SIXTH FRAMEWORK PROGRAMME

PROJECT: INCO-CT2005-015139

ACCENT

ACCELERATION OF THE COST-COMPETITIVE BIOMASS USE FOR ENERGY PURPOSES IN THE WESTERN BALKAN COUNTRIES

Instrument: SSA

Thematic Priority: INCO-2002-C.1.3

Renewable Energy and Hybrid Systems

D16 - FINAL REPORT

Reporting Period: 1 January 2006 - 31 December 2006

Date of preparation: 15 February 2007

Start date of project: 1 January 2006

Duration: 12 months

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Revision: 1

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LIST OF ABBREVIATIONS AND ACRONYMS

BiH	Bosnia and Herzegovina
CAP	Common Agricultural Policy
ETS	Emissions Trading Scheme
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FYR	Former Yugoslav Republic
GDP	Gross Domestic Product
kW	kilowatt
kWh	kilowatt-hour
MS	Member States
Mtoe	Mega ton oil equivalent
MW	Megawatt
NCV	Net Calorific Value
NGO	Non-governmental Organisation
PJ	Petajoule
PPP	Power Purchase Parity
R&D	Research and Development
RES	Renewable Energy Sources
S&MN	Serbia and Montenegro
SME	Small and Medium Enterprise
SSA	Specific Support Action
TWh	Terawatt hour
WBC	Western Balkan Countries
WP	Work Package

LIST OF PARTNERS

Part. Role*	Part No.	Participant Name	Participant Short Name	Country
CO	1	Black Sea Regional Energy Centre	BSREC	Bulgaria
CR	2	Albania - EU Energy Efficiency Centre	EEC	Albania
CR	3	Centre for Environmental Technological Development	CETEOR	Bosnia & Herzegovina
CR	4	Energy Institute "Hrvoje Pozar"	EIHP	Croatia
CR	5	Macedonian Geothermal Association	MAGA	The Former Yugoslav Republic of Macedonia
CR	6	National Agency for New Technology, Energy and Environment	ENEA	Italy
CR	7	University of Belgrade	UB, FMG	Serbia & Montenegro

*CO = Coordinator
CR = Contractor

1. EXECUTIVE SUMMARY

The ACCENT Project was a one-year specific support action (SSA), carried out by a consortium of seven research institutions and agencies, funded by the European Commission under the Sixth Framework Programme.

The goal of the Project was to contribute to the sustainable energy development in the Western Balkan Countries (Albania, Bosnia and Herzegovina, Croatia, the Former Yugoslav Republic of Macedonia and Serbia and Montenegro), by promoting the acceleration of cost-competitive and environmentally friendly solutions for small and medium-scale biomass fuels production, distribution and use in the residential sector and SMEs.

The process of stabilization and recovering of the Western Balkan Countries (WBC) is facing serious energy sector concerns related to security of supply, social affordability and environment protection. ACCENT project focuses on the alleviation of these problems through expansion of the use of biomass for energy purposes.

The findings of the Project are subject of intensive dissemination in the WBC through workshops, meetings and publications and are available for use by state institutions, investors, research institutes and other stakeholders in the form of electronic reports on the ACCESS website, brochures on hard copies and CD. The achievements were presented at the national workshops organized in all the WB countries within the project framework.

This Final Report focuses on the objectives, achievements and lessons learned.

During the past year the ACCESS Project Consortium completed the following tasks:

- Analyses of the feasibility of expanding the use of biomass fuels in the residential sector and SMEs and proposals of solutions most adequate for the WBC, reflecting the best international experience;
- Identification of political, regulatory and financial tools for encouraging the implementation of appropriate options;
- Provision of directions for further research in the biomass technologies, aimed at enhancement of the competitiveness of biomass fuel;
- Dissemination of the conclusions and recommendations to enforce the consensus and tangible actions regarding expansion of biomass use on the basis of competitive prices using the following dissemination activities:
  - Organizing of 5 workshops - one in each WB country
  - Results publishing on the ACCENT project webpage at the BSREC website
  - Elaboration and distribution of 500 copies of the book entitled "Opportunities to Use Biomass Residues and Process Wastes for Energy Purposes" summarising the project results
  - Elaboration and distribution of leaflets in national languages among workshop participants
  - CD-ROMs with project results
  - Articles in journals
  - Project presentation at web sites and events
- The dissemination continues after the end of the project.

2. OBJECTIVES, SCOPE OF WORK AND EXPECTED RESULTS

2.1. Project Objectives

The project goal is to develop cost competitive and environmentally friendly solutions for small and medium-scale biomass fuel production, distribution and use in the residential sector and SMEs in the WBC (Albania, Bosnia & Herzegovina, Croatia, Serbia & Montenegro, and The F. Y. Republic of Macedonia).

The particular objectives of the project are the following:

- To identify the opportunities for production of wood chips, bio-briquettes and bio-pellets from agricultural and forest residues and process waste in the WBC. The particular operational goals within this objective include:
  - ξ To review the technical characteristics and costs of the fuels/electricity used for heating in the WBC;
  - ξ To review the policy and legal frameworks concerning biomass fuel production in the WBC;
  - ξ To assess the potential of forest and agricultural residues and process wastes, in view of its appropriateness to produce wood chips, bio-briquettes, and bio-pellets;
  - ξ To investigate the technologies to produce the considered fuels;
  - ξ To estimate the production costs of these fuels.

This objective was achieved by Month 6 of the project start.

To identify the optimal small and medium-scale energy utilization technologies for the concerned fuels. This objective comprises the following operational goals:

- To review the heating requirements of the population, as well as heating technologies used in the WBC households;
- To review the heat production and consumption technologies at SMEs in the WBC;
- To investigate the EU experience regarding small and medium-scale technologies (up to 500 kW) for energy utilization of the studied biomass fuels;
- To analyse the compatibility of the combustion technologies that are currently applied at households and SMEs in the WBC, with the considered fuels;
- To assess the feasibility of combined utilization of fossil fuels and the studied biomass fuels.

This objective was achieved also by Month 6 of the project start.

To identify and propose measures for encouraging biomass energy utilization. This objective can be broken down into the following operational goals:

- To assess the economic, social, and environmental impacts from increased use of different types of biomass fuels/technologies, in order to identify the best options;
- To identify the barriers that the realization of the best options will face;
- To develop proposals for removal of these barriers;
- To identify future research areas;

This objective was achieved by Month 11 of the project start.

To ensure wide use of the project results. This objective includes several operational goals:

- To involve decision makers from public authorities and representatives from SMEs (or their associations) in the project
- To organize a regional two-day workshop in Zagreb, attended by about 80 participants representing different stakeholders
- To disseminate the project results through a web-page, books, leaflets, CD-ROMS, and articles in journals and newspapers.

This objective was achieved by project Month 12.

2.2. Scope of Work

The following activities were undertaken for attainment of the ACCENT project objectives:

- Analyses of the feasibility of biomass fuels use expansion in the residential sector and SMEs and proposals of most adequate for the WBC solutions, reflecting the best international experience;
- Identification of political, regulatory and financial tools for encouraging the implementation of appropriate options;
- Provision of directions for further research in the biomass technologies, aimed at enhancement of the competitiveness of biomass fuel;
- Dissemination of the conclusions and recommendations to enforce consensus and tangible actions regarding the biomass use expansion on the basis of competitive prices.

2.3. Expected Results

The target groups, benefiting from the Project results include state institutions, the research community, decision-makers, investors, energy companies, environmental organizations, service providers.

It is envisaged that the Project outcomes would also contribute to the emerging new policy measures and legislation in the Western Balkan Countries, which would result in an increase of the medium and long-term deployment of biomass use for energy purposes.

Biomass use for heating of homes and heat production by SMEs will considerably contribute to environmental improvement in the WBCs, higher employment, assisting also the smooth social and economic integration into the EU. The ACCENT Project results are expected to create strong awareness and to raise the confidence in the concerned area.

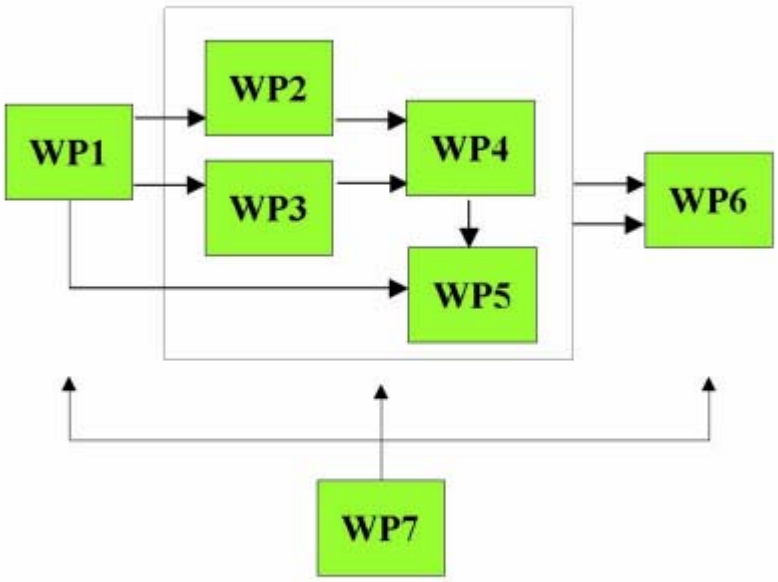
3. PROJECT OVERVIEW AND METHODOLOGY

In order to achieve the Project objectives (to develop cost competitive and environmentally friendly solutions for small and medium-scale biomass fuel production, distribution and use in the residential sector and SMEs), the Consortium structured its activities in six work packages:

- Work package 1 Review of residential heating and heat production in SMEs
- Work package 2 Assessment of opportunities for production of wood chips, bio-briquettes, and bio-pellets
- Work package 3 Identification of optimal combustion technologies
- Work package 4 Analysis of the impact of the expanded use of biomass fuels

- Work package 5 Identification of opportunities to encourage the energy utilization of biomass
- Work package 6 Dissemination
- Work package 7 Project management

The Figure 1 below shows the functional interrelations between the work packages.



Pert diagram - functional interconnection of the work packages

Figure 1

Work package 1: "Review of residential heating and heat production in SMEs" supplies information to Work package 2: "Assessment of opportunities for production of wood chips, bio-briquettes, and bio-pellets" and Work package 3: "Identification of optimal combustion technologies". They, on their part, supply results to Work package 4: "Analysis of the impact of expanded use of biomass fuels". Work package 5: "Identification of opportunities to encourage the biomass energy utilization" receives results from WP1 and WP4 for defining the main project deliverables. WP6: "Dissemination" uses the final results from WP4 and WP5.

4. RESULTS OF THE PROJECT

4.1. Task performed

More specifically the scope of works encompassed a number of tasks described below.

1. Review of the residential heating and heat production in SMEs. The following aspects have been evaluated:
   - Heating requirements of the houses and apartments classified by type of building and (if relevant) by geographic region;

- The degree to which such requirements are met, including an estimate of the actual heating and its effect on the thermal comfort and other social aspects. Reasons for the failure to achieve a satisfactory thermal comfort.
- Characteristics of the fuels and the heating technologies currently in use;
- Costs and tariffs of the different heating options;
- Heat production in SMEs, in particular: heat demand, heat production equipment (if available), type of fuel, and fuel cost.
- The policy and legal frameworks regarding the biomass production and utilization for heat supply to the population;
- Major macroeconomic indicators
- Technologies for combustion of wood-chips, briquettes, and pellets that are currently available in the WBC in terms of technical characteristics and costs.

2. Assessment of opportunities for production of wood chips, bio-briquettes, and bio-pellets

The potential of available resources, namely forest and agricultural residues and process waste and the sufficiency of these resources and their quality in view of appropriateness to produce wood chips, bio-briquettes and bio-pellets was assessed. The assessment was based on methods applied in the EU member countries. The most promising regions for the production of biomass fuels were identified.

The most appropriate technologies for production of wood-chips, pellets, and briquettes were identified. For that purpose, information about the experience and state-of-the-art in the EU Member States was collected, with particular emphasis on low-cost technologies. The applicability of these technologies to the WBC was assessed in terms of cost, capacity, technical requirements, etc. and the most appropriate ones were identified.

The partners estimated the production of the considered fuels in each country, based on calculation of all related capital costs (such as collection and transportation equipment, briquette/pellet/chip technology, briquette/pellet plant, storage, etc.) and operating costs (such as payments for the residues and process wastes, transportation, labour, operation of the technology, etc.) The costs are compared to the costs of alternative fossil fuels, in order to assess the competitiveness of biomass fuels.

3. Identification of optimal combustion technologies

The local partners supported by BSREC and ENEA investigated the experience and state-of-the-art in their countries in the small and medium-scale technologies (up to 500 kW) covering the heat demand in residential buildings and/or SMEs. Particular emphasis was laid on low-cost technologies, due to the poor financial situation of the population in the WBC. Emphasis was laid on combustion technologies with a boiler part. The partners assessed the applicability of these technologies to the conditions in WBC.

In addition, the partners analyzed the compatibility of the existing residential and industrial heat generation technologies in the WBC using the considered fuels (wood chips, bio-briquettes, and bio-pellets). In addition, the feasibility of combustion technologies and facilities for combined utilization of fossil fuels and biomass - both for residential and industrial purposes - was assessed. BSREC and ENEA investigated the technologies for combined utilization available in the EU and, together with the local partners, assessed their applicability to the conditions of the WBC.

4. Analysis of the impact of expanded use of biomass fuels

The partners identified the major factors that affect the feasibility of biomass utilization options, i.e. types of fuels, scale of production, type of technology, application, etc. The various factors of biomass utilization options were analyzed.

- Environmental and health aspects, i.e. greenhouse gases, air pollution, indoor pollution, and others, were assessed and compared to those associated with the fossil fuels to be substituted
- Special attention was devoted to the social benefits of utilization of the resources including the impact of availability of low-cost fuels on the heat comfort of low-income population. In addition, the effect on unemployment, especially in the rural areas, was also identified.
- Security of energy supply due to the high dependence of the WBC on imported primary energy carriers was addressed.

Considering the above impacts, the optimal options for utilization of biomass residues and process wastes were identified.

5. Identification of opportunities to encourage the energy utilization of biomass

The WBC partners identified the major barriers - policy, regulatory, financial, administrative, and information ones and developed draft proposals to overcome the identified barriers. The proposals reflect properly different health, environmental, and social impacts resulting from the options examined in the previous WP. The proposals were sent to BSREC for feedback. After incorporating the feedback the partners from the WBC forwarded the proposals to decision-makers from the central and local governments, as well as to representatives of SMEs (or their associations) for review and comments. The partners organized meetings with the stakeholders to receive their feedback.

In close collaboration, BSREC, EEC, CETEOR, EIHP, MAGA, and UB identified priorities for further research.

Each partner from the respective WBC, (on the basis of the draft report, feedback, etc.) completed the final report on proposals for both overcoming the barriers and research priorities.

6. Dissemination of project results

The partners disseminated the project results throughout the project lifetime involving a wide range of stakeholders - farmers, forest owners, potential investors, producers of wood chips, briquettes, pellets, SMEs, industrial enterprises, NGOs, researchers, decision-makers from governments and municipalities, and others. All dissemination activities targeted all of these stakeholders.

A project web page was established by the BSREC at the beginning of the project. This page will be maintained for two years after the project completion. It includes all project deliverables, national workshops information, and other relevant information. The link to this page was properly circulated.

After discussion with the EC officers in charge of the project, the regional two-day Workshop initially planned was replaced by 5 national workshops in the WB countries organised at the end of the project. The workshops provided detailed information on the opportunities to utilize biomass and demonstrated all related benefits and obstacles before the participants – various stakeholders from the countries.

A book containing the project outcomes and other relevant information was released. Five hundred copies of the book were disseminated among the workshop participants and all other

interested stakeholders. The book was developed with the joint efforts of the partners from the WBC and the BSREC. The final editing, graphic design, and printing were done by BSREC.

Additionally, each partner from the WBC developed and distributed 100 leaflets, including description of the best technologies for pre-processing and combustion of biomass chips, briquettes, and pellets.

The workshop presentations, project results and other relevant information is available on CD-ROMs. Five hundred copies of the CD-ROMs will be largely disseminated at the workshops and other events.

Summary of the project results were published in journals and newspapers.

The BSREC prepared a brief presentation of the project in 3 pages for the general audience. It was prepared in accordance with the requirements specified in the Negotiation Guidance Notes for SSA Coordinators.

4.2. General Characteristics of West Balkan Countries

In its endeavour to assess the domestic conditions for RES utilization in the Western Balkan Countries, the ACCENT Project partners made an overview of the general situation in the Region, including economy, energy generation and demand, as well as export / import possibilities and the RES role in the current energy balance.

Figure 2 shows the West Balkan Countries embedded in the surrounding region.

Figure 2: Western Balkan Region

The Western Balkan Region has a total area of 264 552 km^2 and a population of around 25 Mln inhabitants, with a very favourable geographical location, being the main connection between Europe and Turkey, the Near East and Asia. It is and will continue to be of a high political and economic interest for the EU, no matter how the present transition period will end. The Region has not been stabilized yet, after the crisis, which resulted from the disintegration of the Yugoslavian Federation. With respect to politics, the issues concerning the independency of Kosovo & Metohia, the final organization of the Federation of Bosnia & Herzegovina and the Macedonian/Greek discrepancy about the name have to be solved. With

respect to economy, these countries, which used to have one state economy (except Albania) in the past, still cannot find the way to their independency and at the same time they aim at maximum connection to the EU market. Except for Albania, probably the living standard in all these countries is still far bellow the one they used to have during the Yugoslavian time, which results in continuous changing political situations.

The main political orientation, accepted by all the countries, is to join the European Union and, hence, to find their own place in the European Community and gradually to solve the present political, economical, cultural and other problems. The EU strongly supports such an orientation, however the process goes slowly and involves many problems. Only Croatia has already got the status of a candidate country, The Former Yugoslav Republic of Macedonia is expecting to get it soon and the others are still far from that. Anyhow, the issue whether or when some of these countries would join the European Union is not known and depends on factors which are not always in their power.

The Table 1 below presents some general characteristics of the Western Balkan countries.

Table 1: General characteristics of the West Balkan countries

Western Balkan Countries	Land area	Population (2006 est.)	Growth rate	GDP/PPP (2005 est.)	GDP per capita	Real growth rate	Inflation rate	Official unemployment rate	Labour force
	km^2	Million	%	billion $	$	%	%	%	million
S&MN	102136	10.832	0.0	28.70	2,700	5.0	15.5	31.6[4]	3.2
Croatia	56,414	4.494	-0.03	53.56	11600	3.5	3.2	18.7[5]	1.7
BiH	51,129	4.498	1.4	28.59[2]	26,800	5.3	1.4	45.5[3]	N/A
Albania	27,400	3.58	0.5	18.07	4,900	5.5	2.4	14.3[1]	1.09
Macedonia (FYR)	24,856	2.05	0.3	15.55	7,600	3.7	0.5	38.0	0.85

Comments:
1 Unofficially it can be as high as 30%
2 Bosnia and Herzegovina has a large informal sector that could also be as much as 50% of official GDP
3 Grey economy may reduce actual unemployment to 25-30% (Dec. 2004 est.)
4 Unemployment rate in Kosovo is app. 50%
5 Labour force surveys indicate unemployment around 14% (Dec. 2004 est.)

4.3. Residential Heating in the WBC

In general, in rural areas wood logs and residues from forestry and agricultural activities are used for heating and cooking. In urban concentrations electricity, wood logs and light oil are the most popular fuels. Unfortunately, there is no specific information about the types of consumers: residential, SMEs or commercial and public buildings.

The use of chips and pellets is sporadic. There is a limited briquette trade, but there are no transparent prices, tariff system or biomass standards either. The quality is quite often unsatisfactory. The collection of wood processing and agricultural residues, as a basis for development of production is not developed in a systematic way because the demand of condensed fuels is very limited.

Some biomass (wood waste, briquettes) is being exported to other countries because the prices are higher.

Besides, WB countries have not developed any industry for manufacture of chip, pellet and briquette making equipment. They use imported equipment from the EU MS – Finland, Germany, Italy etc.

The collected data show the following:

- Over the recent years, consumption of firewood is decreasing slightly but steadily (except in The Former Yugoslav Republic of Macedonia and Serbia);
- Consumption of light oil has decreased significantly due to the increase of its price; and
- The share of electricity is still very high due to the absence of acceptable alternatives in many WB regions.

There is no reliable information about combustion technologies in any of the countries in this region. A commonly used technology is primitive low efficiency vertical heating stoves or combined heating–cooking stoves. There is no relevant standardization for the equipment and design of combustion devices, particularly for different types of stoves. During the last several years modern stoves and heaters have started penetrating the WBC market, however they are too expensive for the living standard of the average population.

Production of efficient combustion appliances and boilers is developed only in Serbia.

With some exceptions (Croatia), there is no organized information about the advantages of using modern combustion technologies.

4.4. WBC Potential in Wood Chips, Bio-Briquettes and Bio Pellets Production and Utilisation

Despite the long traditions in biomass utilisation in the WBC, the attention of governments' policy towards wider biomass utilisation was until recently only at a declarative and theoretical level. In October 2005, all WBC plus Bulgaria and Romania signed a treaty establishing the Energy Community with the EU. The Treaty brought significant changes to the national energy markets of Southeast Europe that will unify through energy reforms which are to remove trading barriers (i.e. custom tariffs) and governmental interventions (i.e. price is driven by market forces only).

The next Table 2 shows the available data about forest resources and biomass production in WB countries in 2005.

Table 2: Wood: land area, forest area and fuelwood production in 2005

WBC	Total land area	Forest area	Fuelwood production	Forest in total land	Production intensity
	000 km^2		Volume (1000 m^3 over bark)	%	m^3/km^2
Albania	27	10	144	37	14.40
BiH	51	23	1146	45	49.83
Croatia	56	18	1288	32	71.56
Macedonia (FYR)	25	9	765	36	85.00
S&MN	102	29	1299	28	44.79
Total	261	89	4642	34	52.16

Source: WEC, 2001 and FAO, 2005

(There is detailed information of the RES potential in the countries in Deliverable 2 "Opportunities for Production of Wood Chips, Bio-Briquettes and Bio-Pellets".)

Albania has the lowest level of production intensity considering the present situation in its forestry sector – illegal cutting and bad management of the forests. Albania, Bosnia and Herzegovina and Serbia and Montenegro are recording a drop in forest utilization during the time of transition. Serbia considers its forest insufficient to provide appropriate land coverage, water conservation and protection from erosion throughout territory of the country.

It should be noted, however, that the available information is not systematic and reliable, thus further investigations in assessment of the potential are needed. That particularly applies to agriculture crops residues and wastes because the situation is changing faster and the information is outdated.

This can also be seen in Figure 3 that compares removals of wood products over 15 years. Albania shows a drop in forest utilisation during the time of transition. Bosnia and Herzegovina and Serbia and Montenegro record the same trend although with less severe decrease. Croatia is the only country that has an upward trend in its forest utilisation.

The next Figure 4 shows the percentage of woodfuel and roundwood production in 2005. It can be seen that Croatia, Bosnia and Herzegovina and Serbia and Montenegro have good wood processing industry.

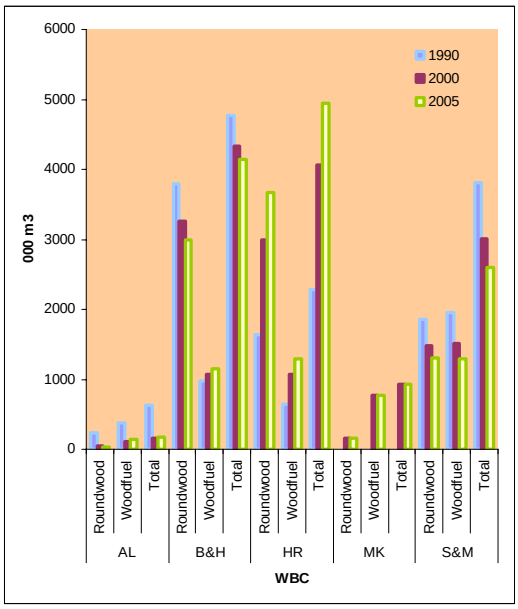


Figure 3: Removals of wood products

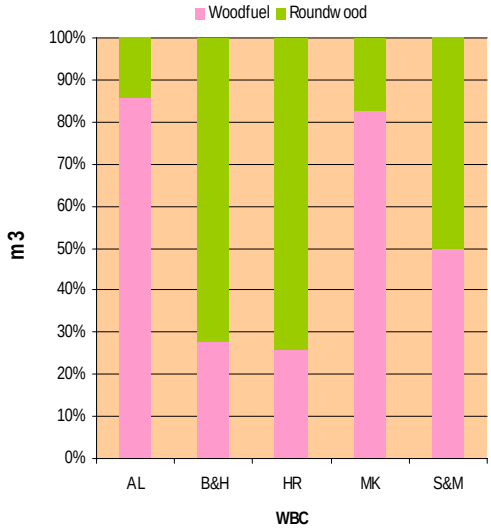


Figure 4: Round-wood and fuel-wood production in WBC (2005)

Source: FAO, 2005

The woodworking industry in some of the countries (BiH, Croatia) is very well developed but the biomass fuel industry is not developed enough to use the wastes to the best advantage. Introduction of better organization of exploitation, collection of wastes and their processing in better forms for highly efficient use will improve the value of the energy resource and open additional opportunities for employment in rural areas.

4.5. Biomass Utilization in Europe

4.5.1. Legislation

The European Commission sets out three main objectives of the energy policy: competitiveness, sustainability and security of supply. This policy is based on the following specific directions of the EU MS energy policy:

- Reduction of energy consumption,
- Increase of internal production,
- Replacement of fossil fuels by renewable energy resources,

- Diversified energy sources.

A significant element of the RES oriented policy of the EU is utilization of biomass for production of heat and electricity. Nowadays, biomass is estimated as the most promising energy source, with the highest potential of all renewables. Biomass energy can contribute to reach the EU's objectives of securing the EU fuel supply while improving the greenhouse gas balance and fostering the development of a competitive European biomass industry. It has also the advantage of being distributed regionally and locally in most European country areas and this offers the opportunity to develop integrated schemes for its intensive use and, subsequently, its effective contribution to improving the family budget and the population's standard of living in the less developed and rural areas of Europe.

The following documents outline the EU policy in biomass sustainable utilization:

The White Paper on Renewable Energy in 1997 outlines biomass resources as woody biomass, residues of the wood processing industry, energy crops, agricultural residues and agro-food effluents, and proposes to double the contribution of RES to the EU's gross inland energy consumption from 6% to 12% by 2010. A target was set to triple the use of biomass from the amount of 45 Mtoe (1890 PJ) in 1997 to 135 Mtoe (5660 PJ) in 2010.

The Green Paper published in the year 2000 "Towards a European strategy for the security of energy supply" outlines again the objective of "Doubling the share of RES in the energy supply quota from 6 to 12% and specifies the contribution of RES for raising the electricity production from 14 to 22% as an objective to be attained by 2010".

Directive 2001/77/EC on the promotion of electricity from renewable energy sources reported that bioenergy contributed 9% of RES electricity and about 98% of RES heat, and accordingly it specifies an indicative target of 22.1% gross electricity consumption of EU-15 to be produced from renewable sources by 2010. After the latest accession of 10 countries the target slightly to 21%. (The individual targets of the new EU Member States are included in the accession treaties of each country).

Directive 2003/30/EC concerning energy used for transport adopted in 2003 aims at promoting the substitution of conventional transport fuels – diesel and petrol derived from oil – by biofuels derived from agricultural crops, notably biodiesel and bioethanol. It sets out an indicative target 5.75% of petrol and diesel consumption for transport purposes to be replaced with biofuels by 2010.

The Common Agricultural Policy (CAP) (June 2003) reports that over half the population of the EU-25 live in rural areas that cover 90% of the EU's territory. In addition to agriculture the CAP strongly impacts bioenergy. Non-food production on agricultural land has become of a greater concern in agricultural policy. The CAP has introduced payments for energy crops as eligible for a new annual carbon credit payment of €45 per hectare, with a maximum area of 1.5 millions hectares across Europe.

In 2003 as a follow-up of the Kyoto Protocol, the EU adopted Directive 2003/87/EC, which entered into force on 25 October 2003 on establishing a scheme for greenhouse gas emission allowance trading (the Emissions Trading Scheme - ETS). In October 2004 the EU adopted an amendment to the Emissions Trading Directive (the Linking Directive) to allow European companies covered by the EU ETS to use credits from CDM projects (from January 2005) and from JI projects (from January 2008). The EU ETS recommends boosting utilisation of bioenergy in all market sectors as fundamental tool for energy production and for the promotion of RES in energy-intensive industry.

On 7th December 2005 the EC published a Biomass Action Plan on a coordinated approach to biomass policy that "sets out measures to increase the development of biomass energy from wood, wastes and agricultural crops by creating market-based incentives to its use and removing barriers to the development of the market". The Action plan will be coordinating the energy policy of the EU MS countries with regard to promoting the further deployment of renewable sources in the main energy-consuming sectors such as those of electricity, transport and heating.

A renewables share of about 20% of total energy in 2020 would necessitate about 210–250 Mtoe of primary biomass, according to energy projections [Source EEA]. The targets for the years 2010, 2020 and 2030 are presented in the following Table 3.

Table 3: EU biomass potential, Mtoe

	Biomass consumption, 2003	**Potential**		
		2010	**2020**	**2030**
Wood direct from the forest (growth and residues)	67	43	39 – 45	39 – 72
Organic wastes, wood industry residues, agricultural and food processing residues, manure		100	100	102
Energy crops from agriculture	2	43 - 46	76 – 94	102 - 142
TOTAL	69	186 - 189	215 - 239	243 - 316

Source: Biomass Action Plan {SEC(2005) 1573}, Brussels, 7.12.2005, COM(2005) 628 final

It should be pointed out that this production of biomass does not rely solely on the natural yield and good management of European forests and agriculture but also on the increased cultivation of fast growing energy crops that is quite well developed in some countries (Sweden, Finland.)

4.5.2. Technologies of biomass processing and combustion in the EU MS

BIOMASS PROCESSING

Among the different wood energy opportunities hereinafter, those relating to heating market of chips, pellets and briquettes are taken into consideration. Among these biofuels, today pellets are the most widely used due to their friendly management as an alternative to fossil fuels adapted to the private dwelling as well as for district heating plants. Briquettes, which have many advantages in terms of storage and transport are less used because of their inconvenience for automatic feeding. In general, both the calorific value and the commercial application of these fuel products depend on their humidity content, the chemical and structural properties of the biomass resource.

The next Table 4 shows some typical physical characteristics of wood pellets, briquettes and chips.

Table 4: Characteristic of commercial biomass for combustion

Biomass	Diameter, mm	Length, mm	Humidity%	NCV, MJ/kg	Operation
Pellets	2-20	6-30	<= 11	>= 16.9	Suitable for automatic feeding to biomass burners
Briquettes	20 - 120	< 400	<= 18	>= 16.9	Less suitable for automatic feeding to biomass burners
Chips	n/a	5 - 50	< 60	6 - 15	Boilers with automated feeding

Wood chips are a very popular fuel in Europe, particularly in forested countries such as Finland, Sweden and Austria. The use of wood chips has increased in the last years, in line with the EU policy for promotion of large scale RES utilization. This process is accelerated by the continuous increase in fossil fuel prices. Modern technologies are developed for production, transport and use of wood chips: crushers / chippers, special trucks, automatic systems for fuel supply, and, finally, boilers burning high-moisture fuel.

Compacting technologies are applied since the middle of last century for the improvement of biogeneous fuel properties by drying and densification of the fragmented biomass.

Untransformed mass (sawdust) occupies a large space, and therefore creates troubles with transportation, storage and feeding to the combustion facilities. In addition, the sawdust from sawmills and cutter-shavings have high moisture content and needs drying at the final stage of the production process.

Compared to chips, pellets have lower humidity (not exceeding 9% because they are dried in the production process) and higher energy value. Pellets are less dependent on transport distances and their storage requirements are lower.

Energy demand for wood pelletizing is around 80-130 kWh/t (and 200-300 kWh/t if drying is included) depending on the source of wood residues. Large capacity pelletizers are available in the range of 200 kg/h to 8 ton/h.

The main prerequisite for the increasing share of pellets at the market are several:

- competitiveness compared to other fuels in the generation of thermal energy,
- comparatively high energy density,
- availability of affordable raw materials for production,
- opportunities for use in automated combustion systems.

Pellets are suitable for small burners (e.g. domestic stoves) and since they can be considered similar to fluids it is possible to use them with automatic feeding to burners.

Briquettes are also a densified fuel but due to their size they are not suitable for automation and could be used mainly in manually fed combustion appliances. Briquettes can be produced with a density of 1.2 g/cm³ from loose biomass of bulk density 0.1 to 0.2 g/cm³. These can be burnt cleanly and are therefore environmentally-friendly along with the advantages associated with the use of biomass.

Briquettes differ from pellets in size. They are bigger, usually round, 5-10 cm in diameter, 2-30 cm long. Similar to pellets, their moisture content is low (15%) but higher than that of pellets. The calorific value of the best briquettes could be about 18 MJ/kg. They are more suitable for domestic use with stoves or small boilers without automatic feeding but can be used also in small size heating plants.

Chips are more expensive than pellets due to the high moisture and less calorific value.

In order to have an idea about their economic characteristics Table 5 shows some data for chips and pellets in Italy.

Table 5: Pellets and chips economic data in Italy

Source	Humidity	MJ/kg	Price, €/t	Cost, ¢/kWh
Chips	20-60%	8.372-14.651	15 - 60	0.645-1.474
Pellets	6-10%	16.744-18.837	100-200	2.150-3.822

Source: CRB (Italy, National Centre Research on Biomass, 2005)

COMBUSTION

Heating of residential households and SME with biomass became a common practice in many countries in EU. It is rather typical in the Northern ones (Sweden, Finland, Poland, etc.) but also in rural and mountainous regions of the Middle European ones. Biomass for residential heating is burned in a wide array of devices ranging from stoves and ovens, small and simple boilers to large highly sophisticated automated facilities. Probably, for the recent 15 years, the most important technological advance has been made in the small and middle-sized boiler units for biomass fuels and systems for automatic feeding and ash collection.

European companies produce a wide variety of efficient stoves and ovens burning biomass, logs and briquettes combined with coal and coal briquettes. The capacities of the facilities are from several kW to several MW.

Similar to wood stoves, centralized wood-burning boilers have been improved over the last several years. Modern, centralized wood heaters use wood gasification technology that burns both the wood fuel and the associated combustible gases, rendering them efficient up to 80%, in some cases – to 90%. In addition, systems are available that can switch to oil or gas if the fire goes out.

The appliances fuelled with pellets, chips, nutshells, corn kernels and similar have automated supply. They are more convenient to operate and have much higher combustion and heating efficiencies than ordinary wood stoves or fireplaces. Pollution is correspondingly very little. In fact, pellet stoves are the cleanest of solid fuel burning residential heating appliances. With combustion efficiencies of 78% - 85%, pellet stoves are suitable for homes as well as apartments or condominiums.

Fluidized-bed combustors are accepted in Europe as the best for the small scale boilers construction. They burn biomass fuel in a hot bed of granular material. Injection of air into the bed creates turbulence resembling a boiling liquid. The turbulence distributes and suspends the fuel. This design increases heat transfer and allows for operating temperatures below 972° C, reducing nitrogen oxide (NOx) emissions. Fluidized-bed combustors can handle high-ash fuels and agricultural biomass residue.

Main technological advances have been made in the controlled distribution of the air in the heating chamber, enabling increase of the burning efficiency.

The market of biomass fuels development in EU resulted from a recognizable development of technologies for combustion, fuel and ash handling, and possibilities for comfortable

operation. What's more important, this process is continuous and results in everyday new improvements which shall increase the competitiveness of this energy source in comparison with the fossil fuels.

4.6. Optimal Biomass Heating Technologies for the WBC

4.6.1. Existing biomass combustion technologies

RESIDENTIAL PURPOSES

Small-scale combustion of biomass is by far the most extensive application of bio energy in West Balkan Countries. Mainly vertical heating stoves and kitchen combined stoves are in use in the WBC. They burn biomass in combination with coal and coal briquettes. Normally, these stoves are used for heating of only one room, or for combined heating and cooking. The efficiency of these appliances is low.

Modern "know-how" and equipment is starting to penetrate the market along with the economic recovery of the region. The process is slowed down by the high investments needs and the subsidized electricity prices in some countries (particularly S&MN). Stoves with water jacket and high efficient pyrolisis boilers and boilers using combination of solid fuels – biomass and coal products and electricity are in use.

Wood is the most often not properly collected and it has usually high content of moisture, without preliminary preparation for combustion (exception of Croatia). Using of wood briquettes or pellets is rarity.

A modest part of the residues from the wood industry was reported to be used for heating purposes by individuals. Densified biomass fuels (briquettes, pellets) are used in areas where these are available, i.e. where they are being produced but the high price of the pellets makes them less popular.

TECHNOLOGIES FOR SME

The heat requirements of SME in– for process and space heating - are usually covered by fossil fuels – solid, liquid or natural gas - combined with biomass.

On the average, boiler systems are old and worn, and of outdated designs that would not likely comply to any emission standards. There is generally little or no automation. Piping networks (in many cases a steam generation system is used) are in a poor state. These result in low overall efficiency and in frequent breakdowns of boiler systems.

The installations as a rule are over capacitated. There is no control of the combustion process, which prevents even carefully maintained installations from being efficient. Most of the equipment is characterized by natural air supply combustion process and can hardly comply with ecological criteria (primarily with the permissible CO_2 level). Heat losses are very high. Metering systems, if existing, are in poor condition.

About 10 – 15% of fuel could be saved at most of the installations by means of control and minimum investment. In specific cases, the potential savings of fuel are enormous, and the improvement of the biomass boiler system could be paid back in less than three years.

Long-term solutions would be possible by replacement of the fossil fuel component by biomass. From financial viewpoint replacement of liquid fuels is the most beneficial.

Combined Heat and Power (CHP) generation using biomass takes place on a small scale. There are currently no district heating boilers that are fuelled by biomass.

LOCAL CAPACITY FOR PRODUCTION OF COMBUSTION APPLIANCES

As a rule, the modern combustion technology is imported but the local industry in some of the countries (BiH, Croatia, S&MN) has started also production of various types of high efficiency stoves and boilers. The energy efficiency values of the available domestic equipment are approximately within the range of 72 - 88% for boilers and 75% for stoves.

The product quality is at a satisfactory level, and there are even some products at the highest EU quality level. They are commercially very successful not only in WBC but in the EU market as well.

There is large room for development of local production of combustion appliances as long as the market is growing. Local production will considerably contribute to further deployment of biomass use provided that the efficiency is at contemporary level but the prices are lower.

LOCAL CAPACITY OF PRODUCTION BIOMASS FUELS

The production of compact fuels is in its initial phase in WBC. The chippers are imported. The timber wood processing SMEs are developing at a high rate and can be a convenient starting point for introduction of sophisticated EU technologies. Unfortunately the sawdust produced by sawmills and cutter-shavings are not utilized properly for production of pellets or briquettes. The main reason for that is the lack of market conditions for fuels and comparatively high price of the condensed fuels. Supporting mechanisms and organization of some demonstration projects with convenient financing can create a show room for advantages of these technologies, and will boost their market share.

The production of wood chips is also in its initial phase due to lack of demand. There are limited attempts to penetrate to the EU market with locally produced chips.

It should be pointed out however that the production and export of chips shall be combined with a system of forest management in order to ensure their sustainable exploitation.

TECHNOLOGIES FOR COMBINED UTILISATION OF BIOMASS AND FOSSIL FUEL

Historically the heating and cooking appliances used in individual dwellings are convenient for burning coal, coal briquettes and wood logs and briquettes. Many companies produce fireplaces, stoves and boilers fuelled by solid fuels – coal products and biomass. Some combined boilers for solid fuels and gas that use two types of burners are also available.

In SMEs biomass and coal can be handled and burned in essentially the same fashion and very similar or even the same equipment. Biomass can be “co-fired” with coal in small percentages in existing boilers.

IMPACTS OF WOOD CHIPS, BIO-BRIQUETTES AND BIO-PELLETS PRODUCTION AND UTILIZATION IN WBC

Biomass energy has a complex social impact due to different technological stages and distribution channels, which can vary depending on the local, national and/or specific features of a society. It brings changes in traditional lifestyles influencing both households (improved cooking stoves, use of biogas, ethanol, wood chips or pellets) and business sectors (almost all business processes involve heat and/or electricity consumption, i.e. biomass-fired electric power plants/CHP). Impacts on the society as a whole can include a demand for new vocations and business profiles, such as biomass boiler engineers, maintenance services, transport for production and utilisation purposes and others. The various impacts of biomass utilisation and production strongly depend on their recognition and promotion.

The following Table 6 presents the Benefits associated with local Bio-energy production.

Table 6: Benefits Associated with Local Bio-Energy Production

Dimension	Benefit
Social aspects	Improved standard of living Environment Health Education Social cohesion and stability Migration effects (mitigating rural depopulation) Regional development Rural diversification
Macro level	Security of supply/risk diversification Regional growth Reduced regional trade balance Export potential
Supply side	Increased productivity Enhanced competitiveness Labour and population mobility (induced effects) Improved infrastructure
Demand side	Employment Income and wealth creation. Induced investment Support of related industries

The fact that forests represent one of the most important natural resources of the WBCs, with an average area of 34% (from 28% in Serbia and Montenegro to 45% in Bosnia and Herzegovina), can be considered a basic prerequisite for successful biomass utilisation and a tool for improving socio-economic welfare.

As described herein, there are a number of beneficial impacts of biomass production and its utilisation on both the macro- and microeconomic levels, as well as on social and environmental affairs. In the case of WBCs, biomass production and utilisation should be prompted in such a way as to provide the basis for rural development, while at the same time ensuring sustainable production in accordance with the local environmental peculiarities. From the social perspective there can be little doubt that bio-energy projects protect existing employment, provide new jobs, give learning opportunities, transfer skills, introduce new skills, and provide training and educational opportunities. The trend towards independent power production using smaller-scale plants and embedded generation should result in a decline in urban drift once rural communities are able to develop and grow using the new sources of bio-energy available to them. This in turn will produce a sense of pride and independence, which is of particular importance in the WBC area. Local health benefits can also result from replacing old wood stoves by efficient district heating schemes for people living in rural areas, to less pollution from traffic emission and power generation for those living in city centres.

THE BEST OPTIONS FOR RESIDENTIAL AND SME HEATING IN WBC

Within their integration process into Europe, all Western Balkan countries are in the process of adjusting the whole concept of the energy sector reform, by introducing a legislative as well as an institutional framework to the EU requirements. The foreseen changes in the markets of grid-based energy systems, which include privatisation and restructuring of the whole energy sector, are going to significantly affect the possibility of introducing bio-energy

and its enhanced utilization and encourage the biomass-related activities in the areas. In that regard, the strategic objective will be to increase the share of wood chips, bio-briquettes and pellets produced from agricultural and wood residues and wastes. Achievement of significant increase is expected, due to the high potential of uncaptured resources.

Recognizing the benefits from the utilization of biomass and on the basis of presented analyses the following best options could be proposed:

1. Implementation of best management of the forests and collection of forest and agricultural residues for better utilization of the considerable energy potential of the countries
2. Utilization of the fallow and abandoned lands (not used for food production) for cultivation of fast growing energy crops, which could complement the natural production of biomass in the countries. This particularly concerns S&MN – the country that finds their forest reserves insufficient.
3. Further use of wood logs as the most usable energy source for heating in the rural regions and small cities accompanied by gradual replacement of old combustion technologies by new modern efficient appliances – stoves, ovens and boilers.
4. Development of a local market for densified fuels – pellets and briquettes – in parallel with the market of state-of-the-art combustion technologies. Participation at the EU market of densified fuels.
5. Development of a wood chips market for local consumption in state-of-the-art automated boilers and for participation at the EU market
6. Expansion of the use of local heating systems intended to heating of city regions and blocks of flats
7. Development of a local industry for production of combustion appliances and equipment for production of biomass fuels.

The implementation of the formulated options is a matter of purposeful state energy policy of the countries. They are in line with the EU energy policy conducted during the last 10 years and subject of further perfecting and enhancement in the new Common Energy Policy of the Union.

4.7. Needs for Transfer of EU Experience to WBC

4.7.1. Applicability of the EU combustion technologies to the local conditions

Applicability of EU technologies to the conditions in WBC depends very much on the present existing constraints and the state policies and support to the development of efficient biomass use for energy production. It also depends on the development of the market of biomass energy materials, i.e. briquettes, pellets, firewood, etc.

Recent development of the prices of liquid fuels and gas plus the expected sharp increase of the electricity price in combination with the low living standard of the majority of the population open a room for wider biomass use, both for residential and SME use.

For the time being only firewood is competitive against the fossil fuels in contrast to the biomass densified fuels, particularly pellets, which have considerably higher prices than coal and coal briquettes. The usual combination of wood logs, agricultural residues (in the rural areas) and coal and coal briquettes will serve in the future for heating individual dwellings. One exception is Croatia where the share of coal in the energy balance is insignificant.

Replacement of the primitive, low efficient heating-cooking stoves by modern appliances is an attractive solution but not an easy process due to their high prices. A good information campaign and a simple incentive system of state support are necessary for encouraging the population, particularly in villages and smaller towns where district heating and large buildings do not exist.

Introduction of chip- and pellet-fuelled combustion technologies could be done on commercial basis through automated local central heating systems of several megawatts capacity. This process is expected to be accelerated by the active involvement of the municipalities. To this end some of the EU structural funds could be used by them.

The most important for all WBC countries is for the governments to embark upon purposeful energy strategies for restructuring of the countries' energy balances through implementing programmes fostering biomass sustainable use, including establishment of legislative and regulatory framework and standards.

4.7.2. Benefits for the WBC countries from EU experience implementation

The Biomass Action Plan of December 2005 sets out measures to increase the development of biomass energy from wood, wastes and agricultural crops by creating market-based incentives to its use and removing barriers to the development of the market.

The growth of an EU biomass market could have a twofold benefit for the WB countries:

to use the EU biomass market for exporting biomass fuels supporting, in this way, their socio-economic development,

to transfer the EU experience in biomass utilization promotional policy to their countries.

In order to support the existing biomass energy potential, it is necessary to transfer technologies, methodologies and experiences from European countries where especially the heating biomass market is already developed. The EU experience shall be adapted to the local socio-economic and technical conditions in the WB regions.

It is expected that in parallel with the economies' recovery the market of wood chips and pellets will start growing rapidly. Their convenience for automation will be assessed at their true worth by the potential users – industrial enterprises and local heating stations. The main barrier to their penetration for the time being is their relatively high price. The increase of the firewood price, which is inevitable – will create conditions for faster chips and pellets penetration into the market.

Gradual implementation of the EU energy legislation systems is necessary. The promotional policy and the expansion of biomass market and use will lead in the future to moderation of the cost and to competitiveness of the biomass products. Quality standards for biomass fuels shall be implemented in order to attract investors and encourage trade. The governmental policy should take the initiative to help SMEs to promote small investments in production of biomass fuels and revive the market.

4.8. Implementation of the Best Options

4.8.1. Major barriers

The major barriers – policy, administrative and regulatory - are systematised in the following Table 7.

Table 7: Major policy, administrative and regulatory barriers

	Albania	**BiH**	**Croatia**	**Macedonia (FYR)**	**S&MN**
Strategy	No	No	Yes	No	No
Targets for RES utilization	No	No	No	No	No
Action Plan	No	No	No	No	No
Law on RES	No	No	Yes	No	No
Secondary legislation	No	No	Not ready	No	No
Administrative procedures	Heavy	Heavy	Heavy	Heavy	Heavy
Competitiveness of prices	Partially	Partially	Partially	Partially	Partially
Market conditions	No	No	Poor	No	No
Electricity non payments level	High	Acceptable	Acceptable	Acceptable	Acceptable
Commercial loan conditions	Poor	Poor	Poor	Poor	Poor
Special RES fund	No	No	Yes	No	No
Supporting mechanisms	No	No	No	No	No
Availability of technologies	Yes	Yes	Yes	Yes	Yes
Availability of information	Poor	Poor	Good	Poor	Good
Biomass database	No	No	No	No	No
Forest management	Poor	Poor	Poor	Poor	Poor
Awareness	Partially	Partially	Partially	Partially	Partially

4.8.2. Measures to overcome the barriers

The measures to overcome barriers ensue from the obstacles presented in the previous Table 7 and are connected with the overall political and economic conditions of the countries and their readiness to implement a sustainable energy policy in line with the EU strategy. At the top of the agenda are energy policy measures: strategy, legislation, regulations, alleviated administrative procedures. The most important, however, are the economic conditions of the countries. In this regard Croatia keeps the best position as a candidate country for accession to EU.

It is worth mentioning that in some of the countries the price of electricity is subsidized or non-payments rate is very high. These are also questions of policy.

All countries have access to modern technologies from the EU market for processing rough biomass to chips and densified fuels – pellets and briquettes – and efficient combustion technologies. The existing obstacles however prevent or slow down the implementation of these fuels and appliances.

4.8.3. Research priorities

ALBANIA

Policy, socio-economic, regulatory and standards

- Adaptation and transfer of the EU experience in forest management to the Albanian conditions
- Development of a Strategy for forests and agricultural biomass energy utilization in Albania
- Evaluation of the socio-economic impact of biomass utilization for residential heating

Biomass energy potential

- Carry out a fuel wood energy survey for defining the amount of fuel wood self-collection unregistered so far from rural areas of Albania
- Inventory and mapping of biomass energy resources in Albania
- Carrying out different research studies to find the possibilities to organize growing of "energy" wood with quick growing forests
- Mapping and determination of composition and quantities of agricultural residues. Carry out different feasibility studies to select the best place, technology ands plants
- Carry out a general study in the main cities of Albania for defining the composition of urban waste in different urban concentrations. Carry out a feasibility study for defining the place, technology (incinerator or landfills with gas recovery) to utilized municipal waste for energy purposes

Technical

- Carry out a feasibility study for promotion of efficient wood stoves technologies under the circumstances in Albania
- Carry out more detail research analyze for technologies for combustion of pellets and briquettes which should be used in Albanian conditions
- Carry out a more detail research analysis for selection of best technologies for production of pellets and briquettes under the circumstances in Albania

BOSNIA AND HERZEGOVINA

Policy, socio-economic, regulatory and standards

- Adaptation of EU MS experience to the institutional structures managing heat and power solutions
- Transfer EU experience through Development of a Strategy, laws, regulations and standards for sustainable use of forests and agricultural biomass energy
- Organization of demonstrational centres to show clear examples how the use of local biomass successfully replaces any fuel in heat production
- Investigation of economic, environmental and social impacts of development of biomass fuels

Biomass energy potential

- New investigations and update of forests distribution and wood production in Bosnia and Herzegovina and preparation of a new map due to significant changes of the previous situation
- Investigations of the agricultural production in Bosnia and Herzegovina, preparation of a map, necessary investigation for determination of most convenient

technologies for agricultural residues and waste collection, storing and processing in different regions of the country

- Assessment of the wood processing industry waste energy potential
- New investigation on real capacities for bio fuel production, with adequate mapping

Technical

- Assessment of the most convenient combustion technologies applicable to local conditions
- Investigation of the EU modern technologies for production of chips, pellets and briquettes and their applicability to local conditions
- Pilot and demonstration projects should target small-size boilers for the rural and suburban area (biomass)
- Programs have to be made to stimulate building of small combined biomass-fired units for electricity and heat production
- Identification of opportunities for suitable, financially competitive biomass plant application solution
- Looking for the best technical and economic solutions for combined biomass and fossil fuel combustion

CROATIA

The current funding available for research in the field of RES is rather limited and insufficient to cover R&D of one of the discussed RES let alone all country needs. Therefore, a balanced R&D programme in Croatia would consider the following priorities and areas:

Policy, socio-economic, regulatory and standards

- Building of national biomass standards and certification capacities
- Environmental impact analyses of the energy sector, including external costs of generation
- Cost-benefit analyses of biomass resources at micro - and macro-economic level
- Environmental cost-benefit analyses of biomass with assessing their externalities in socio-economic and environmental aspects
- Database on foreign practices, best options and experiences in administrative issues related to biomass
- Continuous monitoring of biomass implementation

Biomass energy potential:

- Database of biomass resources characterisation in spatial and time domain
- Reliable biomass resource assessment and mapping
- Research and analyses in the field of spatial planning and policy

Technical:

- Technology-related research areas for biomass best options in Croatia, addressing specific problems associated with different biomass technologies
- Improving reliability of technologies

THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA

Policy, socio-economic, regulatory and standards

Improving the situation with identified barriers for biomass energy resource development and exploitation is neither simple nor easy due to the absence of adequate data and information. There were no systematic research and investigation activities in the country during the recent 15 years and, at the same time, all the production base, management and exploitation has been completely changed. All the technical, technological, production and other data are old and do not represent the real situation and possibilities for improvement of the current adverse situation or definition of possibilities for further development.

It is obvious that wide and intensive research and investigation activities should be organized and performed, such as:

- Identification of possible technologies for production of different biomass energy materials (fuels) and choice of the optimal ones, adapted to local influencing conditions
- Determination of possible participation in the country's energy balance of different biomass energy resources for production of heat and electricity, based on proper socio/economic analyses
- Determination of possible and optimal regional and state development strategies for biomass energy resource development and economic consequences of their implementation
- Identification of possible technologies for combustion of different types of biomass materials (fuels) and possibilities for organization of local production of equipment or in collaboration with foreign industries
- Composition of a relevant state policy for biomass energy resource development, as a part of the strategy for energy sector development in the country
- Development of necessary standardization and its incorporation in the state industrial and trade sector
- Creation of the necessary regulatory and administrative framework to enable implementation of the defined development policy and strategy.

The above-listed research and investigation priorities are complicated for implementation, particularly if intending to realize them in the shortest term possible. Close collaboration with developed EC countries is necessary in order to enable transfer of their positive experience and "know-how" achievements in combination with a decision to increase the priority level for RES development in the country and concentrated efforts towards realization of accepted strategies and strict definition and control of responsibilities for implementation.

Biomass energy resource

The available assessments of the energy potential of forest and agricultural residues are outdated, unsystematic and unreliable. In order to embark on a serious programme for deployment of utilisation of biomass it is necessary first of all to develop a database of the biomass energy potential:

- New inventory and typology of biomass energy resources in the country with their energy valuation
- Identification of free land for development of new forests and energy crops production

- Identification of possible crops and varieties and choice of the optimal ones for concrete regions and climates
- Identification of possible growing and exploitation technologies and choice of the optimal ones, accommodated to locally influencing conditions

Particular research should be directed to sustainable management of the forests i.e. "The stewardship and use of forests and forest land in a way and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil now and in the future, relevant ecological, economic and social functions, at local, national and global levels and does not cause damage to other ecosystems" (Ministerial Conference on the Protection of Forests in Europe, 1993).

Finances

Financing of development is more a matter of a definite system of incentives and supporting measures rather than need for special funds for grants or very soft credits. For the defined market conditions and convenient tariffs without state taxation, the resulting economy of investments and exploitation is positive and shall attract home and foreign stakeholders.

SERBIA AND MONTENEGRO

Policy, socio-economic, regulatory and standards

- Mapping/method/model development of energy potential prediction, technical, economic and environmental evaluation of biomass systems utilisation vs. fossil fuels, Kyoto mechanisms and free market
- Accreditation of laboratories in the field of biomass and other RES for quality and performance control and energy efficiency related labelling of equipment
- Establishment of the information, knowledge and technology transfer network on biomass, and efficient R&D cooperation, as well as productive and business connections and efficient work of all active and responsible domestic entities in the field of biomass and other RES in S&MN and internationally

Biomass energy potential

- Investigation and development of energy plant farming and determination of the related system's energy potential, including biomass characterization for its energy utilization
- Development, design and construction of the sustainable, energy efficient and ecologically clean farming for energy.
- R&D of synergetic biological/technical/technological foundation of "wood for energy" and "planting for energy"
- Investigation and mapping of the seasonal quantity, composition and energy conversion related features of urban waste in municipalities and rural areas

Technical

- R&D in the technology for production of: briquetting equipment, briquettes from biomass and combined biomass and coal; pellets from waste biomass; techniques and market systems for distribution, transportation and delivery of the briquettes and pellets to consumers
- R&D in: high efficiency ovens with natural and forced convection for highly volatile fuels, combined oven-boilers for combustion of different fuels (wood, coal,

briquettes and pellets), small boilers for households fired with briquettes and pellets, and small coal-fired boilers without pre-treatment

- R&D in and construction of: heating and cogeneration plants fired with biomass and wastes in municipal systems, agriculture, paper and pulp industry, wood processing etc., equipment and systems for biodiesel and bio ethanol production

4.9. Overview of the Deliverables

The following table gives an overview of all the deliverables that had been produced during the project. All those, marked as "PU", are available to the public on the ACCENT webpage in the BSREC website (www.bsrec.bg).

The project deliverables are presented in the Table 8.

Table 8: List of deliverables

Del. no.	Deliverable name	WP no.	Lead partici-pant	Estimated person-months	Natu-re[1]	Disse minati on level[2]	Project month[3]
D1	Report "Residential Heating and Heat Consumption in SMEs"	1	5	5	R	PU	2
D2	Report on "Opportunities for production of wood chips, bio-briquettes, and bio-pellets"	2	6	6	R	PU	6
D3	Report "Technologies for combustion of wood chips, bio-briquettes and bio-pellets"	3	3	4	R	PU	6
D4	Report "Impact of and best options for utilization of wood chips, bio-briquettes, and bio-pellets"	4	4	4	R	PU	8
D5	Report "Measures to encourage the utilization of biomass residues and process wastes. Research priorities"	5	2	6	R	PU	11
D6	Project web-page	6	1	1	O	PU	1
D7	National Workshops	6	1	1	O	PU	12
D8	Book "Opportunities to use biomass residues and process wastes for energy purposes"	6	1	1	O	PU	12
D9	Leaflets	6	1	1	O	PU	12
D10	CD-ROMs with project results and other information	6	1	1	O	PU	12
D11	Articles in journals and newspapers	6	1	1	O	PU	12
D12	Project presentation	6	1	0	O	PU	5
D13	Minutes of the kick-off meeting	7	1	0.1	O	CO	1
D14	Progress and financial reports	7	1	0.4	O	CO	N/A
D15	Minutes of the final meeting	7	1	0.1	O	CO	12
D16	Final report	7	1	0.4	R	RE	13
D17	Final plan for using and disseminating knowledge	7	1	0	R	CO	12
TOTAL person months				32			

1) Nature of the deliverable codes:
R = Report
P = Prototype
D = Demonstrator
O = Other

2) Dissemination level codes:
PU = Public
PP = Restricted to other programme participants (including the Commission Services).
RE = Restricted to a group specified by the consortium (including the Commission Services).
CO = Confidential, only for members of the consortium (including the Commission Services).

3) Month in which the deliverables was available. Month 1 is marking the start of the project, and all delivery dates being relative to this start date.

Several deliverables are under the frame of dissemination activities and are crucial for the large-scale use of the project results: the web page, the book, and the workshops. A part of the dissemination was done during the meetings with representatives of governments, energy producers, NGOs and research institutes, in a process of sharing information concerning the project.

The organization of workshops in each country was an important dissemination activity, where the project findings were presented to various stakeholders. Along with the project results, background information on biomass utilization for heating and heat production, and especially information regarding the benefits from that, was also presented. The workshops created an environment of active communication among the participating stakeholders and contributed to the establishment of long-term relations among them. During the workshops leaflets, containing information about the project were distributed to all participants.

4.10. Conclusions

The main obstacle to efficient use of biomass for residential heating and production of heat in SMEs, replacing fossil fuels and electricity in the WB Region, has not attracted the attention of the national energy policy in any of these countries. On the contrary, biomass is everywhere treated as a minor and not urgent issue. The legislation for RES development is most often absent or unsatisfactory. None of the countries has defined a strategy for development of biomass production and use. No attention is paid to the new efficient equipment, no consideration on densified fuels – pellets and briquettes - production and use of chips, forest management, cultivation of energy crops, utilisation of waste from wood processing industry and agriculture. Croatia is the country most advanced in legal framework establishment.

The situation described in the previous paragraph naturally leads to neglecting the need for complete and reliable data of biomass potential. Outdated information is still in use. Often this information is updated to match the present situation, applying, however, unreliable methodologies. The need for organizing proper data collection by using a common methodology is obvious. Therefore, assessment of the biomass energy potential should have the highest possible priority in the national energy strategies.

At this point it should be mentioned that the lack of interest is a reason for poor forest management. In some of the countries (Albania) the forest is under the pressure of illegal cutting, in Serbia the forest is considered insufficient to maintain biodiversity and climate humidity.

Technological studies are not of high priority in the WBC. The main reason for that is the economic situation in the Region. A transfer of EU technologies is very important for helping to offset this gap, but it should be complemented by a high local technological level.

It is worth mentioning that there are efficient available combustion technologies and technologies for production of biomass fuels in the WBC. Most of them are imported but Serbia has set up good production of efficient combustion equipment at highest EU quality

level. Use of state-of-the art combustion technologies, although quite attractive, is impeded by the high initial investments. The WB countries have to apply flexible funding mechanisms to overcome this obstacle and to encourage users in the efficient use of biomass.

The Project has defined a number of priority areas and directions with the main goal to remove the existing obstacles and to boost biomass deployment in the Region. The highest priority is given to the Energy Policy Area: legislation and assessment of biomass potential, management of the forests. The second research priority is given to use of forest and agricultural residues, production of densified fuels, economic problems of biomass use, cultivation of energy crops.

It does not mean that the Technological Research is not important. All these three areas are part of the general RES research policy of every country. Prioritization here is done due to the urgency of the Political Research Area and the Impact / Interaction Area.

5. LESSONS LEARNED

This section describes some of the main lessons learned, focusing on the management and organisational prospects and is intended to present some important aspects of jointly executed research projects, which could be relevant to similar projects in the future.

5.1. Management and Work Organisation

The role of close supervision and close control both at a work-package level and project level is well-known. In the course of project implementation the crucial importance of the WP leaders in the process of ensuring compatibility of the information collected in each country became clear.

Selection of the WP leaders is the most important. The selection should be preceded by evaluating the strong and weak points of the partners. The WP leaders must have extensive experience in work on EU projects. They have to be capable to support the coordinator and to transfer their experience to less experienced partners.

In case of a wrong choice the coordinator will have to replace the weak WP leader, to overstrain himself in his wish to keep the project on schedule, and quality - at desired level.

5.2. Applicability of Results

The establishment of the Energy Community in Southeast Europe obliges the WB countries to follow sustainable energy policy in line with that of the EU. The use of local energy sources, including biomass, ranks first and is one of the alternatives worth consideration. The main project results fall under three groups:

- Measures for removal of obstacles to the large scale use of biomass for heat production
- Establishment of sustainable energy policy
- R&D priorities

The implementation of recommended measures could contribute considerably to promoting biomass use in WBC energy policy. The first and second group of measures should be implemented in the state documents: strategies, programmes, laws, regulations, standards. The third group should be implemented in the activities of the research community in close cooperation with the European research community.

In order to achieve these goals intensive dissemination activities should be carried further after the end of the project: attraction of stakeholders' collaboration, ensuring support from

the investors in biomass fuel production, biomass combustion technologies, clarification of the importance of the forest management, different initiatives, popularization of funding mechanisms etc.

5.3. Reliability of Information

As described above, the available information on biomass energy potential in WBC is outdated and unreliable. The important information on the biomass potential is of higher importance in order to avoid exhausting of the resources and biodiversity imbalance. The measures to promote efficient use of biomass should be coordinated with the forest management. This is also for woodworking industry and the utilization of wood processing wastes.

Due to the absence of a reliable information system, the results of many studies are losing credibility. Therefore, one of the main priorities of the WB countries, along with evaluation of the RES potential, is the implementation of a modern statistical system.

6. PLANS FOR THE FUTURE

The ACCENT Project was a SSA intended to contribute to sustainable energy development in the Western Balkans, through identification of the best options for introduction of efficient biomass use for residential heating and heat production and formulation of research priorities and research areas in the field. In order to achieve that goal, special efforts are needed in the work areas corresponding to the priorities formulated in the Project results. The study has ascertained many open research issues, which still remain unsolved and which will stimulate further research work in the future.

The dissemination efforts will continue in the following directions:

- The webpage will remain online for at least another 24 months
- The ACCENT Project will be presented at relevant national events
- Meetings and discussion will be carried out with the policy makers, research institutes, investors etc.

In order to increase, as much as possible, utilization of the Project results, the Project Consortium will continue its communication with the relevant stakeholders in the identified priority areas:

- Policy
- Biomass energy potential
- Technical

The study revealed serious deficiencies and gaps in all research fields concerning biomass potential and use, as well as lack of basic information and absence of sustainable energy strategies. Urgent efforts are required to compensate for the delay caused by a decade of political and ethnic conflicts.

The policy and economic solutions research area is a direct obligation of the state institutions – ministries responsible for energy, and each partner country will make efforts to popularize the defined research priorities and to contribute to their inclusion in the ministries' research activities. The Consortium will work in close cooperation with other stakeholders – investors, companies, research centres, agencies, etc., that are interested in having a consistent state policy towards the sustainable use of biomass for heating.

The next two research areas – biomass potential assessment and technological solutions – need particular involvement of the market players: energy companies, producers of energy equipment, research institutions, etc. These areas are more universal – they are less dependent on the local conditions. International cooperation within the European Research Area will be of crucial importance for the technological progress of the countries.

The assessment of biomass potential is closely connected with sustainable forest management, which is an obligation of the states. The utilization of agricultural residues has its peculiarities, different from that of forest residues and biomass. The most important problems here are collection and transport. This is another field of research and transfer of EU experience.

The research activities on ACCENT-related topics reflect the EU energy policy requirements and are likely to take place in the research programmes of the Western Balkan Countries, because all of them have taken the course to EU accession and have already signed the binding document – the Energy Community Treaty.

The partners will be working together with the ministries responsible for forest management, agriculture and research in order to include the biomass research priorities into the state research programmes.

The ACCENT partners have made a commitment to contribute to the transfer of EU advanced technologies and to more intensive interactions among the European and the local research centres by means of various instruments provided by the EU or by local sources. To that end, they will participate in the future in EU funded programmes with proposals focused on the sustainable utilization of biomass.

The situation with research in the WB Region presents a broad diversity of opportunities for research institutions to make efforts and do their best for the recovery of their countries in cooperation with the International Research Community.