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BIOMASS AND SUSTAINABLE DEVELOPMENT OF LOCAL COMMUNITIES

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Abstract: Energy production from biomass is very specific because they use different technologies to obtain useful products. All the conversion of biomass into useful energy, efficiency factor describes the energy chain, from biomass resources as the energy source. This includes the collection and preparation of remains, and storage of organic residues to the end use and the conversion of biomass into heat or electricity. In Bosnia and Herzegovina there are many possibilities for both growing and using forest for energy producing. Successful examples taken from forestry management practice in EU countries can be useful for enterprises, owners, commerce and environment in BiH.
Keywords: biomass, forestry management, briquette, pellet, possibilities

1. INTRODUCTION

Any organic matter which is available on a renewable or recurring basis, including agricultural crops and trees, wood and wood residues, plants (including aquatic plants), grasses, animal residues, municipal residues.

Biomass is produced from water and CO_2 by photosynthesis, solar energy acumulated in construction of plants as a chemical energy [1]. In this paper is considered wood biomass, but only remains and residues from different wood processing.

Forest wood residues content:

1. Forest residue
2. Mill waste
3. Urban wood waste.

The primary forestry residues include: logging residues from conventional harvest operations, forest management and land cleaning (Figure 1).


Figure 1. Forest residues

Mill waste is secondary forestry residues and it can be:
– Mill wastes
– Pulping liquors (Figure 2).

Urban wood waste is actually tertiary forest residues which can be made:
– during construction and demolition debris,
– like unusable pallets or
– tree trimmings from the urban environment (Figure 3).

Unfortunately, even there are possibilities for good forestry management and energy producing from wood or wood residues, those possibilities is not realized yet and it is good opportunity for use for bioenergy carriers like as chips, briquettes and pellets.

Figure 2. Mill waste and after processing use as wood chips

Figure 3. Urban wood waste

Main reason is the fact that there is plenty of forest in Bosnia. Forests like resource aren't in short supply. Also, both government and market still do not recognizing opportunity for this type of energy producing and creating new enterprises.

For growing of wood that can be used in energy producing process we can distinguish some benefits and disadvantages [2].

Disadvantages:

- Bio energy activity requires very deep knowledge of wide sector competence,
- High level of mechanization,
- Water, soil, climatic, environmental constraints limiting the biomass productivity and the type of plants,
- Need to adopt horizontal and vertical integration of sub-systems to improve the economic basis of bioenergy complexes.

Benefits:

- Marginal land recovery,
- Protecting the land (improve soil quality),
- Erosion control,
- Less fertilizer, pesticide, herbicide, and fungicide than annual row crops to purify polluted soils (phytoremediation),
- Sequestration of CO_2,
- Income benefits for farmers,
- Positive effects on local employment in rural areas for the biomass resource production.

BIOMASS IN ENERGY PURPOSES

The term 'biomass' describes the biomass of organic matter (it means that containing carbon). According to this, biomass includes:

- Phytoplankton and zoo-plankton (plant and animal),
- Remains of the production, production waste (egg animal excrement or straw),
- Dead (but no fossil) phytoplankton and zoo-plankton,
- All substances with organic origin that are results of technical conversion, for example black fluid, paper and cellulose, waste from slaughterhouse, organic waste from households, vegetable oil, alcohol etc).

In order to distinguish biomass and fossil fuel, there is a remark that peat, product of secondary decomposition, will not be considered like biomass in this paper, even in some countries (Sweden, Finland) it isn't so.

Biomass can be divided to primary and secondary products:

- Primary products of biomass appear directly under effects of solar energy during photosynthesis process and include phytoplankton, agricultural and forest products, some species that are cultivated for energy purpose (fast growing trees or grass), the plant remains, waste from agriculture and forestry (waste and remains from processing of wood, straw).
- Secondary biomass products, unlike to primary, indirectly receive energy from the sun; they are result of decomposition or conversation organic substances in the metabolism of higher

organisms (egg animals). This includes, for example, all the zooplankton, animal excrements (egg solid waste, fluid waste and sludge).

THE STRUCTURE OF TYPICAL CHAIN FOR BIOMASS SUPLYING

Supplying with energy from biomass includes many processes starting with growing high energy plants, preparing the remains of the production, collecting and storage organic waste until the final use and the conversion of biomass energy in the heat or electricity [2].

The chain includes the life cycle of organic matter from its creation (i.e. primary energy) to the preparation- and obtaining useful energy (Figure 4).

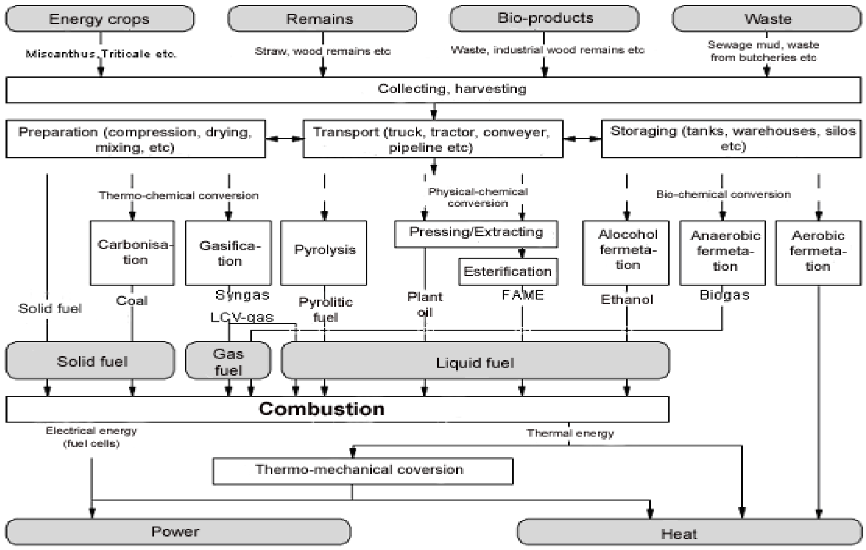

Figure 4. Availability of energy from biomass (gray shadow fields - different carriers of energy, fields without shadow - conversion processes; FAME - fat acid methyl esters, reaction that occurs in fuel cells considered as "cold combustion")

The aim of this biomass supply chain is to meet possible changeable requirements for finally usable energy and providing of necessary installations for conversion. Those installations or even plants must be appropriate for particular size and/or quality of biomass. Each supply chain consists of the life cycle of biomass production, supply, conversation, practical use and disposal. Generally, all previously listed parts are divided into groups in a number of individual processes. For example, derivation of biomass requires, among other things, the preparation of land, fertilizer application and protection. After that, various processes that are conducted in entire life cycle does not occur in the same place, because the necessary transport biomass to the appropriate place (for example: trucks, tractors, pipelines).

Finally, certain supply chain is determined by the framework of conditions, which depend on the production of biomass (supply side) in one hand and the final energy supply (demand side) on the other hand. Further decisive factors are economic, technical and administrative, which have a significant impact to give a practical function to whole supply chain. For example, choosing the appropriate transformation of energy from one form to another depends on the need for some of these forms (heat or electric) in accordance with the legislation regarding to environmental protection.

Furthermore, supply structure is determined by the available (Storage) using and wasted matter during the process (such as the remains which occur in the processes of fermentation after the production of biogas or ashes that remain after combustion of solid fuels).

There are various possibilities of treating remains of production and the criteria could be characteristics of various types of biomass (such as the shape, size and moisture content) and requirements for the application of appropriate technology for energy production, which must be defined before the conversion and providing of energy start.

Remains of biomass (which are previous sorted) can be secondary energy carriers such as: wood pellet, chips, straw bale, etc. More that that, type of biomass (wood or plant biomass), its quality (water content, composition), seasonal differences that are present in different types are effecting on the variability of energy consumption and distribution.

Those specified characteristic of biomass require different ways of storage, and the drying of biomass is an insurance that biomass will be correctly and safety storage in the warehouse. Beside that, certain economic needs must be feasible within the prescriptive conditions and socially acceptable. (Picture 4)

DEFINITION OF EROEI FACTOR

Energy returned on energy invested (EROEI or ERoEI); or energy return on investment(EROI), is the ratio of the amount of usable energy acquired from a particular energy resource to the amount of energy expended to obtain that energy resource [4], [5] . When the EROEI of a resource is less than or equal to one, that energy source becomes an "energy sink", and can no longer be used as aprimary source of energy.

EROEI = USABLE AQUIRED ENREGY / EXPENDED ENERGY

Although many qualities of an energy source matter (for example oil is energy-dense and transportable, while wind is variable), when the EROEI of the main sources of energy for an economy fall energy becomes more difficult to obtain and its value rises relative to other resources and goods. Therefore the EROEI gains importance when comparing different energy alternatives. Since expenditure of energy to obtain energy requires productive effort, as the EROEI falls an increasing proportion of the economy has to be devoted to obtaining the same amount of net energy.

On the figure 5 we have different EROEI factors for some kinds of renewable energy also for production. There are widely spread this number from 1,6 to 100. EROEI number about 1,6 describes process for production biodisel. On the opposite site we have number for EREOI 100, which describes hydroenergy production.

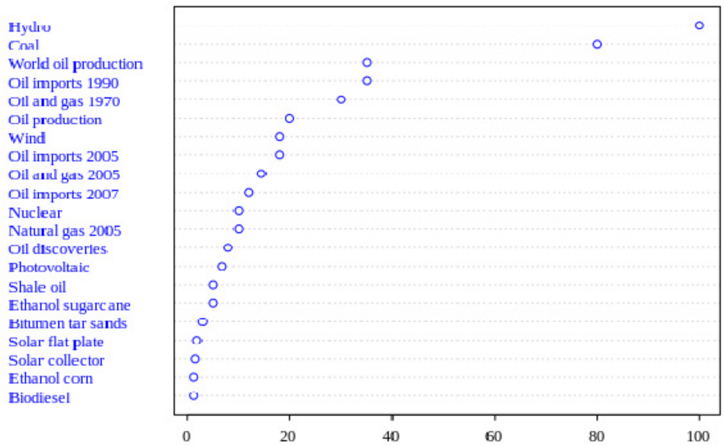

Figure 5. EROI – USA, Ratio of Energy Returned on Energy Invested for different kinds of rewable energy[4]

CONCLUSION

On the figure 5 clearly we see no well-defined value EROEI factor biomass. The question is why? Answer is very simple. Biomass is a very demanding as eneregy resource from different parameters and needs a revamp. This process requires: cutting hauling, drying, transport, processing into fuel transformation. Every part of this process requires a certain amount of energy investment. To get the full picture of the state of energy production from biomass must all be considered. Accordingly the numbers of parameters and actions that must be determine. It is huge job but, when we will develop a good model than we have good situation for analyzing best way solution for biomass energy production.

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