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THE PRODUCTION OF PELLETS IN SERBIA: A STUDY FROM COMPANY C

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Summary

This paper examines the issue of renewable energy through production of pellet as one part of biomass. The research setting consisted of a domestic company that operates in Serbia. The biomass as a potential energy source is well-explored issue by scientists and practioners in developed countries. There are few studies of using biomass in developing countries such as Serbia. The purpose of this study is to analyze feasibility of producing pellets in selected company in Serbia. This paper contributes to the existing literature by assessing production pellet in a company that operates in transition environment. The findings have significant implications for practitioners attempting to manage projects in the domain renewable energy. Furthermore, the study provides the example of good practice for other entrepreneurs in Serbia.

Key words: *renewable energy, pellets, project management, feasibility study, Serbia*

JEL: *Q16, G11, Q01*

Introduction

Eighteen per cent of the total energy comes from renewable sources of energy. The majority of renewable energy – 13% is biomass, the redundant are solar energy, energy of wind as well as thermal energy.

The significance of the use of renewable source of energy is twofold. First, the definition of biomass will be proposed.

According to EU directives, the biomass includes biodegradable materials from agriculture, animal husbandry, as well as biodegradable part of industrial and municipal waste. Thus, the biomass is defined as fuels that can be obtained through biological processes in relatively short periods. Carbon dioxide, water and solar energy occur in the form of plant biomass. Biomass consists of wood, straw, maize, sugarcane, vegetable oil, resin, sugar cane, sugar beets, mash and mass of green.

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Biomass is a traditional, renewable and secure source of animal food, raw materials and energy. For efficient use of biomass as an energy source, it is necessary to know its physical and chemical characteristics. Biomass mainly consists of fuel (50%-60%), moisture is highly variable, and sulphur has only a trace.

The biomass as a potential energy source is well-explored issue by scientists and practitioners in developed countries[4].

It is possible to obtain three tons of straw from wheat, canola and soybean, five tons of corn, four tons of sunflower stalks from one hectare of agricultural land. The chemical composition of these types of biomass is similar to wood.

The following data illustrate the importance of biomass: 2.5 kg of straw can save: 1 litre of heating oil; 1.06 cubic meters of gas; 9.72 kilowatts of electricity; 2.2 kg of wood and/or 1.94 kg of coal.

In the case of Serbia, Vojvodina Province has potentials for production of biomass from agriculture, while the Eastern and South-western Serbia have considerable potentials for production of biomass from woods. The energy from biomass could comprise 25% of total primary consumption in Serbia. In the sector of agriculture food producers have a reasonable chance to become energy producers. This is supported by the fact that in Titel opened a plant for production of briquettes and pellets with new technology. The factory is equipped with modern dryer straw and sawdust, the briquette pellet. Plant capacity is 7,000 tons of briquettes and pellets per year, which is only 3% of the total area planted. Therefore, the perspective and the need for such new technologies in Serbia are extremely large.

"Two million hectares or more than one-fourth of the country's total land area are covered by forests. Biomass from wood is a energy potential in Serbia. In fact, twenty-eight different municipalities have more than 40% of their entire area covered by forests.

Municipalities with the highest share of forest area are in two main regions. In the South-Western Serbia, over 80% of Prijepolje municipality is covered by forest, while in Priboj and Kuršumlija municipality between 61% and 80% of territory is covered by forests. In Eastern Serbia, Majdanpek municipality is over 80% covered by forest, while in Kucevo, Žagubica, Bor, Baljevac, between 41% and 60% of territory are covered by forests. Ownership structure of forest in Serbia is the following: 52.5% of forests are state-owned, while 48.5% of the total forest area is private owned. The majority of companies that producing wood in Serbia are private owned or in the process of privatization"[5].

4 We meant on following studies: Bonilla, D., Whittaker, C. (2009): *Freight Transport and Deployment of Bioenergy in the UK*, Working paper N° 1043, University of Oxford, Murray, G. (2010): *Lillooet Biomass Energy Corporation Business Plan for a Wood Pellet Plant*, Gordon Murray Corporate Finance Ltd.

5 http://www.serbia-energy.com/index.php?option=com_content&view=article&id=292&Itemid=87. The data came from statistics provided from the Serbian Ministry of Agriculture, Forestry and Water Management.

Using biomass, not only to replace part of a much needed energy, which is obtained from conventional sources, but in order to meet the strict criteria of environmental protection. Energy contributes to increased employment, safer and better life, even though considerable investment. Massive use of biomass contributes to reduce the emissions of sulphur dioxide, carbon dioxide and nitrogen dioxide.

Greater use of renewable sources of energy will lead to the development of industry machinery and equipment investment in Serbia. In order to implement EU legislative in Serbia, it is necessary to create a team from Ministry of Agriculture, Environment, Energy and Finance.

The main obstacle for the economic exploitation of biomass is the dispersal and inaccessibility of the terrain for mechanized collection. Installations for the production of energy from renewable sources tend to be relatively small capacity, and thus investments in individual plants are also relatively small. Therefore, there is a reasonable basis for the integration of Serbian economy in the development of technology, production equipment and participation in the competition for the sale of products to neighbouring countries. Bearing in mind that the renewed energy sources mainly located in rural areas, this production can ensure the high employment of the rural population. It is necessary to realize that energy production from biomass brings more jobs than large power plants and mines, which now have to pay the "ecological tax" due to coal combustion. In this process Serbian Government should be an initiator. There are a lot of examples of inventive individuals – producers of renewable energy. The institutional support in Serbia is missing. The extensive use of biomass can be very profitable business, not only for entrepreneurs but for state as whole.

Based on the results of one study, the need of using biomass for households has been identified. The potentials of biomass production in Vojvodina Province were estimated using published data, and measuring the yields provided by farmers. It is necessary to formulize strategy of implementation the production of biomass in order to resolve conflicts between the Government and consumers. The national regulation harmonized with the existing EU standards concerning the use of biomass for domestic heating is the first important issue.

The paper structured as follows. First, an overview of the relevant concept and previous studies is presented. The paper then introduces the research methodology, presents the research findings, discusses them, and draws some conclusions and implications. Finally, the contributions and some possible directions for further research are presented.

European experience in the production of pellet[6]

The production of pellets in Europe began in the 1980s in Sweden, due to high oil prices and the need to reduce air pollution and the environment - that there is a greater use of coal and other fossil (non-renewable) fuels.

Since then, the production and consumption of pellet are growing. In 2006, there have been 200 plants in Europe that producing pellet, with annual production of over 4.5 million tons of pellets.

In early 2000s, the members of EU have been adopted the laws of renewed energy, in order to encourage the use of renewable sources of energy. The main motive for obtain this legislation was an International agreement reached 1998 in Kyoto, to reduce emission gases in the atmosphere that cause the effect of greenhouse. The EU Commission believed that the greatest contribution to achieving this goal may be to provide extensive use of biomass.

In some EU countries, such as Holland and Belgium, the consumption of ecology friendly energy is significant higher than production of renewable energy.

In Slovenia, the legislative regarding the renewable resources consisted of 11 laws, in Switzerland there are 32 regulations, and Romania has ten laws. Therefore, for faster implementation of the Kyoto Protocol and use of renewable energy in the global market, it is necessary to clearly define and to create general conditions for this kind of energy. This is especially true for the production of electricity from biomass.

Before 2001, the biomass is mainly used for heat and very little to produce electricity, and since that time together and using thermal and electrical energy, or biogas produced by an electric current. Regulations on electricity from biomass, which are published in various countries since July 2001, and the improved versions and 2004 and 2005, give encouragement using biomass to produce electricity.

The point is that the companies offering and distribution of electricity required to take any amount of offered electricity produced from renewable sources, and is payable over the next 10 years in Slovenia, 13 years in Austria, 20 years in Germany. The amount of compensation depends on renewable energy sources, power plants and the beginning of exploitation.

The law on renewable energy production from renewable sources of energy in Germany, as well as in Austria, has developed over the last five years in the leading economic sector, which is directly or indirectly employs about 120,000 people. These jobs depend on the degree of implementation and further development of the renewable sources of energy. When the Government creates legislative, investors do business in proposed sector.

Since 1992 many plants that produce electricity using biogas in Germany have been established. This number constantly increased since 1998. Similar activities are taking place in the Czech Republic and Slovakia. For the last ten years, Czech Republic four times increased use of biomass, because they made certain regulations for its use.

6 Data were obtained from European Pellet Centre, http://www.pelletcentre.info/cms/site.aspx?p=878

Romania and Bulgaria are intensively working on drafting regulations that will allow greater and rationally, using biomass to produce electricity, but also as a feedstock for biodiesel and bio ethanol.

Low electricity prices and the limited state budget are the main reasons why there is a lack of massive using renewable energy in Serbia. The EU green energy producers get stimulus from their Governments. What are the advantages of using biomass? Project has been launched in the Swedish city of Vasteras, located about 100 km from Stockholm designed to organic household waste and biomass to the processing of crops to the extent that it gives biogas which is useful for transport. The project is conceived, but also achieved. It involved 17 farmers, together with the local waste disposal company for owners of small factories for processing biomass into biogas. All short, then, from the kitchen, the organic waste, is sorted separately. Local companies transported organic waste into operation with an annual processing capacity of about 25 tons of organic waste. Price of such fuel is slightly lower than conventional, but it is a source that can be renewed, that the environment is protected and that this is a possible way to at least mitigate the consequences of a future energy crisis.

Price of biomass pellets and briquettes without binders in the Vojvodina Province is 100 to 120 €/t of briquettes[7]. If binders are added to increase the price of briquettes, wet biomass must be dried artificially because of the large expenditure of energy, but needs to dry natural draft.

Briquettes formed from crushed material are more stable during storage and transport, but significantly increases the proportion of energy used in grinding material.

Cost of production of briquettes and pellets depend on following factors: row materials, methods of collecting, collection techniques, transport and storage, lines for molding, extrusion technology, packaging, performance line, the number of workers, the value of the facility and equipment, interest on loans, etc. When everything is taken into account the cost of production of briquettes and pellets from wood sawdust (100 €/t) and from plant residues from agriculture to 120 €/t.

The selling price of briquettes and pellets in bulk and wholesale amounts to 100 €/t and retail 150 €/t packed in sacks, on the domestic market, which has not yet been developed[8].

Price of briquettes and pellets intended for the European market is 100 € in bulk, 200€ packed in large sacks and 300€ packed in small bags, but they must be produced according to European standard CEN standards[9] or the country in which the sale of briquettes[10].

7 Brkić, M., Janić, T. (2008): *Briketiranje i peletiranje biomase,* Savremena poljoprivredna tehnika, vol. 34:1-2, pp. 85.

8 Ibidem, pp. 85.

9 See more about CEN standards in Brkic, M., Janic, T. (2009): *Standards for pelleted and briquetted biofuels,* Savremena poljoprivredna tehnika, vol. 35:4, pp. 260-267.

10 Pejanović, R., Jelić, V., Zekić, V., Brkić, M. (2010): *Economic indicators of pelleted biomass combustion,* Savremena poljoprivredna tehnika, vol. 36:4, pp. 411-419.

Material and methods

In the selection process of company, two main criteria were used: (1) the access to the company, (2) previous sustainability activities in Serbia.

The data was collected from a vast array of company archival information that included financial reports, corporate responsibility reports, internal memoranda, and strategy documents.

Main activity of Company C is the production of fruits and vegetables, as well as foreign and domestic trade. Given that each production requires large energy consumption in line with new trends in the world in the field of renewable energy, top managers in Company C have been decided to invest in the production of pellets. This investment would not only meet the energy needs for its own production and processing of fruits and vegetables but would become a significant exporter of high quality ecological fuel - pellets.

Using the pellets in the production and processing of fruits and vegetables significantly reduce the costs of the final product.

Current status of the company can be described by following:

- Medium company according to number of employees and the total operating capacity,
- Years of experience and strong persistence on the market with remarkable goodwill,
- Domestic and foreign market is still open and promising for fruit and vegetables,
- Crisis of years taken as an opportunity to consolidate power and that with education and innovation and in particular maintain product quality and increase market share.

The choice of investment ideas - as a priority, affected the economic viability of primary production and processing of fruits and vegetables, as well as new trends of renewable energy. To regulate international laws and regulations and it is known that the *Kyoto Agreement* means the reduction of greenhouse gases by 5.2% by 2012. The European Union has agreed to achieve by the year 2020 level of 20% share of renewable energy sources (in which the largest share of biomass), which will affect the creation of micro-climate suitable for the realization of the investment ideas.

Long-term strategy of Company C includes:

- Modern equipment and technology for the production of pellets, which closes the circle of the current production of fruits and vegetables from their own source of energy.
- The possibility of continuous production of standardized, high quality and required pellets, which can be achieved enviable export, but also economic and financial effects.
- Provision to the final long-term investments, environmental, economic, high-calorie products to the European Union, known and trusted for the foreign buyer is one of the important motives of investment choices.

When choosing an investment priority, among other essential components of their investment, jobs and provision to the raw material are crucial. To be able to plan their capabilities not

only enough to know the capacity of the plant, but it is tremendously valuable to plan a continuous flow of raw materials.

Amount to approximately 40,000 m^3, providing a projected level of annual production of over 22,000 of tons of pellets.

Around 27.3% of Serbian territory is covered by forests 2,429,642 (ha). More than 50% of forests are state-owned, the rest is private owned. Growing stock in forests in Serbia is around 235 million m^3.

The choice of supplier has been influenced by the overall capacity of Srbija Sume (646,000 m^3 annual production of cordwood - Investments need a hire only 4% of the capacity of the Supplier).

Pellet market in Serbia is in its infancy and at present, exist only four plants with a production of only 50,000 tons of pellets per year. Therefore, the competitors in the sector are weak and insignificant.

Results and discussion

The content analysis has included all-important issues of the feasibility study in Company C. The project cost estimation illustrates Table 1.

Table 1. Estimation of costs

No.	Figure	Amount (in €)	%
1	Land	566,457	20.24
2	Building construction	212,916	7.61
3	Equipment	1,427,700	51.02
4	Feasibility study	95,790	3.42
5	Long term assets (1+2+3+4)	2,302,863	82.29
6	Current assets	495,596	17.71
7	**TOTAL ASSETS (5+6)**	**2,798,459**	**100.00**

Source: The feasibility study of Company C

The table below shows the sources of funding. From the table 2, we see that the investor plans to take two loans: one from the Serbian Development Fund and the second from one commercial bank that operates in Serbian market (*see Table 2*).

Table 2. Financing project producing pellets

No	Figure	Amount (in €)	%
1	Own capital	875,163	31.28
2	Development Fund Of Republic of Serbia	961,648	34.36
3	Bank term loan	961,648	34.36
4	**Total**	**2,798,459**	**100.00**

Source: The feasibility study of Company C

The parameters of the project success are based on the following:

- Optimal use of existing technical and technological capacity (annual production of 22,320 - t, which is approximately 80% utilization of technical capacity), custom real and reliable sources of supply of raw materials (high degree of correlation between those);
- 310 working days required to achieve the projected production and planned revenues;
- Real inputs, both from the standpoint of current prices, and sources from the standpoint of real quality, favourable, competitive supply of raw materials;
- The highest achievable level of exports, not only in terms of empirical performance, but also with regard to quality and competitiveness of production, and supported by global demand and solid export contracts with reliable and respectable foreign partner;
- Inflows from the sale of real, export only;
- The actual positioning of the intensity and cost structure - verified technical and technological standards, and empirically validated;
- Involvement of a multidisciplinary team of experts in the team of managers, specialists and highly skilled employees (21 full time);
- Project life of 10 years;
- The use of partial co-financing, through a soft loan the Serbian Development Fund co-financing and bank loans (by Government of Serbia and with Guarantee Fund);
- Calculating the depreciation on a proportional basis, according to the nature of immobilization and equipment.

Total income can be calculated based on quantity of 22,320 tons and price 125 €/t. It makes total income of 2,790,000€. Projected total costs from the project are shown in Table 3.

Table 3. Costs calculations

No.	Figures	Amount (in €)	%
1.	Material costs	1,840,344	79.99
1.1.	Row material	937,440	
1.2.	Packing	148,800	
1.3.	Energy	221,601	
1.4.	Transport	493,272	
	Other expenditures	39,235	
2.	Immaterial expenditures	34,500	1.50
2.1.	PTT costs	18,000	
2.2.	Marketing expenditures	14,850	
2.3.	Other	1,650	
3.	Amortization	225,682	9.81
4.	Salaries	151,200	6,57
5.	Interest expense	48,957	2,13
6	**TOTAL COSTS**	**2,300,683**	**100.00**

Source: The feasibility study of Company C

After the calculation of costs, it is necessary to include income statement (*see Table 4*).

Table 4. Income statement

No	Figures	Amount (in €)
1.	**Total Income**	**2,790,000**
2.	**Total Expences**	**2,300,683**
2.1.	Material expences	1,840,344
2.2.	Immaterial expenditures	34,500
2.3.	Amortization	225,682
2.4.	Salaries	151,200
2.5.	Interest expense	48,957
3.	**Accounting Income before tax**	**489,317**
4.	**Income Taxes**	**48,932**
5.	**Adjusted Net Income**	**440,385**

Source: The feasibility study of Company C

Most often used methods for project selection are dynamic methods[11]:

- Net present value (NPV),
- The index of profitability,
- The period of recovery,
- Internal rate of return,
- Method of annuities.

In this project, the following dynamic methods have been used (*see Table 5*):

- Calculate the net present value of the Project
- Calculation of internal rate of return of the Project
- Calculating the payback period.

Net Present Value (NPV) of the project demonstrates the ability to repay the funds invested in it. If the project has positive net-present value (NPV), may be eligible for the realization - which also applies to the subject of an investment. It is obvious that the project, after 10 years, makes enough money to finance another, a new project, which is provided more than 1.1 million €.

Internal rate of return (IRR) is the discount rate at which the net present value (NPV) of the Project is equal to 0. If the NPV is positive net inflows, it is clear that this rate will be higher than the discount rate (12%) or the minimal rate of return (16%). The minimal rate of return is the lowest rate of return which makes investment profitable. Bearing this in mind, the subject project may be considered acceptable, especially since, as the IRR for an investment subject even 22.19%.

11 Kontic, Lj. (2009): *Upravljanje projektima,* Kontic, Lj., Belgrade.

Table 5. Financial models

Element	Year									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Annual savings (in 000 €)	5,58	2,79	2,79	2,79	2,79	2,79	2,79	2,79	2,79	2,89
Costs	4,87	2,07	2,08	2,08	2,08	2,08	2,08	2,08	2,08	2,08
Investment (use negative value)										
-2,798.00	**Net annual savings (in 00€)**									
	716	718	716	714	711	710	710	710	710	816

Ratio	Value	Explanation
Cumulative savings	7,231,00	Sum of all annual savings
Payback period	3.87	Period in which investor will back his money
Discount rate	12.00%	Rate that is used to calculate present value of investment
NPV	1,131,16	Net present value
B/C Ratio	1.07	Ratio of all net savings/net costs
IRR	22.19%	Internal rate of rentability
Min IRR	16.00%	The lowest value of IRR at which investment is profitable.
Profitable investment?	Yes	If IRR is higher than min IRR investment is profitable

Source: Authors' calculation

From the table 5, it is clear to see that the underlying investment return in the fourth year of operation, i.e., after 3 (three) years, 10 (ten) months and 27 (twenty seven) days.

Table 6. Financial flows (in 000 €)

Figure	Years									
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**
I incomes	**5,589**	**2,790**	**2,790**	**2,790**	**2,790**	**2,790**	**2,790**	**2,790**	**2,790**	**2,897**
1. Total income	2,790	2,790	2,790	2,790	2,790	2,790	2,790	2,790	2,790	2,790
2. Own capital	875	0	0	0	0	0	0	0	0	0
3. Loans	1,923	0	0	0	0	0	0	0	0	0
4. Redundant of project value	0	0	0	0	0	0	0	0	0	107
II expenditures	**4,932**	**2,639**	**2,619,**	**2,599**	**2,580**	**2,079**	**2,079**	**2,079**	**2,079**	**2,079**
5. Long term assets	2,302	0	0	0	0	0	0	0	0	0
6. Short term assets	495	0	0	0	0	0	0	0	0	0
7. Material costs	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840	1,840
8. Immaterial costs	34	34	34	34	34	34	34	34	34	34
9. Annuities	59	567	545	523	501	0	0	0	0	0
10. Salaries	151	151	151	151	151	151	151	151	151	151
11. Income tax	48	46	48	50	52	53	53	53	53	53
III net income	**657**	**150**	**170**	**190**	**209**	**710**	**710**	**710**	**710**	**816**
IV cumulative	**657**	**807**	**978**	**1,168**	**1,377**	**2,087**	**2,798**	**3,508**	**4,218**	**5,034**

Source: Authors' calculation

Analysis of economic and financial flow of the Project determines the liquidity of the project and gets an insight into the investor's ability to promptly and fully, meeting their financial obligations over the life of the Project:

- The project follows the on-going liquidity in all the years of economic and financial flow;
- Liquidity is reflected in positive cumulative difference between inflows and outflows.

Appreciating that the implementation of the respective investment ideas followed the principles of expediency, the reality, fully present, timeliness, cost effectiveness, legality, optimality, liquidity, systematization, and others. The project can be considered feasible and acceptable.

Economic and financial parameters of the project (accumulation, reproductive ability, efficiency, liquidity, net present value, internal rate of return, payback time indicate its socio-economic acceptability and realistic basis for future development and expansion of the Investor. The special significance of the project provides production and supply with 100% placement through exports (verified by the relevant contracts).

The full consolidation of financial and business investors, with an obvious trend of growth and development, and organizational and human resources, technical-technological and market potential investors, provide a basis for expectations to be able to implement investment ideas to the designed parameters.

Conclusion

Renewable energy sources include biomass, where the traditional, environmentally friendly, safe energy sources that are of increasing importance in the world and even here in Serbia. Under the biomass fuels are considered to be obtained through biological processes in a short time and include wood, straw, corn, cane, vegetable oil, resin, sugar cane, sugar beet, rape and mass of green.

Using biomass, not only to replace part of a much needed energy, which is obtained from conventional sources, but in order to meet the strict criteria of environmental protection. Precisely because of such consequences, many countries have signed an agreement to reduce greenhouse gases called the Kyoto Protocol. In Europe, there is a steady trend of development and use of biomass by opening new factories.

The feasibility study in Company C clearly shows the feasibility and economic viability of investment in plant for the production of pellets. Used capacity will be 80% or 310 days per year. The entire investment will be returned after three years and 10 months.

This and similar facilities are good practice and the future that enable the positive effects of the environment, agriculture, national economy and energy.

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PROIZVODNJA PELETA U SRBIJI: STUDIJA KOMPANIJE C

Ljiljana Kontić[12], Pero Petrović[13], Jovan Kontić[14]

Rezime

U radu se istražuje tema obnovljive energije kroz proizvodnju peleta kao jednog oblika biomase. Istraživanje je sprovedeno u jednoj domaćoj kompaniji koja posluje u Srbiji. Koncept biomase je u fokusu istraživanja naučnika i praktičara u razvijenim zemljama. Mali broj studija bavio se pitanjem korišćenja biomase u zemljama u razvoju. Cilj istraživanja je analiza izvodljivosti proizvodnje peleta u izabranoj kompaniji. Ovaj rad dopunjava prazninu u literaturi nalazima procene proizvodnje peleta u kompaniji koja posluje u tranzicionim uslovima. Rezultati su važni za praktičare koji upravljaju projektima iz oblasti obnovljivih izvora energije. Takođe, istraživanje predstavlja primer dobre prakse za druge preduzetnike u Srbiji.

Ključne reči: *obnovljiva energija, peleti, projektni menadžment, studija izvodljivosti, Srbija.*

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