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## RATIONAL SUSTAINABLE USE OF WASTE BIOMASS IN THE DEVELOPMENT OF THE LOCAL COMMUNITY

**Abstract:** *The use of waste biomass of forest and agricultural ecosystems as renewable energy sources has been a practical and reliable way to obtain energy in most EU countries in recent years. Numerous scientific and practical research has focused on the possibility of using different forms of wood and plant biomass residues as a potential energy source. In this paper, the fragmented energy potentials of wood and plant biomasses from the territory of Citu Cacak are given. A well-planned supply chain with wood and plant biomass with the appropriate preparatory technology can significantly affect the price of energy produced from biomass.*

**Keywords:** *wood and plant biomass, energy potential, regional territory.*

### 1. Introduction Introduction

#### 1.1 Review the current state

The use of available agricultural waste wood and plant biomass for energy or other purposes is significant for the poor energy potential in general, as well as for reducing import dependence, ensuring energy supply, reducing environmental pollution, meeting international obligations to reduce CO<sub>2</sub> emissions. Also, the rational use of available agricultural waste wood and plant biomass for energy and other purposes would significantly influence the raising of the technological level of energy, mechanical engineering, food industry, etc., faster development poorly developed regions rich in waste from agricultural wood and plant biomass realized through: realization of investments, engagement of local workforce, opening of new jobs, improvement of local infrastructure, and realization of revenues through various types of production.

Serbia could become a leader in the use of waste biomass in the Balkan region. If it succeeds in unlocking the huge national potential for the use of waste biomass, it could serve as an excellent example to other countries in the region. There is a great need to improve governance, both in the public and corporate sectors, to enable the exploitation of biomass and the development of its full potential.

The application of waste biomass as an energy resource can have positive effects only if it is based on the concept of sustainability. This implies the need to prevent competition between food production and energy production from biomass, to rational use of waste biomass on the basis of sustainability indicators and to preserve soil quality, as organic content in biomass production. The use of energy from waste biomass on the principles of sustainability is a continuous process that requires an organized systemic approach of all actors at national, regional and local level. Waste biomass from forestry and

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agriculture is the most important renewable resource for energy production in the Republic of Serbia, but it is not inexhaustible.

The cost of using biomass as energy sources is lower than the cost of using competitive fuels, so saved money can be diverted to the demand for other goods and services. The process of supplying waste biomass, as well as the wood processing industry, employs a relatively larger number of people than some other industries, which can increase the opportunity for employment in environments rich in wood biomass.

Serbia has certain obligations regarding the achievement of national goals for the area renewable energy sources, such as the increase in the share of energy from renewable sources to 27% in gross final energy consumption by 2020, in addition to the binding target Serbia has accepted, as well as all EU countries, from 10% of the share of renewable energy sources in the gross final energy consumption in traffic.

Waste biomass is a serious candidate for use in the district heating system in some cities, for which special measures need to be taken. When a biomass is purchased from a local manufacturer, that part of these resources is spent at the local place, and when energy is imported from another local government, the money goes from another continent, irreversibly. Savings on fuel costs are also possible because biofuel is cheaper than some other fuel types. One of the obstacles for investing in this sector is that district heating is a activity of general interest and the performance of this kind of activity is carried out according to a certain procedure, which does not simplify the use of some other fuels. On the other hand, the price of electricity is relatively low. Apart from the fact that the social policy tool effectively represents a barrier to investing. Also, suppliers to competing fuels are in a better position in terms of impact on market events. For the rational use of wood and plant

residues, they should define the energy potentials for a defined territory, which arise from:

- provision of firewood intended for heating,
- wood residues resulting from deforestation of timber plants: unused wood, remains of logs, horns, branches, etc.,
- agricultural residues: straw, leaves, fruit fractions, waste from raspberry and blackberry production, vines, maize stems, etc.,
- waste wood and vegetable biomass from fragments: forest, border, bay,
- landslides, maintenance: electric lines, roads, etc.,
- municipal wood and plant waste from households and industry, etc.

### **1.2 Sustainability of the rational utilization of available energy and wood biomass fuels**

A definite concept for the rational use of available wood and plant biomass will enable sustainable development, since conceptually embedded current energy, industry and life-protection strategies are yet to be embedded in the central policies of economic and social development. The concept of sustainable development of this project has generally three-dimensional aspects:

1. economic (or perhaps techno-economic) sustainability,
2. ecological sustainability and
3. social sustainability.

So sustainable development systems depend on the practical application of appropriate technologies that provide the best "conjunction" between techno-economic feasibility, social acceptability and environmentally sustainable use of available resources.

Some of the aspects of environmental

protection are aggregate environmental impacts from agricultural production residues in emissions into: watercourses and land, air, and on the change or degradation of habitats (humans, flora and fauna). To date, knowledge of such influences is largely based on observation and oral statements.

## 2. Strategic goals for using wood and vegetable biomass as energy

Renewable energy sources from waste wood and plant biomass can significantly contribute to the less use of fossil fuels and to the achievement of defined goals on the share of renewable sources in final energy consumption, as well as to the improvement of the environment. The goals of the energy policy of the Republic of Serbia that relate to the increased use of RES (renewable energy sources) from biomass can be achieved by the realization of the following activities:

- by constructing new facilities that meet the requirements for insight into energy efficiency and utilization of biomass as an energy source,
- energy rehabilitation of buildings, heating heating for biomass energy products in the building sector (mainly in the public sector),
- replacement of oil for coal, coal and natural gas used for heating biomass,
- introduction of district heating systems based on the use of biomass and combined production of electricity and heat,
- use and production of equipment and technologies that will enable more efficient use of energy from biomass.

Key activities to be undertaken to achieve these objectives are covered:

- ensuring the leading role of the public sector in implementing efficient use of energy from biomass,
- Setting up efficient use of energy from biomass in order to encourage the economic development of the country (production of green energy technology equipment),
- development of sustainable biomass production and provision of financial support for development,
- the formation of the energy market from biomass.

In order to achieve the stated goals in the field of energy use from biomass, it is necessary to apply the following support measures:

- adoption and improvement of the legal framework that will stimulate more energy efficient energy use and greater use of biomass as a fuel,
- measures of economic incentives (through the continuation of the already established support scheme for the production of electricity from renewable sources and cogeneration of heat and power with high efficiency of the process, as well as the preparation of guidelines for supporting the production of thermal energy from biomass at the local level),
- direct financial incentives and appropriate tax policies,
- measures that will encourage a sustainable biomass market,
- systematic promotion of best practices applied in EU countries (efficient use of energy from biomass),
- Systematic planning of projects in the area of energy use of biomass and others.

### 3. Technologies for energy use of available energy potential from wood and plant biomass

It can be expected that the rational use of the energy potential of wood and plant biomass will have a very important role in the production of energy in Serbia in the coming years, bearing in mind that it is also necessary to reduce the amount of carbon dioxide emitted into the atmosphere. In all of this, a state should also be involved that would help the development of the market for renewable energy sources by certain incentives.

For the rational use of available wood and plant biomass for energy purposes, the available potentials can be used to generate heat and/or electricity. Cogeneration (often referred to as combined heat and power generation) is at the same time generating useful heat and electricity in one process. Combined heat production and electricity consumption of fuel can be reduced by approximately 25-35% compared to the production of electricity and heat in separate processes. In this way, the emission of CO<sub>2</sub> per heat produced and electricity is reduced and the overall utilization rate is higher. In the case of cogeneration plants, in the production of a current of one MWh, carbon dioxide emissions are reduced by about one ton. A similar situation exists in the case of trigeneration plants where thermal energy, electricity and cooling energy can be produced.

In compost processes, compost is produced as a product of wood and plant biomass residues. Almost all plant residues and moisture of more than 40% (grass, leaves, branches, fruits and vegetables, etc.) can be composted, and some residues of animal origin (meat residues, etc.). As a compost product, useful material (compost) similar to humus, which has no unpleasant odor and can be used as a soil conditioning agent or as a fertilizer. Compost in the soil has a favorable effect on the improvement of the

water, air and heat regime of the soil. Also, compost can be used to improve the quality of degraded land and as a substrate in the production of various plant species. It should be kept in mind that large quantities of solid municipal waste are deposited in landfills and affect human health, but also to the quality of the environment. Gases emitted at this occasion are CO<sub>2</sub>, CH<sub>4</sub> that contribute to the greenhouse effect.

Depending on the place of production, the degree of humidity and the amount of wood and vegetable biomass, appropriate preparation should be made for the rational use of these energy sources. Preparatory technologies for the rational use of wood and vegetable biomass should include appropriate preparation at the source of origin with appropriate machinery. So, this mechanization is necessary to be mobile.

In addition to possible use for energy purposes, available wood and plant biomass can also be used to obtain appropriate technologies and products from them which can be applied in: food, cosmetic, pharmaceutical, etc. industry.

Measures for implementing state support for the use of biomass at the regional and local level may consist of:

- support to producers of biomass energy production equipment to be viewed through support to central heat production systems. This support should consist of: a system of non-refundable subsidies, support for foreign investments, favorable credit support to investors,
- support through subsidies for individual heating systems.

Support to the biomass market consisting of: tax deductions for the delivered biomass in the domestic market, subsidies for raising fast growing forest plantations, support to private forest owners for the production of biomass through rural development funds, giving priority to supplying wood biomass

for domestic consumers of biomass by public companies for the management of state-owned forests.

Key criteria for the rational use of biomass waste:

- minimization of transport costs,
- minimize preparation time,
- minimizing inventory,
- maximize profit,
- maximize utilization of capacity and
- accurate deadlines.

#### 4. Available energetic potentials and their use from waste wood and plant biomass collected by "JKP Gradsko zelenilo" Čačak

From the territory of the Municipality of Gradsko zelenilo čačask, energy use can be used from biomass from forest ecosystems, grass biomass (parks, maintenance around

water courses, etc.)

In the territory under which "PUC Gradsko zelenilo" Čačak in maintaining urban green areas and roads, thus collecting wood and agricultural biomass that can be used for energy purposes. Using the Geographical Information System GIS, the most important territories were identified for collecting waste wood and plant biomass (Figure 1.) To calculate the available energy potential, there are recorded data on quantities and types of energy sources. According to the available data i received from the relevant services of the "PUC Gradsko zelenilo", and according to the adopted values for the thermal power and weight of the corresponding wood and vegetable bitumen residues according to (Glavonjić, 2011), (Ćurčić, 2010), (Brkić), (Ćurčić, 2016), (Local municipal Čačak) calculate the values of the energy potentials given in Table 1. (in MWh/year). Vegetation in Central Serbia is given in Figure 2.



Figure 1. Zone of collection of plant residues in "PUC Gradskozelenilo" Čačak



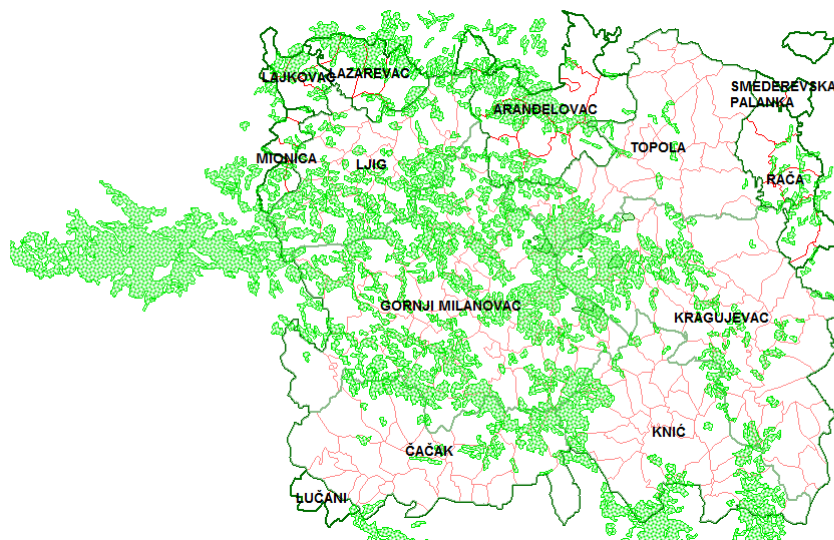


Figure 2. Vegetation in Central Serbia

Table 1. Energy potential of waste wood and vegetable biomass collected by "PUC Gradsko zelenilo" Čačak

Speciesenergy	Quantities per year	Available energy potential (MWh/year)
Grass harvested	close to 800 m <sup>3</sup> – humidity 80%	$800 \cdot 8 \cdot 250 / 3600 = 444,44$
Collected branches	close to 300 m <sup>3</sup> – humidity 50%	$300 \cdot 10 \cdot 300 / 3600 = 250,00$
Waste wood harvested	close to 300 m <sup>3</sup> – humidity 50%	$300 \cdot 10 \cdot 400 / 3600 = 333,33$
Grassy mass collected	close to 100 m <sup>3</sup> – humidity 80%	$100 \cdot 8 \cdot 250 / 3600 = 55,56$
A grassy mass that is not collected	close to 150 m <sup>3</sup> – humidity 50%	$150 \cdot 10 \cdot 400 / 3600 = 166,67$
Other energy waste from wood and plant biomass	close to 2500 kg – humidity 20%	$8 \cdot 2500 / 3600 = 5,56$
TOTAL (MWh/god)		1255,56 (MWh/god)

In the "PUC Gradsko Zelenilo" Čačak, a 30 kw boiler, weighing 6000 kg with a biomass consumption of about 120 kg / hour.

The boiler heats the administrative building, and from the near to heating, the mass and the greenhouse are connected, so that the production of plants throughout the year is enabled in that segment, which was not the

case before. For heating, biomass (wood chips, sawdust, etc.) is used, which is obtained on a special machine designed and manufactured for this purpose. In the heating plant an electronic pump is installed which significantly reduces the consumption of input energy sources.

Also, in the "PUC Gradsko zelenilo" Čačak, a capacity composting plant of about 1000 m<sup>3</sup> was built annually.

BENEFITS of these projects are:

- environmental protection by the rational use of the energy potential of waste wood that occurs through the maintenance of public areas in the city,
- improvement of working conditions of employees and improvement of available potentials in “PUC Gradsko zelenilo“ Cacak by installing a new heating system and providing the necessary heat for the production of planting material throughout the year,
- more rational use of budgetary funds, through additional engagement for the generation of new energy sources and reduction of expenditures for consumed electricity, which is mostly used for heating the room,
- more efficient use of storage space by processing and combustion of waste biomass, which arises as a product of maintaining public areas,
- popularization of the use of renewable energy sources - biomass - introduction of a wider citizen to technologies for the treatment of biomass in “PUC Gradsko zelenilo Cacak.

## 4. Conclusion

The Local Initiative is a key factor in the implementation of concrete projects, so it needs to play a major role in the development of its use in a modern way. Locally, the production of wood fuels opens the possibility of new activities in the agriculture and forestry sector, as well as in the wood industry. In addition to being a safe and inexpensive source of energy, in countries that are rich in forest biomass, it is also a domestic raw material, which is significant for the independence of energy imports. Since today biomass as a renewable

energy source on the market can not compete with fossil fuels, subsidizing the technology of its use is necessary and a significant measure necessary for success.

Using biomass energy on the principles of sustainability is a continuous process that requires an organized systemic approach of all actors at national, regional and local level. Waste biomass is a serious candidate for use in the district heating system in some cities, for which special measures need to be taken. Savings on fuel costs are also possible because biofuel is cheaper than some other fuel types.

Uncertainty and uncertainty in energy supply, pollution and environmental issues, as well as the scary consequences of the climate change we face in recent years, suggest that alternative energy sources must be considered.

The cost of using biomass as energy sources is lower than the cost of using competitive fuels, so saved money can be diverted to the demand for other goods and services. The process of supplying waste biomass, as well as the wood processing industry, employs a relatively larger number of people than some other industry branches, which can increase the opportunity for employment in environments rich in waste wood and plant biomass.

In order to increase the use of waste biomass in the production of heat and/or electricity, the price of electricity produced from biomass must be significantly increased.

Serbia could become a leader in the use of biomass in the Balkan region. If it succeeds in unlocking the huge national potential for the use of waste biomass, it could serve as an excellent example to other countries in the region. In order to achieve this, a great need is needed to improve governance, both in the public and in the corporate sector, in order to enable the exploitation of waste biomass and the development of its full potential.

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