SUSTAINABLE
ENERGY FOR ALL

Rapid Assessment Gap Analysis
Peru

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Rapid Assessment and Gap Analysis

Sustainable Enery for All

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PERU: Rapid Assessment and Gap Analysis

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PERU: Rapid Assessment and Gap Analysis

EXECUTIVE SUMMARY

The Inter-American Development Bank (IDB), in coordination with the United Nations Program for Development (UNDP), supports the work of Sustainable Energy for All (SE4ALL) with the goal of increasing renewable energy, energy efficiency, and energy access in Latin America and the Caribbean. The SE4ALL 2030 objectives and goals are:

- To provide universal access to modern energy.
- To double access to renewable energy.
- To duplicate the implementation of energy efficiency projects.

This document aims to provide a brief evaluation and analysis of gaps in the Peruvian energy sector related to the objectives and goals of SE4ALL for 2030 based on information available in 2013. The scope of this document includes: the energy situation of Peru, the current situation with respect to the goals of SE4ALL, the challenges and opportunities to reach those goals.

The following provides a summary of the main results and conclusions:

Current Situation with Respect to the SE4ALL Objectives

ACCESS TO ENERGY

Programs that use modern energy for cooking in households have, in the past, been temporary, unfocused, and carried out on a minimal scale. They were developed with the support of the Ministry of Energy and Mines (MINEM), non-governmental organizations, and international

cooperation. Since 2013, MINEM has been developing the Peru Cookstove Program by providing kits for LPG cookstoves and constructing improved firewood cookstoves. The recent creation of the Directorate General for Energy Efficiency (DGEE) of the MINEM (2010) to support those programs shows the necessity of having more human and economic resources to achieve the required goals.

In the last 20 years the MINEM, via the Directorate General of Rural Electrification (DGER), has developed an electrification program that by 2013 managed to reach an electrification coefficient of 90% on a national level. However, on a rural level it decreases to 70%. It is estimated that creating improved access in rural sectors is restricted due to the dispersion of inhabitants and the distance from current networks. Despite the limitations of the electrification program, there is an agency responsible that programs and executes projects. Better development requires planning rural electrification to address the problem of expansion to remote small towns with low consumption. Likewise, the economic contribution of the national budget should increase to achieve these goals.

Identified problems

Fuels

- Firewood continues to be the main energy used by the rural residential sector, which results in local pollution and health problems for users.
- The government, via small programs for improved stoves, has replaced kerosene stoves with LPG and conventional wood stoves with efficient wood stoves. However, greater investment is required to expand the program nationally.
- Difficult access to isolated populations with economic insecurity represents a barrier to commercial fuel penetration.
- There is the challenge of increasing the participation of natural gas in the residential sector, which requires large investments in transport and distribution infrastructure.

Electricity

- The unit cost of investment to increase electricity coverage continues to grow due to isolated areas on the border that have low consumption levels and are difficult to access.
- A considerable number of photovoltaic projects executed in isolated areas in the past have not been sustainable over time due to problems with maintenance and systems management.
- The indicators of supply quality SAIDI-SAIFI in companies in rural isolated areas are still high, which reveals a high frequency and duration of interruptions.
- Rural electrification projects in Peru are being executed with public resources with little participation from public and private distribution concessionaries. Given the limitations of government management, it is not possible to improve the efficiency of investments.
- The expansion of the electricity frontier for populations located in the Amazon could result in social and environmental impact for native communities. This is why care should be taken to make investments with a minimum impact and to evaluate other alternatives.

ENERGY EFFICIENCY

Although there is national legislation about energy efficiency like the Referential Energy Use Plan, only pilot programs for energy efficiency and temporary programs to abate energy

demand have been developed. The lack of priority and the scarce resources allocated to the DGEE show minimal progress in terms of rational energy use in the country. Energy price policies have also influenced the lack of importance of energy efficiency in the public and private sector. The vertical structure of state management and the limitations of intersectoral coordination make it difficult to develop programs that require the support of the industrial, commercial, and domestic sector.

Problems identified

- It is necessary to strengthen the Directorate General of Energy Efficiency with greater human, economic, and institutional resources.
- Energy saving and efficiency measures are not a priority for companies in the country, and no investment in these frameworks exists.
- Aside from the LPG cookstove program, the improved cookstove program, and programs to raise awareness about efficient energy use, the government is not executing actions to reach the goals of the Referential Energy Use Plan.
-)Given the small size of the Peruvian market, the weak contribution of existing energy efficiency consultants, and the lack of confidence and interest of banks in lending for these types of projects there are a lack of Energy Service Companies in Peru (ESCO.
- Low energy prices, like those of natural gas and electricity in Peru, result in energy efficiency projects with low rates of return on investment.

RENEWABLE ENERGY

Hydroelectricity generation reached 55.5% of the national electricity system in 2012. However, the expansion of generation supply in the last few years has been predominantly thermal. Energy studies and plans carried out in the country indicated the necessity to expand hydroelectricity offerings in the country. This means overcoming the following barriers: the low price of natural gas for electricity generation, access to financing for large projects, and the social and environmental license for its development.

The implementation of a 2008 law to promote investment in electricity generation with Renewable Energy Resources will allow the first stage of introducing 5% of new sources into the national interconnected system. Non-conventional renewable energy experience in the country is still limited, and the main barriers to greater penetration are still the high initial cost of these technologies and relatively low electricity prices.

In terms of liquid hydrocarbons, since 2011 biofuels mixing has been required: for example, biodiesel DB5 (5% in Diesel 2) and alcohol (7.8% of gasoline) have been used since 2010. In the future, hopefully these percentages of biofuels, biodiesel, and alcohol will increase according to the guidelines of the Promotion of Biofuels law.

Problems identified

- For the development of hydroelectric plants, the main barrier in Peru in the past few years has been the low price of natural gas and the high cost of investment, as well as access to financing and the costs and transaction times (especially those related to studying environmental impacts).
- There are no mechanisms to prioritize national biodiesel consumption, which means that there is a preference for imported diesel due to its lower price.

- The expansion of exportable ethanol production requires registered available land and an assured water supply. The latter requires investments in reservoir infrastructure, which will increase projects.
- In the case of non-renewable conventional energy, the main barrier is the high cost of installed capacity. These are expected to decrease in the future. Currently, its participation will be limited to the energy requirements of renewable energy resource (RER) auctions.
- Another barrier for non-conventional renewable energy is the huge hydroelectric potential in Peru given that it is less expensive and more reliable source.
- Small-scale RER projects have been implemented in Peru without taking into account the sustainability of installation time.
- In the case of biomass, initial prices in RER auctions have not been sufficient to award the offered projects. This is likely due to the fact that they didn't' take into account that bagasse co-generation projects belong to the sugar and alcohol industry, which works with discount rates that are higher than those of the electricity sector.
- In the case of geothermal generation, there are a lack of incentives to carry out this type of project (for example, technical subsidies and auction announcements dedicated to this source).
- The national industry of renewable energy equipment production and services is nascent, which means that for Peru to be more competitive, it must invest in research and energy development.

Since 2010, the Government has been establishing energy policy guidelines and plans that match the goals of SE4ALL.

2010 Supreme decree No. 064-2010-EM defines national energy politics from 2010-2040. The main guidelines are:

1. To have a diversified energy mix with emphasis on renewable sources and energy efficiency.
2. To have a competitive energy supply.
3. Universal access to the energy supply.
4. To have greater efficiency in the productive chain and in energy use.
5. To achieve self-sufficiency in energy production.
6. To develop the energy sector in the framework of Sustainable Development with a minimum environmental impact and low carbon emissions.
7. To develop the natural gas industry and its use in residential, transport, commercial, and industrial activities, as well as efficient electricity generation.
8. To strengthen the institutional framework of the energy sector.
9. To integrate with the energy markets in the region to achieve a long-term vision.

Ministerial Resolution Nº 203-2013 MEM-DM approved in the 2013-2022 Universal Access Energy Plan. The main guidelines are:

- To reach total coverage in the Electricity and Hydrocarbon subsectors.
- To subsidize and/or guarantee the cost of infrastructure and energy supply equipment for low-income segments of the population.
- To involve Regional and Local Governments in the creation of supply programs.
- To promote productive energy use.

- To promote the construction of basic energy infrastructure to cover the necessities of universal service.
- To guarantee the transport and supply of natural gas to implement heating systems in high Andean areas with few resources.

The mechanisms for universal access are:

- Programs to promote and spread the use of natural gas.
- Promotion and/or compensation for access to LPG.
- Development programs for new supplies on the Energy Frontier.
- Programs and improvement of Rural Energy Use.

The established goals of the plan are:

Universal Access to Energy Projects	Beneficiaries	Unit	Period
Mass use of natural gas	50 000	Homes	2016
Compensation for access to LPG	550 000	Homes	2016
Kit for LPG cookstoves	1 000 000	Homes	2016
Rural electrification network projects	6 221 577	Inhabitants	2022
Rural photovoltaic systems without a network	500 000	Installations	2016
Installation of improved cookstoves	80 000	Homes	2016

Challenges and opportunities to reaching the SE4ALL objectives

Institutions and policies

Although there are general government policy guidelines about universal access, energy efficiency, and renewable energy, there are no specific goals and there is no monitoring to allow an ongoing assessment of the advancement to achieving them. It is evident that the lack of institutional structure and adequate planning limit the possibility of reaching the goals.

There is a necessity for greater coordination among the various ministries involved in universal energy access programs (Ministry of Development and Social Inclusion and the Ministry of Energy and Mines) to allow them to focus and prioritize the subsidies in investment and energy consumption. Likewise, the development of energy efficiency and renewable energy requires greater coordination among sectoral institutions. It requires a strengthening of capacities and resources in the Directorate General of Energy Efficiency of MINEM.

Programs and Financing

Universal access programs for electrification and for modern energy use in homes require better planning and state resources in order to confront the difficulties of distance and the dispersion of families. The positive experience of improved cookstoves and LPG cookstoves on a small scale should be expanded to include all regions of the country.

The favorable development of the national economy in the past 10 years and in the near future make it necessary for the state to prioritize SE4ALL programs, specifically those related to universal energy access and energy efficiency.

Also, given the high costs of these programs, the low economic return, and the social character of these, it is necessary to continue seeking financing, donations, and international cooperation.

Private Investment and a Favorable Environment for Business

Since 1993 the economic policies of the free market have allowed the development of private investment in the energy sector in both electricity and hydrocarbons. The process of privatizing state electricity and hydrocarbon companies allowed a first phase of development of private companies in these sectors. They have been dynamic in the expansion of these sectors. This process of privatization of the electricity sector remained partially truncated by social opposition. The government has also developed a process of concessions for both electricity and hydrocarbons. This process has not been developed at the same rate as demand requirements, and it needs to be accelerated to avoid deficits. The regulatory framework for Public-Private Partnerships (PPPs) has also been developed, but its implementation process has been slow.

The government policy option for private investment in the energy sector is clear, but institutional constraints have prevented their development. Stocks have been mainly in the hydrocarbon sector through PERUPETRO and in electricity and natural gas through PROINVERSIÓN.

There is the need for an agreement between the public and private sector to tackle the goals of universal access, energy efficiency, and renewable energy. It is evident that the necessity for profitability in the government private sector and the business need to be made compatible with national SE4ALL goals. This is why it is necessary to demonstrate the active participation of businessmen in diverse programs related to SE4ALL.

The increase in electricity demand and the delay in projects is an opportunity to develop specific energy efficiency programs. Defining clear use policies for hydroelectric resources and the price of natural gas could help achieve the medium-term goals.

The decrease in national crude oil production in recent years and the increase in imports affects the balance of payments and makes it necessary to revise policies that have been developed for the hydrocarbon sector and enable investment risk from the private sector.

Main gaps, barriers, and additional requirements

Thermal Energy for Homes

The main barriers and gaps for the adequate and economic use of energy resources for thermal service in homes are:

- Institutional gap: In the recent past there was not a defined entity in the government responsible for the continuous implementation of improved firewood cookstoves. The programs were limited to temporary ones. There legal framework exists in the Law of Promotion of Efficient Energy Use (Ley No 27345). According to Supreme Decree No 026-2010, the General Energy Efficiency Board will be in charge of managing, promoting, and executing activities assigned by the MINEM by Law No. 27345. Currently the “Peru Cooks” Project headed by the DGEE implements LPG cookstoves and improved firewood cookstoves.

- Improved cookstoves are not viable if they are not subsidized. Despite the health benefits and the reduction in fuel costs, investments in improved cookstoves are not a priority in rural homes because their scarce resources are used for subsistence or investment in capital for economic activities. Considering these facts, International Cooperation Programs should be subsidized by the State to promote the implementation of improved cookstoves in Peru.

- Access to capital for improved cookstove programs: The annual budget assigned to the Ministry of Energy and Mines doesn't cover the cost required for the proposed goals of implementing improved cookstoves. This is why, just like the "Rural Electrification Access and Use" program, a long-term improved cookstoves program to meet the proposed goals should count on a Program in the Annual Budget, which is decided by the Ministry of Economics and Finance.

- The high initial cost of equipment and connection and the low economic return on converting to natural gas in the home: According to OSINERGMIN, with the current price of LPG and the regulated value of natural gas, the typical cost of conversion of US$ 700 is recovered in 8 years (at an interest rate of 12% annually for the standard consumer.

- Access to financing for conversion to natural gas at home: the management of financing and funds in the short-term with the risks of profitability of conversion in the hands of users. It elevates the barrier of access to the natural gas supply and reduces the velocity of conversions. According to OSINERGMIN, a policy of 10,000 monthly conversions with a financing rate of 12% signals the need for a self-sustaining 950 million soles fund starting in the sixth year.

- A lack of statistics for constructing the baseline: There are no national statistics about the current situation of thermal uses in the home or the equipment used (improved traditional kitchens, etc.) or their efficiency.

Electricity Sector

- Low energy consumption in rural homes and low levels of production activity: almost 30% of electricity users in rural homes have a monthly consumption of less than 31 KWh/month. This low consumption limits the profitability of rural service for distribution companies and thus creates a barrier to future investments in infrastructure. This factor is added to the low level of production activity of these communities, which results in a demand profile characteristic of poor communities with 24 hour service: high demand in the morning and at night, mainly for lighting, with low demand during the rest of the day.

- The incremental cost of interconnection to isolated systems: with the exception of Iquitos, the capitals of each region of Peru have already been interconnected. Interconnection to other cities costs more for greater distances and has lower economic returns given the low number of consumers. This is not very attractive to private investment, which is why the State needs to assume these costs or provide special conditions for private investors.

- Increase in the incremental costs of investment in electrification: given the increasing difficulty of access (areas located in the mountains or in the Peruvian Amazon) the investment for each home connection added is growing in cost.

- Barrier to renewable energy in isolated systems given subsidies for the use of fuels granted to concessionary electricity companies for isolated systems. They represent a barrier to the economic viability of renewable technology as compared to the usual scenario of continuing to generate electricity with diesel.

- The low prices of Camisea Gas for Electricity Generation: this price, one of the lowest in the region, creates a price distortion for the development of hydroelectric plants and other renewable technologies and is a disincentive for the efficient use of natural gas in the generation of thermal electricity.

- Access to renewable energy project financing: financing institutions are resistant to evaluating renewable energy projects given the lack of experience in the area. According to the IFC, they tend to lack awareness about the importance of environmental issues, and they don't have a team to evaluate the environmental benefits of derivatives in these projects.

- The high capital cost of renewable energy makes the economic viability of projects difficult: as indicated by ESMPA, to make these enterprises possible, projects require renewable technology at capital costs. There is a high initial cost, but the costs of O&M are lower compared to the cost of diesel thermal generation.

- The lack of synergy between the Government and Universities: there is very little Government support for universities, and the government doestn't take advantage of the experience of existing university groups.

Modern Energy for the Productive Sectors

The main barriers and gaps to access to modern energy services and energy efficiency projects in the productive sectors are:

- Low energy prices, which don't provide an incentive for energy efficiency: electricity rates in Peru are below the average in Latin America. In addition, the low price of natural gas results in fuel substitution projects but not in a reduction of fuel consumption.

- The lack of Energy Service Companies (ESCOs): these companies could be an important component of increased energy efficiency in the economy. They could allow companies to implement energy efficiency improvements on a large scale without financing them with their own resources.

- Lack of interest on the part of commercial banks in financing energy efficiency projects: although some first efforts have been made, in general financial institutions are reluctant to award loans for energy efficiency given the lack of information about the issue and the worries about risks and lack of technical support (IFC, 2011).[5]

- The Peruvian Market is too small for large investments in energy efficiency. The implementation of ESCOs and of large-scale investments in energy efficiency projects are limited given that the industrial sector in Peru is still small and unattractive in terms of profitability for the kinds of companies dedicated to energy efficiency projects.

- The lack of infrastructure in Natural Gas Transport and Distribution: to be able to expand access to natural gas to the productive sectors of the country, it is necessary to build more regional gas pipelines. They require large capital, distribution of infrastructure, and the initiative of private investment (which, with the exception of regions in Lima, has been scarce).

- The limited technical and management capacityof rural producers in productive uses of energy: producers need to be educated about market opportunities, technological options, the cost of efficient equipment, and access to adequate capital and financing.

- The lack of a Useful Energy Balance for the implementation of action strategies: it is necessary to assess energy use in the productive sectors, which would result in the implementation of a Useful Energy Balance.

The following topics listed in order of priority summarize the main gaps and barriers that must be overcome to reach the national objectives of the SE4ALL initiative:

- The need to elaborate a Useful Energy Balance to assess energy use in Peru.

- The need for planning and capital for Rural Electrification Programs, donations for improved cookstoves, subsidies for the cost of capital of renewable energy in isolated systems, and a fund for the mass use of natural gas in Peru.

- The need for institutional strengthening of human resources and State economics related to promoting energy efficiency, productive uses of energy, and renewable energy projects.

- The reduction of barriers imposed by low natural gas prices and a subsidy for fuel for electricity generation.

SECTION I: INTRODUCTION

1.1 VISION OF THE COUNTRY

1. Basic socioeconomic data

POPULATION

The estimated population of Peru in 2013 was 30,475,144 inhabitants. According to statistics, the growth rate tends to drop and is estimated at 1.13% in recent years.

Table 1: Estimate of the Population of Peru on June 30, 2009 and Projections until 2013 (Millions of Inhabitants)

Year	2000	2001	2002	2003	2004	2005
Population	25.983	26.366	26.739	27.103	27.460	27.810
Average Growth Rate (%)	1,54	1,47	1,41	1,36	1,32	1,28

Year	2006	2007	2008	2009	2010	2011	2012	2013
Population	28.151	28.481	28.807	29.132	29.461	29.797	30.136	30.475
Average Growth Rate (%)	1,23	1,17	1,14	1,13	1,13	1,14	1,13	1,13

Source: INEI Peru: Estimates and Projections of the Total Population by Calendar Year and Simple Ages, 1950-2050 Special Bulletin No. 17 September 2009.

GDP PER CAPITA

The gross domestic product in the last 10 years showed an extrordinary average growth rate of 6.75% and a GDP per capita of 6,630 soles in 2009.

Table 2: Gross Domestic Product 2003-2012 (Millions of Nuevos Soles 1994)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
GDP	132,545	139,141	148,640	160,145	174,407	191,505	193,155	210,143	224,669	238,836
Real Percent Variation (%)		5	6.8	7.7	8.9	9.8	0.9	8.8	6.9	6.3

Source: INEI and BCR
http://www.bcrp.gob.pe/estadisticas/cuadros-anuales-historicos.html

Table 3: GDP per capita, 1994-2012
(Values at constant prices of Nuevos Soles 1994)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
GDP per capita	4,659	4,601	4,765	4,890	5,067	5,345	5,689	6,123	6,644	6,630

Source: own elaboration with INEI sources – National Bureau of National Accounts

Year	2010	2011	2012
GDP per capita	7.132	7.538	7.925

Source: own elaboration with INEI sources - National Bureau of National Accounts

ECONOMIC SECTORS

The following table shows the contribution of productive sectors.

Table 4: Gross Domestic Product by Productive Sector 2000 – 2011
(Millions of Nuevos Soles 1994)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Agro/forests 1/	10,729	10,796	11,450	11,795	11,629	12,259	13,286	13,718	14,712	15,050	15,695	16,288	17,433
Fishing	704	626	664	596	779	804	823	879	934	861	719	933	879
Mining	6,608	7,263	8,133	8,579	9,031	9,790	9,926	10,196	10,974	11,040	11,023	11,000	11,246
Manufacture	18,001	18,118	19,147	19,830	21,300	22,887	24,607	27,328	29,804	27,672	31,440	33,193	33,835
Electricity and Water	2,525	2,566	2,706	2,805	2,931	3,094	3,307	3,585	3,866	3,912	4,213	4,525	4,763
Construction	6,099	5,700	6,136	6,413	6,712	7,276	8,350	9,737	11,340	12,037	14,135	14,620	16,762
Trade	17,291	17,444	18,013	18,453	19,604	20,821	23,248	25,495	28,808	28,693	31,473	34,251	36,549
Other services	47,414	47,180	49,069	51,358	53,621	57,029	61,001	66,873	72,635	75,668	81,255	88,221	94,604
Taxed products and right to import	11,686	11,625	12,084	12,717	13,534	14,679	15,599	16,596	18,432	18,222	20,189	21,639	22,524
Gross Domestic Product	**121,057**	**121,317**	**127,402**	**132,545**	**139,141**	**148,640**	**160,145**	**174,407**	**191,505**	**193,155**	**210,143**	**224,669**	**238,590**

1/ Includes the forestry sector.
Source: INEI y BCR Elaboration: Department of Economic Studies
http://www.bcrp.gob.pe/estadisticas/cuadros-anuales-historicos.html

Evoluation of the main indicators for the 1980-2010 period confirms the huge growth of the economy in recent years.

Table 5: Evolution of Scio-economic Indicators in Peru. Period 1980 - 2010

		1980-89	1990-99	2000-2005	2006-2010
Real GDP	Annual % variation	0%	3%	4%	7%
Consumer Prices	Annual % variation	194%	112%	2%	3%
Trade Terms	Base 1980-89=100	100	69	66	88
Current Account	% of the GDP	-5%	-6%	-1%	0%
Investment	% of the GDP	24%	21%	20%	23%
GDP per capita	US$/inhabitant	1,387	1,946	2,375	4,209
Unemployment	Average period	7%	8%	9%	8%
Human Development Index	Average period	0.687	0.737	0.759	0.805
Population	Annual % variation	2.3%	1.5%	1.5%	1.7%

[1] The Human Development Index (HDI), measures a country's achievement in terms of life expectancy, education level, and real income. The HDI covers a variety of social, economic, and political issues that have an impact on the quality of human life. It is calculated by the United Nations.
Source: FMI, World Bank, MEF, BCRP, INEI – NUMES 2012

POVERTY LEVEL

Despite the great advance in the Peruvian economy in the last decade, the country has a significant percentage of poverty, which reached 27.8% in 2011.

According to the Natural Regions, the Sierra has the highest poverty rate, 41.5% in 2011. And in the rural Sierra there is a greater poverty rate, 62.3% in 2011.

Table 6: Evolution of the total poverty rate according to geographic area, 2007 – 2011 (Percent in relation to the total population)

Geographic Area	Year					Variation (in percentage points)	
	2007	2008	2009	2010	2011	2011 - 2010	2011 - 2007
Total	42.4	37.3	33.5	30.8	27.8	-3.0	-14.6
Area of Residence							
Urban	30.1	25.4	21.3	20.0	18.0	-2.0	-12.1
Rural	74.0	68.8	66.	61.0	56.1	-4.9	-17.9

Natural Region							
Coast	29.3	25.3	20.7	19.8	17.8	-2.0	-11.5
Mountains	58.1	53.0	48.9	45.2	41.5	-3.7	-16.6
Jungle	55.8	46.4	47.1	39.8	35.2	-4.6	-20.6

Geographic territory							
Urban coast	31.7	27.4	23.7	23.0	18.2	-4.8	-13.5
Rural coast	53.8	46.6	46.5	38.3	37.1	-1.2	-16.7
Urban mountains	31.8	26.	23.2	21.0	18.7	-2.3	-13.1
Rural mountains	79.2	74.9	71.0	66.7	62.3	-4.4	-16.9
Urban jungle	44.0	32.7	32.7	27.2	26.0	-1.2	-18.0
Rural jungle	69.2	62.5	64.4	55.5	47.0	-8.5	-22.2
Metropolitan Lima	25.1	21.7	16.1	15.8	15.6	-0.2	-9.5

Source: INEI – National Home Survey (ENAHO); 2007-2011

Table 7: Tendency and goals for the population in a situation of poverty and extreme poverty

Indicator	Formula for the indicator	Source of information	Baseline	Trend to 2021	Goal 2021
Percentage of the population in a situation of poverty	Number of people in poverty/ Total population * 100	INEI	34.80%	25%	10%
Percentage of the population in a situation of extreme poverty	Number of people in extreme poverty / Total population * 100	INEI	12.60%	5%	5%

Source: Bicentennial Plan: Peru Towards 2021

TYPE OF LIGHTING USED IN HOMES

According to the National Home Survey, 73% of the poor population had electricity in 2011. According to the 2007 census, 70% of the rural population didn't have electricity.

Table 8: Type of lighting used in homes according to poverty level, 2007-2012

(% of type of lighting and poverty status)

Poverty level	Year					
	2007	2008	2009	2010	2011	2012
Poor						
Electricity by a public network	63.9	65.9	66.3	69.9	73.2	75.1
Kerosene (lighter, lamp)	23.1	19.3	16.4	10.5	3.4	1.9
Oil/gas (lamp)	1.6	2.0	2.3	3.3	4.4	3.8

Candle	22.5	22.0	22.1	19.3	18.5	16.0
Generator	0.1	0.2	0.1	0.2	0.4	0.3
Other	1.1	1.3	1.8	2.7	2.8	2.7
Not used	0.3	0.8	1.0	1.4	1.7	3.0
Not poor						
Electricity by a public network	92.2	93.2	94.4	94.4	94.7	95.4
Kerosene (lighter, lamp)	3.9	3.0	2.2	1.6	0.7	0.2
Oil/gas (lamp)	0.4	0.5	0.4	0.7	0.9	0.9
Candle	6.2	5.6	4.6	4.1	3.8	3.3
Generator	0.1	0.1	0.2	0.2	0.2	0.2
Other	0.5	0.5	0.5	0.6	0.7	0.6
Not used	0.0	0.1	0.1	0.2	0.3	0.3

Source: INEI – National Home Survey ENAHO, 2007 – 2012

REDUCTION OF THE LACK OF ACCESS TO BASIC SERVICES

According to the 1993 and 2007 Census, a high number of the rural population does not have water and electricity service.

Table 9: Reducing the population's lack of access to basic services
1993 – 2007

Services	TOTAL			URBAN			RURAL		
	1993	2007	Reduction	1993	2007	Reduction	1993	2007	Reduction
Without water	40%	23%	17%	18%	13%	5%	93%	56%	37%
Without plumbing	36%	17%	19%	20%	9%	11%	75%	43%	32%
Without electricity	42%	24%	18%	20%	9%	11%	92%	70%	22%

Source: 1993 and 2007 Population and Housing Census

1.2 ENERGY SITUATION

2. Energy supply

PRIMARY ENERGY SOURCES

The 2012 National Balance shows that the main source of commercial energy is natural gas, which is 64.65% of the primary total. Firewood is a non-commercial source that is 8.3% of the primary total.

Table 10: Primary Energy Production (Unit TJ)

Source	2011	2012	Variation (%)
Commercial energy			
Natural Gas + LNG (*)	634 173	649 721	2
Crude oil	147 006	141 266	-4
Hydropower	96 959	96 092	-1

Mineral coal	4 882	6 185	27
Subtotal	*883 020*	*893 264*	*1*
Non-commercial energy			
Firewood	86 091	83 431	-3
Bagasse	18 437	19 430	5
Dung & plant residues	8 585	8 285	-3
Solar energy (**)	263	501	90
Subtotal	*113 375*	*111 647*	*-2*
TOTAL	**996 396**	**1 004 911**	**1**

(*) Supervised production (**) Estimated
Source: National Energy Balance: 2011

Imports of Primary Energy

The import of primary energy during 2012 was 210,890 TJ, of which crude oil represented 91% and mineral coal 9%.

Export of Primary Energy

During 2012, 36,699 TJ of primary energy was sold to the exterior. Crude oil had 90% participation and the rest was charcoal. In relation to the previous year, exports increased 7%.

Table 11: Commercial Balance of Primary Energy 2012 (TJ)

Source	Import	Export	Balance
Crude oil	191,826	32,985	- 158,841
Charcoal	19,063	3,714	- 15,349
Total	**210,890**	**36,699**	**- 174,190**

Source: National Energy Balance: 2012

ELECTRICITY SECTOR

In 2012, the national interconnected system had an installed capacity of 7,620.1 MW and a maximum demand of 5,290.9 MW. The total number of clients in December 2011 was 5,496,523 divided into 5,496,264 regulated clients and 259 free ones.

Table 12: Installed Capacity of SEIN - COES (MW) *

Total SEIN* 2011	Hydro	Thermal	Solar	Total

Installed Capacity	3 244,5	4 291,6	84,0	7 620,1
Effective Capacity	3 140,1	3 896,5	80,0	7 116,7

(*) Comprised of companies made up of COES.
Source: Operations statistics 2012 – COES SINAC

Table 13: Electricity Production (TJ)

	Hydro	Thermal	Solar	Total
Total COES	75,054,96	59,086,44	241,92	134,356,32

Source: Own elaboration with sources from the Annual Electricity Statistics 2012

Table 14: Maximum Demand (MW) *

	Hydro	Thermal	Total
Total COES	2,842,6	2,448,3	5,290,9

(*) Corresponds to the demand for power generation terminals.
Source: Operations Statistics 2012 – COES SINAC

Table 15: International Electricity Transactions – TIE (PERU - ECUADOR) 2009 – 2010 – 2011

Year	Power (MW)		Energy (TJ)	
	Export	Import	Export	Import
2009	71.6		225	
2010	75.2		402,84	
2011 *		53.5		20,628
2012	77.5	43.1	7,920	17,892

(*) Corresponds to the transfer substation loads from Zorritos and Talara to Ecuador
Source: Operations Statistics 2012 – COES SINAC

Table 16: Number of Final Clients- National

Year	Final Clients by Market		
	Total	Regulated	Free
2000	3,352,209	3,351,980	229
2001	3,462,851	3,462,610	241
2002	3,614,484	3,614,223	261
2003	3,727,266	3,727,019	247
2004	3,860,515	3,860,270	245
2005	3,977,100	3,976,856	244
2006	4,165,274	4,165,037	237
2007	4,359,862	4,359,612	250

2008	4,624,792	4,624,534	258
2009	4,878,964	4,878,695	269
2010	5,170,896	5,170,638	258
2011	5,497,639	5,497,367	272

Source: Evolution of Electricity Market Indicators 1995 – 2011

3. Energy Demand

MAIN CONSUMPTION SECTORS

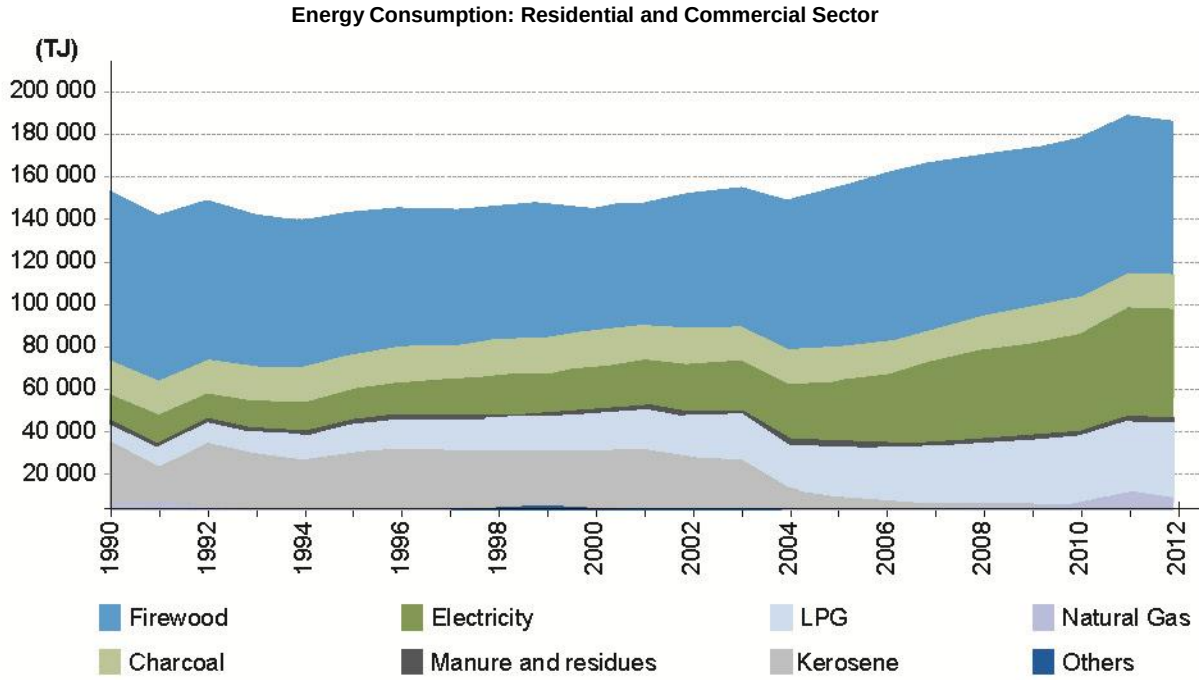
Total Final Energy Consumption by Productive Sector

The following tables show energy consumption in 2012, and the graphs indicate the evolution of energy consumption by sector from 1985 to 2012.

Table 17: Energy Consumption – Residential and Commercial Sector 2012 (Unit TJ)

Final Consumption	Firewood	Liquefied Petroleum Gas	Electricity	Others	**Total**
Residential and Commercial	78,522	32,870	54,783	16,435	**18,2610**

Source: National Energy Balance 2012



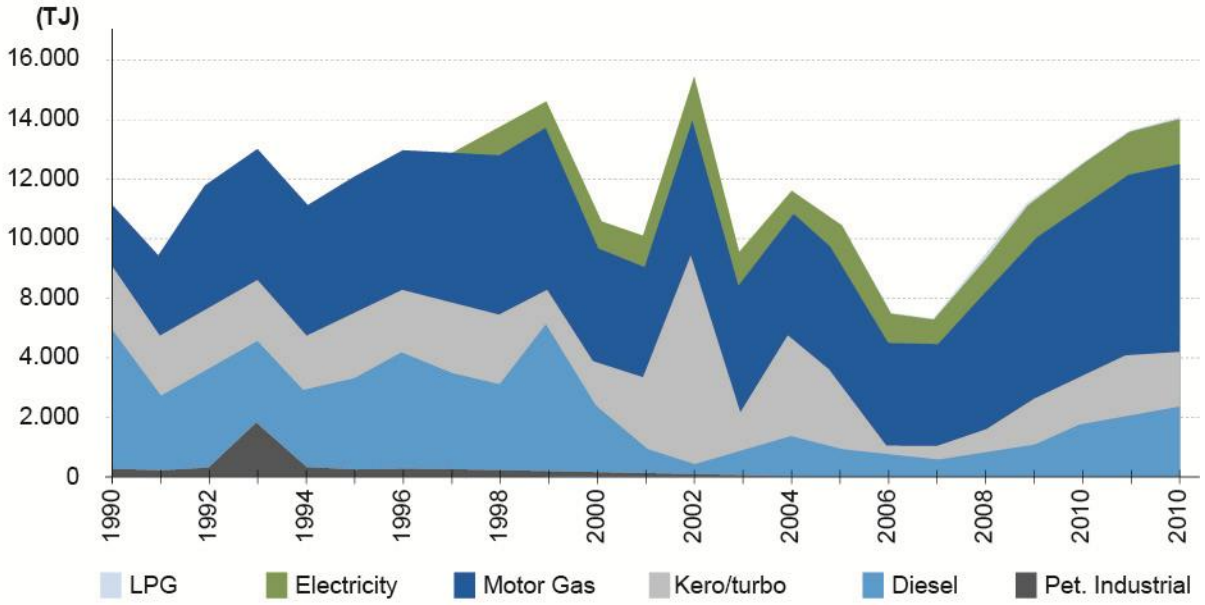
Source: Energy mix from 1985 to 2012

Table 18: Energy consumption – public sector 2012 (Unit TJ)

Final consumption	**Total**
Public	**13954**

Source: National Energy Balance 2012

ENERGY CONSUMPTION: PUBLIC SECTOR



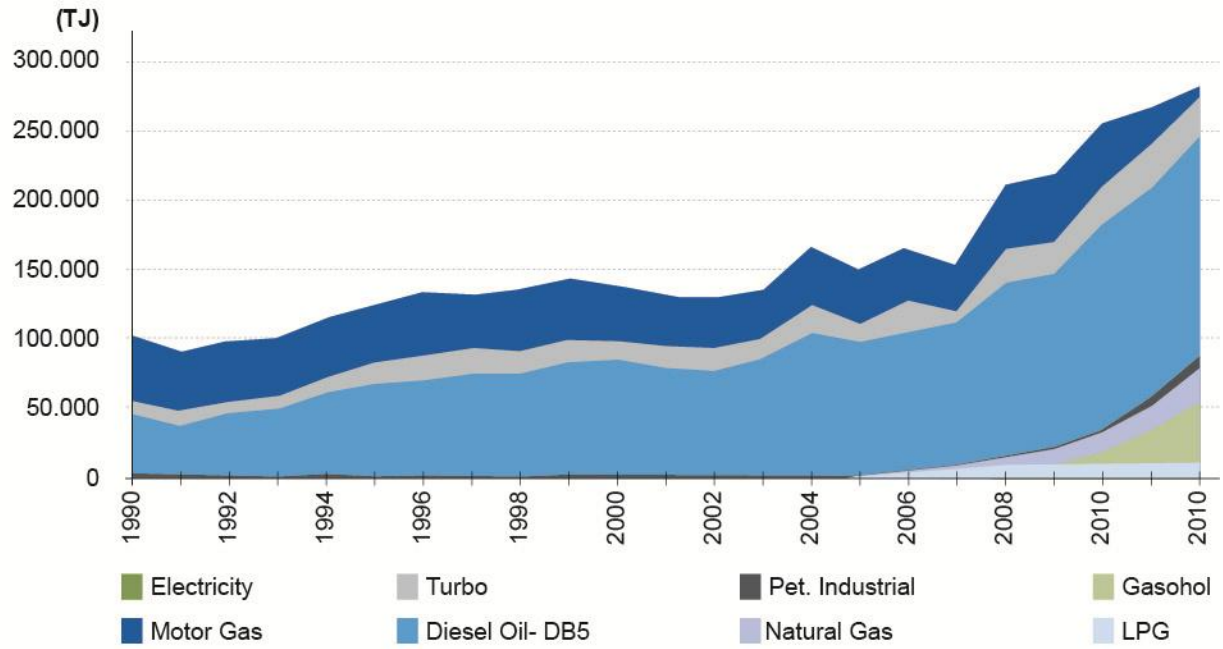
Source: Energy mix from 1985 to 2012

Table 19: Energy consumption – transport sector 2012 (unit TJ)

Final consumption	Gas Dis	**Total**
Transport	23,337	**28,5650**

Source: National Energy Balance 2012.

ENERGY CONSUMPTION: TRANSPORT SECTOR



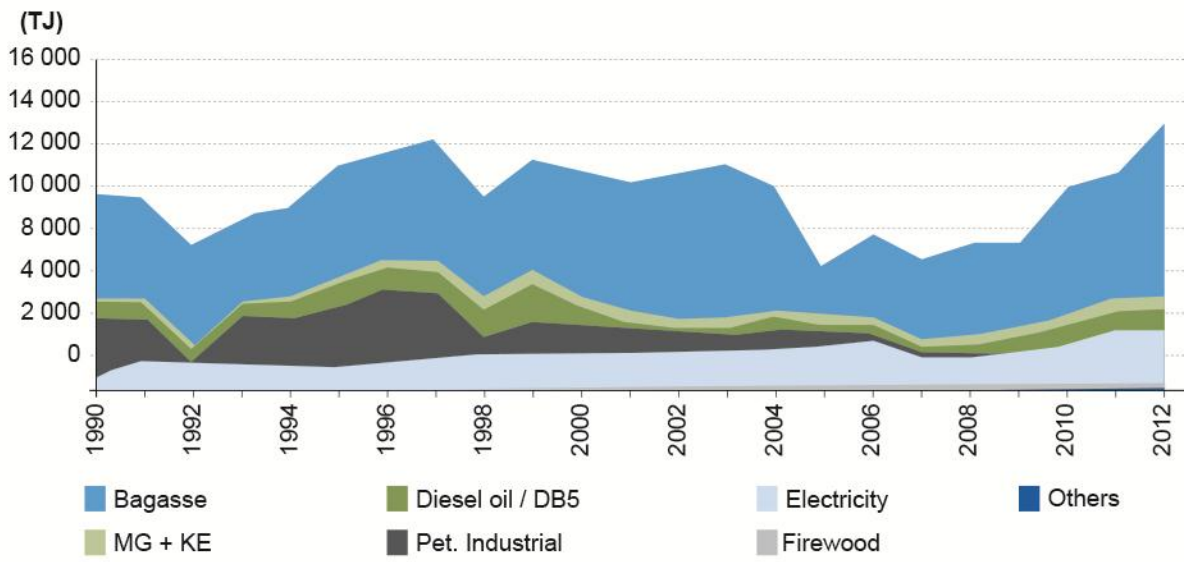
Source: Energy mixes from 1985 to 2012

Table 20: Energy consumption – Agriculture and livestock and agro-industrial sector 2012 (Unit TJ)

Final consumption	**Total**
Agriculture and livestock and agro-industrial	**13341**

Source: National Energy Balance 2012

ENERGY CONSUMPTION: AGRICULTURE AND LIVESTOCK SECTOR



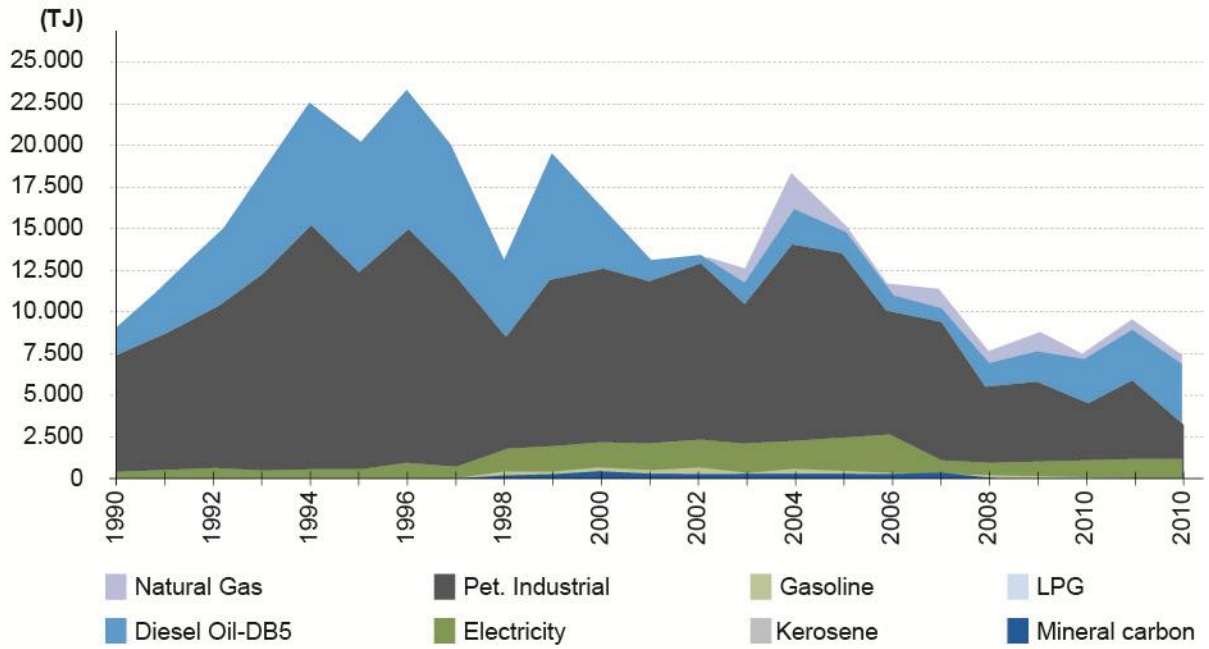
Source: Energy mixes from 1985 to 2012

Table 21: Energy consumption – Fishing sector 2012 (Unit TJ)

Final consumption	**Total**
Fishing	**4294**

Source: National Energy Balance 2012

ENERGY CONSUMPTION: FISHING SECTOR



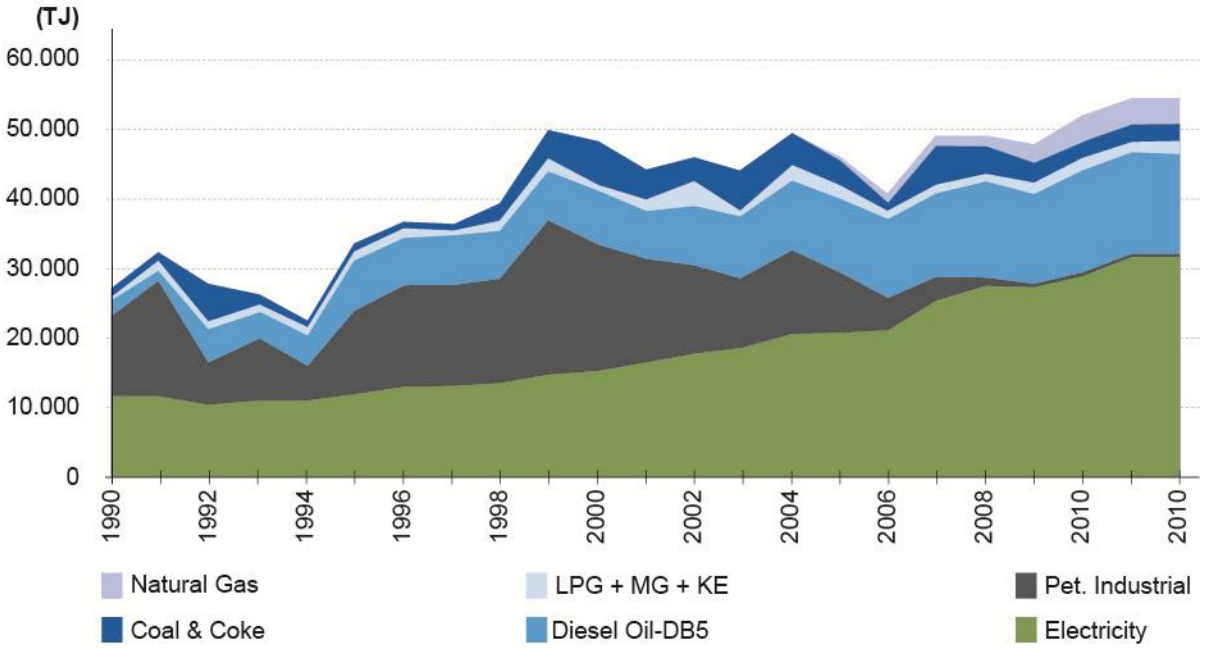
Source: Energy mixes from 1985 to 2012

Table 22: Energy consumption – Mining and Metallurgy Sector 2012 (Unit TJ)

Final Consumption	**Total**
Mining Metallurgy	54591

Source: National Energy Balance 2012

ENERGY CONSUMPTION: MINING AND METALLURGY SECTOR

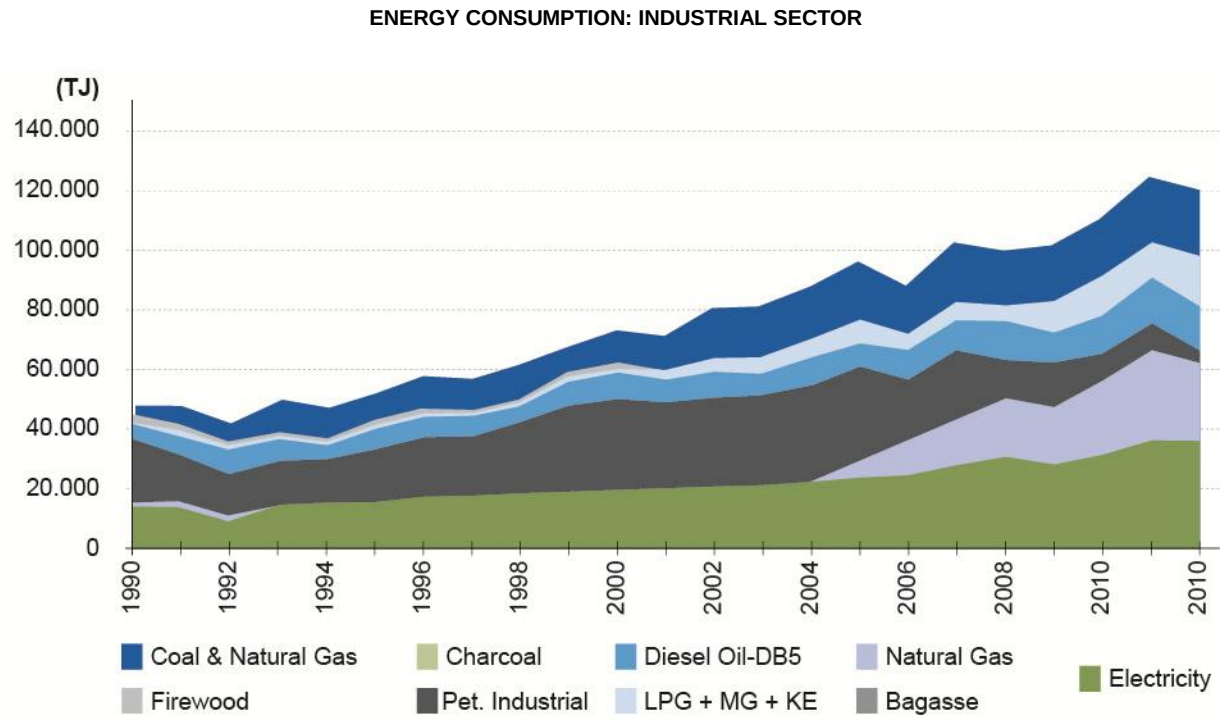


Source: Energy mixes from 1985 to 2012

Table 23: Energy consumption – industrial sector 2012 (Unit TJ)

Final consumption	**Total**
Industrial	122797

Source: National Energy Balance 2012



Source: Energy mixes from 1985 to 2012

In 2012, energy consumption in the Residential, Commercial, and Public Sector was 196,538 TJ, above the Mining and Industrial sector (25%) and below the Transport sector (40%).

Table 24: Evolution of National Energy Consumption by Productive Sector: 1970 – 2010

		1970	**1980**	**1990**	**2000**	**2009**	**2010**
Residential and commercial	**Total TJ**	134 055	166 958	152 483	149 052	164 819	190 020
	% Total	41%	43%	42%	33%	28%	30%
	TCP annual		2,2%	-0,9%	-0,2%	1,1%	
Public sector	**Total TJ**	6 945	8 745	12 050	11 386	10 836	11 917
	% Total	2%	2%	3%	3%	2%	2%
	TCP		2,3%	3,3%	-0,6%	-0,5%	

	annual						
Transport	**Total TJ**	70 249	94 583	104 558	141 688	228 789	253 322
	% Total	22%	24%	29%	31%	39%	39%
	TCP annual		3,0%	1,0%	3,1%	5,5%	
Agro-industry	**Total TJ**	23 974	10 828	9 623	10 731	8 386	10 522
	% Total	7%	3%	3%	2%	1%	2%
	TCP annual		-7,6%	-1,2%	1,1%	-2,7%	
Fishing	**Total TJ**	28 033	8 109	9 121	16 361	10 978	5 827
	% Total	9%	2%	3%	4%	2%	1%
	TCP annual		-11,7%	1,2%	6,0%	-4,3%	
Mining	**Total TJ**	12 426	31 405	27.531	48.205	51 891	51 783
	% Total	4%	8%	8%	11%	9%	8%
	TCP annual		9,7%	-1,3%	5,8%	0,8%	
Industry	**Total TJ**	49 204	69 626	48 359	75 198	110 398	114 796
	% Total	15%	18%	13%	17%	19%	18%
	TCP annual		3,5%	-3,6%	4,5%	4,4%	
Total	**Total TJ**	324 886	390 254	363 725	452 621	586 097	638 187
	TCP annual		1,9%	0,7%	2,2%	2,9%	

TCP: Annual Growth Rate
Source: NUMES 2012 – National Energy Balance

4. Energy and Economic Development

PERCENTAGE OF THE ENERGY SECTOR

The Peru statistics only show the percentage of the GDP of hydrocarbons in the electricity sector together with the water sector.

Table 25: Gross Domestic Product of the Hydrocarbon, Electricity, and Water Productive Sectors in Terms of Percent of Total GDP

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Hydrocarbons (% the total GDP)	0.49	0.47	0.44	0.44	0.51	0.50	0.49	0.49	0.57	0.68	0.75	0.72
Electricity and Water (% the total GDP)	2.12	2.12	2.12	2.11	2.08	2.07	2.06	2.02	2.03	2.01	2.01	2.00
GDP Total (Millions of nuevos soles 1994)	**121,317**	**127,402**	**132,545**	**139,141**	**148,640**	**160,145**	**174,407**	**191,505**	**193,155**	**210,143**	**224,669**	**23,859**

Source: INEI and BCR.
Elaboration: Economic Studies Management
http://www.bcrp.gob.pe/estadisticas/cuadros-anuales-historicos.html

PUBLIC SPENDING ON ENERGY

ENERGY PURPOSE

The resources allocated to this purpose are in the amount of S/. 1,120 million, of which S/. 669 million correspond to PP, representing 59.7% of the resources assigned. The APNOP account for 24.7% of the resources, equivalent to S/. 277 million, while Central Shares reached S/. 174 million, which represented 15.6% of the resources assigned.

Table 26: Resources allocated for energy purposes (In millions of nuevos soles)

Budget Programs	2012 Project Budget	2013 Project Budget
Access and Use of Rural Electrification	457	669
Central Shares	121	174
Budgetary Allocations that don't result in products	313	277
OVERALL TOTAL	**890**	**1 120**

Source: Project of the Budget law of the Public Sector for fiscal year 2012 - 2013

SUBSIDIES

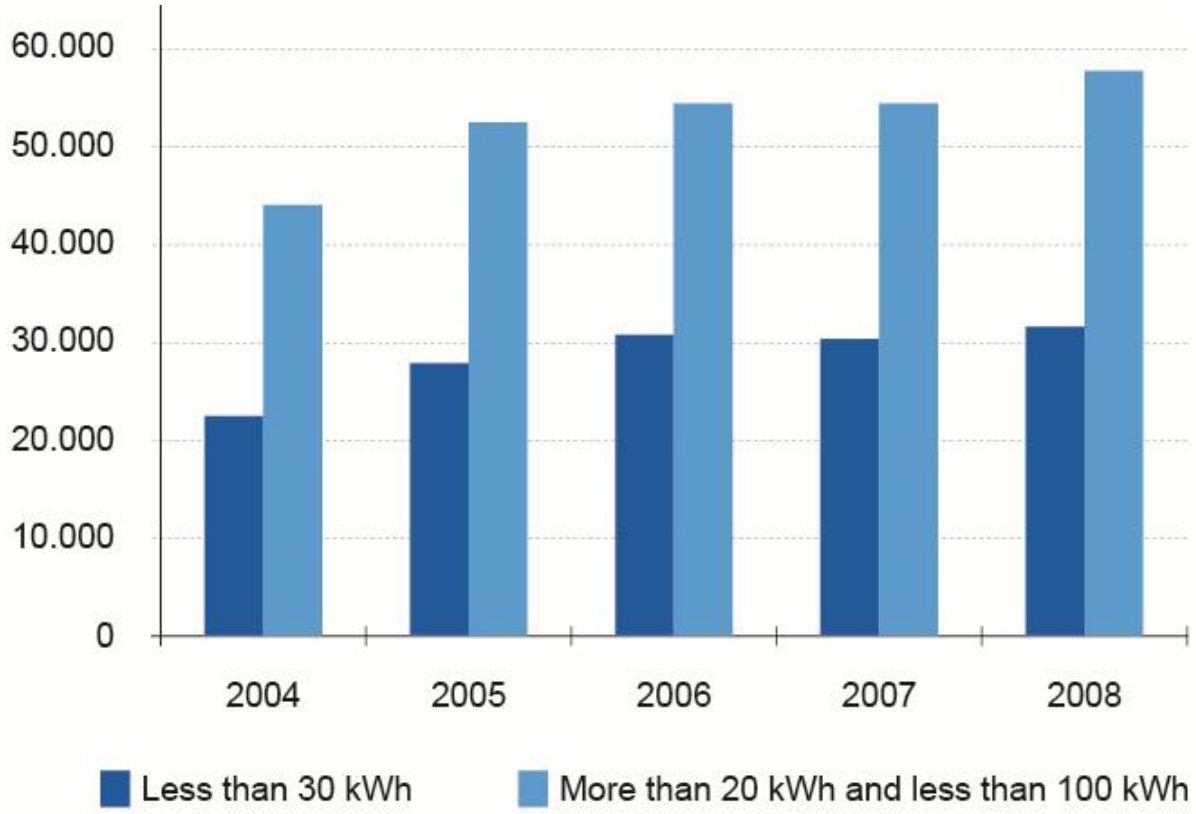
The electricity sector has a crossed subsidy to benefit low consumption consumers. It is called the Fund for Social Electricity Compensation (FOSE). Recently the Fund for Social Energy Inclusion (FISE) was created for rural LPG consumers. In the case of fuel, there is no permanent subsidy.

FOSE

The criteria used to identify consumers who benefit from the subsidy and consumers that finance the fund is a consumption threshold defined as 100 KWH/month.

As for the amounts that FOSE has marked, in 2008 transfers to beneficiaries reached S/. 87 million nuevos soles, although the growth of these transfers slowed down between 2004 and 2008.

Graph: Annual FOSE discount by level of consumption (thousands of S/.)



Source: Regulation Management attached to OSINERGMIN
"Targeting is important: proposal for an optimum subsidy scheme for residential electricity consumption and the social impact of its implementation" – December 2010

On the other hand, the total amount of the surcharges collected from residential clients for the crossed subsidy reached S/. 38.2 million nuevos soles in 2008.

Table 27: Evolution of the surcharges by FOSE concept charged to residential SEIN clients (In thousands of S/.)

	2004	2005	2006	2007	2008
Surcharge	30 156.47	35 640.17	42 170.98	34 010.05	38 272.72
Growth rate	-	18.18	18.32	-19.35	12.53

Source: Regulation Management attached to OSINERGMIN

Source: **"**Targeting is important: proposed scheme for optimum subsidies for residential electricity consumption and the social impact of its implementation" – December 2010.

FISE

The Fund for Social Energy Inclusion was created by 2012 Law No. 29852 with the goal of making social and universal service compesation for the most vulnerable sectors of the population. Social compensation and the promotion of access to LPG were intial priorities. Financing was based on surcharges to free users of electricity, for pipeline transportation of

liquid hydrocarbon products and natural gas, and the monthly billing charges for natural gas transport by pipeline.

At the end of 2013, there were 659,259 beneficiaries with 16 Soles discount vouchers to acquire a ball of LPG. This grant is provided via electricity distribution companies.

SUBSIDY PRICES OF FUELS

Peru is explicitly governed by the parity of fuel prices on an international level and there will only eventually be a temporal subsidy according to the volatility of prices. Thus the fund for stabilizing the prices of oil derivative fuels (FEPC) was created. In 2011, the public sale price of fuels increased to a maximum of 9.1% despite the fact that international oil prices rose to a maximum of 22.6%. This means that the State paid out resources in 2011 worth S/. 2,428,697,341.

Source: Ministry of Energy and Mines – Institutional Strategic Planning PEI 2012 – 2016

ENERGY SECURITY

There is a strong dependence on imported oil for internal consumption. As we can see in the table, the CIF value of crude oil imports and derivative products was 5,873 million US$ in 2012.

Table 28: CIF value of crude oil imports and derivative products (MUS$) 2005 – 2012

YEAR	TOTAL (Crude oil and derivative products)	CRUDE OIL
2005	2,267,850.9	1,696,581.2
2006	2,784,584.4	2,156,712.9
2007	3,564,089.8	2,667,649.3
2008	5,206,328.2	3,379,804.6
2009	2,883,913.3	2,150,762.9
2010	4,108,196.4	2,690,939.4
2011	5,857,871.4	3,699,660.4
2012	5,873,801.3	3,633,110.9

Source: Annual Hydrocarbon Statistics 2012- Ministry of Energy and Mines DGH

5. Energy Strategies and Important Goals

ENERGY STRATEGIES

In 2010, the Government established guidelines for National Energy Policy for the next 30 years.

National Energy Policy of Peru 2010-2040 Supreme Decree No. 064-2010-EM

10. To have a diversified energy matrix with an emphasis on renewable fuels and energy efficiency.
11. To have a competitive energy supply.
12. Universal access to energy supply.
13. To have greater efficiency in the productive chain and energy use.
14. To achieve self-sufficiency in energy production.
15. To develop the energy sector with a minimum environmental impact and low carbon emissions within a Sustainable Development framework.
16. To develop the natural gas industry and its use in home, transport, commercial, and industrial activities, as well as efficient electricity generation.
17. To strengthen the institutional framework of the energy sector.
18. To integrate with energy markets in the region to be able to achieve the long-term vision.

ACCESS

According to the general analysis of the **Strategic Institutional Plan (PEI)** (Ministry of Energy and Mines Strategic Institutional Plan PEI 2012 – 2016) includes:

Cookstove Replacement Program

Under the legal framework of Law 27345, Law for the Promotion of Efficient Energy Use, the MINEM created a program to replace domestic kerosene consumption with LPG (Nina Project) with the objective of carrying out two activities on a national level:

a) To substitute kerosene and other polluting fuel cookstoves with LPG cookstoves, oriented at fundamentally serving marginal urban areas.
b) To substitute traditional firewood coookstoves with improved cookstoves, oriented at rural areas located above 2500 mamsl.

Fund for Social Energy Inclusion

The FISE is a mechanism of a policy of inclusion of the State destined to expand the energy frontier in the most vulnerable segments of the population via:

- Mass use of natural gas (residential and vehicular) in vulnerable sectors
- To develop new supply on the energy frontier focused on the most vulnerable populations.
- To promote access to LPG in vulnerable, urban, and rural sectors.

In the first stage of the process of implementation of FISE, promoting access to LPG is a priority, which means the distribution of a FISE Discount Voucher and a Cookstove Kit for the most vulnerable sectors of the population. Nearly 8 million soles will be invested to by liquefied natural gas that will benefit more than 500,000 families before July 2013.

Rural electrification

The Directorate General of Rural Electrification of the Ministry of Energy and Mines is developing the strategic program “Energy Access in Rural Locations.” In 2011, the budget for

execution was S/. 474.0 million and 177 rural electrification projects were completed. In 2012, the assigned budget was S/. 392.6 and 162 rural electrification projects were completed. In 2013, the assigned budget was S/. 430.5 million for the planned execution of 289 electrification projects, which would allow the electrification of 2,700 locations and would benefit 365,000 inhabitants. It is estimated that rural areas will achieve 71% electricity coverage. By 2016, electricity coverage in rural areas is expected to reach 86%.

CAPACITY

Electricity

By 2016, demand will reach 7,481 MW, and the supply for this growth will be ensured due to the 4 400 MW projects in execution that will open in 2012 and 2016. Of the total of those projects, 1,880 MW correspond to hydroelectric plants.By 2016 they will achieve 60% hydroelectric participation in total production.

Table 29: Supply – Demand Balance 2012-2016

	Base	**Supply – Demand Balance 2012-2016**				
	2011	**2012**	**2013**	**2014**	**2015**	**2016**
Max. Demand (MW)	4 961	5 259	5 664	6 229	6 833	7 481
Installed Hydro Potential (MW)	3 110	3 158	3 268	3 541	3 907	4 988
Percentage Hydro in Production (%)	57	55	53	52	52	60
Total Effective Potential (MW)	**6383**	**6746**	**8 045**	**8 540**	**8 753**	**10 044**

Source: Supply-Demand Balance 2012-2016 Ministry of Energy and Mines – General Electricity Board August 2012

SECURITY

Regasification LNG project

The MINEM via PROINVERSIÓN is promoting a Regasification of Liquefied Natural Gas project via the construction of a plan in the Melchorita installations 170 km to the south of Lima.

The installation in this plant will avoid the shortage of natural gas in Camisea in the domestic market given the potential that it will produce a Malvinas plant and pipelines in lots 56 and 88.

This project is of great importance to energy security in the country because it allows the continuity of electricity service of more than 40% of demand and a savings of more than 500 million dollars per day in natural gas shortages.

Expansion Plan for the Transmission System

According to the regulatory framework, the only transmission planning that exists is prepared by the COES and approved by the MINEM. In the case of generation, it is defined according to the

supply and demand of market agents. The 2013-2022 plan includes a linked plan for 2018 and a transmission plan for 2022.

Binding Plan 2018
Power upgrade of 250 MVA (60%) at the L.T. Trujillo -Cajamarca 220 KV existing [1]
Power upgrade of 250 MVA (30%) at the L.T. Tingo María -Vizcarra - Conococha 220 KV existing [1]
Power upgrade of 80 MVA (60%) at the L.T. Aguaytía - Pucallpa 138 KV existing (**) [2]
Power upgrade of 250 MVA (60%) at the L.T. Paragsha - Vizcarra 220 KV existing [1]
S.E. Carapongo First Stage [1]
Power upgrade of 250 MVA (60%) at the L.T. Pachachaca-Callahuanca 220 KV existing [1]
Power upgrade of 250 MVA (60%) at the L.T. Pomacocha-San Juan 220 KV existing [1]
Power upgrade of 250 MVA (60%) at the L.T. Huanza-Carabayllo 138 KV existing (***) [1]
L.T. Mantaro-Marcona-Nueva Socabaya 500 kV [1]
L.T. Azangaro - Juliaca - Puno 220 kV [1]
Capacitor Bank of 20 MVAR in 60 kV in the Pucallpa substation (**) [1]

Source: Updated Transmission Plan 2013-2022 – COES SINAC, September 2012.

Transmission 2022
Connection to L.T. Chiclayo - Piura 220 to S.E. La Niña 220 kV [2]
L.T. Trujillo - Cajamarca 500 kV [2]
Power upgrade of 250 MVA (60%) at the L.T. Trujillo -Cajamarca 220 KV existing [1]
Power upgrade of 250 MVA (30%) at the L.T. Tingo María - Vizcarra - Conococha 220 KV existing [1]
L.T. Tingo María - Conococha 220 kV [2]
Power upgrade of 80 MVA (60%) at the L.T. Aguaytía - Pucallpa 138 KV existing [2]
Power upgrade of 250 MVA (60%) at the L.T. Paragsha - Vizcarra 220 KV existing [1]
S.E. Carapongo First Stage + Second Stange [1]
Power upgrade of 250 MVA (60%) at the L.T. Pachachaca-Callahuanca 220 KV existing [1]
Power upgrade of 250 MVA (60%) at the L.T. Pomacocha-San Juan 220 KV existing [1]
Power upgrade of 250 MVA (60%) at the L.T. Huanza-Carabayllo 138 KV existing (***) [1]
Connection of L.T Mantaro-Independencia 220 kV to S.E. Huancavelica 220 kV [2]
L.T. Nueva Yuncan - Nueva Yanango 500 kV [2]
L.T Nueva Yanango-Carapongo 500 kV [2]
L.T. Mantaro - Marcona - Nueva Cocabaya 500 kV [1]
L.T. Nueva Socabaya - Montalvo 500 kV [1]
Transformer 500/220 kV in Montalvo [2]
L.T Tintaya - Azangaro - Juliaca - Puno 220 kV [1]
L.T. La Niña - Piura 220 kV (third cable) (*) [2]
L.T. Piura - Talara 220 kV (third cable) (*) [2]
Nueva Yuncan - Nueva Paramonga - Trujillo 500 kV (*) [2]
Capacitor Bank of 20 MVAR in 60 kV in the Pucallpa substation (**) [1]
L.T. La Niña - Frontera Peru 500 kV (***) [2]

Source: Updated Transmission Plan 2013-2022 – COES SINAC, September 2012.

SECTION II: CURRENT SITUATION WITH RESPECT TO THE SE4ALL OBJECTIVES

2.1 ACCESS TO ENERGY WITH RESPECT TO THE SE4ALL OBJECTIVES

6. Overall Vision and Evaluation

Peru is a country with a significant percent of low income inhabitants with who live in isolated rural areas and marginal urban ones with limited or scarce access to modern fuels and electricity. This situation is exacerbated by the lack of infrastructure to provide energy services

and the inability of the population to pay the service costs. They currently supply their needs with traditional non-commercial energy sources like biomass and use low efficiency technologies that have negative impact on people's health and the environment.

The government policy is provide universal access to energy services, which is why it develops programs to integrate the commercial energy system via connection to distribution networks from the national electricity system and subsidy programs for modern energy supply like LPG and natural gas.

Via the DGER, the MINEM and Regional Governments, the government has been developing the implementation of the National Electrification Program in areas outside of the concession areas of electricity distribution companies. Also, in parallel to eradicating the kerosene market due to its use in drug trafficking, it recent years it has been developing a replacement program that offers LPG cookstoves and improved firewood cookstoves.

The effort carried out in recent years in commercial energy integration programs is limited with respect to the size of the access deficit. Additionally, it is considered that meeting the needs of the most isolated populations will have a greater economic cost. On the other hand, service coverage alone is not sufficient to achieve improved human development indexes. It is possible to improve the centralized management and implementation of available budgetary resources.

MINEM directed national electrification programs should respond to concerted and decentralized planning to increase coverage. It will also be necessary for Distribution Dealers to participate actively in their execution given that later they are in charge of operating the service. This situation should extend concessions to the entire national territory.

The program for replacing cookstoves should be structured on a national level in the framework of public universal access policy and should have an economic and executive capacity similar to the DGER to achieve greater goals. It should notnot restrict itself to programs that fight against drug trafficking.

It is necessary to develop special programs for locations that, for economic reasons, can't be incorporated into commercial energy networks. The effort should not be limited to installing equipment. It should provide programs that are sustainable over time. In this field it is necessary to develop capacities with the participation of the populations.

7. Modern Energy for Thermal Applications (Cooking and Heating)

PHYSICAL ACCESS

PERCENTAGE OF HOMES WITHOUT ACCESS TO MODERN ENERGY

Modern Cookstoves

According to the Women's Ministry, in 2011 there were 6,744,705 homes on a nation level and 1,622,725 on a rural level. The number of homes without access to modern kitchens is 2,690,064 on a national level 1,510,964 on a rural level.

Table 30: Homes without access to modern cooking

	Current homes in Peru	Homes without access to modern cooking	%
National Level	6,744,705	2,690,064	39.9
Rural Level	1,622,725	1,510,964	93.1

Source: Women's Ministry, Results presented in the V Forum on Clean Air, Lima 2011

Heating

This information is not available

Industrial and Agricultural Use

This information is not available

AVAILABILITY

Quality of the supply chain

This information is not available

Current Situation

The supply of modern energy on the retail market is carried out by small private or individual companies that don't reach the whole national territory due to limitations in transport access and in the purchasing power of rural populations. This means that there is still significant consumption of firewood for cooking in rural areas.

TYPE OF FUEL USED FOR COOKING

The National Homes Survey shows the high rate of firewood consumption for cooking (32.5% en el 2010).

Table 31: Type of fuel used for cooking food in Peru 2005, 2007, 2009, and 2010

TYPE OF FUEL	2005	2007	2009	2010
Electricity (%)	2.2	2.5	4.9	6.3
LPG (%)	52.5	60.2	66.2	69.6
Kerosene (%)	11.0	5.4	3.2	2.1
Coal (%)	5.1	7.3	8.7	9.5
Firewood (%)	37.3	35.2	34.6	32.5
Other (%)	14.6	16.5	20.5	23.7
Don't cook at home (%)	4.0	4.1	3.5	3.3

Note: homes can use one or more types of fuels to cook foods, which is why the percentage exceeds 100.
Source: INEI-National Homes Survey: 2005, 2007, 2009, 2010.

ACCESSABILITY

Fuel Prices

Prices of fuels derived from hydrocarbons in the country were in parity with international prices according to the economic policy of the country.

Table 2-3: Fuel Prices

Supply	Monthly Cost (Soles/GJ)
LPG	53.19
Natural Gas	19.17

Source: Mass use of natural gas in Peru-OSINERGMIN

Accessibility of fuel-efficient cookstoves and supplies

According to statistics, there are significant economic limitations in rural sectors in accessing modern cooking fuels.

Table 32: Percentage of income per capita for fuel consumption (Annual Average 2011)

Area	Per Capita Monthly Income 2011	Monthly spending on LPG	Monthly spending on NG	Aimed at LPG (%)	Aimed at NG (%)
National	S/.721.2	S/.52.5	S/.16.3	4.69	1.68
Urban	S/.850.3			3.97	1.42
Rural	S/.349.8			9.65	3.45

Source: Poverty Evaluation 2007- 2011; INEI, Mass use of natural gas in Peru-OSINERGMIN

SUSTAINABILITY

Biomass and other participation in RER

There is information about final energy consumption by source in the residential sector. However, it doesn't specify the purpose of each energy service (cooking food, heating, lighting, etc.)

Table 33: ENERGY CONSUMPTION – RESIDENTIAL SECTOR 2011 (Unit TJ)

Final Consumption	Firewood	Manure	Solar	Charcoal	Total
Residential	81 142	8 585	143	1 809	91 679

Source: National Energy Balance: 2011

Percentage of homes without access to efficient cookstoves

According to the 2007 National Census, a total of 2,036,901 families cook with biomass for a fuel: firewood or manure. However, it doesn't indicate if these are traditional or improved cookstoves.

The installation of 500,000 certified improved cookstoves was proposed for families with few economic resources, with coverage on a national level. It was projected to start in December 2011. The advance of the campaign as of June 2012 was 235,263 certified improved cookstoves installed.

Source: For Peru Without Smoke, National Campaign for Half a Million Improved Cookstoves 2010. http://www.cocinasmejoradasperu.org.pe/

Table 34: Percentage of families that have improved cookstoves (%)

Date	Mar-10	Jun-10	Sep-10	Mar-11	Jun-11	Sep-11	Nov-11	Feb-12	Abr-12	Jun-12
Percentage of families with improved cookstoves(%)	3.6	4.4	5.5	6.7	7.6	9	10.6	10.9	11.2	11.5

Source: For Peru Without Smoke, National Campaign for Half a Million Improved Cookstoves 2010.

8. Electricity access

PHYSICAL ACCESS

Connection to the urban-rural network

According to 2007 census results, it had the following values: National 74.1%, Urban 89.1%, and Rural 29.5%. By the close of 2011, it was estimated to have the following coverage: National 84.8% and Rural 63%.

Table 35: National and Rural Electricity Coverage

Year	National (%)	Rural (%)

2000	68.5	23.2
2001	69.8	24.4
2002	70.2	24.7
2003	70.8	25.6
2004	71.1	25.9
2005	72.8	28.2
2006	73.4	28.9
2007	74.1	29.5
2008	76.0	38.0
2009	78.5	45.0
2010	82.0	55.0
2011	85.2	59.0
2012	87.0	63.0

Source: National Rural Electrification Plan 2011

Population categories with a minimum level of physical access

Table 36: Counties with the lowest electricity coverage

County	Electricity coverage (%)
Loreto	70.6
Puno	79.8
San Martin	79.5
Ucayali	71.6
Cusco	85.7
Huancavelica	84.6
Amazonas	78.0
Apurímac	79.0
Huánuco	73.4

Source: National Rural Electrification Plan 2011

Goals

The objectives of the National Rural Electrification Plan are: for the next 10 years to count on nearly 7 million inhabitants with access to public electricity services. To promote rural development in the most isolated areas, with a greater predominance of projects based on infrastructure that uses renewable energy. To locate the country in the top third of Latin American countries with the highest rate of electricity coverage.

Table 37: Electrification Ratio Projection

DESCRIPTION	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
National Electrification Coefficient	88,9%	90,6%	92,0%	93,3%	94,3%	95,3%	96,2%	97,1%	98,1%	98,6%
Rural Electrification Coefficient	71,0%	76,8%	81,9%	86,0%	88,2%	90,4%	91,4%	92,4%	93,1%	95,8%

Source: National Rural Electrification Plan 2013-2022

Prioritization Methodology

Given the great number and diversity of projects that the population demands and given scarce State resources, it is necessary to prioritize Central Government projects that are part of the plan. The prioritization criteria are:

- Lowest Coefficient of Rural Provincial Electrification
- Highest Poverty Index
- Proportion of subsidy required for home connection
- Ratio number of new home connections
- Use of renewable energy

Source: National Rural Electrification Plan 2011

AVAILABILITY

Frequency and Duration of the Interruptions

Statistics on the quality of service show poor electricity service provided to isolated systems on the distribution level.

Table 38: Indicator SAIFI 2010

Area	Interconnected System			Isolated System		
	Distribution	Generation	Transmission	Distribution	Generation	Transmission
Lima	4.95	0.16	0.99	21.26	7.95	0
Rest of the Country	16.46	0.82	7.66	38.36	30.62	9.69
Whole Country	11.86	0.56	4.99	38.01	30.17	9.5

Source: Quality of Supply; OSINERGMIN 2011

Table 39: Indicator SAIDI 2010

Area	Interconnected system			Isolated system		
	Distribution	Generation	Transmission	Distribution	Generation	Transmission

Lima	13.53	0.17	2.27	208.24	0	44.98
Rest of the country	35.98	1.05	15.08	57.33	83.69	9.89
Whole country	27.01	0.7	12.38	60.29	82.95	9.7

Source: Quality of Supply, OSINERGMIN 2011

Load Shedding

These statistics are not compiled.

ACCESSABILITY

Rates

Table 40: Average Price of Electricity (US $/ kJ)

Year	Market Type			Distributors			Generators		
	Total	**Regulated**	**Free**	**Total**	**Regulated**	**Free**	**Total**	**Regulated**	**Free**
2009	298.8	367.2	205.2	356.4	367.2	237.6	201.6	-	201.6
2010	298.8	378.0	201.6	363.6	378.0	248.4	194.4	-	194.4

Source: Evolution DGE – MINEM 2010

Family income

This information is not available.

Subsidies

Currently there is a crossed subsidy that functions on the consumer level. The limit is 100 kWh a month. The total amount of the surcharges charged to residential clients reached S-. 38.2 million nuevos soles in 2008.

Table 41: Evolution of surcharges by FOSE concept charged to residential SEIN clients (In thousands of S/.)

	2004	**2005**	**2006**	**2007**	**2008**
Surcharges	30 156.47	35 640.17	42 170.98	34 010.05	38 272.72
Growth rate (%)	-	18.18	18.32	-19.35	12.53

Source: **"**Focalization is relevant: proposal for an optimum scheme for subsidies for residential electricity consumption and the social impact of its implementation" – December 2010; Management of Regulation Connected to OSINERGMIN

SUSTAINABILITY

Participation of RES in the SEIN

The following table shows the evolution of energy production in the SEIN, which by 2010 had reached 32,424 GWh, of which 58.5% was hydro and 41.5% was thermal. Of that, 30.8% of total thermal energy was produced via the natural gas project Camisea.

Table 42: Energy Production of SEIN (TJ)

Year		2004	2005	2006	2007	2008	2009	2010
Production (MWh)		77 943 312	81 272 758	86 488 427	98 117 762	106 411 349	107 306 100	116 729 525
Hydro		60 093 432	61 563 017	67 214 131	66 918 442	64 836 832	67 506 012	68 276 812
Thermal		17 947 080	19 709 741	19 274 296	31 199 321	41 574 514	39 800 088	48 452 713
Source in the Production of Thermal Energy	Coal	3 576 827	2 991 172	3 171 517	3 024 490	3 273 419	3 344 936	3 840 923
	Natural Gas Total	9 537 260	13 225 637	12 937 867	26 364 082	34 054 549	33 401 614	41 199 930
	Natural Gas Camisea	3 475 501	6 720 854	6 674 238	20 090 916	27 182 804	27 577 033	35 984 963
	Others (Gas Norte and Oriente)	6 061 756	6 504 782	6 263 633	6 273 166	6 871 745	5 824 584	5 214 967
	Diesel and R6-R500	4 735 793	3 492 929	3 164 911	1 810 750	4 246 546	3 053 538	3 411 864

Source: COES – SINAC; NUMES 2012

9. Modern Energy for Productive Uses

ACCESS AND DEMAND IN THE PRODUCTIVE SECTORS

According to the 2011 National Energy Balance, the sectors with the highest demand of hydrocarbons are industry and mining and metallurgy.

Table 43: Final Consumption of Hydrocarbon Derivatives and Biofuels by Economic Sector (TJ)

Economic Sector	Charcoal	GLP	Gasohol	Motor Gas	Kerosene Jet	DB5	Residual Oil	Gas Distr.	Electricity	Total
Industrial	1	13383	296	393	0	14035	10824	31079	35419	105430
Mining and Metallurgy	0	1263	35	47	0	14756	937	3849	31438	52325
Fishing	0	49	11	15	0	3031	4871	536	1028	9541
Commercial	116	2843	4	6	0	475	13	6669	23782	33908
Agriculture Agro-industrial	0	23	328	436	0	812	56	0	2598	4253
FINAL ENERGY CONSUMPTION	117	17561	674	897	0	33109	16701	42133	94265	205457

Source: National Energy Balance 2011

AVAILABILITY

Quality of the Supply Chain

The State has been promoting the marketing of less polluting fuels via Law 28694 that regulates the sulfur contents in diesel fuel in order to protect air quality and public health. It established that, starting on January 1, 2010, the marketing of diesel fuel with sulfur levels above 50 ppm would be prohibited for domestic consumption. The law would also authorize the Ministry of Energy and Mines to exempt geographic areas in the interior of the country that could be authorized to use diesel with a higher sulfur content. The main refineries in the country will not be able to comply with the obligation established by Law 28694 due to the fact that they don't have the funds to construct desulfurization units. Thus, DS-061-2009-EM, established criteria to determine geographic areas where marketing diesel fuel with a maximum sulfur content of 50 ppm could be authorized. On January 1, 2010 the sale of diesel B2 with a sulfur content above 50 ppm was prohibited in establishments that sold fuel for automobiles. It was also prohibited for Direct Consumers (located in the provinces of Lima and Constitucional del Callo) that use diesel B2 as automobile fuel. The high demand for diesel fuels for automobiles in the provinces of Lima and Constitucional del Callo means that 86% of air pollution comes from diesel fuel.

In parallel with the reduction of pollution, biofuels will be added to motor fuel. The Regulation for the Marketing of Biofuels was approved in April 2007 via D.S. Nº 021- 2007-EM. This regulation establishes requirements for marketing and distributing biofuels, as well as the technical quality regulations of the products mentioned. According to this regulation:

- In 2010, Gasohol use was required in the whole country, resulting in a mix of 7.8% Alcohol fuel and 92.2% gasoline.
- In 2009, diesel B2 was required, a mix of 2% biodiesel B100 and 98% diesel 2 which in 2011 became diesel B5 5% biodiesel B100 content.

Source: NUMES 2012

LPG Transport by Pipeline

In order to improve the supply system of LPG produced in Pisco and shipped to Lima by maritime transport, the Government plans to concession a LPG Transport System from the producer (Pisco) to the geographical boundary of the province of Lima by pipeline. The project has an estimated investment of U.S. $ 90 million and includes:

• An approximately 250 km pipeline from Pisco to a terminal located between the towns of Lurin and Conchán. An initial estimated transport of 1,000 tons of LPG per day.
• A storage terminal and dispatch office to be placed between Lurin and Conchán.
• A pumping station, metering equipment, valves, pig traps, and communications equipment.

The construction of infrastructure for the project will take an estimated 28 months.
Source: NUMES 2012

Natural Gas Transport

To date, the final destination of Camisea gas is markets in Pisco, Lima, and Callao via the Gas Conveyor Transport System of Peru (TGP). The Transportation System company consists of two pipelines: A 729 km pipeline that transports natural gas and a 557 km pipeline that transports LNG. Both pipelines begin in the Amazon River basin at the Malvinas River in the

Echarate district in the province of Convention in the department of Cusco. They cross the Andes and reach the Pacific Ocean, ending at the city gate of Lurin and the fractionation plant in Pisco, respectively. Taking into account the extension work already executed, TGP has made an investment of approximately U.S. $ 1,900 million. In 2000, the Transport System by Pipeline from Lima to Callo was granted to the TGP company.

Source: NUMES 2012

Availability of technologies required for productive applications

Information is not available

ACCESSABILITY

Fuel Prices

The development of the Camisea project has allowed the price of natural gas to be at a competitive promotional price on the domestic market.

Table 44: Fuel Costs

Product	Prices	S/./GJ	US$/GJ
LPG	5,96 S/./gl	59,2	21,6
Gasoline 90	13,10 S/./gl	100,8	36,7
Diesel B5	12,36 S/./gl	85,8	31,3
CNG	1,18 S/./m3	29,5	10,8

Source: Mass use of natural gas in Peru – OSINERGMIN 2012

Accessibility of Technology

To convert a home from LPG to natural gas involves enabling the connection to the home to make an internal network so that all devices function with natural gas. The conversion cost is regulated by OSINERGMIN.

Table 45: Average Natural Gas Cost, 2012 (In Soles)

Cost	LPG	Natural Gas
Monthly Cost	52,50	16,33
Additional Investment for Conversion		2 230

Source: Mass Use of Natural Gas in Peru – OSINERGMIN 2012

Natural Gas is cheaper than LPG, but the investment for conversion is more expensive.

2.2 ENERGY EFFICIENCY RELATED TO THE SE4ALL OBJECTIVES

10. Overall vision and evaluation

Peru had success with energy efficiency pilot programs in the 90s, but they haven't had the necessary continuity. It is necessary to point out that past programs have mainly focused on the electricity sector. Currently there is a legal framework and a referential plan for energy efficiency 2009-2018 with goals for the residential, productive, service, public, and transport sectors. While recognizing that the formulation of goals was adequate, the low level of support received both on a governmental level and in terms of the potential users who would benefit has meant that the main goals have not been met. Given the crosscutting features of institutions, it is not sufficient to be able to count on the General Directorate of Energy Efficiency in the MINEM given the restrictions placed on government entities. In many countries, a special government agent has been put in charge of carrying out plans.

Unlike other programs, energy efficiency programs require both the participation of providers and of consumers. Additionally, they require price signals for energy that reflect the economic cost with the goal of evaluating the benefits of carrying out the programs. It is indispensable that the public, private, and residential sector agree on energy efficiency programs and have adequate financial and institutional resources.

Although there are no doubts about the potential benefits of energy efficiency, it is believed that the plan and its implementation should be reconsidered as a State policy with the goal of providing resources and having participation from all economic sectors of the country.

11. Energy Intensity and the National Economy

Table 46: Energy Intensity by Sector in Peru (TJ/10^6 US$)

Year	Total Energy (TJ)	GDP 10^6 US$(*)	(TJ/10^6 US$) (**)
1995	420 050	56 555	7,4
1996	438 614	57 979	7,6
1997	439 105	61 959	7,1
1998	434 494	61 551	7,1
1999	469 455	62 113	7,6
2000	458 706	63 946	7,2
2001	442 543	64 084	6,9
2002	464 664	67 298	6,9
2003	462 228	70 014	6,6
2004	501 100	73 499	6,8
2005	491 640	78 517	6,3
2006	499 450	84 594	5,9
2007	515 346	92 128	5,6
2008	574 207	101 159	5,7

2009	623 377	102 031	6,1
2010	661 345	111 004	6,0
2011	707 537	118 678	6,0

(*)Type of exchange in 2000

(**)Type of exchange in 2000

Source: National Energy Balance of Peru 2011

Energy Use in the Industrial Sector

Table 47: INDUSTRIAL SECTOR ENERGY CONSUMPTION 2011 (Unit TJ)

Final Consumption	Coal Min.	Firewood	Coke	Charcoal	LPG	Gasohol	Motor Gas	Kerosene +Jet	DB 5	Oil Residues	Gas Dis.	Electricity	Total
Industrial	21 293	3	0	1	13 383	296	393	0	14 035	10 824	31 079	35 419	115 902

Source: National Energy Balance: 2011

Domestic Use of Energy

Table 48: ENERGY CONSUMPTION – RESIDENTIAL SECTOR 2011 (Unit TJ)

Final Consumption	Firewood	Manure/Residues	Solar	Charcoal	LPG	Kerosene +Jet	Gas Dist.	Electricity	Total
Residential	81 142	8 585	143	1 809	28 625	0	424	30 418	151 146

Source: National Energy Balance: 2011

Energy Savings by Sector

Table 49: Energy Demand Reduction with Energy Efficiency Programs (TJx1000)

Sectors	2009	2010	2011	2012	Total
Residential sector	2,76	4,84	8,57	13,96	30,13
Productive and services sector (Industrial - Commercial)	3,77	7,67	11,56	16,46	39,46
Total (TJx1000)	6,53	12,51	20,13	30,42	69,59

Source: Energy Efficiency: Public Policies and pending actions in Peru – FRIEDRICH EBERT STIFTUNG

2.3 RENEWABLE ENERGY WITH RESPECT TO THE SE4ALL OBJECTIVES

12. Overall vision and evaluation

Peru has a long tradition of generating electricity for electricity systems based on its vast hydroelectricity potential. In the last decade, given the lack of policy with a long-term vision, there is evidence of a progressive decrease in the percentage of renewable energy in the

electricity sector, especially given the introduction of subsidized Camisea gas. On the other hand, since 2008 the country has promoted investment in electricity generation with the use of new renewable energy like wind, solar, and small-scale hydroelectric. Initially the target was 5% to receive a premium from the system operator. The auctions have allowed them to reach these goals. In 2011, the MINEM developed the study “Elaboration of a New Sustainable Energy Mix and Environmental Strategy Evaluation as an Instrument of Planning” in which they laid out the vision of greater renewable energy participation in the energy mix until 2040.

In the National Interconnected System there is currently a delay in the supply of new generation in general with respect to demand, as well as weakness in the transmission systems. Add this to the restrictions in transporting Camisea gas, andit is evident that the situation is becoming unfavorable increasing the percentage of reserves.

To this date, the measures taken to incorporate new renewable energy are considered positive, but it is estimated that the legal framework should be adjusted to increase the percentage of renewables in the electricity sector. This means that an indiscriminate subsidy for new technologies with limited potential for domestic development should be avoided

One area that merits greater support is the development of the renewable energy supply in isolated locations. The effort made in the past, both in small diesel plants and small hydroelectric plants, as well as in photovoltaic and wind systems, has not had successful results given that they don’t function now, have incurred extra costs, and have had a short life.

To avoid future damage, local renewable energy projects should be integrated with productive projects and should involve the active participation of the community.

13. Renewable Energy Connected to the Network and Isolated System

National statistics show the importance of renewable energy in interconnected and isolated systems.

Table 50: Energy Production in the SEIN (MWh)

Year		2004	2005	2006	2007	2008	2009	2010
Production (MWh)		21 650 920	22 575 766	24 024563	27 254 934	29 558 708	29 807 250	32 424 868
Hydro		16 692 620	17 100 838	18 670 592	18 588 456	18 010 231	18 751 670	18 965 781
Thermal		4 985 300	5 474 928	5 353 971	8 666 478	11 548 476	11 055 580	13 459 087
Source in the production of thermal energy	Coal	993 563	830 881	880 977	840 136	909 283	929 149	1 066 923
	Natural Gas Total	2 649 239	3 673 788	3 593 852	7 323 356	9 459 597	9 278 226	11 444 425
	Natural Gas Camisea	965 417	1 866 904	1 853 955	5 580 810	7 550 779	7 660 287	9 995 823
	Others	1 683 821	1 806 884	1 739 898	1 742 546	1 908 818	1 617 940	1 448 602
	Diesel and others	1 315 498	970 258	879 142	502 986	1 179 596	848 205	947 740

Source: COES – SINAC; NUMES 2012

Table 51: Summary of the installed potential of electricity generation units from RER in isolated systems (kW)

Region	PCH	Wind	Biomass	Biogas	Solar	Geothermal	Total
Amazonas	23 720				189,8		23 909,8
Ancash	6 520				279,4		6 799,4
Apurímac					105,2		105,2
Arequipa					247,1		247,1
Ayacucho		1,0			136,4		137,4
Cajamarca	16 850	10,1			495,1		17 355,2
Cusco	3 300	1,0			580,0		3 881,0
Huancavelica					105,5		105,5
Huánuco					205,1		205,1
Ica		5,0			40,0		45,0
Junín	12 100	2,0			173,8		12 275,8
La Libertad	4 730		34 400		131,6		39 261,6
Lambayeque		8,7	8 400		126,2		8 534,9
Lima	29 280	2,0			196,6		29 478,6
Loreto					382,7		382,7
Madre de Dios					25,2		25,2
Moquegua	9 000	1,2			30,3		9 031,5
Pasco	22 850				132,3		22 982,3
Piura	500,0	1,5			312,2		813,7
Puno					265,1		265,1
San Martín					228,5		228,5
Tacna					43,4		43,4
Tumbes					27,2		27,2
Ucayali	870,0				269,9		1 139,9
Total	129 720	32,5	42 800		4728,5		1 77 281,0

Source: Renewable Energy in Medium and Long-Term Strategic Planning
CEPLAN December 2011

14. Use of Renewable Energy Sources (RES) for Thermal Applications (Cooking/Heating)

Traditional biomass (firewood, manure, and yareta) are sources that are mainly used for cooking food and heating water in the residential sector, especially in rural and peri-urban areas. In the case of manure, this is specifically used in rural areas at a high elevation where there is scarce availability of other energy sources. Similarly, bagasse (the fibrous residue that comes from processing cane sugar) has been used in sugar mills to generate heat – from the water vapor of the boiler – and to generate electricity – associated with the vapor turbines that operate with the boilers. In this category, we can also consider solar energy for thermal uses. This includes hot springs (widespread in the southern highlands of the country where there are around 30,000 springs), green houses, kitchens, and solar dryers, which, even though they have been used marginally, have been successful in specific areas. This is the case of "Troje Model" dryers in the valley of Urubamba in Cusco and the solar kitchens of the mountains of Ancash.

SOURCE: CEPLAN 2011

15. RES Use for Productive Activities

Renewable Energy Use for Isolated Electricity Generation in the Network

Peru is one of the Latin American countries with the least electrification: around 4 million Peruvians, 15% of the total population as estimated in 2011, still didn't have electricity at home. The majority live in rural areas and are often far from existing electricity networks and are very scattered. In recent years, the government has executed aggressive rural electrification programs via the extension of electricity networks. The cost of connecting a rural family to the electricity network currently is, in many cases, over US $1,800, which is more than the cost of a "Photovoltaic House System."

For many regions, the only form of supplying electricity that is economically viable is via local generation, which is only possible based on renewable energy, preferably hydro or wind energy, if they are available. In the majority of cases, the only solution is photovoltaic panels. This is also known as the Master Electrification Plan with renewable energy that was created in 2008 for a JICA project, and it estimated that 280,000 homes were electrified.

In Peru, compared to other countries in the region, there are still few PV installations. The first projects were in Puno and were initiated twenty years ago with German cooperation after the CER-UNI project in Taquile. The most important project is a recent GEF with 4,500 home photovoltaic systems mainly in the jungle regions. Aside from that there are some private institution activities of which the most important is the installation of 1,000 home photovoltaic systems in Chota and Bambamarca in Cajamarca, financed by the Spanish NGO "Ayuda en Acción." Here we will briefly present two projects because they offer to different management options.

In the CER-UNI project, the home solar systems were sold to users in Taquile and on the Uros islands with three years of financing (and they were partially subsidized). Users owned the equipment and were responsible for its maintenance. Different evaluations made after the project, which between 1996 and 1999 installed a total of 421 home solar systems, demonstrated that practically all of them continue to be in operation. In the case of the GEF

project, the MEM opted for “assignment in use” management: the user pays a fee for the installation and later pays a monthly fee that should at least cover the costs of replacing equipment, especially the battery. The home solar systems continue to belong to ADINELSA (a state company that manages electrification projects that require a subsidy) that is also responsible for maintenance. Considering that these systems have been installed for less than two years, there still isn’t enough data to evaluate if this management system is sustainable enough to at least finance the costs of operation and maintenance or to determine whateconomic contribution is permanently required of the State.

Source: Energy Matrix in Peru and the Contribution to Renewable Energy – FRIEDRICH EBERT STIFTUNG; December 2009

Projects with Renewable Energy

- Project: “Implementation of a Photovoltaic Productive System.”
- EUROSOLAR Program: “Implementation of Hybrid Wind-Photovoltaic Systems.”

16. Brief Summary: Formulating the Problem with Respect to Energy Access, Energy Efficiency, and Renewable Energy

ENERGY ACCESS

An analysis of energy access in Peru could indicate the following:

- It is the desire of the state to drive universal energy access and it is explicit in Energy Policy (D.S. Nº 064-2010-EM). This is reflected in the quantity of resources assigned to the concept, which reached S/. 457 million in 2012, mainly directed at electrification programs.
- This may be reflected in the evolution of electrification in the country in 1993 when the National electrification coefficient was 54.9% and rural 7.7%. By the end of 2011, national coverage was estimated at 84.8% and rural at 63%. The current government will continue the “Light for All” program.
- There is an inverse correlation between the percentage of the population with access to electricity service and the percentage of the population in conditions of poverty. The latter are located in the rural areas of the mountains and the jungle.
- In 1993, firewood represented 55% of energy consumption in the residential sector, while in 2010 it represented 43%. During the same time period, LPG increased from 7% to 18% of energy consumption in the residential sector.
- The prices charged for providing electricity service managed by municipalities or local self-managed companies are not cost efficient and clients don’t benefit from subsidies based on their consumption, especially those that depend on thermal self-generation.
- Despite the economic and environmental benefits of using natural gas, it represented only 1.4% of energy consumption in the sector in 2010.
- The MINEM has been considering using solar panels as an alternative energy supply for rural isolated locations that are impossible to reach with conventional systems. The execution of the following projects should be highlighted: “Implementation of a productive photovoltaic system” and the Eurosolar program “Implementation of Hybrid Wind-Photovoltaic Systems.”

- Experiences like the “productive uses” of energy programs that can make energy access programs sustainable by increasing the level of income of the population via the use of energy to give them added value to local economic activities.

Problems Identified

Electricity

- The investment cost per unit increase of electricity coverage is higher each time due to the isolated areas on the border that are difficult to access and also have low consumption densities.
- A considerable number of the photovoltaic projects in isolated areas executed in the past have not been sustainable over time given problems with systems maintenance and management.
- The SAIDI-SAIFI indicators of supply quality in the companies in isolated areas are still high which means that there are high frequency, long interruptions.
- Rural electrification projects in Peru are being executed with public resources and with the participation of small public and private distribution concessionaries. Given the limitations of government management, it is not possible to achieve efficiency in investments.
- Expanding the electricity frontier to populations located in the Amazon could result in environmental and social impact for native communities, which is why investments should try to make a minimum impact, as well as evaluate other alternatives.

Fuels

- Firewood continues to be the main energy used in the rural residential sector, which results in local pollution and health problems for users.
- Via small programs for improved cookstoves, the government has replaced kerosene cookstoves with LPG cookstoves, and conventional firewood cookstoves with efficient cookstoves. However, greater investment is required to expand the program on a national level.
- Difficult access to isolated populations represents a barrier for the penetration of commercial fuels.
- The challenge of increasing natural gas participation in the residential sector requires large investments in transportation and distribution infrastructure.

ENERGY EFFICIENCY

The report on Energy Efficiency in Peru highlights the following:

- It is part of the energy policy in Peru to count on increased energy efficiency in the productive chain of energy use. There is a legal framework and an Office in the Ministry of Energy and Mines that is in charge of its promotion.
- Energy intensity in Peru has decreased from 8.90 TJ/10^6 US$ in 1995 to 7.07 TJ/10^6 US$ in 2010. This is due to a reduction in firewood use, an increase in less energy

intense economic sectors like the service sector, and an increase in the efficient energy use.

- The government has created diverse Energy Efficiency programs in the past like the Energy Savings Project (PAE), the MINEM-BID agreement "Consolidation of Institutional Framework for Sustainable Services of Energy Efficiency Use between 2003 and 2008.
- The private initiative of the ELI Project managed by the electricity distribution company EDELNOR and FONAM-BID Project stand out even though the benefits of these initiatives haven't had a multiplying effect in other companies and haven't continued.
- Peru has a Referential Plan for Energy Efficiency Use 2009-2018 that is multisectoral in character and which establishes 15% energy savings in comparison to the baseline. This would result in a savings of 5,291 million US$, 600 MW in demand, and an investment of 673 million US$. Despite the good design of this plan and its goals, it doesn't have a real or sufficient multisectoral mechanism for its implementation.
- There have been numerous pilot projects that replace diesel fuel and fuel oil with natural gas in the industrial sector. Some of those have benefited from being MDL projects. However, co-generation projects have not been duplicated in Peru as was hoped.

Problems Identified

- It is necessary to strengthen the General Office of Energy Efficiency with greater human, economic, and institutional resources.
- The savings and energy efficiency measures are not a priority in companies in the country because they aren't the central business of the company, and the company prefers to invest in its own activities and productive chains.
- Aside from the program for LPG cookstoves, improved cookstoves, and awareness programs about energy efficiency use, the government is not taking actions that will allow it to reach the goals of the Referential Plan of Energy Use.
- There is an absence of ESCOs in Peru given the small size of the Peruvian market, the weak contribution of existing energy efficiency consultants, and the lack of confidence and interest on the part of banks that make loans for this type of project.
- Low energy prices, like those of natural gas and electricity in Peru, result in energy efficiency projects with low internal rates of return.

RENEWABLE ENERGY

The report on the progress of Renewable Energy in Peru resulted in the following points:

- In 2010, domestic production of primary energy had a participation of 19.6% renewable energy, mainly hydropower (9.17%) and firewood (7.7%).
- The Law to Promote Investment in Electricity Generation with Renewable Energy and its Regulation established 5% of electricity generation based on RER as an objective for the first five years (it doesn't include hydroelectric plants).

- The legislation established mechanisms for RER auctions which have been successful in Peru and which awarded 1887 GWh/year in the first auction and 1152 GWh/year in the second at average prices that were below the world RER average.
- There are currently obligatory regulations for mixing biofuels: 7.8% of ethanol in gas (Gasohol) and 5% of biodiesel in diesel (Diesel B5).
- The ethanol produced in the country supplies internal demand, and the surplus is exported. The majority of biodiesel is imported despite the fact that there is existing installed capacity to cover domestic demand.
- Renewable resources like biomass and geothermal that offer firm power has not been exploited to scale. In the case of biomass, two auctions have only awarded 157 GWh/year, and for geothermal so far no project has been executed despite the relevant potential in Peru.
- Many renewable energy projects have been authorized as CDM, mainly hydroelectric projects.

Problems identified

- In the case of hydroelectric plants, the main barrier in Peru in recent years has been the low price of natural gas and the high cost of investment, as well as access to financing and the costs and transaction times (especially related to studies on the environmental impact).
- There are no mechanisms to prioritize the national consumption of biodiesel, which means that there is a preference for imported biodiesel, which has lower prices.
- To expand the production of exportable ethanol, it is necessary to inventory available land and the supply of assured water. The latter requires investments in reservoir infrastructure, which makes projects more expensive.
- In the case of non-conventional renewable energy, the main barrier is the high cost of installed capacity, and is expected that they will decrease in the future. Right now, its participation is limited to the energy requirements of RER auctions.
- Another barrier for non-conventional renewable energy is the great potential of hydroelectricity in Peru since it is a cheaper and more reliable source.
- Small-scale RER projects in Peru have been implemented without taking into account the sustainability of installation time.
- In the case of biomass, initial prices in RER auctions have not been sufficient to award the projects offered. This is probably due to the fact that it doesn't take into account that co-generation projects with bagasse belong to the sugar and alcohol industry, which work with discount rates that are above those in the electricity sector.
- In the case of geothermal generation, there are a lack of incentives to carry out these types of projects, such as, for example, technical subsidies and announcements about auctions dedicated to this source.
- The national production industry of renewable energy equipment and services is new, which is why it is necessary to invest in research and development in energy areas where Peru would be most competitive.

2.4 SE4ALL OBJECTIVES

17. Objectives

ENERGY ACCESS

The goals laid out related to an increase in electricity coverage in Peru are in the 2010 MINEM National Rural Electrification Plan (PNER) which consolidates defined Regional and Local Development Plans and programs to expand electricity distribution companies. Electricity coverage goals and the are presented below:

Table 52: Required investment

Description	2014	2015	2016	2017	2018	2019	2020	2021	2022	2024
Annual Investments (thousands of S/.)	775.188	1.032.782	909.363	434.688	239.009	216.875	236.362	233.608	217.030	200.110
Total Population Benefited per year (Thousands of inhabitants)	692.999	1.185.640	1.141.161	600.011	250.431	241.887	266.452	258.842	276.499	264.188
Coefficient National Electrification	92.00%	95.00%	96.00%	97.00%	97.30%	97.70%	98.00%	98.30%	98.70%	99.00%
Coefficient Rural Electrification	78.00%	86.00%	92.00%	94.00%	95.00%	95.60%	96.20%	96.80%	97.40%	98.00%

Source: PNER 2013-2022

Investments to achieve these objectives will be distributed as is displayed below:

Table 53: Project Investment

No.	PROJECT	PERIOD 2013-2022
I.	**INVESTMENT**	**Millions of Soles**
1	TRANSMISSION LINES	190,4
2	RURAL ELECTRICITY SYSTEMS	3 205,4
3	HYDROELECTRIC PLANTS	132,4
4	PHOTOVOLTAIC MODULES	734,3
5	WIND FARMS	106,4
6	ELECTRICITY COMPANY WORKS	880,0
	TOTAL INVESTMENT	**5 248,9**
II.	**GOALS**	
	POPULATION BENEFITTED (Inhabitants)	6,221,577

Source: PNER 2013-2022

Regarding improved cookstoves, according to the June 2012 “Improved Cookstoves for a Peru without Smoke” initiative, the country had 235,263 homes with improved kitchens. Based on that and the estimated costs for an improved kitchen, the following goals were established:

Table 54: Homes with Improved Cookstoves Installed and the Accumulated Investment Required

Description	2012	2015	2020	2030
Homes with installed improved cookstoves (miles)	235	447	800	1300
Accumulated investment required (Miles US$)	-	16942	45179	85179

Source: Improved Cookstoves for a Peru without Smoke

In regard to natural gas access in the residential sector, ideally by 2030 Peru will have mass use of natural gas and consumption in the residential sector will represent a percentage equal to what Colombia currently has (UPME Bulletin of Energy Statistics 2010).

Table 55: Natural Gas Participation

Description	2010	2015	2020	2030
% participation of natural gas in the residential sector	1,4%	6%	10,8%	20,2%

Source: NUMES 2012

ENERGY EFFICIENCY

In 2009, the “Referential Plan for Efficient Energy Use 2009-2018” (PRUE) was officially launched. It established goals and annual programs to be executed until 2018. The guidelines for this plan have been updated in the NUMES study, and currently the MINEM is working on an Energy Plan that will define achievable actions. Goals for reducing energy consumption are presented below:

Table 56: Summary of the Reduction of Energy Demand with Energy Efficiency Programs(TJx1000)

Description	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Reductions with efficiency programs (TJx1000)											
Residential sector	2.76	4.84	8.57	13.96	18.92	18.92	18.92	18.92	18.92	18.92	143.63
Productive and Services Sector	3.77	7.67	11.56	16.46	17.95	17.95	17.95	17.95	17.95	17.95	147.14
Public Sector	0.05	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.91
Transport Sector	1.15	2.39	3.76	5.23	6.8	8.48	10.24	12.2	14.27	16.43	80.95
Total	**7.73**	**15**	**23.99**	**35.74**	**43.76**	**45.44**	**47.2**	**49.16**	**51.23**	**53.39**	**372.64**
Emissions reduction (X1000 TM CO2/year)	779	1499	2362	3468	4262	4381	4506	4645	4791	4945	35638
Annual economic savings Ahorros(x 10^6 USA $)	121	231	347	490	571	612	655	703	754	807	5291
Certified coal earnings (x10^6 USA $)	8	14	20	27	30	30	30	30	30	30	251
Investment required (x10^6 USA $)	97	100	124	185	98	14	14	14	14	14	673

Source: PRUE (2009)

Table 57: Annual savings by energy in 2018 (TJx1000)

Sector	Residential				Production and services				Public	Transportation	Total	%
Program	Kitchen	Lighting	Cables	Consumption habits	Motors	Boilers	Lighting	Co-generation	Lighting	Efficient Conducting		
Biomass savings	16.53										16.53	30.97
Hydrocarbons savings						8.75		5.95		16.43	31.13	58.31
Electricity savings		0.8	1.16	0.41	1.4		1.84		0.1		5.72	10.72

Source: PRUE (2009)

Table 58: Summary of the reduction of electricity demand by sector (MW)

Sectors	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Residential										
Efficient illumination	109	113	116	121	121	121	121	121	121	121
Electric heater	0	0	0	0	0	0	0	0	0	0
Improvement of consumption habits	20	40	60	80	80	80	80	80	80	80
Productive and Services										
Replacement motors	20	40	60	80	103	103	103	103	103	103
Cogeneration	20	40	80	160	196	196	196	196	196	196
Efficient illumination	27	70	95	95	95	95	95	95	95	95
Public										
Efficient illumination	3	6	6	6	6	6	6	6	6	6
Total	**200**	**309**	**417**	**543**	**602**	**602**	**602**	**602**	**602**	**602**

Source: PRUE (2009)

The framework of the study “New Sustainable Energy Mix and Strategic Environmental Evaluation as Planning Instruments in Peru” presents an Energy Efficiency Plan (PLANEE), which has a timeframe of 30 years. Its objective is to reduce consumption by 15% by 2040 in relation to the baseline scenario.

On this timeline, the annual energy savings that can be obtained would reach 3,615 TJx1000 and have an estimated economic benefit of US$ 66,257 million dollars. Its NPV would be US$ 7,579 million dollars and the emissions avoided would reach 305.7 million tons of CO2.

This plan serves the long-term goals of energy efficiency for Peru. Below is a summary of the reductions due to energy efficiency:

Table 59: Summary of Energy Demand Reduction with Energy Efficiency programs

Sectors/year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Reductions with efficiency programs (TJx1000)															
Residential sector	3.2	6.4	10.8	16.9	23.9	24.6	24.7	24.8	24.8	28.3	28.4	28.5	28.6	28.8	34.7
Productive sector and services	4.0	8.1	12.1	17.3	19.6	19.6	19.6	19.6	19.6	22.6	22.9	23.2	23.5	23.9	28.6
Commercial and Public Sector (Electricity)	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4
Transport Sector	5.1	6.6	8.3	10.0	12.5	15.2	18.2	21.5	25.1	32.6	36.1	38.5	41.1	43.8	56.1
Total	**12.3**	**21.2**	**31.5**	**44.5**	**56.3**	**59.7**	**62.7**	**66.2**	**69.9**	**83.9**	**87.7**	**90.6**	**93.6**	**96.8**	**119.8**
Emissions reduction (X1000 TM CO2/ year)	893	1.839	2.856	4.129	5.338	5.615	5.824	6.055	6.302	7.506	7.786	8.003	8.232	8.471	10.411
Annual economic savings Ahorros (x 106 USA $)	241	394	543	720	878	977	1.072	1.178	1.291	1.610	1.760	1.864	1.976	2.094	2.655
Income by carbon certificates (x105 USA $)	13	22	31	40	47	48	48	48	48	59	60	60	61	62	74
Required investments (x105 USA $)	140	149	181	251	214	154	227	367	499	759	926	1102	1292	1501	2043
Annual net savings (x105 USA$)	$115	$267	$392	$508	$710	$871	$893	$869	$840	$910	$893	$823	$745	$654	$686

Current net value of investments ($x10^6$ US$)	**$4.729**
Current net value of investments ($x10^6$ US$)	**$7.579**

Sectors/year	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	3038	2039	2040	Total
Reductions with efficiency programs (TJx1000)															
Residential sector	34.8	35.0	35.1	35.3	40.2	40.5	40.7	40.9	41.2	46.4	46.7	47.0	47.4	47.7	916
Productive sector and services	28.6	28.6	28.6	28.6	32.9	33.3	33.7	34.2	34.6	38.7	38.7	38.7	38.7	38.7	761
Commercial and Public Sector (Electricity)	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	11.1
Transport Sector	59.8	63.7	67.9	72.2	86.6	93.9	101.5	109.6	117.9	141.6	148.9	156.4	164.2	172.3	1927
Total	**123.7**	**127.7**	**132.0**	**136.6**	**160.2**	**168.1**	**176.5**	**185.1**	**194.2**	**227.2**	**234.7**	**242.6**	**250.8**	**259.3**	**3615**
Emissions reduction (X1000 TM CO2/ year)	10.672	10.949	11.243	11.556	13.501	14.085	14.696	15.334	16.000	18.588	19.114	19.663	20.237	20.835	305.731
Annual economic savings Ahorros (x 106 USA $)	2.808	2.970	3.143	3.327	3.975	4.300	4.641	4.999	5.375	6.437	6.745	7.066	7.401	7.750	90.190
Income by carbon certificates (x105 USA $)	74	74	74	74	85	86	87	88	89	99	99	99	99	99	1948
Required investments (x105 USA $)	1864	2110	2373	1331	1677	1939	2216	2507	33	7	7	7	7	7	25.882
Annual net savings (x105 USA$)	$1.018	$935	$844	$2.070	$2.383	$2.447	$2.513	$2.580	$5.431	$6.530	$6.837	$7.158	$7.493	$7.842	$66.257

Source: NUMES 2012

Table 60: Summary of Electricity Demand Reduction by Sector (MW)

Sectors	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Residential															
Efficient illumination	55	110	165	220	220	220	220	220	220	220	220	220	220	220	220
Electric heaters	15	30	45	60	75	90	30	30	30	30	30	30	30	30	30
Improvement of consumption habits	18	38	40	42	44	46	48	51	53	56	59	62	65	68	71
Productive and services															
Motor replacement	20	40	60	81	101	101	101	101	101	121	141	161	181	201	201
Cogeneration	20	40	80	160	196	196	196	196	196	196	196	196	196	196	196
Efficient illumination	27	70	95	95	95	95	95	95	95	95	95	95	95	95	95
Public															
Efficient illumination	8	16	21	26	31	31	31	31	31	31	31	31	31	31	31
Total	**163**	**344**	**506**	**683**	**762**	**779**	**721**	**724**	**726**	**749**	**772**	**795**	**818**	**842**	**845**

Sectors	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Residential														
Efficient illumination	220	220	220	220	220	220	220	220	220	220	220	220	220	220
Electric heaters	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Improvement of consumption habits	75	79	82	87	91	95	100	105	110	116	122	128	134	141
Productive and services														
Motor replacement	201	201	201	201	222	242	262	282	302	302	302	302	302	302
Cogeneration	196	196	196	196	196	196	196	196	196	196	196	196	196	196
Efficient illumination	95	95	95	95	95	95	95	95	95	95	95	95	95	95
Public														
Efficient illumination	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Total	**849**	**852**	**856**	**860**	**885**	**909**	**934**	**960**	**985**	**990**	**996**	**1.002**	**1.009**	**1.015**

Source: NUMES 2012

RENEWABLE ENERGY

The goals for increasing the use of renewable energy can be divided into Renewables for the Electricity sector and Renewables for Transport (Biofuels). For the Electricity Sector, the NUMES study establishes the goal that by 2040 there will be **20% RER participation** in electricity generation. This represents 4,321 MW of RER capacity to be installed in the SEIN.

Table 61: Projected Installed Power Total SEIN 2040

Source: NUMES 2012

Table 62: Installed Potential with RER in the SEIN 2040

Technology	Installed capacity -MW		Percentage %
	2010	2040	
Hydro	3.098	9.771[a])	39.2
Thermal	3.329	11.319	45.4
Wind		1.342	5.4
Solar		360	1.4
Geothermal		1.500	6.0
Biomass	20	623	2.6
Total	**6.438**	**24.915**	**100**

Technology	New capacity -MW	Percentage %
	Total	
Mini-hydro	492	11.4
Wind	1.342	31.1
Solar	360	8.3
Geothermal	1.500	35.2
Biomass	623	14.1
Total	**4.321**	**100**

RER participation without hydro	**15.4%**
RER participation with hydro	**17.4%**

Source: NUMES 2012

By 2040, this capacity could supply 368,255 GWh, equivalent to 14.2% of the energy demanded by the SEIN during this period.

Table 63: Dispatched Energy Objective of RER Plants (2011-2040)

Technology	New energy - GWh	Percentage %
Mini-hydro	73.017	19.8
Wind	54.891	14.9
Solar	70.212	19.1
Geothermal	119.391	32.4
Biomass	50.745	13.8
Total	**368.255**	**100**

RER participation without hydro	**11.4%**
RER participation with hydro	**14.2%**

Source: NUMES 2012

The investment required to reach these objectives of increased installed RER power by 2040 are US$ 6,687 million.

Table 64: Required investment in plants. Total SEIN and RER by 2011-2040.

Technology	Investment amount US$
Hydro	10.187
Thermal	5.584
Wind	3.159
Solar	1.072
Geothermal	1.020
Biomass	1.436
Total	**22.458**
Total RER	**6.687**

Source: NUMES 2012

For biofuels, the NUMES study establishes modest goals of a mix of 5% biodiesel and 10% ethanol by 2040. This document lays out long-term goals for 2030 based on successful experiences and goals in other countries in the region.

By 2030, the goal is for gasoline to include 25% ethanol, and to use the experience in Brazil as a reference. For biodiesel, it should be taken into account that Colombia recently established a 10% biodiesel mix. The goals for increasing biofuels consumption in the transport sector in Peru are summarized below:

Table 65: Percentage of Biofuels

Description	2012	2015	2020	2030
Biodiesel (% mix in diesel)	5%	5%	7%	10%
Ethanol (% mix in gasoline)	7,8%	10%	15%	25%

Source: NUMES 2012

SECTION III: CHALLENGES AND OPPORTUNITIES TO REACH THE SE4ALL GOALS

1.1 INSTITUTIONAL AND POLICY STRUCTURE

18. Energy and development

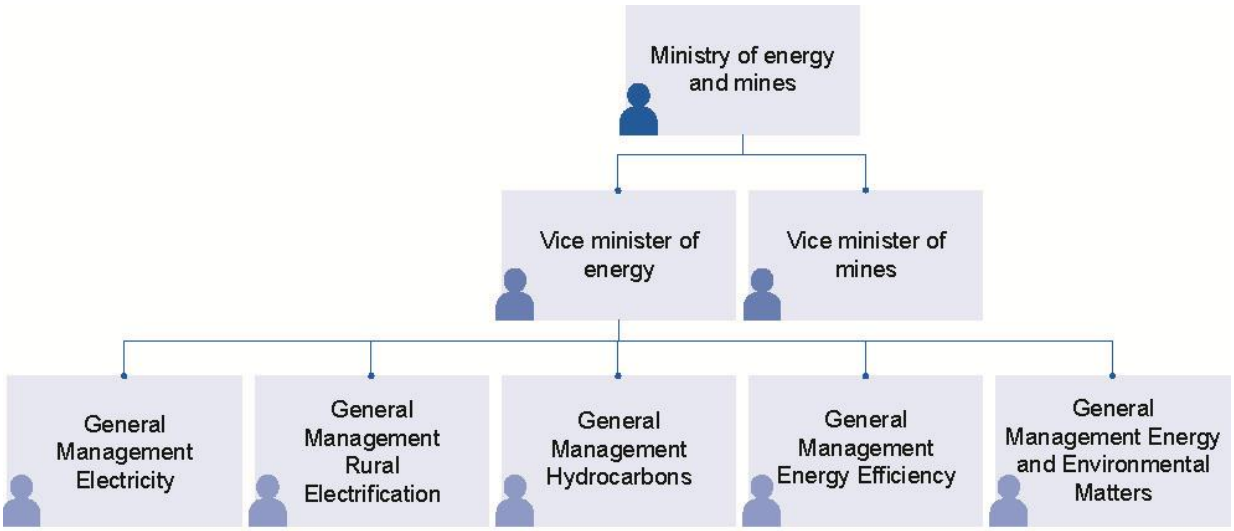
MINEM

The regulatory body of the energy sector is the Ministry of Energy and Mines (MINEM), which is in charge of formulating and evaluating national policies related to electricity and hydrocarbons. Its objectives include promoting comprehensive development in energy activities, establishing norms and regulating compliance, and caution in the rational use of natural resources in harmony with the environment.

Among its general functions are formulating referential plans on a national level for the energy subsector, granting concessions, and entering into contracts on business matters.

The Vice Minister of Energy participates with the Minister in establishing electricity subsector policies in hydrocarbons, energy efficiency, rural electrification, environmental energy issues, and its work regarding those subsectors.

The MINEM has the following organizational structure:



The Ministry of Energy and Mines (MINEM) defines the country's energy strategy. A revision of its policies finds:

- To have a diversified energy mix with an emphasis on renewable sources and energy efficiency.
- Universal access to energy supply.

The Ministry of Development and Social Inclusion (MINDIS) is in charge of poverty reduction. Among its objectives are:

- To ensure that temporary and targeted programs contribute efficiently to homes in a situation of extreme poverty or vulnerability that can access public services to help them have a more dignified life and the exercise of full citizenship.
- To ensure that social programs promote sustainable income generation and employment strategies that allow them to overcome poverty in the medium term.

MINEM is in charge of the active role of energy programs. It is hoped that in the future there will be greater coordination between the MINEM and MINDIS on programs to reduce poverty.

In 2010, the Peruvian government via Supreme decree No. 064-2010 EM approved the National Energy Policy for 2010-2040, establishing the following objectives:

- Universal Access to energy supply.
- To have greater efficiency in the productive chain and in energy use.
- To develop an energy sector with minimum environmental impact and low carbon emissions within a sustainable development framework.

In 2013, the MINEM, within the framework of Law No. 29852 created the "System of Energy Security in Hydrocarbons and the Fund for Social Inclusion." It approved the Universal Energy Access Plan 2013-2022 with the goal of promoting projects that expand energy access to populations with fewer resources. The main guidelines are:

- To reach total coverage in the Electricity and Hydrocarbon energy subsectors.
- To subsidize and/or guarantee the cost of infrastructure and energy equipment supply for low income segments of the population.
- To involve regional and local governments in the creation of supply programs.
- To promote productive energy use.
- To promote the construction of basic energy infrastructure to cover the necessities of universal service.
- To guarantee the transport and supply of natural gas to implement heating systems in high Andean areas in regions with few resources.

The following mechanisms are for universal access:

- Programs to promote the mass natural gas use.
- Promotion and/or compensation for LPG access.
- Programs to develop new supply on the Energy Frontier.
- Programs to improve rural energy use.

19. Thermal Energy for Homes

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According to studies, 30% of the national population and 62% of the rural population use solid fuels as thermal energy for home use. This means that 2,490,204 families use solid fuels and only 15.65% use a chimney to remove contamination. This is a potential risk that could affect people's health.

In the past, thermal energy programs for homes were developed by diverse state organizations on a national and regional level with the participation of international and non-governmental organizations. Since 2009, a program to introduce half a million improved firewood cookstoves has been promoted by the Alliance of the PCM, JUNTOS del MINDIS, the Work and Family Institute, the OPS, GIZ, and UNDP with the support of the MINEM. According to the UNDP, 88,380 improved firewood cookstoves were installed in February 2003 which benefitted 530,000 people in provinces with the lowest human development index: Huancavelica, Ayacucho, La Libertad, Arequipa, and Cusco.

Considering the necessity of eradicating the use of kerosene for cooking food given how the fuel is used in drug trafficking activities, the MINEM has been developing a program to substitute them with LPG Cookstoves since 2013.

PERU COOKSTOVES

According to the 2014 Operative Plan, Senior Management of the MINEM has been developing a Peruvian Family Cookstove Program since 2013 that integrates both LPG cookstoves and improved firewood cookstoves. In 2013, the program gave out 240,406 LPG cookstove kits and 9,776 improved firewood cookstoves.

In 2014, the program is expected to give out 246,000 LPG cookstove kits and 10,000 improved firewood cookstoves.

The 2016 goal is to benefit 80,000 families with improved firewood cookstoves.

FISE

Since 2013, a monthly program has delivered vouchers to citizens in the most impoverished regions to purchase a 10 kg cylinder of LPG at a discount of S/16. The compensation program is being managed by the OSINERGMIN as assigned by the MINEM, and it is mostly financed by large free users in the electricity.

20. Electricity Sector

DGE

The General Directorate of Electricity is the regulatory body in charge of participating in energy policy formulation in the Electricity Subsector. Depending on the situation, it proposes or expedites the necessary regulations; it promotes the development of generation, transmission, distribution, and marketing activities; it contributes to exercising the guarantor role in the name of the State for the sustainable development of electricity activities. Hierarchically, it depends on the Vice Minister of Energy.

The main roles of the General Directorate of Electricity are: to create the Annual Operative plan, to supervise the functions of regional organizations, to promote the rational use of energy resources in electricity production, to evaluate reports on concession applications and authorization of electricity activities.

OSINERGMIN

The Supervisory Agency of Investment in Energy and Mines (OSINERGMIN), which is attached to the Presidency of the Council of Ministers, is the energy sector regulatory body.

The main functions of the OSINERGMIN are: to regulate and control activities in the chain of hydrocarbons and the electricity subsector, in technical, legal, and environmental aspects. In addition, it currently has regulatory functions in electricity and natural gas, and its decisions should prioritize fixing rates, quality, incentives for innovation, contractual conditions, and all other relevant issues related to market development and satisfying the interests of users.

COES

The Committee for the Economic Operation of the System (COES) is a private non-profit entity with Public Law legal capacity in charge of managing the short-term electricity market. It is made up of all the Agents of the SEIN (generators, transmitters, distributors, and free users) and Agents must comply with their decisions. It was created in November 1992 with the goal of coordinating the operation of the SEIN in the short, medium, and long-term at a minimum cost and to plan the development of the transmission of the SENI and to manage the Short Term Market.

RATES

Rates for regulated clients are set by OSINERGMIN and large consumers agree upon the rate set by the provider (generator or distributor) and the client.

21. Modern Energy for the productive sectors

The Organic Hydrocarbon law establishes relevant policies for the sector:

Activities in the sector are carried out based on constitutional regulations that safeguard free competition and open access.The State is in charge of formulating hydrocarbon policy, promoting investments, creating regulations, and supervision and control.

The figure of the Contract License is incorporated for hydrocarbon exploration and/or exploitation. In the license, the contractor is the owner of the extracted hydrocarbons and is responsible for them. The contractor of the license pays a royalty to the State.

The Services Agreement is regulated, oil ownership remains in the hands of the State, and the contractor receives remuneration.

PERUPETRO SA, a state company under private law, was created to promote oil exploration and exploitation; to negotiate, conclude, and monitor the quality of contracts with the Contractor on behalf of the Peruvian State. The State confers ownership of extracted oil in order to conclude contracts that are transferred to the titleholders of License Contracts, which markets the hydrocarbons that belong to the State.

It also establishes that the price of commercial liquid fuels will be set in agreement with the international parity of supply and demand.

22. National Monitoring Structure for SE4ALL

To date, there is no national monitoring structure and there are no indicators.

1.2 PROGRAMS AND FINANCING

23. Thermal Energy

The main Thermal Energy programs are developed with the direct and indirect support of MINEM.

IMPROVED COOKSTOVE PROGRAM

The National Campaign for Half a Million Certified Improved Cookstoves for a Peru without Smoke aims to contribute to a reduction in indoor pollution by replacing traditional cookstoves with certified improved cookstoves.

Campaign activities are developed in partnership with the Technical Secretary of the Interministerial Committee of Social Affairs of the Presidency of the Council of Ministers (PCM/ST CIAS), the National Program for the Direct Support of the Poor (JUNTOS), the Work and Family Institute via the Planting Program, the Pan American Health Organization (PAHO), and the Energy Development and Life Project (EnDev run by the GIZ). In addition, the work performed by the regional and local government stands out because it contributed to the institutionalization of measures to promote and ensure the mass use of quality sustainable certified improved kitchens.

The adoption of the relevant legislation has been one of the determining factors for achieving the campaign objectives. Supreme Decree No. 015-2009-HOUSING was approved by the Improved Kitchen Technical Regulation. State financing was provided via Emergency Decree 025-2010, which allowed regional and local governments to invest 2.5% of mining royalties and fees as a current expenditure of certified improved kitchens. The institutions that form part of the campaign committed to installing 319,462 improved kitchens by December 2011.

MINEM PERUVIAN COOKSTOVE PROGRAM

To eradicate kerosene, the Ministry of Energy and Mines has been carrying out the following activities since 2009:

LPG COOKSTOVES KIT

The Program for Replacing Kerosene Cookstoves and other polluting fuels with LPG is targeted at marginal urban areas where there is oil distribution. The program provides beneficiary households a cookstove kit that includes: a cookstove with two 1.1kw burners with a regulator, hose, clamp, and a 10kg LPG container (includes the use of the container).

The program has a general process for locating beneficiaries.

The average cost of an LPG cookstove (including direct, indirect, and administrative costs) is S/. 180.00.

As of April 2012, the program had benefited a total of 43,172 homes nationally.

The 2016 goal is to provide 1,000,000 with LPG cookstove kits.

IMPROVED FIREWOOD COOKSTOVES

This is a Program to Replace Traditional Firewood Cookstoves with Improved Firewood Cookstoves in marginal rural areas above 2,500 mamsl that lack LPG distribution. It is important to note that the benefitting household should also provide construction materials which are found in the area and don't imply an excessive expense for the family. The cost of the improved cookstove including direct, indirect, and administrative costs amounted to S/. 250.00. To date, the program has benefitted more than 64,000 homes in the departments of Ayacucho, Cusco and Huancavelica, which have experienced an immediate improvement in quality of life.

Funding is through the MINEM.

FISE SUBSIDY

Compensation for LPG access was created via 2012 law No. 29852 that established the Fund for Social Energy Inclusion (FISE) with the goal of compensating the most vulnerable sectors of the population. The fund provides monthly vouchers to citizens in regions with greater levels of poverty so that they can buy a 10 kg LPG canister with a S/16 discount. The fund will be financed with a surcharge to monthly users of free electricity, and when liquid oil and natural gas derivatives are transported by pipeline. A monthly bill will be sent for tariff charges for users of natural gas transport pipeline services.

OSINEGMIN administers the MINEM fund and electricity distribution companies distribute the vouchers. Projects for promotion and/or compensation for access to LPG in the Universal Access Plan have the goal of reaching 550,000 benefitting households in 2014. According to the 2013 OSINERGMIN report, 659,259 households had already benefitted.

24. Electricity Sector

RURAL ELECTRIFICATION PROGRAM

This program is a high priority for the MINEM and has a large impact on social inclusion in the poorest sectors of the country. The 2007 census showed a national coverage of 74.1% and rural coverage of 29.5%. The program "Light for All" began in 2007 with the goal of accelerating the process of coverage.

In 2012, 162 works were completed for S/ 276 million and electrification in 1,808 rural locations was achieved, providing a supply to 75,000 households with a population of 365,000 inhabitants.

In parallel, the program developed the promotion and execution of rural electrification projects by concessionary distribution companies under a grant funding scheme with a total of 65 works included, of which 49 were finished. This project had financing from the World Bank.

In 2011, the EUROSALAR program benefitted 130 communities by providing renewable energy systems with health and education infrastructure. This project had the financial support of the European Community.

By 2013 it had an assigned budget of S/ 430.5 million to execute 289 projects in 2,700 locations that would benefit 365 million inhabitants. Estimates predict that rural coverage will reach 71% and and that by 2016 it will reach 86%.

Ny 2022, according to the Universal Access Plan, 6,221,521 inhabitants should benefit from Rural Electrification Projects and be connected to the network. By 2016, some 500,000 residential photovoltaic systems will be installed and will benefit 2,200,000 inhabitants isolated from the network.

25. Modern Energy for Productive Use

Currently there are no specific modern energy programs for use in productive sectors.

1.3 PRIVATE INVESTMENT AND A FAVORABLE ENVIRONMENT FOR BUSINESS

Structural reforms carried outin the energy sector market in 1993 as a mechanism to assign resources and reduce State participation in the economy and its policy and regulatory body role. In this context, the main state companies moved into private hands via a process of privatization, which facilitated the entry of private investment in the electricity and oil sectors. The state was left with a subsidiary role in economic activity.

The 1993 Constitution guaranteed a judicial framework for the stable development of national and foreign private investment. In addition, it developed a legal framework for the treatment of foreign investment that promotes and establishes safeguards and legal stability mechanisms for foreign investment in the country (DL Nº 662 and DL Nº 757).

The rules empower domestic and foreign private investors and their companies to sign a stability contract with the State that is legally binding. In addition, in the case of disputes, it authorizes using national and international arbitration tribunals outside of the justice system.

Currently the Government promotes private investment via the Agency to Promote Private Investment (PROINVERSIÓN) that aims to promote investment that is not dependent on the State via state agents dependent on a private system to boost competitiveness and sustainable development. The following are among the main functions of the organization:

To propose and execute national policy for promoting private investment.

To promote the incorporation of private investment in public services, public infrastructure works, and in state assets, projects, and companies and other state activities.

PROINVERSION and its predecessors have been important players in the privatization process of State energy companies and in the process of developing new electricity and oil infrastructure. The MINEM, as the body responsible for the energy sector, have been doing commissions for PROINVERSION according to the needs of expanding infrastructure.

In addition to the usual process of private investment, Public Private Alliances (APP) have been established to execute infrastructure works and services that include issuing certificates of recognition of payment rights to guarantee the adequate financing of investment and infrastructure projects in the private sector developed under this modality. The APP is specifically a long-term concession contract via which the private investor provides the State with a public service with a pre-established standard of quality that is measured through use or availability. It has a physical asset that will design, construct, finance, maintain, and operate it for a specified number of years based on the quality of service received and corresponding deductions.

In summary, it is estimated that Peru has adequate mechanisms for active participation in the national and foreign private sector in the energy sector. It is thus the government´s job to design new specific forms of private investment that will facilitate achieving universal energy access and will increase the growth rate of incorporating renewable energy and energy efficiency.

26. Thermal Energy for Homes

PRIVATE PARTICIPATION IN UNIVERSAL ENERGY ACCESS

Various studies have been conducted to make an expansion of private sector participation possible (currently it participates in construction and equipment as a provider) in rural electrification. However, limits have been discovered in terms of difficulties due to the geographic distance of the rural poor population without access to electricity. This population doesn’t have consumption volumes or income levels that allow it to deal with the costs. It is necessary to evaluate new alternatives for participation given the limitations of the State to directly develop an expansion of the electric frontier.

In terms of supplying LPG and natural gas to regions with extreme poverty, it is necessary to design new mechanism that allows financing and crossed subsidies in order to guarantee the necessary income for private investors.

27. Electricity Sector

PRIVATE PARTICIPATION IN THE ELECTRICTY SECTOR

In 1993, the electricity sector was reformed and restructured via a process of privatization and concession under the 1992 Law of Electricity Concessions and its regulations. The property of the installations and its management passed to private hands. The State remained responsible for the management of rules and regulations.

The economic regulation of the sector establishes that the generation business is competitive and transmission and distribution are regulated. At present, private and state generation companies coexist, although the most dynamic extensions are the private companies. High voltage transmission is in private hands and distribution in Lima is in private hands. The provinces are managed by the State. OSINERGMIN is the regulatory body with the job of fixing prices in the non-competitive segments and supervising services.

Private companies are important actors in the electricity sector and consider that the environment for participating in business is favorable except for the non-consensual changes to the rules of the game that happened in emergencies.

Its participation in universal access is limited given that it only provides electricity distribution in Lima, and that the interior of the country is in the hands of state companies. Due to opposition by local populations, state companies haven't passed into private hands.

In terms of energy efficiency programs, there has only been one pilot project on energy savings light bulbs which was carried out with the World Bank. Energy efficiency programs should consider the participation of private agents and should design adequate incentives.

In terms of renewable energy bids from current generators, there have been none. New generators have introduced new technologies. The experience of recent auctions is considered promising for greater future participation by private agents.

28. Modern Energy for Productive Sectors

PRIVATE PARTICIPATION IN THE OIL SECTOR

Before 1990, the state company PETROPERU monopolized the oil sector. It was divided up, and each segment was transferred to the private sector. Currently the majority of the sector is in private hands and PETROPERU only has the Talara, El Milagro, Iquitos, and Conchán state refineries and it participates only partially in marketing. In terms of upstream, PERUPETRO was created to give concessions to private operators to explore and exploit diverse fields. This also happened with Camisea natural gas, which was granted each segment. Given that fuel in the country has parity with international prices, the rules of the participation of the private sector are guaranteed.

1.4 GAPS AND BARRIERS

29. Thermal Energy for Homes

The main barriers and gaps for the adequate and economic use of energy resources and thermal services in homes are presented below:

- Institutional gap: In the recent past, there was no defined government entity responsible for the continued implementation of improved cookstoves since they were limited to temporary programs. The Law to Promote Efficient Energy Use (Law No. 27345)

provides a legal framework, and according to Supreme Decree No. 026-2010, the General Directorate of Energy Efficiency would be in charge of conducting, promoting, and/or executing activities managed by the MINEM under Law No. 27345. To date, there is the DGEE program “Peru Cookstoves” that implement LPG and improved cookstoves.

- Improved cookstoves are viable if they are subsidized: despite the fact that they benefit health and reduce fuel costs, investments in improved kitchens are not a priority in rural homes because residents spend their scarce resources on survival or invest the capital in economic activities. Taking this into account, the implementation of improved cookstoves in Peru should be subsidized by the State or by International Cooperation programs.

- Access to capital for improved cookstove programs: the annual budget assigned to the Ministry of Energy and Mines doesn’t allow them to cover the required cost of the proposed goals of implementing improved cookstoves. Similarly, “Rural Electrification Access and Use,” a long-term program for improved cookstoves, needs a Program in the Annual Budget (defined in Peru by the Minister of Economy and Finances) in order to meet the proposed goals.

- High initial costs of equipment and connection and the low economic return of converting to natural gas in homes: according to Osinergmin (2012), with current LPG prices and the regulated value of natural gas, the typical cost of conversion of US$ 700 for the standard consumer will be recouped in 8 years, paying 12% interest.

- Access to financing to convert homes to natural gas: the management of short-term financing funds, with the risks of profitability of the conversion in hands of users, raises the barrier of access to natural gas supply and reduces the speed of conversions. According to Osinergmin (2012), a policy of 10,000 monthly conversions with a 12% annual financing rate means that a 950 million soles fund is necessary and that it should be self-sustaining starting in the 6th year.

- A lack of statistics to make a baseline: there are no national statistics about the current situation of thermal use in homes,about the equipment used, or about its efficiency.

30. Electricity Sector

- Low energy consumption in rural homes and low levels of production activity: almost 30% of electricity users in rural homes have monthly consumption below 31 kWh/month. This low consumption limits the profitability of rural service for distribution companies and consequently forms a barrier to future investment in infrastructure. In addition to this, there is the low level of production activities in these communities which results in a demand profile characteristic of poor communities with 24 hour service: peaks in demand in the morning and at night, mainly for lighting, with a low demand during the rest of the day (ESMAP 2012).

- The incremental cost of interconnection of isolated systems: with the exception of Iquitos, the capitals of departments in Peru are interconnected.Interconnections with other cities are more costly because the distance and there is less economic return given the low number of consumers. This is not attractive to private investment, which is

why the State should assume these costs or provide special conditions for private investors.

- The increase in the marginal investment costs of electrification: Given the increase in the difficulty of Access (areas located in the mountains or in the Peruvian Amazon) the cost of each home connection is continually growing.

- Barrier to renewable energy in isolated systems due to subsidies for fuels for energy generation: subsidies for fuels awarded to electricity concession companies for isolated systems that represent a barrier to the economic viability of renewable technologies that face the “business as usual” scenario to continue generating electricity with diesel.

- The low price of Camisea Gas for Electricity Generation: this price, one of the lowest in the region, produces a distortion of prices for the development of hydroelectric plants and other renewable technologies, as well as being a disincentive for the efficient use of natural gas in thermal electricity generation (ESMAP,2010).

- Access to project financing for renewable energy projects: financial institutions resist evaluating renewable energy projects given the lack of experience in the area. According to the IFC (2011), they tend to lack an understanding of the importance of environmental matters, and they don’t have a team to evaluate the environmental benefits of the projects.

- The high cost of capital of renewable energy makes the economic viability of projects difficult: as indicated by ESMAP (2007), the capital costs of renewable technologies are required to make these enterprises possible. Due to the high initial investment, the cost of O&M is lower compared to the costs of diesel thermal generation.

31. Modern Energy for Productive Sectors

The main barriers and gaps for Access to modern energy services and energy efficiency projects in the productive sectors are:

- Low energy prices, which don’t encourage energy efficiency projects: electricity rates in Peru are below the average in Latin America. In addition, the low cost of natural gas results in fuel replacement projects but not in a reduction of fuel consumption.

- The lack of Energy Services Companies (ESCOs): ESCOs could be an important component to increase energy efficiency in the economy. They could allow companies to implement improvements in energy efficiency on a large scale without financing them with their own resources.

- Insufficient interest from commercial banks in financing energy efficiency projects: although some initial efforts have been made, in general financial institutions are reluctant to award loans for energy efficiency given the lack of information about the issue, the worry about risk, and the lack of technical support (IFC, 2011).

- The Peruvian Market is small for large investments in energy efficiency: the implementation of ESCOs and investments in large-scale energy efficiency projects are limited given that the industrial sector in Peru is small and not attractive in terms of profitability for the type of company dedicated to energy efficiency projects.

- The lack of infrastructure in Transport and Natural Gas Distribution: to be able to expand access to natural gas to the productive sectors of the country, it is necessary to construct more regional pipelines, which require large amounts of capital and infrastructure distribution. In turn, this requires private investment, which, with exceptions in the regions of Lima and Ica, has been scarce.

- Limited technical and management capacities of rural producers in the productive use of energy: these producers need to learn about market opportunities, technology options, the cost of efficient equipment, and adequate access to capital and financing (ESMAP,2012).

- The lack of a Useful Energy Balance for the implementation of action strategies: it is necessary to analyze energy use in the productive sectors in order to get the Useful Energy Balance.

32. Summary: Key gaps, barriers, and additional requirements

The following provides a summary of the main gaps and barriers to be overcome in reaching the national objectives which coincide with the SE4ALL initiative and the main issues in order of priority:

- The need to prepare a Useful Energy Balance to analyze energy use in Peru.

- The need for capital for Rural Electrification Programs, for donations of Improved Cookstoves, for subsidies for the capital costs of renewable energy in isolated systems, and the fund for the mass use of natural gas in Peru.

- The need to strengthen State institutional human and economic resources in terms of promoting energy efficiency, the productive use of energy, and renewable energy projects.

- The reduction of barriers imposed by low natural gas prices and by the fuel subsidies for electricity generation.

Annex I-Matrix of Existing Erograms and the Necessary Financing to Achieve the SE4ALL Objectives

Current initiatives by the government and development partners

TITLE	MAIN ORGANIZATION	FINANCIER	RELEVANT SE4ALL OBJECTIVES (ACCESS, EFFICIENCY, RENEWABLE ENERGY)	BRIEF DESCRIPTION AND TIMEFRAME	VALUE
Study of the Master Rural Electrification Plan with Renewable Energy for the Republic of Peru	MEM/DPR(DEP), MEM/FONER, FONCODES, INADE	Includes the Shock JBIC, etc. Japan, Germany, Italy, Las Bambas Peru-Ecuador Luxemburg, USAID, World Bank, IDB, ACEI	Electrification with renewable energy in 33,701 locations with 361,847 homes.	To promote economic development, the elimination of poverty, and improvement of the quality of life. To increase the electrification coefficient from 78.1% in 2005 (78.7% by 2006) to 88.5% in 2011 (this goal has been increased to 90.1%) and eventually to 93.1% for 2015. Execution period: 2011 – 2020.	217,555,640 (US$)
Program to replace cookstoves - Peru Cookstove Project	MEM	MEM	Access to the modern cookstove, substituting biomass with fuel	The objective is to replace 125,000 firewood cookstoves with improved firewood cookstoves in poor homes in high Andean areas of the country.	15,000,000 (U$S)
Rural Electrification	MEM	MEM	To ensure that all locations on a national level have electricity service and that this will improve living conditions.	To expand the electricity frontier by executing electrification plans and projects in rural areas and isolated locations and along the border.	1.847 (Million S/.)
Program to Expand the Electricity Frontier III Stage (PAFE III)	Cajamarca Regional Government	Japanese International Cooperation Agency (JICA)	To electrify 1,023 locations and benefit a population of 211,000 inhabitants.	In the case of Cajamarca, this includes 19 projects located in diverse provinces of the department	200 (Million S/.)
Program to Expand the Electricity Frontier III Stage (PAFE III)	Loreto Regional Government	JICA	To electrify 123 locations to benefit a population of 35,000 inhabitants.	6 projects located in the department of Loreto will be executed by the Loreto Regional Government.	S/. 37 (Million S/.)
Program Euro - Solar	MEM	UE	Objective to reduce poverty by offering access to renewable electricity sources.	This program is based on boosting clean energy and environmental protection	35.8 (Million Euros)

UNIVERSAL ACCESS PLAN

Universal Energy Access Projects	Beneficiaries	Unit	Period
Mass use of natural gas	50,000	Homes	2016
Compensation for LPG access	550,000	Homes	2016
LPG kitchens kit	1,000,000	Homes	2016
Rural electrification network projects	6,221,577	Inhabitants	2022
Rural photovoltaic system without a network	500,000	Installations	2016
Improved cookstove installations	80,000	Homes	2016

Source: Ministerial Resolution No. 203-2013 MEM-DM of 24.05.13

NATIONAL RURAL ELECTRIFICATION PLAN 2014-2024

Description	2014	2015	2016	2017	2018
Annual investment (thousands of S/.)	775188	1,032,782	909,363	434,688	239,009
Total population benefitted per year (thousands of inhabitants)	692,999	1,185,640	1,141,161	600,011	250,431
National Electrification Coefficient	92.00%	95.00%	96.00%	97.00%	97.30%
Rural Electrification Coefficient	78.00%	86.00%	92.00%	94.00%	95.00%

Description	2019	2020	2021	2022	2024
Annual Investment (thousands of S/.)	216,875	236,362	233,608	217,030	200,110
Total population benefitted per year (thousands of inhabitants)	241,887	266,452	258,842	276,499	264,188
National Electrification Coefficient	97.70%	98.00%	98.30%	98.70%	99.00%
Rural Electrification Coefficient	95.60%	96.20%	96.80%	97.40%	98.00%

Source: National Rural Electrification Plan 2014-2024

IMPROVED COOKSTOVES

Description	2012	2015	2020	2030
Homes with installed improved cookstoves (thousands)	235	447	800	1300

Accumulated required investment (thousands US$)	-	16942	45179	85179

Source: Improved Cookstoves for a Peru without Smoke

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