THE AGRICULTURAL AND FORESTRY SOLID BIOMASS POTENTIAL AT NATIONAL, REGIONAL AND ON AREAS LEVEL

POTENȚIALULUI DE RESURSE DE BIOMASĂ SOLIDĂ AGRICOLĂ ŞI FORESTIERĂ LA NIVEL NAȚIONAL, REGIONAL SI ZONAL

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Abstract: *In this paper it was pursued the identification and the presentation of the agricultural and forestry biomass potential from Romania, referring to the measures taken in the EU states, for the pollution reduction and the identification of new regenerative energy sources.*

Rezumat: *În această lucrare s-a urmărit identificarea şi prezentarea potențialului de biomasă agricolă şi forestieră din România, referitor la măsurile luate în statele UE pentru reducerea poluării şi identificarea de noi surse de energie regenerabilă*

Key words**:** *biomass, resources, agricultural, forestry, potential*
Cuvinte cheie: *biomasă, resurse, agricol, forestiere, potențial*

INTRODUCTION

The regenerative energy is referring to energy forms, produced by the energetic transfer of the resulted energy from regenerative natural processes. This way, the solar energy, the winds energy, the flowing waters energy, the biological energy and the geothermal heat can be captured using different procedures. The non-regenerative energy sources include the nuclear energy and also the energy generated by burning fossil fuels, such as oil, coal and natural gases. Between the regenerative energy sources there are the aeolian energy, the water energy: hydraulic and tides energy, geothermic energy, biomass derivate energy: biodiesel, bio-ethanol, biogas. All this energy forms are capitalized by serving to electric current generation, warm water generation, etc. Usage of conventional energy sources releases in atmosphere huge quantities of green house effect gases, of which the most important is the carbon dioxide (CO_2). Excessive usage of non-regenerative resources has negative consequences on the environment, such as accentuating the green house effect, acid rains and increment of atmospheric dust concentration.

The global warming, determined by green house effect amplification, is the most visible sign of the climatic changes which are happening at the entire globe level. The increment of the extreme meteorological phenomena frequency (excessive heat, floods, and storms), glaciers melting and rising of the oceans level represent serious threats to the survival of many plants and animals species, and also to the humans' health and well being.

The air and water quality alteration has lead to population's health deterioration, being recorded an amplification of cardio-respiratory affections which lead to alarming levels of morbidity and mortality at world level together with the thermal stress produced by the heat waves and rising of infectious diseases spreading from the tropical areas to other locations because of the climate warming. The technologies based on regenerative energy have the great advantage that are using exhaustless resources, very little polluting, with an insignificant contribution to the climatic changes. Plus, their usage is reducing the dependence of conventional resources which will be depleted in a future not far away.

Even if in present the clean energy is more expensive (because of the high investments costs and of the more modest performances), lately there were recorded major technological

leaps, which give us the hope that in a close future this will represent a viable alternative to the traditional sources.

REGENERATIVE ENERGY SOURCES IN ROMANIA

The primary energy sources, named generally regenerative, are those sources from the natural environment, available in quantities practically unlimited, or which are regenerating by natural processes, in a much faster rhythm then the one in which are consumed. There are distinguishing the following main categories of regenerative energy sources: solar, hydraulic, aeolian, geothermal, of tides, of waves, biomass. These regenerative energy sources are presented as viable alternatives for covering the energetic necessities of the humanity in the conditions of depleting the fossil fuels reserves. The use of regenerative energy resources presents the following main advantages: it helps the exhaustible reserves preservation, it reduce the impact on the environment produced by the energetic sector by reducing the green house effect gases emissions.

When we refer to the usage of regenerative energy sources in Romania, we actually talk about hydro-energy, the other sources being weak represented. A very little number of projects about using the aeolian, solar, biomass and geothermal energy were implemented in Romania, most of them with success, but the volume of new investments in this sector is reduced. The RES quote (regenerative energy sources) in the total consume of primary energy was estimated to 10,1% in 2000 and there were established objectives for 2010 (11%) and 2015 (11,2%) in the national strategy regarding the capitalization of the regenerative energy sources.

Emissions of green house effect gases

In the case of maintaining the current situation, by using the regenerative energy would result in annual reductions of 430-600 million tons (Mt) of CO_2 in 2020. At a weight of the regenerative energy of 20%, the equivalent number would be of 600-900 Mt. The climatic warming is directly linked to the increment of GHEG quantities from atmosphere and can lead to serious consequences for the planet. The GHEG emissions are owed to transportations in proportion of 30%, industry: 26%, followed by animal husbandry: 22% and by agriculture: 22% (figure 1).

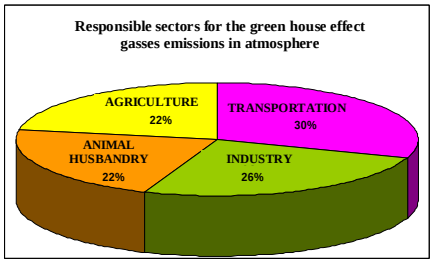

Figure 1

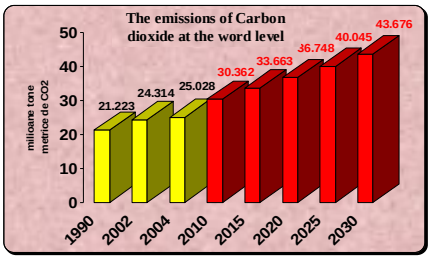

Figure 2

From the analysis of the histogram for carbon dioxide emissions at world's level (figure 2) can be remarked a constant rising of their level of approx. 3000 million metric tons CO_2 at every five years. This way there is recorded a duplication of the carbon dioxide emissions between 1990-2030. The CO_2 emissions at world's level (million metric tons of carbon dioxide), are presented in figure 3 (source: Energy Information Administration, International Energy Annual, System for the Analysis of Global Energy Market).

The energetic sector represents a pollution source as a repercussion of the extraction activities, processing and burning of fossil fuels, this activities being responsible for evacuating in atmosphere of: 90% of the SO_2 emissions; 88% of the NOx and CO_2 emissions; 72% of the suspension powders quantity (figure 3). At energy production by burning fossil fuels there are eliminating polluting substances with a negative impact on the environment: carbon oxides (CO and CO_2), sulphur oxides (SO_2 and SO_3), azote oxides (NOx and N_2O), hydrocarbons, dust, etc. According to Eurostat- Energy Statistics for Romania, during 1990-2006 the CO_2 emissions, the

main responsible for accentuating the green house effect, have recorded a drop from 167 Mt to 98 Mt (figure 4). Source: Energy Statistics for Romania.

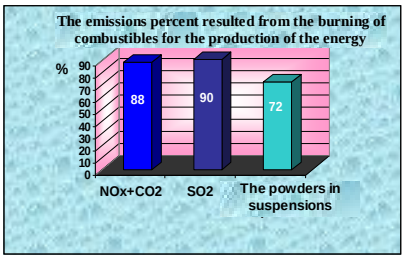

Figure 3

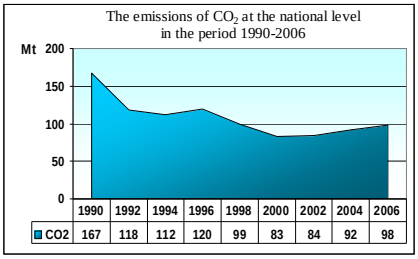

Figure 4

The solutions for green house effect emissions reduction are: limitation of energy production by burning fossil fuels and promoting of energy production from regenerative resources and limitation of green house effect gases emissions in the main productive sectors: industry, transportation, agriculture, energy.

Orientation towards regenerative energy sources

The biggest part of regenerative energy from Romania is produced currently by the hydro-energetic sector. The solar energy represents the safest energy source. On Romania's territory, on a square meter surface is possible to capture an annual energy quantity which ranges from 900 to 1450 kWh. The aeolian energy is more expensive than the solar energy. The biomass reserves are especially wood waste, agricultural waste, garbage and energetic cultures. Production of biomass represents a significant opportunity for rural development. In present, in the European Union 4% of the energy necessary is assured by biomass. At European Union level is estimated the creation of approx. 300.000 working places in the rural environment, by exploiting the biomass.

The European Union states have taken a series of measures for encouraging the citizens and companies to invest in regenerative energies. The solar energy is used and subsidized in Great Britain, partially in Spain too, Greece and Sweden. In Germany, the aeolian energy is one of the main sources of regenerative energy. The bio fuel obtained by rape, soy or sun flower oil can be used both to the machines from agriculture and to the auto-vehicles. The usage of bio fuels is essential, especially in the conditions in which the green house effect gases emission has doubled in Romania from 1999-2000 until 2004. Introducing the bio fuel would be benefic for the common carrier too. Three types of fuels contribute to energy generation from biomass: solid biomass, biogas and biodegrading fraction from the solid urban waste. There is more information about solid biomass and biogas. The energy from biomass constitutes 2% of the total energy consume of EU. The total biomass has risen with 18% in 2002, 13% in 2003, 19% in 2004 and 23% in 2005. It is clear that the progresses were accelerated in a significant way in the last years. If the rising rate from 2004 could be maintained until 2010, the total biomass weight could get to 167 TWh, which corresponds to the needs for achieving objective of 21% for the energy originated from regenerative sources. But the Holland contribution in 2005 in what concerns the biomass risks only to be a success on a short term. In figure 5 is presented the historical evolution of energy production from solid biomass, biogas and solid urban waste in the EU-25 member states from 1990 to 2004 and extrapolation until 2010, looking to an annual rate of rising of 19%.

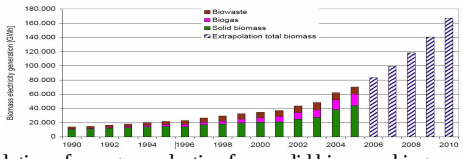

Figure 5 – The historical evolution of energy production from solid biomass, biogas and solid urban waste in the EU-25 member states from 1990 to 2004 and extrapolation until 2010, looking to an annual rate of rising of 19% (Source: Eurostat until 2004. The prefigured numbers for year of 2005 are originated from The International Agency for Energy – IAE and from the member states)

The regenerative energy sources distribution on Romania's geographic regions

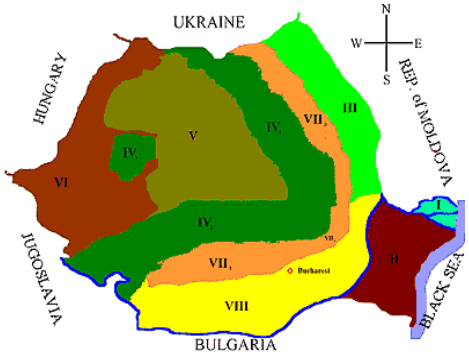

Figure 6 - The disposal of regenerative energy sources on the Romania's territory
I. Delta Dunarii–solar energy; II. Dobrogea – solar energy, aeolian energy; III. Moldova – field and platter: micro-hydro, aeolian energy, biomass; IV. Carpathians (IV1 – East Carpathians; IV2 – South Carpathians; IV3 – West Carpathians) - increased potential in biomass, micro-hydro; V. Transylvania Platter – increased potential for micro-hydro; VI. Câmpia de Vest – increased potential for geothermic energy; VII. Sub-Carpathians(VII1 - Getic Sub-Carpathians; VII2 – Curve Sub-Carpathians; VII3 - Moldavia Sub-Carpathians – increased potential for biomass, micro-hydro; VIII. South Field - biomass, geothermic energy, solar energy.

Romania's potential in the green energy production domain

Source	Percent
Solar energy	12 %
Aeolian energy	17 %
Hydro energy of which under 10 MW- micro-hydropower plant	4 %
Biomass and biogas	65 %
Geothermal energy	2 %

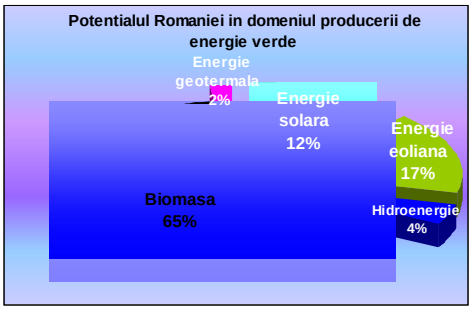

Figure 7

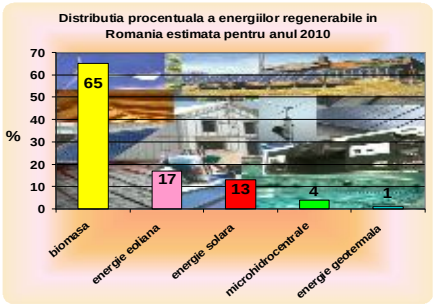

Figure 8

The estimations for year 2010 (figure 8) indicate the maintaining on the first place of the biomass obtained energy, followed by aeolian energy. The solar energy will rise with a percent, and the geothermal energy will decrease with a percent in the next three years.

The usage of alternative energy forms looks to be an important solution at European and at world's level, both for the environment and for the resources protection too. This is the reason why it is already a consistent part of the future European strategy in the energy domain. Romania has too, to make efforts in this sense and to carry out come clear engagements in the regenerative energies domain. This way, our country has engaged itself that until year 2010,

the electric energy originated by green sources to represent 33% of the national consume, for after that, in year 2015, the percent to rise to 35%, and in year 2020 to achieve 38%.

The biomass is the main rural fuel, being used especially for heating the space and the water, and also for cooking. The maximum exploitation of the biomass potential presumes the usage in totality of the residues from the forestry exploitations, of sawdust and other wooden scraps, of the agricultural waste resulted from cereals or corn stems, vegetal residues from vineyards and also urban waste and residues.

On medium and long term, the increment of the biomass can be assured from plantations (trees and bushes with reduced growing period) on degraded surfaces, disaffected agricultural terrains or brought out from the agricultural circuit. The biomass potential in Romania was estimated at 7.594.000 tons/year, which represents almost 19% of the total consumption of primary resources at year 2006'th level. The biomass (figure 9) includes:

- forestry waste and fire wood = 1.175.000 t;
- sawdust and other wood scraps = 487.000 t;
- agricultural waste = 4.799.000 t;
- biogas = 588.000 t;
- urban garbage = 545.000 t.

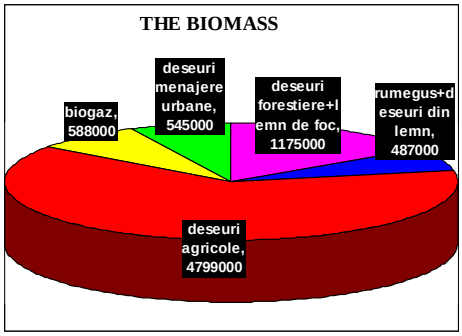

Figure 9

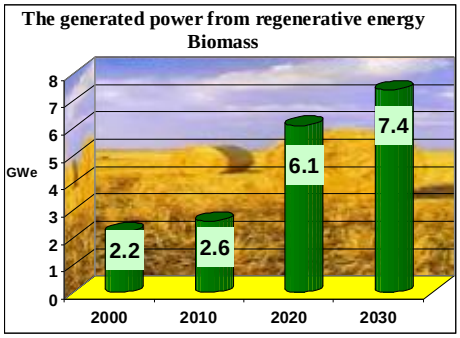

Figure 10

Source: Arrested Development-Energy Efficiency and Renewable Energy in the Balkans

Solid biomass

The energy from biomass is energy obtained by burning of all types of products derivate from plants: ligneous mass, culture plants, forestry residues etc. Although the energetic performance rating for biomass is more reduced than for coal (17,5-20 Gj/tone, comparing to 20-30 Gj/tone), the resulted residues after burning the biomass are much more reduces quantitative, don't have in composition toxic components or contaminated and can be used as fertilizers in agriculture

The energy originated from solid biomass is generated based on burning the forestry and agricultural products, and also of thermal power stations residues. In the case of total biomass, the development of solid biomass exploitation was significant accelerated in 2004 and 2005. The annual growing rates from the last years have risen in the EU-25 member states to 20% in 2002, 13% in 2003 and 25% in 2004 and it will continuously rise until 2030 (figure 10).

The historical evolution of the energy produced from solid biomass (excepting solid urban waste) in the EU-25 member states from 1990 to 2005 is presented in figure 11. Between 2002 and 2004, a supplementary quantity of 10 TWh was added to the electric network. The most important producing states of biomass energy are Finland and Sweden, followed by Germany, Spain, Great Britain, Denmark, Austria and Holland.

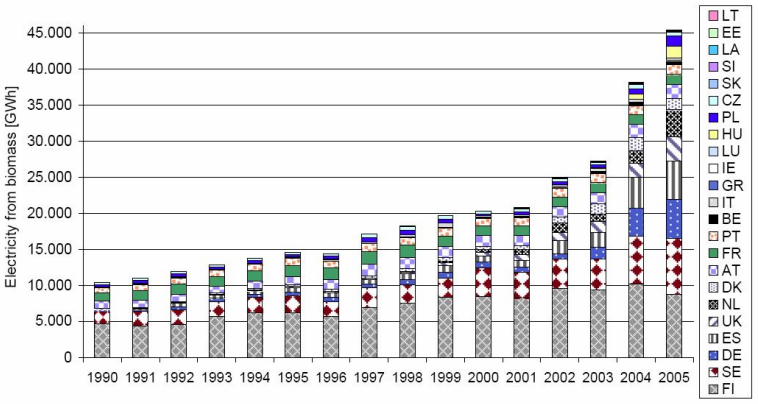

Figure 11 - The historical evolution of the energy produced from solid biomass (excepting solid urban waste) in the EU-25 member states from 1990 to 2005 (Source: Eurostat until 2004. The prefigured numbers for 2005 are originating from the International Agency for Energy – IAE and from the member states)

Of course, the long term traditions from the biomass sector and the importance of the forestry industry, as well as the fact that most of the factories are industrial units of big capacity for cogeneration of electric and thermal energy (CHP) represent major factors which sustain the rising of the energy quantity originated from biomass in the Nordic countries. The progress recorded by Germany comes mainly from medium capacity units, of under 20 MW, while, because of the support accorded to electric and thermal energy cogeneration, more and more factories for biomass are using this method

Almost half of the member states are allowing the simultaneously combustion of the solid biomass in the conventional electric power plants. In Great Britain, the electricity produced from biomass by simultaneously combustion process was dominating inside the general electricity quantity produced from solid biomass in 2004 and has risen with almost 75% (+1,4 TWh) in 2005. In present, there are used 630.000 tons of biomass in three simultaneously combustion power plants of big capacity from Hungary.

The commission has recently approved and has forwarded to the European Council and Parliament an Action Plan regarding the EU forests. This Action Plan sustains, among the rest, the use of forestry resources as raw material for producing energy, fact which represents a very important factor for the production of solid biomass.

ROMANIAN FORESTRY AND AGRICULTURAL BIOMASS POTENTIAL ANALYSIS. EVALUATION OF AVAILABLE BIOMASS

a) Forestry biomass – wood and waste from wood

Romania disposes of a rich stock of wood, totalizing approx. 6367 thousands forest ha, representing approx. 27% of the national territory surface. In Europe, after percentage of stock of wood surface, Romania occupy the 8-th place, having in front countries as: Slovenia – 54,9%, Germany – 31%, Poland – 29,4%, France – 28%, Byelorussia – 38%, Bulgaria – 32,9%.

The spreading of the stock of wood at counties level is uneven, from counties very rich in forests (Suceava, Caraş-Severin, Neamț, Bacău) to poor counties (Constanța, Brăila, Teleorman). The forests structure on age class is characterized by an exceeding of young trees (until 40 years old) and a deficit of mature trees (over 80 years old) because of the excessive exploitations from period 1949-1989, to which it's added the abuses from period of after 1990.

▪ **Evaluation of the harvested biomass and the identification of the resulted waste from the industrial processes**

After analyzing the base indicators of the wood stock, taking into consideration the structuring into classes of age for forests, and the low accessibility grade, for assuring of equilibrated harvests it can be considered for year 2010 an optimum cutting quote of 19 mil. m^3/year. The ligneous waste resulted inside the manufacturing processes can be framed in the next main types:

▪ wood exploitation: branches with diameter lower or equal with 3 cm; branches with diameter comprised between 3 – 5 cm; roots; as well as the assortment "fire wood".

▪ primary and secondary wood processing: peal; wood residue; veneer scrap; sawdust; wood shavings; dust.

The ligneous waste quantities are in function of the disposed manufacturing technologies, of production's volume and of the raw material quality. The quantitative evaluation of the available forestry biomass for being used in energetic purposes:

a) Forestry exploitation mil*m^3/year

No.	Assortments	Quantity	
		2005	2010
1.	Fire wood	3,059	3,198
	Total	3,059	3,198

b) Primary processing mil*m^3/year

No.	Assortments	Quantity	
		2005	2010
1.	Residue	0,840	0,878
2.	Sawdust	1,104	1,152
3.	Peel	1,161	1,215
	Total	3,105	3,245

c) Secondary processing mil*m^3/year

No.	Variety	Quantity	
		2005	2010
1.	Rests	0,276	0,288
2.	Sawdust	0,375	0,392
3.	Dust	0,022	0,023
	Total	0,673	0,703

d) Biomass (branches) not contained in the harvest plan mil*m^3/year

No.	Variety	Quantity			
		2005		2010	
		Coniferous	Broad leaved trees	Coniferous	Broad leaved trees
1.	Branches with ∅ < 3 cm	0,144	0,110	0,152	0,120
2.	Branches with ∅ 3 – 5 cm	0,072	-	0,076	-
3.	Knots	0,072	0,110	0,076	0,120
	Total 1	0,288	0,220	0,304	0,240
	Total 2	0,508		0,544	

e) Total forestry biomass which constitutes energetic resource mil*m^3/year

No.	Forestry biomass	Quantity		%
		2005	2010	
1.	Forestry exploitation	3,059	3,198	44,7
2.	Primary processing	3,105	3,245	45,4
3.	Secondary processing	0,673	0,703	9,9
	Total	6,837	7,146	100

From the total biomass analysis can be observed that the biomass resulted from the exploitation activity constitutes about 45 % from total. This variety – firewood – it's meant for the population use as combustible. A quantity approximate equal, 3,245 mil*m^3/year (in 2010), results from the primary processing activity of the wood, from which, it is being considered that 0,440 mil*m^3/year (13%) from this resource is being exploited also as firewood for population, this wouldn't be an efficient usage, the rest of mil*m^3/year (86,5%) practically is throwed away, causing serious injuries to the environment.

The wastes resulted from the secondary processing activity, in a quantity of 0,703 mil*m^3/year in 2010, represent approximate 10% from the total of the resource, from which approximate 0,500 mil*m^3/year are used in the trading companies, respectively as combustible. Primary processing of the wood constitutes the activity object for 6641 companies, and for the secondary processing – 3962, so the amount of approximate 11.000 companies has as object of activity the wood processing, which conduces to a high degree of dispersion of the resource in the territory.

f) Total forestry biomass which constitutes the energetic source available, un-used in present mil*m^3/year

No.	Forestry biomass	Quantity - 2010
1.	Primary processing	2,805
2.	Secondary processing	0,203
	Total	3,008

b) Agricultural biomass

Total agricultural area from Romania is of approximate 14.800 thousands hectares, from which approximate 9.420 thousands hectares of arable area, approximate 230 thousands hectares of vine and 227 thousands hectares orchards.

Characteristic to the transitory period traversed now is that the annual agricultural productions are extremely irregular depending on a series of factors, from which, only a few, as the atmospherically conditions are fairly.

The evolution of the agricultural production (according to the table) from which it results unusable wastes as combustible (cereals, flax, hemp, and vine).

Thousands tons

Year	1998	1999	2000	2001	2002	2003	2010
Wheat cereals	6.808	6.092,7	5.567	9.726,2	5.928,9	3.360,3	10.700
Corn	8.623,4	10.934,8	4.897,6	9.119,2	8.399,2	9.577	9.577
Sun flower	1.073,3	1.300,9	720,9	720,9	1.002,8	1.506,4	1.506
Textile plants	11,8	8,0	2,3	3,2	6,4	3,9	5.6

As it results from the table, the agricultural productions are extremely irregular. As a consequence, the evaluation of the biomass available, as base, for the year 2010, production that is closer to the real agricultural potential.

The potential of agricultural biomass of Romania varies from a year to another because of the following main factors:

- the variation of the cultivated areas with the main plants which constitute the source of biomass determined from the market demand for agricultural products and of the crop rotation of the agricultural cultivations.
- the level of the biomass production varies function of the climacteric conditions of each year and of the cultivated varieties or cross-breeds, thereby it is being detected that the extension tendency of the varieties and cross-breeds of low height (half scrub) which determines the decrease of the secondary agricultural production.

For a fair estimation of the biomass potential we have performed the study in the period 2001 – 2006, the data regarding the cultivated areas and the production obtained, were supplied

to the Agriculture Ministry. The biomass production was calculated having as base the statistical data of the main production and the rate between the main production and the secondary production for the cultivated plants, presented in the speciality literature.

For the calculus of the energy quantity, which can be obtained from the agricultural biomass, are used the following equivalent values:

- straws of grain and rye = 15,92 MJ/kg;
- straws of barley, two-row barley and oat = 14,92 MJ/kg.
- stems and corn cars = 15,37 MJ/kg;
- spindle of soy, peas and bean = 16,11 MJ/kg;
- stems of sun-flower = 18,34 MJ/kg.

In the matter that concerns the evolution of the vegetable agricultural production in the period 2001 – 2006, we have according to the National Institute of Statistics from Romania the following data:

Specification	U.M.	2001	2002	2003	2004	2005	2006	Media
Grain + Rye								
Area	Thousands ha	2257,8	2158,7	1748,0	2008,1	2479,8	2055,5	2117,98
Medium production	Kg/ha	3040	2057	1428	3870	2954	2717	2678
Total production	Thousands tones	6868,2	4441,1	2496,4	7771,4	7325,2	5583,4	5671,95
Biomass production	Thousands tones	5013,6	3241,7	1822,2	5672,5	5 346,8	4075,4	4140,10
Barley								
Area	Thousands ha	315,8	291,5	120,2	186,1	222,8	127,5	210,66
Medium production	Kg/ha	3344	2278	1966	4170	2798	2651	2867,83
Total production	Thousands tones	1056,0	663,9	236,2	776,1	623,5	338,9	604,13
Biomass production	Thousands tones	844,5	531,1	188,9	620,9	498,8	271,1	483,30
Two-row barley								
Area	Thousands ha	210,3	258,3	209,4	248,1	249,2	202,2	229,58
Medium production	Kg/ha	2492	1992	1455	3037	2055	2418	2229,8
Total production	Thousands tones	524,0	496,5	304,7	753,7	512,0	427,5	511,92
Biomass production	Thousands tones	419,2	397,2	243,8	602,9	409,6	342,0	409,5
Oat								
Area	Thousands ha	218,8	230,9	242,3	242,8	217,6	203,7	226,01
Medium production	Kg/ha	1748	1348	1334	2201	1768	1706	1685,83
Total production	Thousands tones	382,4	327,4	323,0	534,6	384,7	347,7	381,01
Biomass production	Thousands tones	347,6	297,6	293,6	486	349,7	316,1	346,4
Corn + sorghum								
Area	Thousands ha	2924,0	2763,0	3206,5	3201,9	2673,3	2550,9	2886,6
Medium production	Kg/ha	3120	3041	2988	4630	3797	3490	2511
Total production	Thousands tones	9124,2	8401,7	9581,7	14820,2	10152	8900,7	10134,8
Biomass production	Thousands tones	7018,6	6462,8	7370,5	11404	7809,2	6846,7	7796
Pease bobs								
Area	Thousands ha	11,7	14,8	18,8	20,9	20,2	18,4	17,46
Medium production	Kg/ha	1860	1378	1249	2387	1803	2097	1795,66
Total production	Thousands tones	21,7	20,5	23,5	49,9	36,5	38,6	31,35
Biomass production	Thousands tones	11,4	10,8	12,4	26,3	19,2	20,3	16,5
Bean bobs								
Area	Thousands ha	21,3	25,6	27,3	23,3	22,8	21,9	23,75
Medium production	Kg/ha	1047	882	895	1264	1112	1360	1093,33
Total production	Thousands tones	36,5	33,6	36,7	29,4	25,3	26,9	25,96
Biomass production	Thousands tones	18,3	16,8	18,4	14,7	12,7	13,5	13,0
Sun flower+colza								
Area	Thousands ha	870,6	914,7	1205,1	1007,8	1014,4	1124,1	1022,78
Medium production	Kg/ha	1063	1134	1257	1753	1425	1588	1370
Total production	Thousands tones	925,1	1037,1	1514,5	1767,1	1445,9	1785,5	1401,2
Biomass production	Thousands tones	770,9	864,1	1266,6	1472,6	1204,1	1487,9	1177,7
Soya								
Area	Thousands ha	43,5	69,8	128,8	122,4	130,0	192,6	114,51
Medium production	Kg/ha	1672	2091	1746	2452	2487	1769	2036,16
Total production	Thousands tones	72,7	145,9	224,9	300,1	323,3	340,7	233,16
Biomass production	Thousands tones	60,6	121,6	187,4	250,0	269,4	283,9	194,3
Total biomass	*Thousands tones*	*14.394,6*	*11.820,2*	*11.219,0*	*200.145*	*157.486*	*134.440*	*14.440,15*

The description of the agricultural biomass

Starting from the structure of the agricultural production it is obvious that the structure of the agricultural wastes is extremely various. On principle almost all the agricultural wastes resulted can be utilised as combustible, but taking into consideration the possibilities of collecting and bundling in view of transport, it has been taken into account only the following varieties of agricultural wastes: straws, corn stems, corn cars, sun flower – stems, column head and seed shells, vine cords, flax and hemp chaff. In the category "straws" were included wastes resulted from the harvesting and the treatment of the main crops for wheat cereals – grain, rye, barley, and oat. It is obvious that function of the variety and breed the weight of the straws, in proportion with the weight of the bobs fluctuates within wide limits. In this conditions it has been considered as an average that the weight of the straws is of almost 90% from the bobs weight. The corn stems represent the plant, as it is harvested lesser the corn-cob. The weight of the corn stems is very various in functions of the corn variety and the humidity at the harvesting process. It can be taken into consideration as an average the stem weight of approximate 1,9 times greater than the corn-cob weight. The weight of the corn-cobs is on an average equal with the weight of the bobs. The vine cords are materials of woody nature which result from cutting the grape vine for the conservation of the plant vitality. At a normal density of the grape vine results from the maintenance of the cutting, the quantity of approximate 1 tone/hectare of vine cords. The chaff on flax and hemp are remaining of the plant stems after the fibre were extracted. The weight of the chaff represents approximate 50% from the weight of the plants. Starting from the above mentioned the total production of biomass utilised for combustible is:

- straws 3.357 thousands tones/year
- corn stems and corn cars 17.286 thousands tones/year
- sun flower 7.530 thousands tones/year
- vine cords 255 thousands tones/year
- flax and hemp chaff 5,590 thousands tones/year

b) The actual usage of the resource

The agricultural biomass resulted have conventionally 3 possibilities of usages namely: the re-usage in agriculture (zoo culture); the raw material in the cellulose industry and of the boards and combustible. What is not consumed by one of this form is fired on the land, incorporated in the soil or dumped in view of biological degradation. Besides the above mentioned it results the biomass usage is the following:

thousands tons

No.	Biomass type	Re-used in agriculture	Raw material	Combustible consumed in the own farm	Combustible – available potential energetic
1.	Straws	3.358	1.679	1.259	2.098
2.	Stems + corn-cars	9.098	910	5.186	12.100
3.	Sun flower – stems, capital and seeds shell	-	1.506	3.765	3.765
4.	Flax and hemp chaff	-	-	-	5,590
5.	Vine cords	-	-	-	255
	Total	12.456	4.095	10.210	18.223,590

In areas with lot of terrain arable the biomass can play an essential role in energy production.

In Romania the sector is still in transition, being continued the action of appropriation and crystallization of the new administrative system. In these conditions the statistic data could not correspond with the reality, in what concerns the forests situation (for example it is

estimated that almost 30.000 ha are cut and aren't regenerating as it should be), but there are not official data to confirm this.

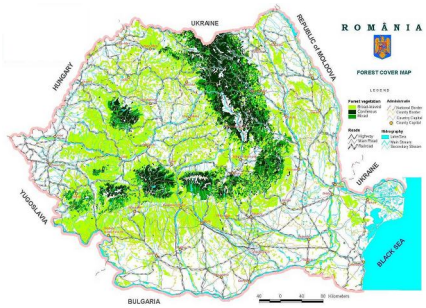

Figure 12 The map of covering with forests (Source: Institute of researches and forestry establishments)

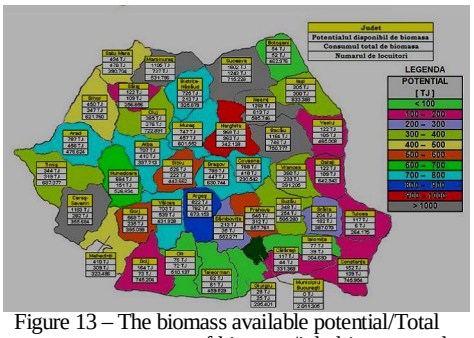

Figure 13 – The biomass available potential/Total consume of biomass/inhabitants number

In what concerns the area of the biomass potential on counties, that is presented in figure 13, being observed that Harghita County has the highest potential of biomass reported to the county inhabitants number.

CONCLUSIONS

After analyzing the agricultural and forestry solid biomass potential it was concluded that Romania dispose of sufficient biomass for obtaining alternative energy. The biomass potential in Romania is appreciated at 15 million tons (dried biomass), equivalent with 6 million tons of oil, from which on the first place are situated the agricultural waste (approx. 63%). Exploitation and rational usage of this type of waste in energy production, confers the necessary premises to cover a significant part of the energetic needs necessary to the domestic and industrial needs, especially in the rural areas. Regarding the forestry biomass, this has a weight of 10% of the total of vegetal biomass and presumes the usage in totality of the residues from the forestry exploitations, of sawdust and other scraps from wood.

The technologies based on regenerative energy have the great advantage that are using inexhaustible resources, very little polluting, with an insignificant contribution to the climatic changes. Plus, their usage is reducing the dependence of conventional resources which will be depleted in a not far away future. The European Council has agreed at Bruxelles in period 8-9 march 2007 the following realizable coordinates until the year 2020: 20-20-20-10:

- 20% reduction of the green house effect gases emissions,
- 20% reduction of the energy consume in Europe,
- 20% usage of energy from regenerative sources
- 10% transportation on bio fuels.

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