

THE SOCIAL DIMENSION OF THE ROMANIAN ENERGY SYSTEM

MIRON Ramona¹, MĂNDESCU Ionel²

Lucian Blaga University of Sibiu

Abstract

Development towards a more sustainable energy system is today a priority for most governments around the world. In this paper we analyze one of the four dimensions of the energy sector in Romania. Based on but not limited to the four Energy Indicators for Sustainable Development regarding the social dimension published by the IAEA in 2005 and using data published by the Romanian National Institute of Statistics we aimed to reflect the need for (safe) access to basic energy services in the form of commercial energy at affordable rates and put it into a larger political and policy perspective of the present situation in Romania. We provide recommendations regarding further options for policy makers to obtain sustainability including the possibility to increase the use of renewable energy sources. Suggestions for future research are also discussed.

Keywords: *energy, social dimension, energy indicators*

JEL classification: *Q40*

1. Introduction

Today, energy in the context of socio-economic-development and environmental protection is a top priority for most governments around the world and also an important theme for deliberation in different groups and at different levels. We all agree that for the functioning and evolution of our society energy is indispensable. But it can also be one of the most important

¹ *Ph.D. student, Faculty of Economic Sciences, "Lucian Blaga" University, Sibiu, Romania, ramona.miron30@gmail.com*

² *Ph.D. student, Faculty of Economic Sciences, "Lucian Blaga" University, Sibiu, Romania, ionut_mandescu@yahoo.com*

factors that can facilitate the poverty eradication and the change of the production and consumption patterns that proved to be unsustainable and harmful for the natural environment, the society and the economic environment.

Many countries that are now implementing sustainable development objectives regarding the energy sector are facing different challenges. "A common need is the ability to accurately assess current conditions, policy effectiveness and goals for the future." (Vera et al., 2005)

In 2005, the IAEA in cooperation with the United Nation Department of Economic and Social Affairs (UNDESA), the International Energy Agency (IEA), Eurostat and the European Environment Agency (EEA) published a set of Energy Indicators for Sustainable Development (EISD) together with guidelines and methodology sheets. This two-step project began in 1999. In the first phase 1999-2001, a set of 41 Indicators for Sustainable Energy Development was identified. In the second phase 2002-2005 seven countries implemented the original set of indicators, the product of this phase being the final reports of these countries summarized in country case articles published in the Natural Resources Forum and the joint interagency report mentioned above. The present paper is the first of a series of four articles that analyze the energy sector in Romania. It presents the results of a research on the social dimension of the energy sector.

2. The three major dimensions of sustainable development

Sustainable development in any sector addresses three major dimensions: social, economic and environmental. The EISD project identifies four dimensions - the fourth being the institutional one. For this dimension, indicators are still being developed as it is difficult to measure institutional issues and the variables tend to be structural or policy responses to sustainable development needs (IAEA et al., 2007). The institutional dimension also occupies a special place among the four, being able to influence the sustainability of the whole energy system. A sound institutional structure is essential for an efficient and reliable energy system. The indicator set published in 2005 consists of three dimensions: social, economic and environmental.

There are 30 indicators classified in 3 major dimensions, 7 themes and 19 sub-themes. The *social indicators* (SOC 1 to 4) address the themes equity (with three sub-themes: affordability, accessibility and disparity) and health.

The *economic indicators* (ECO 1 to 16) are grouped considering two themes: use & production patterns and security. The use and production patterns include considerations about overall-use, overall productivity, supply efficiency, production, end use, diversification, and prices, and the security theme addresses the issues of imports and strategic fuel stocks. The *environmental indicators* (ENV 1 to 10) are grouped regarding their impact on the atmosphere, the water and the land. The six sub-themes are climate change, air quality, water quality, soil quality, forest and solid waste generation & management (IAEA et al., 2005).

The core set of energy indicators, now called Energy Indicators for Sustainable Development (EISD), has been designed to provide information on current energy related trends in a format that aids decision making at the national level in order to help countries assess effective energy policies for action on sustainable development. According to the Guidelines and Methodologies of EISD (IAEA et al. 2005) the indicators can help to:

- integrate energy into socio-economic programs,
- combine more renewable energy, energy efficiency and advanced energy technologies to meet the growing need for energy services,
- increase the share of renewable energy options,
- reduce the flaring and venting of gas,
- establish domestic programs on energy efficiency,
- improve the functioning and transparency of information in energy markets,
- reduce market distortions and
- assist developing countries in their domestic efforts to provide energy services to all sectors of their populations.

3. The social dimension

Energy is indispensable for almost every human activity. Directly we use it in form of electric energy for lighting, electric and electronic equipment, thermic energy for heating, gas for mobility etc. and indirectly it is incorporated in every good that is produced on this planet. The production, availability and consume patterns of energy have a direct impact on the economy of countries and on the environment. More difficult to define are the social impacts of energy. The availability, price and the characteristics of energy consume have an impact on welfare/ poverty, employment, education, and health.

In rich countries, energy for lighting, heating/cooling and cooking is available through modern energy services and does not affect the health, security and time of the users. It is available and affordable. In contrast, the energy in the poor countries comes from sources that require time (collecting wood for heating and cooking), are expensive (coal, paraffin, kerosene) and/or endanger the human health (inadequate equipment or ventilation). These issues have led to the two major themes of the social dimension: equity and health. Social equity involves the degree of fairness and inclusiveness with which energy resources are distributed, energy systems are made accessible and pricing schemes are formulated to ensure affordability. (Vera et al., 2005) The most ambitious targets aim the availability of free energy (micro-generation, zero energy homes etc.) or at least at a fair price.

Four EISD measure the impact of the energy services on the social well-being:

SOC1 shows the share of households (or population) without electricity or commercial energy, or heavily dependent on non-commercial energy like fuel wood, crop wastes and animal dung (more than 75% of total energy use – although this is an arbitrary benchmark). An alternative definition of *SOC1* is Per capita consumption of non-commercial or traditional energy. The measuring unit of *SOC1* is percentage. The purpose of this indicator is to monitor progress in accessibility and affordability of commercial energy services including electricity percentage of households or population with no access to commercial energy options, or heavily dependent on ‘traditional’ noncommercial energy options, such as wood, crop wastes and animal dung. In most countries, the availability of data on the number of households or share of the population without access to commercial energy or electricity constitutes a limitation of this indicator. (IAEA et al. 2005)

SOC2 shows the share of household income spent on fuel and electricity (on average and for the 20% of the population with the lowest income) or the share of income needed to satisfy minimum household commercial energy requirements for household income group. The measuring unit of *SOC2* is percentage.

The purpose of this indicator is to provide a measure of energy affordability for the average household and for the poorest segment of households. It is important to examine income, wealth and in particular, affordability of modern energy services across the population. If a large percentage of the population has no possibility to meet their needs for

commercial household energy at current energy prices and private income levels there is a need to decrease the burden of expenditure on fuel and electricity in household budgets for the lower-income groups of the population. In developing countries, this is an important key to promote social and economic development. Limited income (affordability) may force households to use traditional fuel and inefficient technologies, and results in disparities of both access and affordability. (Vera et al., 2007)

SOC3 shows the household energy use for each income group and corresponding fuel mix. (Household incomes divided into quintiles (20%)). The measuring unit of SOC 3 is tones of oil equivalent (toe) per year per household, for electricity: kilowatt-hours (kWh) per year and per household, percentage for fuel mix.

The purpose of this indicator is to provide a measure of energy disparity and affordability. The indicator is an assessment of the amount of electricity and fuels used by the population relative to income level and the corresponding fuel mix.

SOC 3 is linked to energy prices and to several indicators of the social dimension, such as shares of households without access to electricity or heavily dependent on non-commercial energy options, shares of income spent on fuel and electricity, etc. The indicator might indirectly reflect a related use of forest resources as fuel wood, which in turn could cause deforestation. (IAEA et al. 2005)

SOC4 or accident fatalities per unit of energy produced by fuel chain shows the number of annual fatalities per energy produced in energy systems and related activities. It is also used to assess the risk to human health derived from energy systems, and in particular by various fuel chains per energy produced.

Although this issue is often ignored, the risks to the population and the rates of occupational injury and mortality from energy related accidents are high. Operating a liquefied natural gas terminal, transporting petroleum, running a coal mine or exploiting a hydropower dam also require the conscious assessment of system-wide resilience in response to human or technical failure in order to minimize the risk of accidents and consequently of fatalities.

Nuclear energy represents a special case in this context in that the scope of an accident could be potentially large, but major efforts exist to actively assess and manage the multidimensional risk in the nuclear industry. In addition, the

use of traditional fuels in many countries is linked to fatalities resulting from fires and smoke inhalation. (IAEA, 2005)

4. The social dimension of the energy sector in Romania

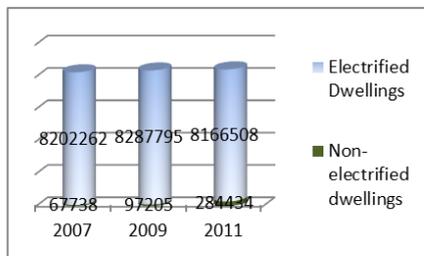
4.1 SOC1: Share of households (or population) without electricity or commercial energy, or heavily dependent on non-commercial energy

In 2007, the Romanian government identified 67.738 households not connected at the public electric system. Through the program “Electrification 2007-2009”, the government aimed to connect them to the national grid. The estimated costs were 479 million Ron. In 2007, no funds were allocated for electrification and in 2008 the allocated sums were blocked through a budget amendment. The budget for 2009 was the only one that allocated money for this project, 13 million Ron, just enough for 11.367 homes.

In 2009, a governmental study showed that 97.805 households in 2284 localities were non-electrified. 62.308 households were located in 1223 localities where the SC Electrica SA energy distributor operates and 35.497 households in 1.061 localities where private distributors operate. In March 2010, the government adopted by memorandum the completion of electrification of the villages without electricity - almost 100.000 - by 2012. In the year 2010, in Romania, 97 localities and about 2.000 hamlets were completely non-electrified. The required investment value amounted to 225 million Euros.

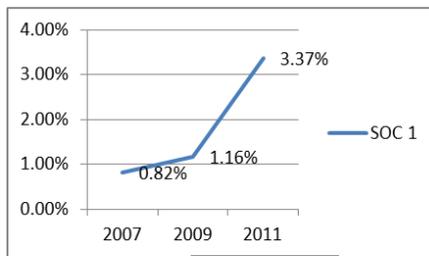
The 2011 census showed that 96.6 percent of the Romanian dwellings were electrified by that time (INSSE, 2012). This means that over 287.000 dwellings are still un-electrified. The inconsistencies between the data from different sources presented above could be explained by the increase of number of dwellings between 2007 and 2011 (from 8270 thousand to 8450 thousand) and by the fact that data used for the 2007 and 2009 studies wasn't as accurate as the 2001 census.

Figure 1: Electrification overview in Romania 2007-2011



Source: Processed by the authors

Fig.2 SOC1 evolution 2007-2011



Source: Processed by Horizontal (Category) Axis

A closer research is needed. Some of the households although not connected to the central electricity network, do benefit from electricity using micro generation technologies such as diesel or gas generators, solar panels or even hydropower. The number of this households is however very small.

Besides electricity, we also looked at the situation of the natural gas distribution and at that of thermal energy. They come as second and third in priority after electricity.

Table 1: Households provided with natural gas

	2000	2002	2004	2006	2008	2010	2011
Number of localities provided with natural gas	542	609	684	774	815	866	876
Simple length of natural gas distribution pipes (km)	21598	24068	25879	28960	31927	34726	35681
Natural gas distributed (million m3)	9194	10018	12734	10332	11049	9639	10270
of which: for household use	3742	3086	2745	2687	2731	2823	2963

Source: Statistical Yearbook of Romania 2009 and (INS, 2012a)

As we can see (from Table 1) almost 900 localities of the total 3180 are connected to a gas distribution system. In Romania, there are around 100 gas distributors. The two biggest gas distributors E.ON GAZ and GDF Suez have together about 2.6 million clients (both households and industrial consumers). The about 2.300 localities not connected to a gas distribution system are villages where firewood or gas-tanks are used for heating and cooking. Considering the high investment cost (both from the gas companies and the consumers) necessary to deliver gas in localities that are not already

connected, an important increase of the number of localities provided with natural gas is not to be expected. As said wood is the first choice of the poor families and some of the other house owners. Regarding the heating: 121 localities of the existing 3180 in Romania are provided with thermal energy through the centralized system (INS, 2009). These are mainly towns most of them located in the eastern part of Romania. Because of the old production and distribution-system – thermal plants, pipes - important energy leaks were generated. A tendency of decentralization has been registered. On the one hand many consumers chose to have their own heating systems and on the other hand, the big thermal plants that served an entire city are now replaced with smaller and more efficient district plants.

4.2 SOC2: Share of household income spent on fuel and electricity

In Table 2 the evolution of the income and energy expenditure of the households in between 2001 and 2010 is shown – Energy Indicator SOC 2.

Table 2: Evolution of SOC 2

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energy expenditure Ron	50.82	69.27	83.89	110.544	134.76	157.85	171.22	212.99	365.92	382.51
Income	521.79	658.51	795.09	1085.79	1212.18	1386.32	1686.7	2131.7	2315.9	2304.28
SOC2	9.73	10.52	10.55	10.18	11.11	11.38	15.5	15.6	15.8	16.6

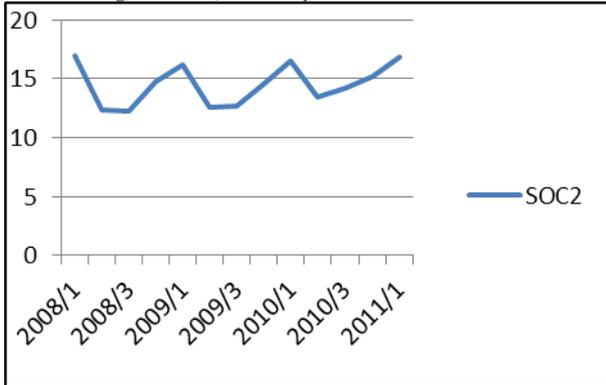
Source: Data from INS processed by the authors

The share of household income spent on fuel and electricity does not seem to be too high. We should however take in account that the Gini index for Romania is increasing: from 28,8 in 2003 to 32 in 2008 and 33,33 in 2010. The first two deciles (the poorest 20%) of the population earned in 2010 up to 349 lei per month that means a household income of up to 1501 lei for the poorest quintile (Table 3). Comparing this income to the medium energy expenditure in 2010, we can see that it represents an important part the income of the first quintile.

Concrete data about the energy expenditure of the poorest 20% of the population were not available. Low-income households that cannot afford to pay for the energy, especially those located in communes and hamlets use

wood for heating and cooking. In many districts of Romania, timber theft is a worrying phenomenon.

Figure 3: Quarterly evolution of SOC2



We used data from the press release of the Romanian National Institute of Statistics to represent the quarterly evolution of the share of household expenditure on housing, water, electricity, heating and other fuels from the first quarter of 2008 to the first quarter of 2011 (Figure 3). The medium SOC2 shows an upward trend. The highest values are as expected in the first trimester due to the increased heating expenditure costs in the winter months and the lowest in the second and

third trimester – spring and summer months when the heating is less used.

Source: Processed by the authors

4.3 SOC3: Household energy use for each income group and corresponding fuel mix

Regarding the household energy use for the different income-groups, the authors were faced with the problem of missing information. With the available data we will try to draw a realistic imagine in the idea of the SOC3 indicator. Table 3 shows the total income by deciles and households.

Table 3: Total income by deciles and households

Decile of total income per person ¹⁾ (Ron):									
Decile 1 up to	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10 over
236	236-349	349-434	434-531	531-629	629-736	736-867	867-1048	1048-1393	1394
Total income (lei, monthly per household)									
1197,39	1501,48	1596,68	1786,93	2006,03	2131,1	2271,19	2611,16	3251,52	4686,94
¹⁾ Income intervals are expressed in the prices of January 2010.									

Source: Statistical Yearbook of Romania 2011

The total energy use of the population in 2008 and 2009 was 8037 toe respectively 8089 toe and the consumption of electricity 894 respectively 948 as shown in the table below. In the last five years, we can see an upward trend in the consumption of the electricity use (Table 5) by the households. The causes of this are, growing number of households and the growing number of electrical household equipment per household.

Table 4: Electricity consumption and prices 2005 -2012

Time	2005	2006	2007	2008	2009	2010	2011	2012
Electricity consumption of households (1 000 toe)	794	860	893	894	948	974	995	-
Electricity prices for household consumers -/kWh	0.06 55	0.07 92	0.08 55	0.08 85	0.08 14	0.08 56	0.08 48	0.0 79

Source: Eurostat

The electricity prices are different for households and legal entities. The prices that the households have to pay also differ taking in concern the medium monthly consume. An upward trend of the electricity prices can although be noticed (Tab. 4).

Table 5: Natural gas consumption and prices 2005 -2012

Time	2005	2006	2007	2008	2009	2010	2011	2012
Residential consumption of natural gas TJ	96,32 4	106,66 3	86,55 8	91,63	89,88 2	92,34 3	97,63 5	-
Gas prices for household consumers -/Gigajoule ron	15.37	23.46	25.79	21.83	20.49	17.34	17.31	17.3 1

Source: Eurostat

Opposite to the situation regarding the electricity consumption, the final energy consumption on natural gas has fluctuated and is now slightly increasing (Tab. 5). Many households, especially those located in communes use wood for heating and cooking. Some of them switched from natural gas to wood because of the increasing prices of gas and the important cost difference between heating with natural gas and heating with firewood. In cities the insulation of buildings (through programs supported by the local authorities) had an important role in reducing the quantity of energy used for heating. Renewable energy systems: solar panels and geothermal heating systems are also taking slowly but firmly ground in Romania. The Romanian government and the local authorities offer money support to the poorest households during the winter months. During the financial and economic crisis, the responsibility of supporting the disadvantaged part of the population was transferred totally to the local authorities. The subventions will decrease in future.

4.4 SOC4: Accident fatalities per energy produced by fuel chain

The use of energy should not damage human health, but rather should improve it by improving living conditions. Yet the production of energy has the potential to cause injury or disease through pollution generation or accidents. A social goal is to reduce or eliminate these negative impacts. The health indicator has the sub-theme of safety, which covers accident fatalities caused by the extraction, conversion, transmission/distribution and use of energy. Oilrigs and, particularly, coalmines are subject to accidents that injure, maim or kill people. Oil refineries and power stations may release emissions into the air that cause lung or respiratory diseases. However, per unit of energy, the toll from energy use in households is often much higher. In households that burn coal and wood for cooking and heating in traditional fireplaces and stoves, there are high levels of respiratory diseases, especially in children. (IAEA, 2005)

In the data provided by the Romanian National Institute of Statistics, the cases of injury caused by the extraction, conversion and transmission/distribution and use of energy are not separately highlighted. That is why we will present a situation of injuries and deaths caused by external causes with the amendment that more than half of the cases are caused by traffic accidents (Tab. 6).

Table 6: Injury and death cases by external causes

New cases of illness, by disease classes, declared by family physicians / thou											
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Injury, poisoning	374	410	434	444	452	444	413	308	314	295	321
Total	13610	15713	15791	15439	16205	16159	15324	14287	14604	15407	16204
Deaths by											
Injury, poisoning and other consequences of external causes / number											
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Male	10963	10958	11216	10819	10356	9818	9732	9343	9908	9510	9280
Female	3449	3312	3293	3304	3106	3223	3037	2914	2892	2675	2752
Total	14412	14270	14509	14123	13462	13041	12769	12257	12800	12185	12032

Source: Statistical Yearbook of Romania 2011

A clearer and more detailed situation is provided by the ambulance services of some districts. A centralization of this data does not exist and the available date could not offer a realistic imagine of this issue for the whole country. In 2008, 64 children died in accidents at home and 111 were hurt. This determined the Health Minister to start in 2009-2010 the campaign "A home without dangers for your child". Because of the campaign, in 2010 the deaths and accidents were reduced to half.

5. Conclusions

The accessibility and affordability indicators are clear markers of progress towards development. Today in Romania 3.6 percent of the dwellings are not electrified. Regarding the affordability, limited income may force households to use traditional fuel and inefficient technologies, and the time needed to find and collect fuel wood is time that cannot be spent cultivating fields or otherwise working. The poor usually have to spend a large share of their income on indispensable energy fuels such as those required for services like cooking and heating. Some of the households do not dispose over the necessary sums. This is the underlying cause of a worrying phenomenon: the timber theft. As we could see, in the last decade, the part of the income spent on energy increased by 7 percentage points.

There also may be disparities in access or affordability between regions and between income groups within a region. Disparities within Romania may result from uneven income distributions (Gini index) and inadequate energy transport and distribution networks. Thermal energy systems with great losses in the cities lead to increased energy costs for the

households connected to the centralized thermal energy distribution system. The consumption of electricity by the households has increased over the past 5 years, while the natural gas consume fluctuated. The electricity and natural gas prices also show an upward trend.

Regarding the health protection of the energy consumers actions have been taken through the campaign “A home without dangers for your child”. A future research based on a survey regarding the perceived affordability, availability and safety of energy could complete this study by shoving the social opinion.

The allocation of bigger sums for programs like “The Green House“, with a focus on the non-electrified localities could be a solution for communes and hamlets without electricity or natural gas – that are faced with deforestation problems.

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