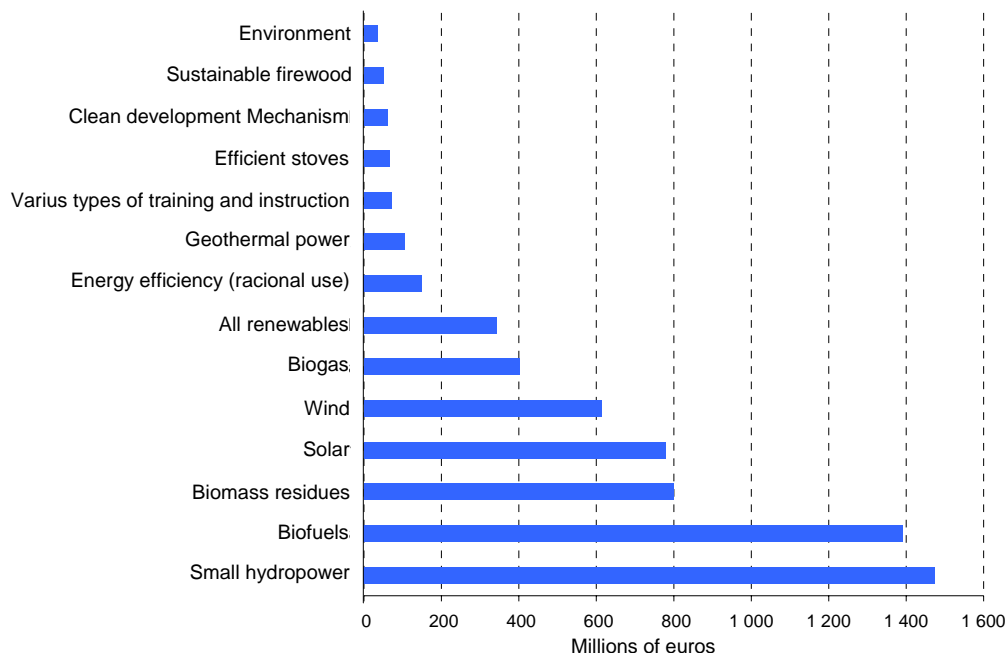
FIGURE 19
RELATIVE VARIATIONS IN INSTALLED CAPACITY FOR ELECTRICITY GENERATION
AND IN CO₂ EMISSIONS: COMPARISON OF THE PERIODS
1970–1990 AND 1990–2007



Source: Prepared by the author on the basis of information from Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE), 2008.

Note: there was a total increase in electricity generating capacity of 3 200 MW between 1970 and 1990 and 4 640 MW between 1990 and 2007. Energy sources other than thermal and hydroelectric accounted for only 5% of the total in the period 1970–1990 and 7% in the period 1990–2007.

FIGURE 20
DISTRIBUTION AND AMOUNT OF FUNDING EARMARKED PER ITEM IN THE CENTRAL
AMERICAN INTERNATIONAL COOPERATION PROGRAMMES ANALYSED



Source: Prepared by the author on the basis of information from United Nations Development Programme (UNDP).

5.3 Lessons learned and approach required to introduce the energy-poverty-environment linkage into future reforms

It is and will continue to be crucial to learn from the positive and negative lessons of recent reforms and experiences in the countries of Latin America and the Caribbean to ensure that energy access is included in the effort to attain the Millennium Development Goals.

The following aspects will therefore need to be taken into account:

1. The revised legal and regulatory frameworks for introducing second-generation reforms to attain the Millennium Development Goals and the environmental protection targets will need to consider the various environmental impacts arising from energy use.
2. Access to cleaner, cheaper and more efficient sources by the lowest strata must be actively promoted in order to lessen the current pattern of inequity.
3. It is necessary to promote the advantages of systems of explicit subsidies by means of residential stratification and by designing methodologies for defining and periodically updating them.
4. Tariff calculation methodologies must be established with special emphasis on pricing the energy consumed in excess of basic thresholds so as to improve social equity and prevent energy wastage. This will help to cut per capita CO₂ emissions and reduce the investment required for expanding the total energy supply, or contributions from the biggest consumers can be used to help finance the expansion.
5. The macro-economic policy frameworks that accompany energy policies must be monitored to guarantee stability, growth and equity, with special emphasis on preventing breakdowns and crises for which the poor tend to pay the most dearly.
6. An analysis should be made of any factors likely to heighten people's sense of social discrimination arising from their perceived inability to access services under equal conditions of service provision and quality.
7. Specific coverage goals should be set for poor sectors with no access to energy.
8. The costs of such programmes should be estimated and the planned sources of financing identified.
9. Comprehensive analyses of the behaviour of the entire energy sector should be made in order to guarantee energy access and supply for the poor in a way that is environmentally sustainable and economically viable.

6. Firewood consumption and the challenge of sustainable use

The use of firewood for cooking, water heating and air conditioning is almost invariably a clear indicator of poverty associated with lack of access and ability to afford clean and modern sources of energy for such purposes. Although this point has been made earlier, it does no harm to reiterate it: higher firewood consumption rates usually go hand in hand with lower HDIs.

The results of our analysis confirm that, until the mid-1990s, total firewood consumption decreased steadily in Latin America and the Caribbean simultaneously with the process of urbanization. However, although urbanization has intensified, total firewood consumption has begun to rise again as a result of increasing poverty in the region. This increase may be connected with the impact of the rise in international prices of oil and its derivatives between 2004 and 2008.

Thus, despite the lack of specific data for most countries that would allow firewood consumption to be differentiated between urban and rural households,¹¹ such consumption has probably also increased in poor urban and peri-urban households.

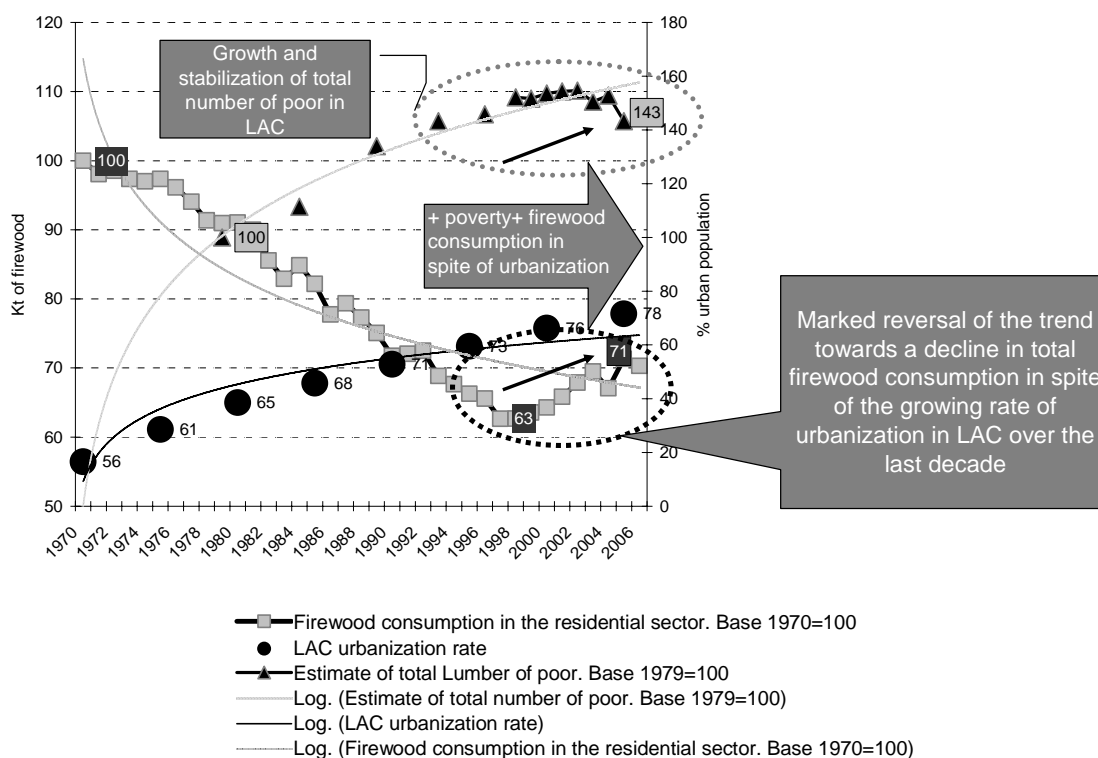
Figure 21 illustrates the trend in total firewood consumption, urbanization rates and the absolute number of poor throughout the 1970–2006 period, with a few gaps in the poverty data.

Thus the rise in the number of poor in Latin America and the Caribbean has coincided with a reversal in the decline in residential firewood consumption. Although this has been exacerbated by energy price rises, especially since 2004, the upward trend had undoubtedly begun even before the price rises, indicating the gravity of the structural problem and of problems in consolidating progress with poverty reduction.

The unsustainable use of firewood also has numerous links with and adverse repercussions on gender equality, the environment, health, child mortality and other factors related to poverty and the Millennium Development Goals.

¹¹ Only countries that have conducted energy consumption studies based on raw data for estimating net and useful energy consumption by homogeneous modules tend to have information available for differentiating energy consumption between urban and rural households by source and use, and in some cases also classified according to income strata. However, these data are available for a single point in time only and have not been systematized on a country-by-country basis. Notable cases of countries that have made this effort are Peru (1998), the Dominican Republic (2001) and Uruguay (2007/2008).

FIGURE 21
TOTAL FIREWOOD CONSUMPTION IN LATIN AMERICA AND THE CARIBBEAN,
POVERTY AND RATE OF URBANIZATION 1970–2006



Source: Prepared by the author on the basis of information from Latin American Energy Organization (OLADE), Economic Commission for Latin America and the Caribbean (ECLAC), Latin American and Caribbean Demographic Centre (CELADE) - Population Division of ECLAC.

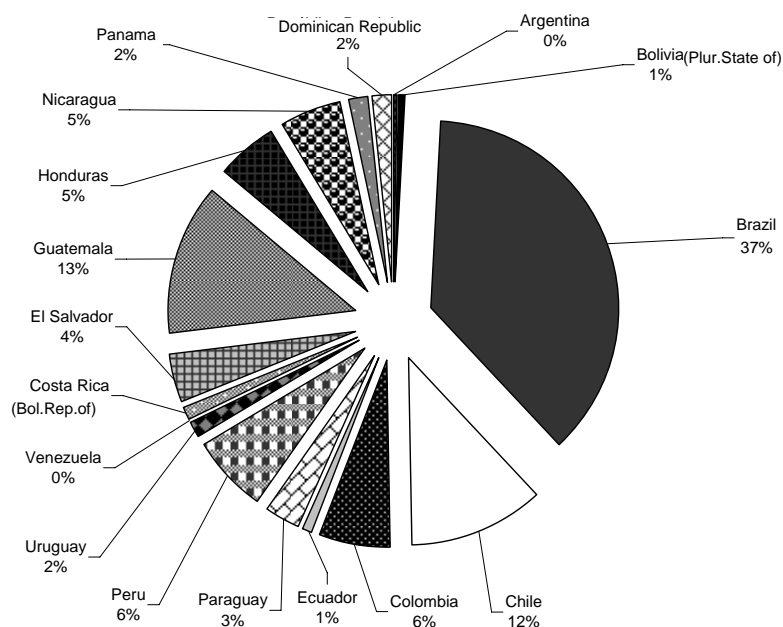
Note: Trends in the number of poor in index numbers with 1979=100 and percentages of urban population are shown on the right axis, while the total firewood consumption attributable to the residential sector is shown on the left axis (1970=100).

However, in only a few Latin American and Caribbean countries is the use of firewood for energy considered to contribute significantly to the problem of deforestation. In most South American countries, deforestation tends result from changes in land use patterns owing to the expansion of agriculture and livestock activities. Reforestation programmes exist in only a few countries, including Chile and to some extent in Brazil, despite the fact that deforestation problems stemming from firewood use can be very serious in some Central America and Caribbean countries. Haiti is an extreme case.

Firewood use by the poor tends to have other repercussions on the soil, as removing forest residues alters the natural nutrient-recycling process in cases where harvesting does not involve felling.

However, the worst impact of firewood consumption is on the use of women and children's time, as well as on air pollution in homes caused by defective or outdated appliances (inadequate chimney flues) and their public health consequences. At the same time, where there are no programmes to promote the efficient use of firewood, existing appliances tend to use more firewood than necessary for the purpose (e.g. cooking and water heating).

FIGURE 22
FIREWOOD CONSUMPTION IN THE RESIDENTIAL SECTOR BY COUNTRY
IN LATIN AMERICA AND THE CARIBBEAN -2007

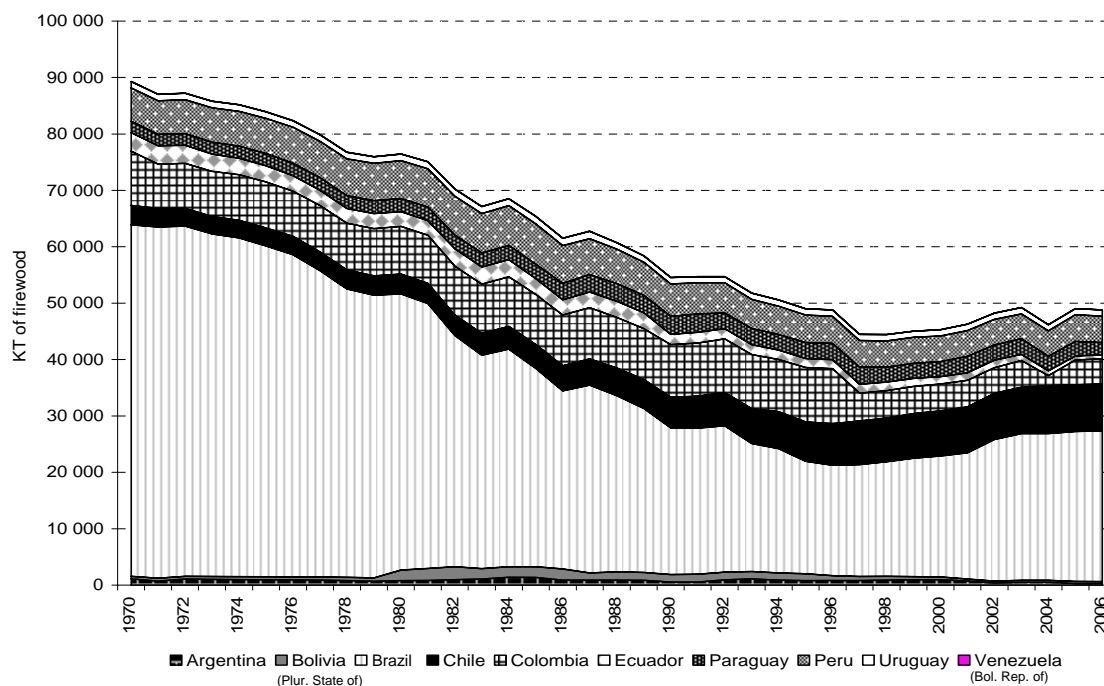


Source: Prepared by the author on the basis of information from Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE).

In the South and Central American countries analysed, a mere six countries account for 77% of total firewood consumption: Brazil, Guatemala, Chile, Peru, Colombia and Honduras. The remaining 23% is shared by 11 countries. If Nicaragua, El Salvador and Paraguay are added to the aforementioned six countries, together they account for 90% of total residential firewood consumption in the aforesaid countries. In some countries, like the Bolivarian Republic of Venezuela and Costa Rica, the percentages are very low or non-existent. In the case of the Bolivarian Republic of Venezuela, the main reason is the abundance of oil derivatives, together with a tradition of very low prices for these products on the domestic market. In the case of Costa Rica, it stems from cultural factors and the country's broad coverage of energy services (figure 22).

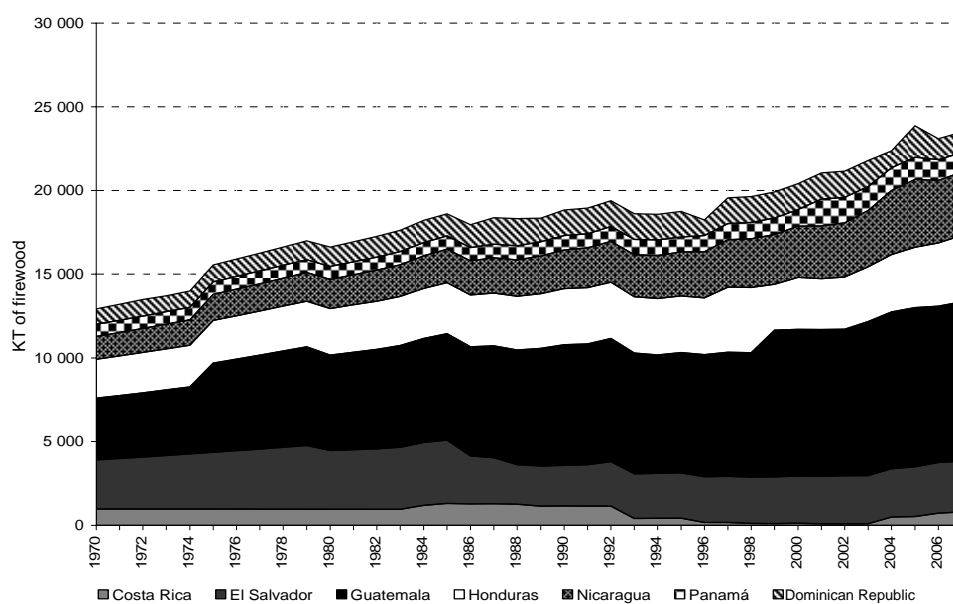
The decline in firewood consumption occurred predominantly in South America, although, as mentioned earlier, the downward trend leveled off and started climbing again after the mid-1990s. By contrast, in Central America firewood consumption is growing, despite a very slight reduction in 2007 (figures 23 and 24).

FIGURE 23
FIREWOOD CONSUMPTION IN THE RESIDENTIAL SECTOR BY COUNTRY IN SOUTH AMERICA FOR THE PERIOD 1970–2006



Source: Prepared by the author on the basis of information from Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE).

FIGURE 24
FIREWOOD CONSUMPTION IN THE RESIDENTIAL SECTOR BY COUNTRY IN CENTRAL AMERICA FOR THE PERIOD 1970–2006



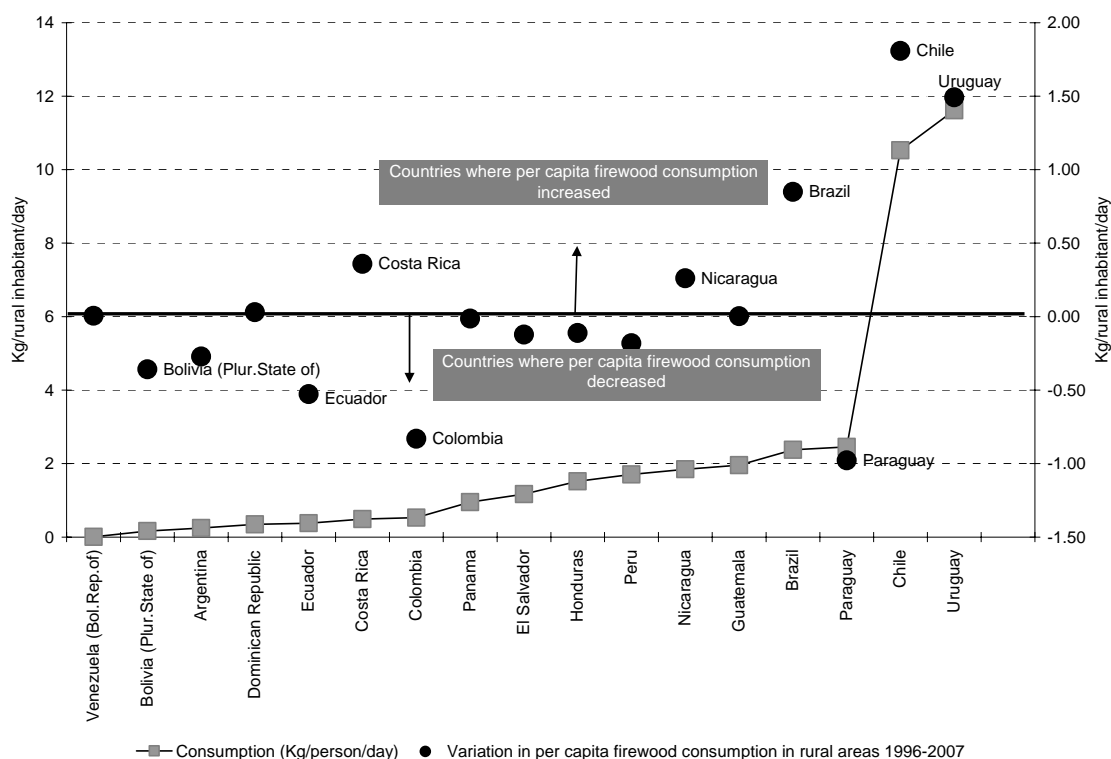
Source: Prepared by the author on the basis of information from Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE).

The fact that the populations of the poorest Central American countries, such as Guatemala, Nicaragua and Honduras, are increasingly dependent on firewood to satisfy their energy needs for heating purposes, like cooking and water heating, and that firewood consumption per rural inhabitant has increased sharply in countries such as Costa Rica, Brazil, Chile and Uruguay (figure 25), shows just how little progress has been made with rural energization using modern and efficient sources for what are the most basic necessities: cooking and water heating. This analysis reveals once again how important it is not to confuse electrification efforts with the more comprehensive process we call integrated energization.

In the cases of Chile and Uruguay, the high indicators may be attributed as much to the fact that poor urban consumers are resorting to fuelwood as their source of energy as to a lack of availability of other sources, coupled with higher incomes in rural sectors. In fact, Chile is a special case in that it has the smallest gap between the average incomes of rural and urban inhabitants and a strong tradition of firewood consumption, added to which the country is a net importer of oil and gas, which affects the affordability of these fuels.

In the case of Brazil, following a marked decline in per capita firewood consumption, the national energy balances show that there has been sharp growth since 1996. Added to the difficulties in measuring and validating the available data, there is the problem of the sustainability of consumption over time, which makes both comprehensive programmes of firewood use (wood energy) and cultural traditions for using firewood in the home (improved stoves) a problem of inequity and quality of life.

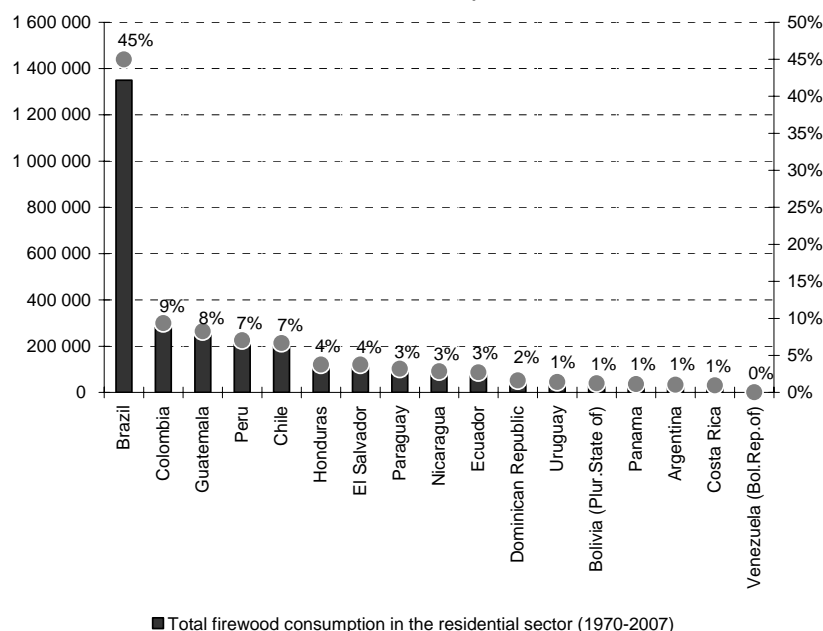
FIGURE 25
ESTIMATED FIREWOOD CONSUMPTION PER RURAL INHABITANT:
MULTICOUNTRY COMPARISON AND VARIATIONS OVER THE PAST DECADE



Source: Prepared by the author on the basis of information from Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE), Economic Commission for Latin America and the Caribbean (ECLAC), Latin American and Caribbean Demographic Centre (CELADE) - Population Division of ECLAC.

According to the national energy balances,¹² between 1970 and 2006 total firewood consumption in the residential sector throughout South and Central America was around 3 billion tons (figure 26), which would be equivalent to the deforestation of a total of only 2 million hectares (an average of 0.06 per year), 45% of which would be in Brazil. In fact, this figure is a tiny fraction of the region's total deforestation, estimated to be some 4.7 million hectares per year.¹³

FIGURE 26
TOTAL FIREWOOD CONSUMPTION IN LATIN AMERICA AND THE CARIBBEAN,
PERIOD 1970–2006
(Thousands of tons)



Source: Prepared by the author on the basis of information from Latin American Energy Organization (OLADE), Energy-Economic Information System (SIEE), 2008.

Indeed, some studies (Jaramillo and Nelly, 1993) point out that the most serious causes of deforestation are changes in agricultural and livestock production methods, logging for forestry and industrial purposes and infrastructure construction in frontier areas.¹⁴ In fact, deforestation can compound the problems of families that use firewood as their main fuel source, creating a vicious circle of worsening problems because the relationship between deforestation and climate change can make the poor more vulnerable and even lead to firewood shortages.

¹² As is commonly known, national energy balances may contain severe underestimations. For instance, in the case of Argentina, it is estimated that real consumption may have been three times higher than that reported in the energy balances of Argentina's Energy Secretariat.

¹³ Data from the Food and Agriculture Organization of the United Nations (FAO) indicate that 4.7 million hectares are being deforested every year in Latin America, of which Brazil accounts for 52%. Only a small portion of this deforestation can be attributed to firewood consumption in the residential sector, although this assessment may vary depending on the different hypotheses concerning forest productivity, typology, climate and other parameters.

¹⁴ According to Jaramillo and Kelly (1997), "Excessive deforestation has been taking place in tropical areas of Latin America for the past several decades. Among the causes of accelerated deforestation are population and income growth, extensive logging, expanding agricultural growth patterns and lagging agricultural yields. Government policies have also contributed to accelerating deforestation, by adopting measures to increase the profitability of agriculture in forested areas, constructing roads in frontier areas and adopting patterns of agricultural growth favouring large-scale mechanized production and low employment generation."

All this indicates that there is vast scope for the introduction of programmes for the integrated management of forest resources, which would not only diminish the impact of climate change but may also help to increase access to sustainable ways of using wood for energy.

Bearing in mind that, in many areas, the most readily available energy systems are biomass based, and that when they are properly managed they are not only versatile and sustainable but also effective in generating income and creating jobs, biomass systems should not be ruled out. Employment opportunities have been singled out as the biggest advantage of biomass-based systems because of their multiple knock-on effects in terms of economic activities and strengthening the economy.

In recent years, many Asian countries have become involved in modern applications using wood as an energy source. They are not pilot or research projects but investments that use biomass to generate heat, steam or electricity for industry using modern, convenient and more efficient technologies, such as cogeneration (using the heat produced from industrial farms to generate electricity) and wood-fired power plants (which generate electricity by burning biomass). These projects are proving to be both technically successful and economically profitable. What is more, they demonstrate the huge potential for woodfuels in the future as a technically efficient, economically viable and environmentally sustainable energy option. Thus, wood energy (as a broader term than firewood energy) could play an important role within a multipurpose forest-management model for the combined production and harvesting of wood, fuel and non-timber forest products. This would be a useful complement to productive uses in countries (and regions within certain countries) where, for income- and supply-related reasons, it is not feasible to replace firewood with modern fuels. Some countries¹⁵ have recorded their experiences with wood energy¹⁶ in the form of programmes for reforestation, rural energization, sustainable firewood use in rural households and harvesting and marketing methods.

While it is virtually impossible to quantify the progress achieved with sustainable firewood use in the region, the large-scale replication of a number of experiences in the region should be considered as a policy priority of energy plans for attainment of the Millennium Development Goals. In this study, the concept of sustainable use refers not solely to reforestation programmes or to devising proper guidelines for harvesting firewood, but also to the installation of efficient stoves and, above all ensuring that they are equipped with an adequate chimney flue to prevent respiratory disease in households, which has a serious impact on the health of women and children, as it is they who spend the largest amount of time inside the home (Accinelli and others, 2004; Pelaez and Rodríguez, 2004).¹⁷

For instance, according to the results of Peru's 2007 population and housing census, more than 2 million households (30.2%) use firewood for cooking, while only 200,000 or so households (4.2%) use dung and around 170,000 households (2.5%) use charcoal. Firewood is an important fuel source in rural areas, used by 77.4% of households, while dung is used by 14.5% of rural households. Peru's census included a question on whether households that cook using firewood, charcoal, dung or kerosene have a chimney flue in the stove. The results reveal that of the almost 2.7 million private homes where fuels such as these are used for cooking, only around 400,000, that is to say 15.1%, had a chimney flue in the stove, while more than 2 million had none (83.0%) and the remainder omitted to answer the question (2.0%).¹⁸

The German Technical Cooperation Agency (GTZ) has been running sustainable-development pilot projects jointly with the private sector since the 1970s via the Public-Private Partnerships (PPP) Programme funded by Germany's Federal Ministry for Economic Cooperation and Development (BMZ). GTZ has supported initiatives such as the Global Compact and social

¹⁵ See PROLEÑA (2005).

¹⁶ There are four main sources of woodfuel: firewood, charcoal, black liquor and others. Firewood and charcoal are traditional products that come from the forest, the timber industry and recycled wood waste, while black liquor is a by-product of the papermaking process.

¹⁷ For a wide-ranging discussion on firewood use and its health impacts in other latitudes, see Cumbe, Sharma and Lucas (2007).

¹⁸ PAHO/WHO and GTZ, 'Juntos' programme to expand the use of improved stoves (Programa Juntos para masificar el uso de cocinas mejoradas), 2008, San Jerónimo, Apurímac, Peru.

responsibility strategies (ISO 26000, etc.). The German Government's International Migration and Development Centre (CIM) has also supported private initiatives in a number of countries in the region by including experts in their project teams.¹⁹

However, no inventory of programmes exists to enable us to evaluate their scope to ascertain how much work remains to be done, especially in poor Central American countries where firewood sometimes accounts for more than one third of the energy matrix and poses a serious threat to the future sustainability of forests.

In summary, while the firewood use issue is clear conceptually and a few efforts have been made to rationalize firewood consumption, make it sustainable, link it with rural development programmes or promote clean, modern and more efficient sources to replace it, the lack of aggregate indicators of progress or specific data in energy plans would appear to show that programmes for the sustainable use of firewood have, for the most part, not been made a specific political priority prompting the major effort needed to improve the energy situation of the rural poor.

¹⁹ Seminar/workshop on public/private coalitions for the protection of forests: best practice and prospects (Coaliciones público privadas en la protección de bosques: buenas prácticas y perspectivas), ECLAC/GTZ, Santiago, Chile, 17-18 November 2008.

7. Energizing planning frameworks for development

7.1 General considerations

Chapter 2, which analyses the explicit priorities assigned by Latin American and Caribbean national planning frameworks to energy access and its relationship with the Millennium Development Goals, has shown that, although the issue is being addressed, no systematic, organic or priority approach is being taken. Not only is there considerable evidence that the subject is being dealt with in a piecemeal fashion, even more worrying is the somewhat superficial approach that belies any genuine interest in resolving energy poverty.

There is still no explicit differentiation of the diverse situations described in this study, including:

- Problems of access to and affordability of energy services and products for the growing number of urban poor.
- The question not only of linking rural electrification with environmental sustainability but also of comprehensive frameworks for the development of rural energization programmes that would substantially improve the standard of living and monetary income of the rural poor.
- Consideration of the environmental impacts arising from increased energy access for the poor, backed by measures for the rational use of energy for all sectors that consume energy, explicitly stated using scenario and method analysis to reveal the underlying assumptions.
- The fact, which is still denied despite the evidence, that the 1990s reforms have not succeeded in expanding supply in a cost-efficient manner but that, by contrast, in many cases energy prices have increased without improving the reliability of energy systems and the security of supply, increasing the future vulnerability of the poor.
- The little-analysed linkage between equipment access by the poor and its impact on current and future consumption rates.

In addition, in many Latin American and Caribbean countries there has been a dismantling of the most highly trained teams of State technicians in association with the disintegration of energy chains and the vertical and horizontal reintegration of markets headed by groups of private actors with significant market power. Faced with this situation, public actors such as the planning departments of the respective ministries or regulatory bodies, are becoming aware of the need to resume responsibility for planning processes, in many cases at the demand of private actors themselves because uncoordinated signals lead to a vicious circle of delayed investment decision-making which in turn produces critical situations of the kind that occurred in Brazil in 2001, in Argentina after 2004, in Peru in May 2008 and in Colombia throughout 2007 and part of 2008, to mention only the most notable cases (Kozulj, 2008).

Clearly, such situations do not encourage priority to be given to poverty and the energy needs of the poor, so they are postponed (or feebly tackled) and, when they are finally addressed, they are resolved in a pragmatic manner.

Contrast this situation with what happens in developed countries, where major utilities like British Gas, E.ON and EDF have introduced social tariffs to protect poor and vulnerable groups from fuel poverty. In some cases, the social tariff applies to customers who spend more than a certain percentage of their income on energy ((EurActiv, *Social tariffs to tackle fuel poverty*; BBC News, 2009).

Another worrying trend in the region is that competition for the necessary investment also hinders decision-making in the private sector among national managements of groups with interests in several countries. This is because implicitly it is becoming standard practice to seek to equalize profit margins across widely diverse national realities. This factor is all the more crucial because a fairly small group of actors that coordinate their investment decisions both inside and outside the region appears to have established a presence in the region. In some cases this prompts the authorities to focus on finding formulas to make private investment more attractive, neglecting other priority areas of public energy policy.

As the priority is to secure overall supply, unsurprisingly national planning frameworks give priority to this issue and relegate to a secondary role not only the poverty issue but also, in practice, the issue of strategies to prevent adverse environmental impacts. None of this has diminished the rhetoric though, which appears to continue unabated.

In spite of the region's wealth of experience with rural electrification using renewable sources, as well as with programmes for the sustainable use of firewood, a genuine political will is needed to study and address the issue as part of a comprehensive agenda and not as a series of fragmented, uncoordinated, one-off experiments with no follow-up.

It also means that energy access has been correlated closely with the issue of renewable sources in rural areas, as it is not uncommon for pilot projects to fail, particularly when they are unable to ensure continued plant maintenance. Moreover, even nowadays, such technologies can be costly in spite of the progress achieved through learning curves, apart from the fact that there is reluctance to use tariff subsidies even though willingness exists to subsidize all or part of the investment.

It is not that such policies are totally questionable or without foundation but certainly little progress has been made in pinpointing the type and scale of programmes that would be required and the financing efforts that a solidarity contribution from the entire energy sector should be able to cover, in particular by means of suitable management models for supplying basic services to the poor. In any case, few systematic efforts were found in the literature to make it possible to ascertain how much it would cost society to provide sufficient funding to cover the basic energy needs of the poor in accordance with defined typologies and appropriate technologies.

Up to now, international cooperation has been insufficient, in particular because it tends to be targeted at small projects each with very small amounts of funding, except for a few large-scale works or

generic support for restructuring the energy sector, such as the European Union Energy Initiative for Poverty Eradication and Sustainable Development (EUEI, 2008).²⁰

The region has amassed a wealth of experience and knowledge in the areas of regularizing illegal users in deprived urban areas, rural electrification, increasing the penetration of renewable sources and programmes for the sustainable use of firewood, much of it thanks to international cooperation agencies. This shows that what is really required is a genuine political will to study and address the issue as part of a comprehensive agenda and not as a series of fragmented, uncoordinated, one-off experiments with no follow-up.

By the same token, corporate social responsibility is crucial in enabling the Latin American and Caribbean countries, aided by their own efforts, to rise to the challenge of reducing energy poverty. However, this will need to be stated in a more transparent and explicit manner than has been the case in the past, especially since very small-scale programmes can give a false picture of the real efforts made and their specific achievements. Therefore future energy plans ought to define coherent and comprehensive goals and strategies, including the actions and instruments required to accomplish them and an explicit programme for monitoring the results at least every four years.

7.2 Towards the design of plans

At a minimum the plans should include the following:

- Identification of the population segments to be served, definition of their energy needs, their geographical location and the funding earmarked for resolving the problem within a specific timeframe.
- The minimum consumption rates of a diversified basket of energies for the various household uses in line with diverse economic, climatic and geographical situations.
- A timetable of energy coverage prioritizing the poorest sectors.
- Criteria for selecting energy supply by types of source and technology.
- Investment, operating and maintenance costs, their sources of financing and the definition of appropriate management models.
- Energy supply and demand scenarios to measure the impact of social inclusion policies on energy access in terms of the need to increase supply and hypotheses based on expected energy savings in other social sectors in order to increase security of supply.
- Assessment of greenhouse gas emissions and other potential environmental impacts.
- Scheme of energy tariffs and prices, in order to guarantee the overall sustainability of the energy system and the inclusion of the poor.
- Estimated resource contributions from the public and private sectors, including the share from international cooperation.
- Design of job-creation programmes around small-scale energy industries in rural and peri-urban areas.

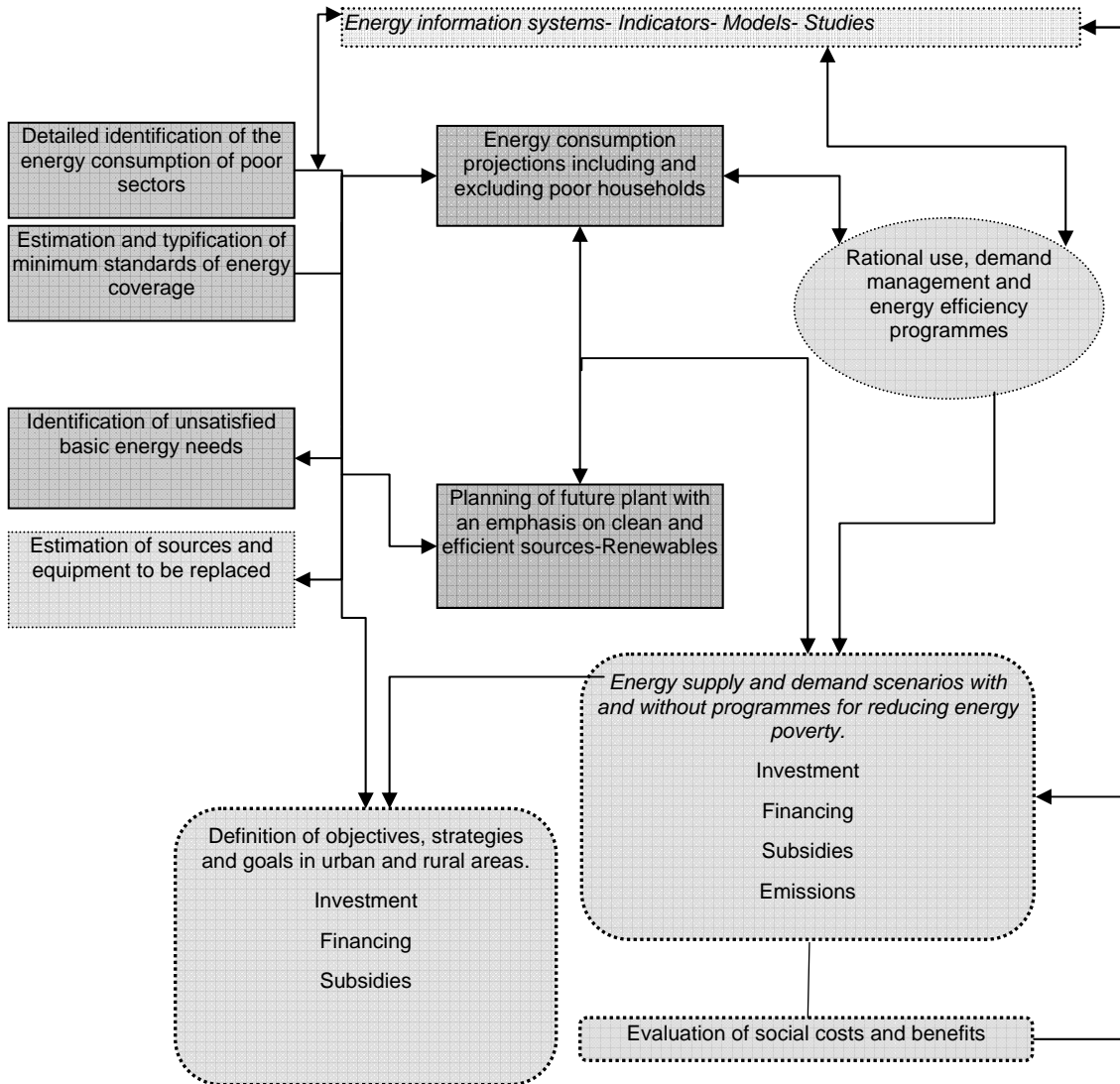
²⁰ The European Union Energy Initiative for Poverty Eradication and Sustainable Development (EUEI) was launched at the 2002 World Summit on Sustainable Development. The project database provides information on the international cooperation organizations involved in each Latin American and Caribbean country, projects supported between 2002 and 2010, the amount of funding and a description. Even though the scope of this study did not allow us to process all of this information, a cursory examination would indicate that the projects tend to be small and dispersed, without a systematic policy framework that would make it possible to consider the real implications in terms of energy poverty alleviation.

- Inclusion of progress monitoring in information systems by means of appropriate indicators linked with national data-collection systems to enable progress to be quantified and the attainment of specific goals to be monitored, including links with the Millennium Development Goals.
- Identification of the government agencies responsible for the implementation, monitoring and control of these plans and their objectives, strategies, instruments and actions.

Figure 27 illustrates the series of analytical and planning processes required to develop comprehensive programmes for reducing energy poverty that make it possible to quantify the efforts to be made by each country and the scale of international cooperation required to:

- Ascertain the unsatisfied basic energy needs of the poor in accordance with a breakdown of current sources, uses and technologies and what it is hoped to provide in the future.
- Identify the diverse specific situations in urban and rural areas in accordance with climate typology and basic consumption standards estimated for each case.
- Estimate the investment, maintenance and operating costs, as well as determining sources of financing and establishing compensation for the beneficiaries.
- Analyse impacts and determine the amounts of subsidies required and their sources.
- Ascertain the potential for policies of cross subsidies with other sectors, and for efforts for rational use and promotion of renewable sources.
- Evaluate the social costs and benefits achieved by the programmes in order to allow a continual process of learning and programme improvement.

FIGURE 27
INTEGRATED ANALYTICAL CHART OF PROGRAMMES FOR REDUCING ENERGY POVERTY IN NATIONAL PLANNING FRAMEWORKS



Source: Prepared by the author.

8. Conclusions and recommendations: towards the design and implementation of comprehensive energy strategies within the context of attainment of the Millennium Development Goals

This study has shown that not only has the contribution of energy services to the attainment of the Millennium Development Goals been addressed in a highly unsystematic manner but that conceptually there is a tendency to bundle key aspects together in an extremely generic and rather confused fashion. International cooperation agencies have contributed to and participated in many international and regional programmes by prioritizing the linkage between energy access and renewable energy. However, a preliminary examination of existing initiatives reveals fragmentation of efforts, concentration on the rural poor and a shortage of specific resources, culminating in a series of difficult-to-evaluate studies and experiments.

In rural areas, programmes to supply electricity using renewable sources still present problems of both scope and approach. If the aim is to make serious progress in this area, new management models will need to be incorporated into programmes of electricity access for rural areas using renewable sources in order ensure continuity and expansion of supply. It is also necessary to move towards rural energization programmes that ensure the provision of sufficient energy to improve the productivity of economic activities in rural communities in order to achieve poverty reduction by this means.

It would therefore be desirable to ensure that the provision of services is not dispersed and that an integrated approach is taken to access to clean and efficient fuels to replace firewood or, when such a leap forward is not feasible in the short and medium term, for programmes to result in sustainable use of firewood. It would also be desirable for electricity access to ensure that sufficient installed capacity is available to allow for the development of productive uses.

A system for the integrated management of such programmes involving a variety of sources to serve a variety of uses, could be implemented by rural public utility companies, as happens in urban areas. The cost of these integrated systems, which will undoubtedly require large-scale subsidies, must be weighed against the cost of continued rural-urban migration, which tends to exact heavy social costs that are never properly considered and quantified as a set of positive and negative externalities. This is all the more important since, over the past three decades, such migratory processes have been shown to simply displace rural poverty and increase urban deprivation.

As regards the problem of the urban poor, serious research must be done on the implications of defining basic consumption standards, introducing social tariffs and giving explicit consideration to cross subsidies, in order to prevent *a priori* barriers and at the same time introduce stable criteria that would lead to their social acceptance.

To address the legitimate concern about the potential impact on security of supply from an increase in energy consumption as a result of providing energy services to the poor, it is necessary to ensure that the increase in energy supply is sustainable as energy access is broadened, which means that comprehensive planning is needed, adopting measures in other areas and sectors of energy consumption to ensure that the solution is not social exclusion.

In other words, it is not acceptable to continue to argue that enhancing social inclusion in the area of energy access would have a detrimental impact on the environment, without considering the current energy wastage by other social segments, mainly in the use of transport but also in productive activities and in higher-income households. It is therefore necessary to raise awareness of the fact that the energy-poverty-environment issue cannot be addressed in a piecemeal fashion but calls for a global integrated approach.

The contribution of energy services to the Millennium Development Goals should be considered not as something marginal or merely symbolic, but as a serious challenge for expanding markets sustainably, which also means introducing the principle of redistribution into the energy field.

It is well known that the reforms undertaken in the nineties took the reverse approach of redistribution, in the interests of a so-called economic efficiency that failed to materialize in practice. However, even in Anglo-Saxon countries like New Zealand and Australia, the results of more than two decades of reform have aroused serious misgivings about the self-regulated market model and led them to adopt criteria of social and national interest in their energy programmes, requiring more State intervention in regulation and planning (Kozulj, 2008; Hay, 2008; Petrie, 2008; Ministry of Economic Development, 2008),²¹ As this study has shown, there is a host of precedents and initiatives on this matter, so now it is time to put the matter in order and to include it explicitly in national planning frameworks. If the aim is for energy services to make a substantive contribution to attainment of the Millennium Development Goals, it will not enough to formulate a regional and international agenda that is as vague, fragmented and experimental as it has been in recent decades.

In view of all this, it would be highly advisable to consider at least the following proposals:

- Include explicitly the issue of energy access and affordability for poor sectors in national planning frameworks.
- Aim to build institutional capacity and to establish proper information systems organically. In particular it would be desirable for household surveys to provide information on energy access, energy sources used for each purpose, quantities consumed, the size of bills paid for both grid and off-grid energy services and the equipment used (specifying such information as the product's year of manufacture, brand and type). This should be done at regular intervals on an on-going basis, with broad geographical coverage.
- Include highly trained and motivated technicians into national planning bodies and agencies.
- Set goals for annual coverage of the energy needs of the poor in rural and urban areas, specifying energy sources, use and production technologies and the specific geographical location of each programme and initiative.
- Quantify the funding needed to implement the programmes for coverage of energy services.

²¹ Ministry of Economic Development, compilation of a variety of documents about the development of the reforms.

- Define the mechanisms for attaining the aforesaid goals, including: planned infrastructure works; actors and management models; tariffs and subsidies and their relationship with national budgets and international cooperation contributions.
- Incorporate integrated planning practices as dynamic processes and include comprehensive simulations of the energy sector in order to quantify the overall expected impacts of increased energy consumption by the countries' poor and non-poor sectors.

Moreover it is suggested to:

- Incorporate new management models in programmes of electricity access using renewable sources, with the aim of ensuring continuity and expansion of supply.
- Progress towards rural energization programmes ensuring the provision of sufficient energy to improve the productivity of the economic activities of rural communities, in order to reduce poverty by this means.
- Set goals so that the provision of services is not dispersed and an integrated approach is taken to access to clean and efficient fuels and proper equipment to replace firewood or, when this qualitative leap is not feasible in the short and medium term, programmes result in sustainable use of firewood in the context of a concept of integrated management of forest resources.
- Set thresholds for access to electricity so that sufficient power is provided for productive uses.
- Provide funding for agencies responsible for researching and developing new technologies, supervising results at the design stage and at the stage of prototype production, experimental testing, manufacture and actual use in poor sectors of the population.

Undoubtedly this still-incomplete list can be improved in the future, in particular based on the practical experience gained from making more accessible and affordable energy for the poor in all countries a key objective of the government agencies responsible for national energy planning.

So, this is not a question of blueprint planning or of a return to rigid central planning models. Instead the aim is to devise operational planning processes jointly with all the actors involved. To do this it is vital to raise gradual awareness of the importance of the issues and problems discussed in this project document.

Bibliography

- Accinelli, Roberto and others (2004), "Evaluación del efecto de los combustibles de biomasa en el aparato respiratorio en tres comunidades rurales andinas: Cutini Capilla (3850 m snm, Puno), Ayamachay and Uyshahuasi (2850 m snm, Lambayeque)" [online] http://www.cepis.org.pe/bvsapi/fulltext/le%F1a_2004.pdf.
- ACIJ (Civil **Association for Equality** and Justice) (2007), *Informe público: incumplimientos y déficit detectados en la implementación de programas sociales de subsidio para la adquisición de garrafas*, Buenos Aires, April.
- Anneck, W., M. Endelli and C. Carpio (2004), "Report on the acceptability and socio-economic impact of prepayment meters in Merlo", *Report for ACCESS Programme*, Paris, Electricité de France (EDF).
- Aritzía Correa, R. (2002), *Estudio comparativo de las crisis eléctricas en Chile, California y Brasil; aspectos relevantes para el nuevo marco regulatorio chileno*, Santiago, Chile, Catholic University of Chile.
- Arza, Camila (2002), "El impacto social de las privatizaciones. El caso de los servicios públicos domiciliarios", working paper, No. 3 of the **Project privatisation and regulation in the Argentine economy** (BID1201/OC-AR PICT99-02-07523), Buenos Aires, Latin American Faculty of Social Sciences (FLACSO), March.
- BBC News (2009), "Tax plan to tackle fuel poverty" [online] <http://news.bbc.co.uk/2/hi/business/8091917.stm>, 9 January.
- Bertero, R., E. Greco and F. Rodríguez (2005), "Equidad distributiva y tarifas", Buenos Aires, **Center of Studies of Energy Regulatory Activities** (CEARE), March.
- Bouille, D., H. Dubrovsky and C. Maurer (2002), "Argentina: market-driven reform in the electricity sector", *Power Politics: Equity and Environment in Electricity Reform*, N. Dubash (ed.), Washington, D.C., World Resources Institute (WRI).
- Bravo, G., R. Kozulj and R. Landaveri (2008), "Urban and periurban energy access. UPEA II. Buenos Aires case study" [online] http://www.gnesd.org/Downloadables/UPEA_II/FB%20final.pdf.
- Bravo, V. (2004), "Requirements básicos y mínimos de energía de los pobladores urbanos y rurales pobres e indigentes de América Latina y el Caribe", San Carlos de Bariloche, Fundación Bariloche, unpublished.
- Colombia (2007), *Plan Energético Nacional 2006-2025. Contexto y estrategias*, Bogota, April.
- CONPES (National Council on Economic and Social Planning) (1991), *Documento CONPES*, No. 2571, Bogota, National Planning Department (DNP).
- Cravino, M.C. (2006), *Las villas de la ciudad*, Buenos Aires, Universidad Nacional de General Sarmiento.

- Cumbe, Fabio, Deepak Sharma and Carlos Lucas (2007), *The Status of "Clean Cooking Fuels" in Mozambique Faculty of Engineering*, Sydney, University of Technology **Sydney**.
- Daher, Zulema (2006), "Sesiones ordinarias 2006", *Orden del día*, No. 391 [online] <http://www.diputados.gov.ar/dependencias/dcomisiones/periodo-124/124-391.pdf>.
- De Dicco, Ricardo (2005), "El negocio de la garrafa de GLP en Argentina", *Boletín del MORENO*, No. 126, Buenos Aires, November.
- ECLAC (Economic Commission for Latin America and the Caribbean) (2008) Social Indicators and Statistics Database (BADEINSO) [online] www.eclac.cl/badeinso/Badeinso.asp.
- ECLAC (2007),
- ENDA (Environnement et Développement du Tiers-monde) (ed.) (2006), "Réduction de la pauvreté: les énergies renouvelables peuvent-elles vraiment y contribuer de manière significative?", *Bulletin Africain*, No. 16, Dakar, September.
- _____ (ed.) (2005), "Accès à l'énergie: les résultats", *Bulletin Africain*, No. Special, Dakar.
- European Commission/European Union Energy Initiative (EUEI) (2008), Projects Database [online database] http://ec.europa.eu/development/policies/9interventionareas/waterenergy/energy/euei/index_en.cfm.
- Fidanza, E. (2002), "Análisis del proyecto fideicomiso redes solidarias, San Miguel" [online] <http://fpvs.org/download/Informe-interpretativo-FPVS.pdf>, October.
- Fundación Bariloche (2006), *Renewable Energy Technologies for Poverty Alleviation in Argentina. Niche Assessment and Policy Outlines*, San Carlos de Bariloche, Global Network on Energy for Sustainable Development (GNESD).
- _____ (2004), *Energy Access Theme Result: Assessment of Energy Reforms in Latin America and the Caribbean*, San Carlos de Bariloche, Global Network on Energy for Sustainable Development (GNESD).
- Gallie, D. and S. Paugman (2002), *Social Precarity and Social Integration*, Brussels, European Commission, October.
- Gas Natural BAN (2006), "Nuevos métodos para lograr la gasificación de barrios" [online] <http://www.gasnatural.com/archivos/ar/cuartelv.pdf>.
- Gasparini, L. (2007), *Monitoring the Socio-Economic Conditions in Argentina*, Center for the Study of Distribution, Labor and Social Affairs (CEDLAS), Universidad Nacional de La Plata, June.
- GNESD (Global Network on Energy for Sustainable Development) (n/d), "RE and poverty alleviation workshops. Highlight regional needs and solutions" [online] http://www.gnesd.org/Downloadables/2007_Regional_workshop/workshopsummary.pdf.
- _____ (n/d), "Outcome of energy assess working group" [CD-ROM].
- _____ (2007a), "Regional workshop: renewable energy and poverty reduction in Africa, best practices for productive use and job creation" [CD-ROM] Dakar.
- _____ (2007b), "Renewable energy technologies and poverty alleviation: overcoming barriers and unlocking potentials" [online] http://www.gnesd.org/Downloadables/RETs_II/RETs_II_spm.pdf.
- _____ (2007c), "Reaching the MDG and beyond: access to modern forms of energy as a prerequisite" [online] http://www.gnesd.org/Downloadables/RETs_II/RETs_II_spm.pdf.
- _____ (2006a), "Energy for poverty reduction", Flyer for partnership presentation, 8 May.
- _____ (2006b), "GNESD news", *Issue*, No. 4, May.
- _____ (2006c), "GNESD news", *Issue*, No. 5, November.
- _____ (2006d), "Poverty reduction. Can renewable energy make a real contribution?" [online] <http://www.gnesd.org/Downloadables/PovertyReductionSPM.pdf>.
- _____ (2006e), "Regional workshop on electricity and development in Africa, Asia and Latin America. Consolidation report" [online] <http://www.gnesd.org/Downloadables/GnesdRegionalWorkshop.pdf>.
- _____ (2005), "GNESD news", *Issue*, No. 3, October.
- _____ (2004a), "GNESD news", *Issue*, No. 2, April.
- _____ (2004b), *Energy Access Theme Results. Summary for Policy Makers (SPM)*, United Nations Environment Programme (UNEP).
- _____ (2004c), *Energy Access Theme Results*, United Nations Environment Programme (UNEP).

- _____ (2003), "The need for better energy services" [online] <http://www.gnesd.org/Downloadables/Flier.pdf>.
- Haselip, J. (2003), *An Investigation into the Impacts of Electricity Sector Liberalisation upon Low-Income Consumers in Buenos Aires, Argentina*, Imperial College of Science, Technology and Medicine University of London.
- Hay, James L. (2009), "Challenges to liberalism: the case of Australian energy policy, energy policy", *Resources Policy*, vol. 34, No. 3.
- IDB (Inter-American Development Bank) (2008), "Sistemas sostenibles de electrificación rural a partir de fuentes renovables de energía", document presented at the fourth International Symposium on Energy and the Technological Frontier in the Rural Sector, Medellin, July.
- IEA (International Energy Agency) (2004), *CO2 Emissions From Fuel Combustion, Highlights 1971-2002*, Paris, Organisation for Economic Co-operation and Development (OECD).
- informe de Wang del Banco Mundial en el 2001
- IPCC (Intergovernmental Panel on Climate Change) (2007), *Climate Change: Impacts. Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the IPCC*, Cambridge, Cambridge University Press.
- _____ (1997), *The Regional Impacts on Climate Change. An Assessment of Vulnerability*, Cambridge, Cambridge University Press.
- Jaramillo, C.F and Thomas Kelly (1997), "Deforestation and property rights in Latin America" [online] <http://www.iadb.org/sds/doc/1411eng.pdf>.
- Karekezi, S. and J. Kimani (2002), "Status of power sector reform in Africa: impact on the poor", *Energy Policy*, vol. 30, No. 11-12.
- Khan, S.I. (2003), "Protecting the the poor in the era of utility privatization", *Energy for Sustainable Development*, vol. 7, No. 2.
- Kozulj, R. (2008), "Análisis de la experiencia internacional en materia de mercados de energía", working paper (FB-01/2008), San Carlos de Bariloche, Fundación Bariloche.
- _____ (2007a), "Taxes impact analysis on the liquid and gaseous hydrocarbons sector in Argentina", (FO/AGR/07/006) Project, Buenos Aires, United Nations Development Programme (UNDP), October.
- _____ (2007b), "Energy, development and poverty in the 21st Century: which are the challenges? Which are the answers?", document presented at the **twentieth** World Energy Congress (WEC) "Energy Future in an Interdependent World", Rome.
- _____ (2003), "People, cities, growth and technological change: from the golden age to globalization, technological forecasting and social change", *Elsevier Science*, vol. 70, No. 3.
- _____ (2002), "Los desequilibrios de la economía argentina: una visión retrospectiva y prospectiva a diez años de la convertibilidad", *Revista comercio exterior*, Mexico City, Mexican National Bank, Agust.
- Kozulj, R. and H. Dubrovsky (2003), *Alternatives for Subsidizing the GBA Urban Poor Study*, Buenos Aires, Argentine Council of the World Energy Council.
- Kozulj, R. and N. Di Sbroiavaca (2004), "Assessment of energy reform: case studies from Latin America", *ESD Special Issue*, vol. 7, No. 4, December.
- López Moreno, Eduardo (2005), "How far is the world from the slum target?", *Habitat Debate*, vol. 11, No. 3, September.
- Mendizabal, Enrique (2006), "Building effective research policy networks: linking function and form" [online] <http://www.odi.org.uk/resources/download/130.pdf>
- Ministry of Energy and Mines of Peru (2006), *Balance nacional de energía, 2006*, Lima.
- OLADE (Latin American Energy Organization) (2008), *Info Bulletin*, Year 2, Edition 9, June.
- PAHO/WHO/GTZ (Pan American Health Organization/World Health Organization/German Agency for Technical Cooperation) (2008), "Programa juntos, para masificar el uso de cocinas mejoradas", San Jerónimo, Apurímac.
- Pelaez, Sandra and Rosalía Rodríguez (2004), "Factores de riesgo de infección aguda", *Revista aire libre*, vol. 1, No. 3.

- Petrie, Sonia (2008), *National Inventory Reporting for Agriculture. The New Zealand Experience*, Ministry for the Environment of New Zealand.
- Prévôt Schapira, M. (2002), “**Buenos Aires** en los años '90: metropolización y desigualdades”, *EURE*, vol. 28, No. 85, Santiago, Chile, December.
- PROLEÑA (Asociación para el Fomento Dendroenergético de Honduras) (2005), *Fortalecimiento de los mecanismos de participación y concertación para el fomento y desarrollo dendroenergético en Honduras*, Tegucigalpa.
- Rodríguez, M.C. and others (2007), “Producción social del hábitat y políticas en el Área Metropolitana de Buenos Aires: historia con desencuentros”, working paper, No. 49, Buenos Aires, Instituto de Investigaciones Gino Germani, Universidad de Buenos Aires, February.
- Sauer, I.L. (2003), *A reconstrução do setor elétrico brasileiro*, vol.1, São Paulo, Paz e Terra.
- Suárez, C., V. Bravo and R. Kozulj (2001), *Revisión bibliográfica sobre energía y pobreza en América Latina*, Fundación Bariloche/World Energy Council (WEC).
- UNDP (United Nations Development Programme) (2008), *Human Development Report, 2007/2008*, Oxford University Press.
- _____ (2007a), *Energizing Poverty Reduction. A Review of the Energy-Poverty Nexus in Poverty Reduction Strategy Papers*, New York.
- _____ (2007b), *A Review of Energy in National MDG Reports*, New York, January.
- _____ (2005), *Energizing the Millennium Development Goals. A Guide to Energy's Role in Reducing Poverty*, New York.
- UNDP/DESA/WEC (United Nations Development Programme/United Nations Department of Economic and Social Affairs/World Energy Council) (2004), *World Energy Assessment Overview: 2004 Update*, New York.
- UNFCCC (United Nations Framework Convention on Climate Change) (2007), *Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries*, Bonn.
- _____ (2006), *Background Paper. Impacts, Vulnerability and Adaptation to Climate Change in Latin America*, Lima.
- United Nations (2005), “World Urbanization Prospects: the 2005 revision” [online database] <http://esa.un.org/unpp>.
- United Nations Human Settlements Programme (2006), *Meeting Development Goals in Small Urban Centres. Water and Sanitation in the World's Cities*, Earthscan.
- Verner, Dorte (2006), “Rural poor in rich rural areas: poverty in rural Argentina”, *Policy Research, Working Paper*, No. 4096, World Bank, December.
- WEC (World Energy Council) (2006), *Alleviating Urban Energy Poverty in Latin America*, London.
- Zanca, Rosana (2007), “Territorialización alternativa y economía solidaria”, *Revista otra economía*, vol. 1, No. 1 [online] <http://www.riless.org/otraeconomia/rosana.pdf>.