

CURRENT STATE AND CHALLENGES OF RENEWABLE ENERGY PRODUCTION IN ALBANIA, MACEDONIA, MONTENEGRO AND KOSOVO

Elvin TOROMANI

Prof.assist. - Agricultural University of Tirana - Faculty of Forestry Sciences
Address: 1029 Koder - Kamez, Tirana, ALBANIA
E-mail: etoromani@ubt.edu.al

Vasillaq MINE

Prof.assist. - Agricultural University of Tirana - Faculty of Forestry Sciences
Address: 1029 Koder - Kamez, Tirana, ALBANIA
E-mail: vmine@yahoo.com

Dritan AJDINAJ

Prof.assist. - Agricultural University of Tirana - Faculty of Forestry Sciences
Address: 1029 Koder - Kamez, Tirana, ALBANIA
E-mail: d_ajdinaj@hotmail.com

Abstract:

This study was conducted during the autumn period of 2011. During the field work based on face to face interviews were identified all processed wood fuels and stakeholders in Albania, Macedonia, Montenegro and Kosovo. Our survey identified several producers working on the production of wood fuels such as: pellet (Albania) and briquette (Kosovo, Macedonia and Montenegro). In all countries there was an urgent need to increase the value of wood, because still after timber logging in the forest remain about 20-30% of harvested timber which could be use for chips production. Such residues are partly due to low level of mechanization because work is mostly carried out by chainsaw and axes. There is a high demand for improving forest supply promoting establishment of fast growing tree plantations. Another important issue was the energy efficiency which in rural areas is too low. This study indicated that each country needs to take measures to improve the thermal insulation and to find ways for installing central heating systems. The wood fuel value chain in the six regions showed that this activity is in infancy phase and needs further development for the future. The vision for the development of wood fuel value chain covers the strengthening and diversification of the use of wood fuel as an environmentally friendly, renewable, socially acceptable and widely established source of energy.

Key words: *briquette; pellet; renewable energy; value chain.*

INTRODUCTION

It is recognized that forest biomass and wood fuels are broadly used for heating and cooking in rural areas especially in developing countries like Albania, Montenegro, Macedonia and Kosovo. Strengthening value chains of forest biomass can enable communities to be engaged better in the wood fuel production process and trading, increasing their incomes and getting employed. There is a commitment of these countries to increase the share of renewable energy versus national energy demands. They have set ambitious targets to increase the contribution of renewable energy derived from wood resources in the total Primary Energy consumption. These countries aspiring for the EU membership, have committed the transfer of EU legislation (*Aquis Communautaire*) into their legal system.

Various surveys showed that firewood in Albania meets 36% of energy demands for heating and 12% of energy for cooking (EESDC 2008), whereas in Macedonia the firewood provides only 6.53% of total energy demands (Popovska 2010). Furthermore the firewood consumption in Kosovo cover only 31% of total primary energy while according to the Macedonian State Energy Balance (SEB), about 800 000m³ of wood annually provide about 8.9% (2 600GWh) of the total primary energy sources (Glavonjic 2010).

The National Strategy for Integration in the EU emphasizes the improvement of the energy efficiency and the inclusion of more renewable's in the energy consumption, as of high importance for the security of the energy supply, economic benefit and for stability of the overall energy sector of the country. All aforementioned countries except Kosovo, have signed the Energy Treaty for South East Europe which obligates that each Contracting Party provides to implement the Directive 2001/77/EC on the promotion of electricity within one year of the date of entry into force of the Treaty.

Through of a comparative analysis we have defined a clear picture of common approaches and differences that exist between each country involved in this study. This study is important for these countries because the major part of the population still live in the rural areas using the wood fuel for heating and cooking. For that reason the energy provided from firewood has a great contribution in the national Energy balance of each country. The efficient utilization of biomass resources enhance also the contribution of forest sector and reduce the losses of timber from forest areas. In this point of view the use of alternative wood fuel products such as: chips, pellet, briquette etc will increase the burning efficiency and will provide a great amount of energy.

The objective of the study was the analysis of wood fuel value chain in all regions involved in the study and identification of practical interventions to make the wood fuel value chain functional in a sustainable manner increasing the household incomes and other actors (producers and traders) benefits.

METHOD, MATERIALS AND EQUIPMENT

The methodology used is focused on the analysis of wood fuel value chain beginning with wood production till to the end user. The information used in this study was provided by field visits carried out in four countries (6 regions), where Netherlands Development Organization (SNV) has identified the first attempts of wood fuel production such as pellet and briquettes. The study was carried out in the regions of Elbasani and Pogradeci (Albania), Berovo (Macedonia), Bijelo-Polje (Montenegro), Mitrovica and Decani (Kosovo). Two approaches were applied for information obtaining: (1) Interviews with experts of relevant fields connected with biomass energy; (2) assessment of the available documentation. During field work conducted from 17 September to 20 October 2011, in all above-mentioned regions were conducted face to face interviews with various stakeholders such as: public forest enterprise directors, representatives of private forest association, representatives of private forest logging companies, representatives of public education institutions (schools, kindergarden), representatives of wood processing industry, representatives of wood fuel production (pellet and briquette), lumberman, vender of wood stoves, household consumers at rural areas. The research was accomplished based on a careful analysis of data provided from responsible institutions of forest and energy sector as well as from data provided during interviews. This analysis was focused on the evaluation of the potential raw timber at country level, current state of the wood fuel producers as well as on value chain characteristics for briquette and pellet as main wood fuel produced in the studied countries. The evaluation of the potential raw timber was done based on the data provided from responsible institutions at each country, while the value chain and current state of the wood fuel sector was elaborated based on the data provided by interviews with all stakeholders.

RESULTS

Raw timber supply for renewable energy production

The amount of available raw material is important for assessment of wood fuel potential production (Table 1). The analysis of available forest resources was completed using the data provided for each country from responsible institutions, field visits and information provided from numerous sources.

Statistics of forest resources in the studied countries

General information	Albania	Macedonia	Montenegro	Kosovo
Total forest area(ha)	1 502 161	947 653	620 890	464 800
State forests (ha)	525 756	854 214	377 322	278 800
Communal forests (ha)	901 297	-	-	
Private forest (ha)	75 108	94 146	243 568	185 920
Broadleaves %	65.3	58.5	79	66
Conifers %	34.7	41.5	21	34
Total standing volume (m ³)	73 500 000	73 300 000	76 400 000	53 000 000
Of state forests (m ³)	-	67 600 000	64 000 000	33 500 000
Of private forests (m ³)	-	5 710 000	12 400 000	19 500 000
Gross annual increment (m ³)	1 150 000	1 830 000	1 500 000	1 300 000
Annual allowable cut (m ³)	850 000	1 300 000	832 177	900 000
Official figures of harvested timber (m ³)	2 700 000	752 000	520 000*	210 000
Industrial roundwood (m ³)	444 110	169 000	218 316	23 596
Firewood (m ³)	2 300 000	583 000	301 684	187 667

*Source: *Danon et al. (2010)*.

These figures showed that each country can generate a sustainable yield ranged from 832 thousand (Kosovo) to 1.3 Million cubic meter (Albania) of fresh solid wood which is a minor part of the wood fuel consumed in the market. Other sources of wood supply like sawmills can provide a small amount of wood available for fuel production through offcuts, sawdust etc. The exact identification of wood fuel amount in the market is a difficult equation that needs detailed surveys. Results from the forest resource assessment conducted for each source of timber supply have been drawn together in order to present an overall picture of the raw material supply at regional and local level.

Table 2

Raw timber supply from various sources for energy production at national and local level in studied countries

Sector	Wood fuel	Albania		Macedonia		Montenegro		Kosovo	
		National level	Case study	National level	Case study	National level	Case study	National level	Case study
Forest logging	Firewood or chips	2 300 000	1 400	583 000	4 620	226 517		187 667	45 000
Sawmill									
Off-cuts	Firewood or chips	97 770	572	37 180		36 086	3 470	5 191	2 739
Sawdust	pellet or briquette	35 553	260	13 520	1 680	13 122	1 360	1 888	996
Thinnings	Firewood or chips	30 000	4 500	5 000	500	2 500		5 000	1 000
Illegal cutting	Firewood or chips	28 400		8 000		9 000		100 000*	5 000

*Source: *Rec et al. (2010)*

Present situation of wood fuel production

All the activities of wood fuel production were located in the districts with high amount of forest area and with a great potential for raw material supply. We noted that in Montenegro (Bijelo-Polje), Kosovo (Decan) and Macedonia (Berovo) was developed the industry of briquette production. This industry was established as a successive part of wood processing industry and the raw material was provided from off cuts and sawdust. That was the best solution because they reduce the transport cost and have a secured supply with raw material. In Albania was developed the pellet industry, but it was not part of wood processing

industry. The producers have provided the raw material from wood processing companies, without being secure in the long-term supply of raw material. In order to meet the demands for raw timber the pellet producer in Elbasani has used a sieve machine for fractioning all shavings provided from sawmills. The summary data about wood fuel producers and their infrastructure are given in the Table 3:

Table 3

Summary data of available capacity of woodfuel production in studied regions

Woodfuel producer	Location	Woodfuel type	Production Capacity	Raw material supply	Storage facility	Nr of employee	Price of woodfuel	Product packaging	Market
MakTex	Berove / Macedonia	briquette	200 kg/hour	Local area	indoor	2	150 euro/ton	No data	Local market
Evropa transport	Berove / Macedonia	briquette	120 kg/hour	100 %	indoor	2	Na	10 kg	Local market
Jeta-H	Strelc / Kosovo	briquette	350 ton/yr	60%	indoor	2	120 euro/ton	20 kg	Local market
Fa & Bio	Elbasan / Albania	pellet	800 kg/hour	Local area	indoor	3+2	180 euro/ton	15 kg	Local market and public institutions
Nature energy	Pogradec / Albania	pellet	125 kg/hour	Local area	indoor	2	130 euro/ton	15 kg	Export Italy and Macedonia
Viena-Commerc	Veleshnje / Macedonia	pellet	125 kg/hour	Local area	indoor	2	250 euro/ton	10 kg	Local market

Wood fuel value chains

Briquette value chain

Briquette / Bio-coal or white-coal is a solid fuel made from a variety of waste materials such as charcoal from low-density wood, agro-forestry waste material, domestic, municipal solid wastes and typically any type of biomass waste. Briquetting is the process which converts these low density biomass into high density and energy concentrated fuel briquettes. Briquettes have Gross Calorific Value (GCV) up to 4200Kcal/kg. About 2.2kg of briquettes are equivalent to 1 liter of furnace oil (Serup *et al.* 2005).

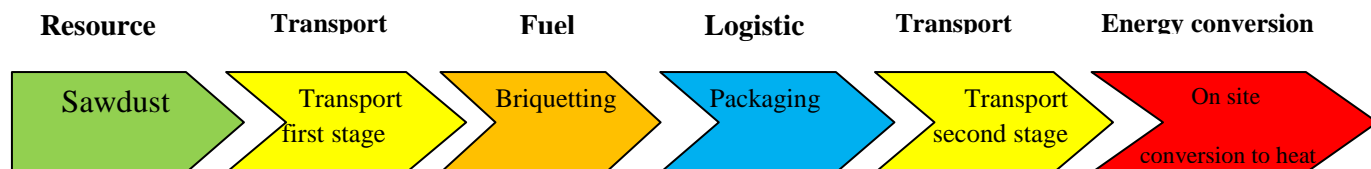


Fig. 1
Views of briquette production in the studied sites.

We noted that all briquette producers have used only dried sawdust for briquette production. They didn't have grinding machines for using slabs or other off cuts for briquette production. For that reason they were buying sawdust (40-50 euro/truck) to fulfill their demands. Shredding might be required depending on the waste being processed. The raw material (sawdust) is mixed with a film of binders usually starch to enhance adhesion and produce uniform briquettes. In case of lignin rich biomass waste, there is no need to use binders since lignin liquefies during carbonization and acts as natural binder. The briquettes usually contain about 10% of binder and about 30% of water before drying down to about 5-10% moisture content. This mixture is then transferred into a briquetizer / molder which form uniform-sized briquettes. These are then dried and packaged. In the value chain analysis we have considered the maximal distance of 50km for providing the raw material (sawdust) for briquette production. Based on the data of briquette producers

(Macedonia and Montenegro case) the cost for sawdust purchase was 12.5 euro/ton. From their activity of wood processing they are able to provide only 60% of their demand. The cost for transport was 1 euro per 4 ton of sawdust or 0.25 cent per tonne. The cost of plastic for packaging was 10 euro/tonne and the briquette producers consider it as very expensive. The value chain of briquette production is estimated based on the following scheme:

Briquette value chain.



Based on the upper scheme we have estimated the cost of briquette per unit weight for various segments of value chain (Table 4).

Table 4

The price of value chain segments for briquette

Price of the sawdust	12.5 euro/ton
Transport 1-stage (distance 50 km)	0.25 euro/km/ton or 12.5 euro/ton
Cost of briquetting	65 euro/ton
Packaging	10 euro/ton
Transport 2-stage	12.5 euro/ton
Gross benefit	37.5
Total	150 euro

The produced briquettes have a calorific value of 19.7GJ/tonne and the total cost for delivered wood energy is 7.6 euro/GJ. The price of briquettes in the market ranging from 120 (Kosovo) to 150 euro per tonne (Berovo and Bijelo-Polje) and the price depends on the briquette moisture and the costs for each segment of briquette value chain.

Wood pellets value chain

The pellet could be produced from forest residues or directly from sawdust. To make wood pellets from forest residues requires comminuting the material to a particle size of less than one millimeter and drying to at least 15% moisture content (wet basis) prior to the press. Pellets produced from forest residues are likely to be of lower quality than wood pellets made from wood-processing residue. For example, they are likely to have higher ash content due to bark and other contaminants. These pellets could be referred to as an industrial-grade pellet. In comparison to the chains considered this chain contains much more fuel processing. This greater processing is more costly but leads to a higher-quality fuel that can reduce transport and heat plant costs. At both cases of pellet producers, identified in Elbasani and Pogradeci region, they use for pellet production the sawdust bought from wood-based industry. They provide the sawdust at the distance till to 20km in order to reduce the impact of transport cost on the final pellet cost. In this value chain, sawdust is transported (first-stage transport) to the manufactory where it is dried firstly and then is pelletized. The pellets after production are transported (second-stage transport) to the pellet consumer. The main pellet consumers were hospitals and kindergardens especially to Elbasani area. The pellet value chain was analyzed based on the prices provided from the existing pellet producers. The scheme and the cost estimation for each segment of pellet vale chain are presented as follow:

Pellet value chain.

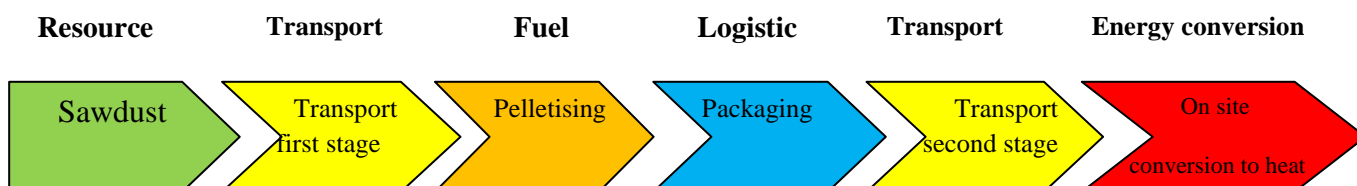


Table 5

The price of value chain segments for pellet

Price of the sawdust	33 euro/ton
Transport 1-stage (distance 20 km)	2.86 euro/ton
Cost of pellet processing	90 euro/ton
Packaging	10 euro/ton
Transport 2-stage	2.86 euro/ton
Gross profit	41 euro/ton
Total price	180 euro/ton



a



b

Fig. 2

View of the pellet manufactories: a - Elbasani; b - Pogradeci.

Analysis of woodfuel demands according to countries

Based on the interviews with households and data provided from public forest service we have assessed the annual demands of fuel wood at family and national level in all studied countries. The results are given in the following table:

Table 2

Annual demands of fuel wood for households based on data provided from field visits

Country	Household Dwellings		Annual demands of woodfuel per dwelling			Total demands for woodfuel		
	Rural area	Urban area	Firewood (mst/yr)	Pellet (ton/yr)	Briquette (ton/yr)	Firewood (m ³)	Pellet (ton)	Briquette (ton)
Albania	396 800	361 800	12	5.5		2 856 960	2 182 400	
Macedonia	286 238	411 905	10-15		5	2 146 785		1 431 190
Montenegro	116 951	199 132	10-15		5	877 132		584 755
Kosovo	242 075	161 384	12.5		5	1 815 562		1 210 375

Note: the calculation of demand is carried out based on the number of dwelling in rural areas where the consumption is much higher than in urban areas.

The total demands for wood fuel exceeds the supply for all countries involved in the study leading to maladministration of forest resources (see table 1). The situation is a bit different for Montenegro where there is approximately a balance between demands and supply offered by forest resources.

SWOT Analysis

This analysis intended to make evident the weaknesses, opportunities and threats occurred during the development of renewable energy sector at regional scale and use of forest biomass for energy production.

SWOT analysis for wood fuel in the studied countries

Stakeholder group	Strengths	Weaknesses
Producers	Renewable energy potentials, especially hydro energy Considerable number of private companies Low raw material costs Different typology of raw material Established local and somehow export markets. Environmental concerns aiming at EU level Trading legislation in accordance with EU Additional source of income Support to rural development	Scarce quantities of raw material regarding to high level of processing Bad or medium quality of raw material base Most of the companies are very small Lack of supporting schemes Unsuitable working conditions; Low productivity Low dry capacities The lack of cultivation of the crops for biomass production Low awareness about RES potential Poorly developed consumer market Institutional capacity Infrastructure in energy sector Insufficient locally available know-how Production of equipment in the country
Users	Competitive prices Ecological product Comfortable usage and storage (pellets & briquettes)	Considerable investment for stoves/boilers regarding to pellets Non comfortable usage for other types of biomass.
Stakeholder group	Opportunities	Threats
Producers	Growing demand High potentials in foreign markets Investments in new/modern technologies and kiln-dry capacities High opportunities to maximal valuation of biomass products High opportunities increasing employment. International fund and investment program and donors Public procurements Projects financed through private sector Low labor cost	Uncontrolled exploitation of the forests; (lack of biodiversity, erosion) Lack of domestic raw material Strong competition on the export markets Rising of wood biomass imports Lack of ability to reach and maintain the export quality. Import of wood biomass Strong competition from substitute products (fossil fuel etc.). Better quality of imported products; Lack of the ability to reach/maintain the export quality. Possibility of late payments
Users	Construction boom creates great demand for such products; Investments in new technologies; Export demand.	

CONCLUSIONS

The present situation of the woodfuel value chain in the studied countries showed that this activity is in the infancy stage and needs further development in the future. The vision for the development of wood fuel value chain consist in the diversification, strengthening and the well-ordering of the rings of the woodfuel chain recognized as an environmentally friendly, renewable, socially acceptable and widely established source of energy. The sustainable management of woodfuel value chain will enhance the share and the contribution of forest biomass energy in the national energy balance meeting the defined targets. The main purpose for this sector will be the increasing of renewable energy share from forest biomass to the sustainable economic development of energy sector. The achievement of this target will be attained by: (1) development and strengthening of a supportive enabling environment for wood fuel chain; (2) strengthening of marketing, trade and export; (3) increasing of the production, productivity and export; (4) strengthening of service delivery, cooperation, coordination and capacity building; (5) use of more efficient thermal generators for heating and installation of central heating systems in the public institutions; (6) improvement of energy efficiency via thermal insulation improvement and double glass windows.

For the future development of the woodfuel value chain the role of government in development and enabling of a favorable environment is very important. This role must be focused on the application of the subsidy (funding) schemes for the wood fuel producers. The establishment of a State Agency with government and donor funds will facilitate this process. The financial support for this sector could be provided by trading of carbon credits in the international market (e.g. Carbon Fund). On the other hand the government should provide financial support for enabling silvicultural interventions especially in young forests as well as for establishment of fast growing specie's plantation for energy purposes. The establishing of such plantations with short rotation may help in increasing of the raw timber production. These plantations might be established on abandoned or lands with low productivity. Despite this another important instrument is the improvement of tax system for wood fuel producers (e.g. application of the tax free for all machineries that will used for wood fuel production such: pellet, briquette, and chips) as well as the improvement of credit conditions for logging companies with concession contracts focused on the activities related with renewable energy production. During our field visits we noted the need for setting contacts between wood fuel

producers and their organization in an association which will enable lobbying to government for fiscal instruments and other facilities. On the other side there is an urgent need for organization of cooperation between producers and salesman for ruling their business. We suggest the preparation of preliminary contracts between them avoiding the verbal contracts, arranging much better their activity. At present the relationships between seller (producers or traders) and users (public institutions or private) are characterized by a low level of cooperation. Organization of common meetings between all stakeholders aim to facilitate a dialogue between them. Such meetings will promote the enhancing of awareness of public institution managers (schools and hospitals) regarding to benefits of wood fuel products for energy use (e.g. Elbasani region).

All pellet and briquette producers have emphasized the lack of information about the trend and prices of their products in the market. They also need to have information for a number of wood products that are used as raw material for their activity, their price and location. More attention within the value chain must be paid to the establishment of linkages with export markets. We noted that only one producer in Pogradeci region (Albania) was exporting his products to Italy and Macedonia. The lack of technical specifications conform EU standards is preventing the wood fuel producers to export their products. For that reason they need to certify their products in order to have access in the European market. They have a good advantage because their products might be cheaper because of low wages for employee. Long-term supplying contracts between wood fuel producers and foreign buyers must be stimulated as a tool for healthy competition and implementation of international standards in the local market.

Modern techniques for forest logging are very important during timber harvesting in the forests. They will reduce the wood wastes after logging, will mitigate the negative impacts on environment and will provide better conditions for natural regeneration of forest areas. It is very important that residues that remain on the forest areas calculated to an amount of 20-30% of harvested timber to be further processed for chips production. Investments are needed in all different segments of wood fuel value chain. Producers need to invest more in the technology of wood fuel production using also some auxiliary machines that help the preparation of raw material: such as grinding and packaging machines, drying rooms for raw material etc. We noted that all the producers were producing only one product, thus we suggest that they must extend the range of their wood fuel products.

Another important issue is the investments for improving energy performance in all public buildings. At all new buildings exist central heating systems, but the demands for investments in old buildings are high and government in all countries must invest for that. The energy efficiency at all countries was lower in rural areas where the main thermal generators were stoves with efficiency of 40-50%. The energy produced by efficient wood fuel thermal generators is healthy for the children (e.g. kindergarden in Elbasani) and environmental friendly. Public institutions such as: schools, kindergarden and hospitals are very important users of briquette and pellets. For that reason is very important that public institutions to meet standards required for energy efficiency. These institutions must make investments toward the thermal insulation and investing on central heating systems. During field visits we identified a lot of cases where such investments are carried out in the schools, kindergarden and hospitals. On the other side long-term supplying contracts between wood fuel producers and public institutions must be stimulated. Another important issue was that investments regarding to energy efficiency from private buildings. They all must respect the energy code and must foresee investments to fulfill the standards required. We noted examples of improving energy efficiency in all new buildings, but still needs to make investments for old buildings.

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