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RURAL DEVELOPMENT THROUGH THE OPTIMIZATION OF THE RENEWABLE ENERGY POTENTIAL

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Abstract

The development strategy of the European Union until the year 2020, Europe 2020, militates for an intelligent economy, sustainable and favorable to inclusion. Following these principles, each Member State establishes its targets and action plans at a national level. On the other hand, the rural zones benefit from diverse forms of renewable energy which can assure their development and energetic autonomy, bringing important advantages to the rural community: the diminishing of energy bills, stimulating new investments in the village, the new jobs possibilities, the decline of poverty, the development of access roads, etc. Starting from these presumptions, the paper makes an analysis of the available renewable energy from the rural environment and an evaluation of the way in which this energy can be exploited by the local community. For this study, an advanced methodology is used, methodology which was developed within the Network of Small Rural Communities for Energetic-neutrality, IEE/07/547/SI2.499065/2008 project, financed through the Intelligent Energy Europe program. The necessary steps are presented for the fulfillment of this analysis which is applied, through exemplification, on the actual case of a rural community, community which benefits especially by biomass as renewable energy source. Quite laborious and requiring a rigorous approach and expertise, the method is extremely useful for the local development strategy. It allows the mobilization of the local community in attracting investments to optimize the potential of renewable energy of the area.

Key words: biomass, energetic autonomy, renewable energy, rural communities

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1. Introduction

The National Rural Development Program for the period of 2014-2020, was realized based on the principles promoted by "Europe 2020" (EC Communication, 2010) and European strategy "Rural development 2014-2020" (EC, 2014).

The program supports the accomplishment of a smart growth through maintaining the technology of agricultural and livestock performance, envisages a durable growth which lays emphasis on the decline of gas emissions with the greenhouse effect, including the advancement of utilizing renewable sources in the rural environment, and the backing of a friendly agriculture, from an environment point of view. In this sense, the development of exploiting the renewable energy source in the rural environment, for the benefit of the local communities, would contribute to the decline of poverty and to creating new occupation possibilities for the work force available in the rural environment and to making the objectives assumed by Romania, including those in the area of renewable energy.

The EU concern about the conspicuous climate changes greatly influenced its policy in the field of energy and led to setting the targets for 2020. The so-called „20-20-20" objective asks for a reduction of greenhouse gas emissions by 20% compared to 1990, supplying 20% of the energy consumption from renewable sources and increasing

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the energetic efficiency by 20%. The EU energy dependence on imports, about 50% of the primary energy consumption comes from imports, is another significant cause for the necessity of switching to alternative energy sources.

The policy of the European Union in the field of renewable energy is relatively recent, and it started by adopting the White Paper in 1997. Over the years, it went from general recommendations to defining certain legally binding objectives, supported by a proper legal framework. The latest Directive concerning the production of energy using renewable sources ensures the necessary regulations for increasing the energy productions using renewable energy sources (EC Communication, 2010; EC Directive, 2009).

The estimations on European level are optimistic, with great chances of achieving the objectives set for 2020, but reaching these objectives cannot be done without the participation of the rural areas.

2. The rural area and the renewable energy sources

The problem of linkage between the rural development and the renewable energy sources was discussed many times (ARE, 2009; Barnes and Floor, 1996; Cherni and Hill, 2009; Kristoferson, 1997; Takase, 1997). Despite the century we live in, there still are rural areas with a weak connectivity to the energy networks or completely isolated, and in such situations, the local production of energy would be a good solution (Havet et al., 2009).

Such systems can be small in size, designed based on the necessities of the area, in places in which the extension of the distribution networks would determine too high of a cost (Kaundinya et al., 2009). At the moment, about 2 billion people of the world, mostly from the countries which are in course of development, do not have access to any forms of modern energy (Alazraque-Cherni, 2008), and their life would be completely different if the local exploitation of the renewable energy sources would commence.

In general, the EU programs for stimulating the use of renewable energy sources and for increasing the energy efficiency, as well as certain flexible financial mechanisms, addressed mainly to the areas with higher population density, to the great cities. A series of large range actions on European level such as Energy Cities, Covenant of Mayors, etc. are also addressed mainly to large cities. However, 56% of the population in the European Union lives in the rural area, over a surface that represents about 91% of the European territory (EC, 2008,), and the rural areas have a diversity of renewable energy sources which could ensure their energy autonomy:

- There is plenty of biomass in the rural area, being used especially as a source of thermal energy. In the case of Romania, the biomass covers about 7% of the primary energy demand and about 50% of the renewable resources potential (Ministry of Economy, 2010);
- The geothermal energy can be exploited in the most common systems for heating (homes, greenhouses, fish culture stations, thermal treatments in the food industry, etc.), but it can also be used in mixed cogeneration systems.
- The solar energy has several applications, being used in the rural area, especially in homes or in isolated houses for producing hot water.
- Life in the rural areas is strictly connected to the existence of a water source, and the hydraulic energy of rivers situated near the villages can be exploited by means of micro hydro plants or turbine engines placed on the rivers, which can be an option for the rural areas that are not connected to the electrical grid;
- The wind energy can also cover the electricity demand in the remote rural areas which are difficult to reach and are non-electrified (Ministry of Economy, 2010).

All these renewable energy sources, largely available in the rural area, can lead to the energetic autonomy of the small rural communities, to reducing the energy bills, increasing investments in the area and creating new jobs (Bhattacharyya, 2006; Gruia, 2011; Karekezi and Kithyoma, 2003; Rourke et al., 2009; Vuckovic, 2014), reducing the greenhouse gas emissions, thus contributing to reaching the EU objectives (Santisirisomboon et al., 2001).

The rural development policy of the European Union for the period 2014-2020 (EC, 2014) is based on three long-term strategic objectives, which are according to the Europe 2020 Strategy, respectively:

- Stimulating the agricultural competitiveness,
- Guaranteeing the sustainable management of the natural resources and fighting the climate changes, as well as
- Encouraging a balanced territorial development of the economy and of the rural communities, creating and maintaining the places of employment.

The rural area has a variety of renewable energy sources which can be used and can ensure energy autonomy on local level. The biomass has a great ratio among these resources. According to the National Renewable Energy Action Plan, the amount of biomass available in Romania is of 318 PJ per year, and it is distributed as follows: „15.5% waste from forest exploitation and firewood, 6.4% wood waste, sawdust and other scrap wood, 7.7% biogas, 7.2% wastes and urban household waste and, most importantly, 63.2% agricultural waste resulting from cereals, corn stalks, vegetal waste, grape vine and others" (Ministry of Economy, 2010).

The biomass can be a good solution for thermal energy as well as for cogeneration. A problem that should be solved is the raw material which should be supplied for a period of time extending over several years.

The projections made for the Renewable Energy Road Map of January 2007 suggested that the use of biomass can be expected to double, to contribute around half of the total effort for reaching the 20% renewable energy target in 2020.

3. Methodology for the energy assessment of a community.

The methodology presented below has been developed within the project *Network of small RURal communities for ENERgetic-neutrality*, IEE/07/547/SI2.499065/2008 (Rurener, 2010, 2011), project financed by the program Intelligent Energy Europe and is a good estimation solution for the energy assessment of a community and a good working tool for drawing up future development plans for the community, especially for achieving the Sustainable Energetic Action Plan.

We must specify that this methodology is quite laborious and it requires collecting a great amount of data, the final result and the precision of the assessment depending on the accuracy of the data gathered. Starting from the recorded data for the energy situation at a certain moment, the method allows us to attain a simple and clear view of different energy sources, of the means of using the energy within the community and, being applied successively in the following years, it allows us to observe the evolution of the community from this point of view.

It offers communities the necessary tool for monitoring the production, the conversion and the consumption of energy, enabling them to adapt any future development plans through measures that should ensure environment protection and a sustainable energy development, according to the European provisions and objectives.

Basically, there are two main categories of data that must be collected: the energy consumption and the energy production on community level. By comparing the data, we can determine the degree of energy autonomy of the community, the extent to which it can produce the energy necessary for its normal functioning. The following paragraphs show the method and the type of information that must be collected.

3.1. Data concerning the community- Identifying the community

The energy assessment of the community requires first of all collecting certain preliminary data, involving:

- Setting the physical borders of the community;
- The community surface;
- The number of inhabitants;
- The sectors existing in the community structure and their size: residential, commercial, public services, industry, transport, agriculture, forests, fishing facilities, others.
- The types of transport systems existing in the community: public, private, individual and their extent – if applicable.

Collecting some of this data is not always a simple task. The physical borders of the community have the role to set the area which is subjected to the analysis, which can be part of a place, a district or a whole municipality. Only after setting the physical borders can we start collecting the data.

3.2. Energy production and consumption in the community

The first step in changing the energy policy on community level requires first of all knowing the way in which the energy is produced, if and how much of it comes from fossil of from renewable sources and which are its distribution grids. This information is relatively easy to find out, the energy suppliers being in small numbers on local level.

Only afterwards can we get to the next step which consists in determining the energy consumption on sectors of activity: industrial, agricultural, residential etc. Knowing the way in which a community uses its energy is an important exercise in improving its use and making it more efficient. Gathering data on the energy consumption is a combination between the detailed and the holistic approaches, according to the opportunity of gathering punctual data or just data on large fields of activity. Making an inventory of the energy consumption is the most difficult part of the methodology presented here. The algorithm presented in the following paragraphs is recommended for collecting this data, but each user of this methodology, according to the specific features of the community and to the goal of the analysis, could choose another type of approach.

3.2.1. Identifying all the suppliers of the community and all the types of energy used in the area.

The great suppliers which offer energy through a grid, as well as the small private suppliers will be identified, and an inventory of the quantity and of the types of energy available for that area will be done, as well as an inventory of the fuels used, fossil or renewable fuels: electricity, coal, charred coal, natural gas, wind energy, hydroelectric energy, biomass, solar energy, geothermal energy, gasoline, Diesel fuel, kerosene, etc.

This evidence will separately record the energy produced within a community and the one that comes from outside its physical borders, from the great regional energy suppliers (Fig. 1).

3.2.2. Calculating the energy produced on the level of the community from renewable energy sources

From the data collected previously, we will separate the quantity of energy from renewable sources which will allow us to determine the percentage of this type of energy from the total amount and in what measure the community valorizes the renewable energy sources existing in the area. This quantity of energy will contribute to setting the indicator of the community energetic autonomy.

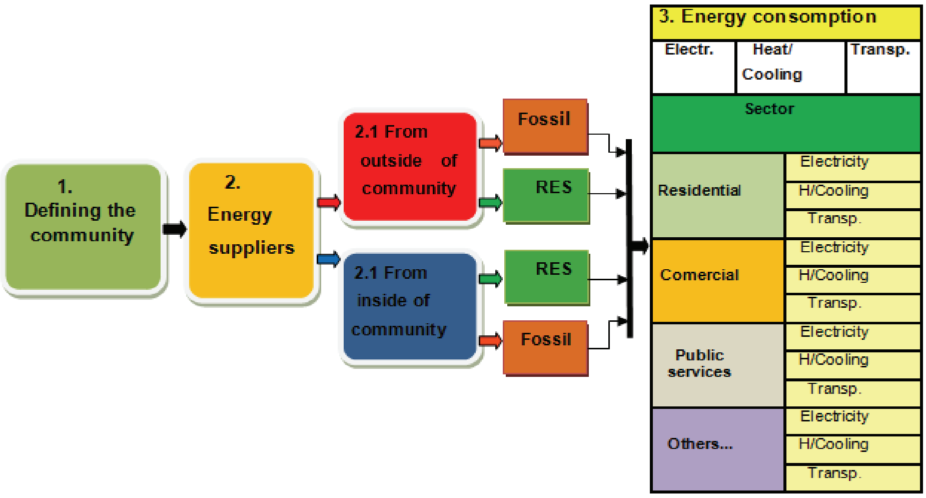

Fig. 1. Data collection chart

The distribution diagram must be drawn up for all the types of energy identified at items 1 and 2, indicating the final consumers, as shown in the chart included in Fig. 1.

On the level of the rural communities, the target of this paper, the energy produced on local level is largely coming from renewable sources. However, the analysis on the possibility of certain conventional energy sources shall not be omitted, for example heating using stoves running on coal.

At this stage there may be certain difficulties in collecting the data, for example if some of the citizens use wood for heating it is necessary to take into consideration the quantity of raw material procured by the suppliers (which can be from outside the community) as well as the one procured by the citizens themselves by individually cutting down trees. In order to solve this problem as accurately as possible, citizen surveys can be done and virtually the statistics offer data on the average amount of wood fuel necessary per month for private houses, reported to the average temperature of the winter months.

3.2.3. Calculating the energy consumption on sectors of activity and types of energy

An important item in building the future action plans for the community is identifying the way of using the energy and the final consumers. Thus, we will know the areas in which the community can work in order to increase the energy efficiency or to cover the consumption demand exclusively from local sources. According to the specific features of the community, the energy consumption is registered for each of the following sectors: residential, commercial, public, small local industry, agriculture, animal husbandry, fishing, forests, etc. In case data is available on the energy consumption in certain sub-sectors, they can be underlined and detailed by creating some more cases in the Tables.

We have analyzed the following objectives:

• The electric energy – meaning the total electric energy consumption on local level, distributed on different sectors of activity, no matter the source of production: renewable or not, locally produced or not.

❖ The energy produced from the two types of sources will be recorded separately. We will also include here the quantity of energy produced individually, using photovoltaic panels, wind turbines, etc.

• The fossil fuels – including here the fuels used for producing thermal energy such as pit gas, coal, crude oil, as well as the ones used for transport: Diesel fuel, gasoline, kerosene, LPG, etc.

❖ When calculating the energy consumption for transport, we must take into consideration the public transport system, the commercial and the private systems which run on local level. In this case, the community will be completely assessed from the point of view of energy. Or, we may record only the amount of fossil fuel used for producing electric and thermal energy, the transport being considered separately, based on the same methodology but adapting it to the requirements of this type of assessment.

❖ In this category, biofuels will be considered separately, including the ones produced on local level (if applicable), for which separate lines will be introduced in the table.

All this information will be introduced in the first part of the energy balance of the community, as it is presented in Figs. 2 - 3. This step of the methodology is the most difficult and we can collect the necessary information from different sources like: the owner or the manager of the electricity grids, national, regional or local energy centers, independent energy producers, fuel companies, end users, departments of the city halls, etc. In some cases, when a part of the data can't be obtained in another manner, a survey can be conducted directly among the citizens of the area. As we can see in Fig. 3, we also take into consideration the efficiency of the energy production equipment which, in fact, determines the amount of energy that gets to the consumer. In the same way we collect information concerning the local energy production, which can be from renewable or conventional sources. We also distribute this amount of energy on types of consumers. The report between the local energy production and the total energy consumption within the community allows us to calculate the degree of energy autonomy of this community (Fig. 4).

3.2.4. Setting the conversion factors for different types of energy sources, according to the calorific value / the energy content and the unit of measure

Within this methodology, attention must be given to the units in which the energy is expressed. The production capacity of power plants is usually expressed in units of energy (for example MWh).

ENERGY BALANCE	Community name							
	Country				Template instructions			
	Year				All yellow field must be filled in with data			
Energy Source Input Data	Population							
Fuel type:	Energy (amount)			Total	Units (eg. GWh, tn, litres)	Conversion (Heat Content)	Energy	
	Electricity	Heat	Transportation					
Energy Consumption								
Electricity Consumption 1				0.00	GWh	3,600.00	-	GJ/y
Electricity Consumption 2				0.00			-	
Electricity consumed in sites off the grid (eg. photovoltaïc, wind				0.00			-	
Coal (eg. Lignite, Pet Coke, etc)				0.00			-	
Heavy oil				0.00			-	
Light oil				0.00			-	
Diesel				0.00	lt			GJ/y
Petrol								
LPG				0.00			-	
Gasoline								
Kerosane				0.00			-	
Sub Total Petroleum Products							-	GJ/y
Natural gas				-			-	
Wood and biomass for heating (all types)				-	m3	0.03	-	
Combined Heat and Power (electricity)				-			-	
District heating from waste				-			-	
District heating from biomass				-			-	
District heating from fossil fuels				-			-	
Sub total District heating				-			-	
Solar thermal (heating)				-			-	
Other fuels (specify)				-			-	
Total Energy Consumption							-	GJ/y
Population							#DIV/0!	GJ/yr/i

Fig. 2. Energy consumption of the community

K	L	M	N	O	P	Q	R	S	T	U	V	W	X
					Sector								
% of Total Energy	Efficiency	End Use		% of Total Final Energy	Residential	Commercial	Public Services	Industry	Transport	Agriculture	Forestry	Fishing	Other use

Fig. 3. Distribution of the consumption on types of users

Local Energy Production								
Energy produced from Renewable fuels								
Wind power				0.00			-	
Hydro power				-			-	
Wave power				-			-	
Solid Biomass Plants and boilers					m3	0.03	-	GJ/y
Biomass (mainly wood) used on the territory for individual heating				-	m3	0.03	-	
Biogas				-			-	
Sub Total Energy from Biomass				-			-	
Biomass imported (-) from the territory for energy purposes				-			-	
Biomass exported (+) from the territory for energy purposes				-			-	
Energy from Biomass								GJ/y
Landfill gas				-			-	
Waste Heat and power Recovery				-			-	
Geothermal energy				-			-	
Solar thermal				-			-	
Solar PV				-			-	
Other Renewable (please specify)				-			-	
Total RES production in the Community								
Energy produced from non Renewable fuels								
Fossil and nuclear fuels				-			-	
Other				-			-	
Total non RES production							-	
Total Energy Production							-	
Population	0						#DIV/0!	
Autonomy rate				0.00%				

Fig. 4. The local energy production

However, the materials used in the power plants (coal, petrol, etc) are often reported using physical units of measure, for example tons of coal or liters of petrol. Thus, in order to be able to use this data, it is necessary to turn them into the same unit of energy, for example Gj.

The methodology presented here has the advantage of allowing for multiple types of analysis, among which we can mention: determining the report between the total quantity of energy consumed and the one coming from renewable sources – we can thus determine how "green" that community is; the ratio of a certain type of energy in the total consumption, the proportion of a certain type of fuel, or of certain economic sector etc. Henceforth we can perform sustainable community development plans.

4. Case study – analysis of a rural community

As the purpose of this paper is to analyse the extent to which the rural environment can ensure energy autonomy with all its advantages, and at the same time to contribute to achieving the targets set by the European Union program, a case study is required. We have chosen Tasca area, located in Neamt County, Romania, as the subject for applying the methodology presented above for calculating the energy autonomy and for drawing conclusions in this direction. Tasca area is situated in a hilly area covered with forests and meadows, along Bicaz River and, from an administrative point of view, including the following villages: Tasca, Hamzoaia, Secu, Neagra and Ticos Florea (Fig. 5). The area has two schools, a police station, a human clinic and a veterinary one, a pharmacy and a public park with a playground for children. At the moment of this study, the area had 2715 inhabitants, 1035 houses. Its surface of 9.563 ha was distributed as follows: 115 ha arable, 1418 ha meadows, 1083 ha grazing ground, 6609 ha forests, 338 ha for other uses.

The main occupations of the inhabitants are in the field of agriculture, raising animals, processing wood, rural tourism and trade, but there are also economic units in the field of construction materials, one of the greatest cement factories in the country being situated in this area. From the geographical point of view, Tasca area is situated at the intersection of the 45°55" parallel north with the 26°27" meridian east and is situated about 600m above sea level, from a climatic point of view being included in the mountain area climate of the Oriental Carpathians. The height of the mountain peaks between 1100 and 1500 m situates it in the medium height mountain climatic area.

The annual average temperature in the lower part of the valley is around 8°C; the coldest month is January, when the average temperature is lower, under -4°C. In the month of July there is the highest thermal value, the average being over 19°C.

Choosing Tasca community for this case study is motivated by the fact that one biomass power plant, co-financed by the Environment Protection Agency Denmark, Neamt County Council and Tasca Local Council, was built here. Moreover, a small photovoltaic system for street lighting was built in this area, system placed within a playground. The thermal power station using sawdust was designed to supply thermal energy for 40% of the inhabitants of Tasca village but, at the date when this study was made, it supplied thermal energy for 132 subscribers, of which: 125 population, 1 economic agent and 6 public institution buildings.

The characteristics of this power plant are presented in Table 1. Other technical characteristics of the power plant are:

- Pressure in the installation - 2 bar;
- Tank capacity - 7600 liters;
- Temperature in the furnace - 700 ^{0} C;
- Exit temperature of the water 90 ^{0} C;
- η=87%.

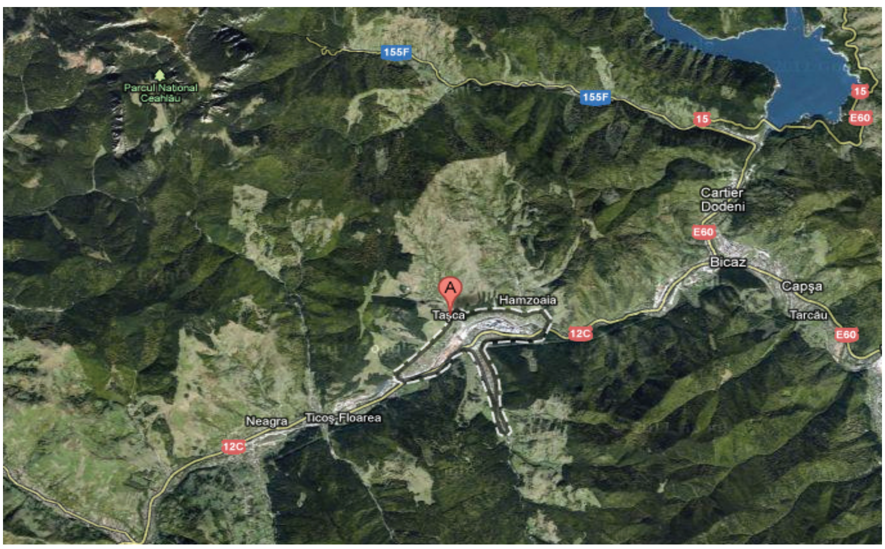

Fig. 5. Position of Tasca area and of its villages (from Google maps)

We must notice that, although the power plant was designed to burn 2500 tons of fuel per year, at the date when this study was made, in November 2011, it used only 1300 tons/year and ensured less than 25% of the thermal energy needs of the village. The reasons for this are connected especially to the reduction of the quantity of sawdust that could be supplied.

When the power plant was designed, the sawdust was for free or it was very cheap, and the construction of the power plant also solved the problem of storing it (Figs. 6, 7). Later on, it was no longer supplied for free, and its price increased continuously. At present, it is purchased for a price that varies between 22-35 euro/ton, which is a high price for the local administration.

The general data regarding the community being already presented, we briefly present below the essential information concerning the energy and the hypotheses that were used in order to apply the methodology for determining the degree of energy autonomy of the community.

Fig. 6. The sawdust warehouse

4.1. Identifying all the suppliers and all the types of energy used in the community

The electricity is supplied through the grid from the local supplier and the average consumption of the community is 1.587 GWh/year. In order to ensure the public lighting in the park area, poles with photovoltaic panels were installed, which produce a total of 2.044 MWh/year.

The thermal energy is supplied from several sources:

- from the local thermal power plant which uses the sawdust in the area;
- from the regional grid for the distribution of natural gas;
- from wood and agricultural waste, a great proportion of the local people using traditional stoves and in some cases, in the new houses built during the last few years, central heating units using biomass.

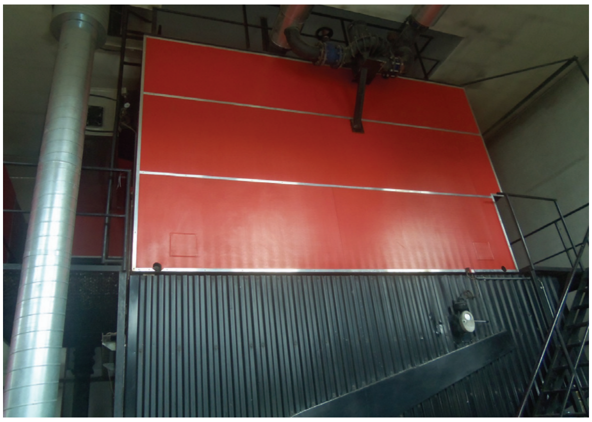

Fig. 7. The power plant tank

In order to calculate the energy produced using natural gas, we considered population surveys which were correlated with the statistical data concerning the residential consumption on the level of Neamt County. On the level of Tasca community, the calorific power over the average value taken into consideration (according to the data supplied by E-ON) is of 10.540 kWh/m^3, reaching a total of 1.0818 GWh thermal energy per year.

4.2. Calculating the energy produced on community level using renewable energy sources

The energy production on community level refers first of all to the thermal energy, and it is represented by the biomass power plant and the individual heating systems.

Table 1. Characteristics of the biomass plant

Subject	*Unit*	*Data*
Heat output capacity of the biomass boiler system	MW	2.5
Fuel		Mostly sawdust, woodchips and bark
Water content of biomass fuel	%	Up to 50
Maximum quantity of wood waste combusted (sawdust)	tons/year	2500
Heat calorific value of wet sawdust	GJ/ton	8.27
Typical emission factor - oil	kg CO_2/GJ fuel used (based on lower calorific values)	77.30
Efficiency of flue gas cleaning system (multi cyclone and bag filter unit) at 10% dry oxygen.	mg/Nm3	CO emissions < 250 NOx emissions < 500 Dust emissions < 40
CO_2 emission reduction generated by the demonstration project in Tasca	tons/year	Approx. 1600

At this point, the analysis can become more complicated if we take into consideration the amount of sawdust locally produced and the amount purchased from other sources. The individual heating systems can also be divided into central heating systems with certified biomass and the classical stoves.

As the purpose of this research is to exemplify the way in which a rural community can become energetically autonomous by using wisely the resources existing in the area, we took into consideration the power plant as working according to the initial project, thus ensuring thermal energy for 40% of the population in Tasca village (within the area with the same name), which means hot water and heat during the winter, and during the summer only hot water. Taking into consideration the variations of the consumption necessary during the two seasons, a quantity of thermal energy amounting to 11,167 GWh/year resulted.

As to the private homes with classical individual heating systems, the quantity of wood necessary is between 10-12 m^3 per year. As the average annual temperature in Tasca area is quite low, we adopted the value of 12 m^3 of biomass per year. During the first stage of the study, we also considered that all the individual homes use certified biomass. This is a problem which has not been thoroughly solved on national level, although some regulations were elaborated (MO 1341, 2012; MO 85, 2013). Having all the necessary data, with the hypotheses listed above, we can now calculate the degree of energetic autonomy of this community.

In the two charts from Figs. 8, 9 we can see that the numbers without decimals are taken but at the conversion to GJ/year, the exact quantity of used and produced energy appears. In our analysis we did not take into consideration the activity of the cement factory situated in the neighborhood, as the local administration could not interfere with its consumption. The analysis aimed at the energetic autonomy of the inhabitants and of the public administration buildings within the community.

It is important to underline that the construction of the biomass power plant and the photovoltaic street lighting system gave rise to 9 temporary jobs and 1 permanent full job.

4.3. Analysis of the case study

According to the hypotheses presented before, the degree of energy autonomy on community level is 66.80 %, most of it being achieved through the use of biomass (Figs. 8, 9).

We thus proved that a rural community can achieve a high degree of energetic autonomy by using the natural resources. The exploitation of renewable energy sources has led to the creation of some temporary and permanent jobs in a different domain than the traditional ones for rural area. Of course, a few problems should be solved first:

- the power plant should work according to the parameters listed in the project;
- the amount of sawdust necessary for the power plant should be supplied;
- the quality of the biomass for the fuel used in the private homes should be certified;
- the classical stoves should be replaced, as much as possible, with high performance heating systems; we should notice that certain classical heating systems, for example certain terracotta stoves which are properly built and used can have quite high energetic efficiency, up to 82%, but there are also heating systems with low efficiency: between 35% (the stoves without a hearth) and 75% (the stoves with a hearth) (Zaharia, 2012) which should be replaced.

In fact, according to the Master Plan for Biomass (document issued in 2010 by the Ministry of Economy - Romania, NL Agency – Netherlands and ENERO – Romania) it is estimated that, until 2020 the main contribution of biomass will be represented by the heating using traditional stoves in the rural area. For this reason, it is recommended that measures should be taken allowing the use of high-performance individual heating systems, with high energetic efficiency by at least 85%. In the present day, systems based on pallets which have an efficiency of 94-95% have been developed and any new construction of a power-station should utilize the latest technologies in the field.

The use of central heating installations leads to increased energetic efficiency, also ensuring hot water, increasing the comfort of the population and reducing the differences between the rural and the urban areas. Starting from the results of the study, a community can better manage its energy consumption and can achieve and orient its strategy for sustainable development in the desired direction.

As to Tasca community, in order to complete the energy need, a plan was initiated concerning the installation of a wind farm placed on Damoc hill, on the boundary of several communities. The wind farm would ensure the energy demand for all the public administration buildings and the street lighting in all the communities which are part of the project.

The study carried out also considered the fuel necessary for transportation. Ensuring the bio-fuel on local level, or the electricity for all the means of transport, are problems which cannot be solved during the next years, and not on local level.

In case the energy necessary for transportation is excluded from the previous calculations, the level of the energy autonomy is of 88.03%. In the situation in which only 10% of the individual stoves (of the new houses) fill into the category of biomass central heating systems, the community energy autonomy is reduced to 40.89%. This fact reveals how important it is to apply the correct technology for the use of the biomass.

ENERGETIC AUTONOMY BALACE				
	Community name	TASCA		
	Country	Romania		Template instructions
	Year	2011		All yellow field must be filled in with data
Energy Source Input Data	Population	2715		

Fuel type:	Energy (amound) Electricity	Heat	Transportation	Total	Units (eg. GWh, tn, litres)	Conversion (Heat Content)	Energy	
Energy Consumption								
Electricity Consumption 1	1.59			1.59	GWh	3,600.00	5,713	GJ/y
Electricity Consumption 2				0.00			-	
Electricity consumed in sites off the grid (eg. photovoltaïc, wind power...)	0.00			0.00	GWh	3,600.00	7	GJ/y
Coal (eg. Lignite, Pet Coke, etc)				0.00			-	
Heavy oil				0.00			-	
Light oil				0.00			-	
Diesel			412000.00	412000.00	lt	0.03579	14,743	GJ/y
Petrol				0.00	lt	0.03579	-	GJ/y
LPG				0.00			-	
Gasoline			338000.00	338000.00	lt	0.03185	10,764	GJ/y
Kerosane				0.00			-	
Sub Total Petroleum Products			750,000	750,000			25,507	GJ/y
Natural gas		1		1	GWh	3,600.000	3,894	
Wood and biomass for heating (all types)		20		20	GWh	3,600.00	70,650	
Combined Heat and Power (electricity)				-			-	
District heating from waste				-			-	
District heating from biomass				-			-	
District heating from fossil fuels				-			-	
Sub total District heating				-			-	
Solar thermal (heating)				-			-	
Other fuels (specify)				-			-	
Total Energy Consumption				750,022			105,772	GJ/y
Population	2,715						38.958	GJ/yr

Fig. 8. Energy consumption of the Tasca community

Local Energy Production								
Energy produced from Renewable fuels								
Wind power				0.00			-	GJ/y
Hydro power				-			-	
Wave power				-			-	
Solid Biomass Plants and boilers		11		11	GWh	3,600.00	40,201	
Biomass (mainly wood) used on the territory for individual heating		8		8	GWh	3,600.00	30,449	
Biogas		-		-			-	
Sub Total Energy from Biomass				20	GWh	3,600.00	70,650	
Biomass imported (-) from the territory for energy purposes				-			-	
Biomass exported (+) from the territory for energy purposes				-			-	
Energy from Biomass				20	GWh	3,600.00	70,650	
Landfill gas				-			-	
Waste Heat and power Recovery				-			-	
Geothermal energy				-			-	
Solar thermal				-			-	
Solar PV	0			0	GWh	3,600.00	7	
Other Renewable (please specify)				-			-	
Total RES production in the Community							70,657	
Energy produced from non Renewable fuels								
Fossil and nuclear fuels				-			-	
Other				-			-	
Total non RES production							-	GJ/y
Total Energy Production							70,657	GJ/y
Population	2,715						0.19	GJ/y
Autonomy rate				66.80%				

Fig. 9. Calculation of autonomy rate of Tasca vilage

5. Conclusions

The methodology presented here, developed within the project Network of small RURal communities for ENERgetic-neutrality, IEE/07/547/SI2.499065 (Rurener, 2011), allows us to assess the energy consumption necessary within a community, no matter its size, and it does a radiography of the community in question from the point of view of energy. The results are a good starting point for drawing up the sustainable development strategy for any municipality.

The presented case study confirms the fact that intelligent use of the resources which nature offers us, can assure a high degree of energetic autonomy of the small communities, like the ones in the rural area, with important benefits in terms of environmental protection, the reduction of gas emissions with the greenhouse effect and, by default, the fight against climatic changes.

Another important conclusion which results from this analysis, advises that the exploitation of renewable resources be made through the usage of last generation technologies, with high energetic efficiencies.

In fact, the national policies regarding the renewable energy resources should be headed so that the number of green certificates for 1 MW be granted also by the facts which relate to energy efficiency, higher investments costs having a faster absorption rate. It is also necessary to specify that according to the statements of specialists in the field (Bizlawer, 2014), in the period 2014-2020, the only renewable resources for which Romania will receive EU funding will be biomass and small hydropower, the targets for wind and solar energy being accomplished.

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