

## **PROVIDING ENERGY STABILITY OF THE STRPCE MUNICIPALITY BY SELECTION AND IMPLEMENTATION OF THE BEST TECHNOLOGIES FOR THE UTILIZATION OF RENEWABLE ENERGY SOURCES**

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### **Abstract**

The territory of the municipality of Strpce, which extends to the south and south - eastern part of Kosovo, has been facing very frequent power cuts since the year 1999. This has a detrimental effect on the local population and on the undeveloped economy of the region. On the other hand, this municipality possesses vast resources of renewable energy in the form of biomass, wind energy and especially solar and hydro energy. Therefore one of the possible solutions for the production of electricity is the construction of power plants which utilize renewable sources of energy. In order to analyze the current position of the Strpce municipality regarding these issues, a SWOT analysis was conducted. Furthermore, Analytic Hierarchy Process (AHP) method was used for the selection of an appropriate technology which utilizes the following alternative renewable energy sources: solar, wind, biomass and hydropower. The criteria based on which the ranking was carried out were: investments, environmental impact, number of employees and maintenance costs. Results obtained using this methodology gave a priority to the solar power plant and then to the biomass plant. Based on these results a multi-project was developed which describes the implementation of these two technologies in practical terms. The development of the energy sector and focus on renewable energy sources provides an eminent improvement of the quality of life of the local population and promotes the rational utilization of natural resources.

**Keywords:** *Renewable energy, SWOT, production of electricity, AHP, multi-project*

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### **1. INTRODUCTION**

Serbia has considerable energy potential in renewable energy sources, but it is not sufficiently exploited, especially when it comes to certain sources of energy such as glass, biomass or solar radiation. Energy Law was adopted in July 2011. defined the energy policy of Serbia and was a mandatory step that Serbia had to take because of membership in the Energy Community in South East Europe as a framework for the integration into the EU energy market. This law encourages investment in renewable energy, by simplifying procedures for investment and the introduction of privileged producers of energy from biomass, water, wind, solar and geothermal energy.

The municipality of Strpce has a reasonable potential of biomass, wind energy, particularly solar and hydro energy. Currently in the municipality of Strpce There is not a plant for the production of electricity from RES. However, during the construction of two mini hydroelectric power plants.

The very idea of this paper is the presentation of multiple ideas, which aims to combine the two alternatives for better utilization of available resources. The first project idea relates to the utilization of solar energy, that is, to the installation of solar panels. After a certain amount of time, if there is a need to increase capacity and absorb sufficient funds, another project idea could be developed for the installation of a biomass plant.

## **2. POTENTIAL UTILIZATION OF RENEWABLE ENERGY SOURCES IN THE MUNICIPALITY OF STRPCE**

Strpce Municipality extends to southern, and south – eastern part of Kosovo, about 72 km south of Pristina. It borders the municipalities of Prizren, Suva Reka, Ferizaj, Kacanik and with Macedonia. Surface area of Strpce is 247,36 km<sup>2</sup>, with a population about a 13.900 residents. The territory of the municipality of Strpce has exceptional conditions for the development of winter and summer tourism.

Brezovica represents tourist-recreation center and very promising ski center even at the European level, where there are a number of hotels, resorts, mild to attractive ski slopes in winter, as well as the green slopes suitable for recreation during the summer. With its tourist very valuable geomorphological (high tops Sare, steep cut, the valley of glacial origin, etc.) and hydrological (numerous springs and streams that are active during the year) phenomena, is one of the most valuable tourist sites in the region.

Regardless of the existing potentials, regional prosperity and development of the economy is inconceivable without regular power supply. Unfortunately, residents of the municipality of Strpce from 1999 until today are exposed to very frequent power cuts. Of course, one must take into account that Kosovo after the war in 1999 had major problems with the production and supply of electricity in the whole territory, but nevertheless it is evident that the Serbian middle were often subjected to power cuts. Undoubtedly, and as a form of political pressure.

Main production capacity of electricity in Kosovo are two thermal power plants (Kosovo A i Kosovo B), while brown coal used to produce 97% of the total electricity produced in Kosovo. This is a great dependence on one source of electricity generation speaks about energy security of Kosovo. Strpce with the environment is supplied from the transmission line of 110 KW which reaches from the substation at Pristina via substation in Ferizaj continues to Strpce. The main problem of the current situation of energy supply in Strpce, as indeed in all of Kosovo and Metohija, the lack of production of sufficient quantities of electricity. [1]

## **3. SWOT**

*Table 1. SWOT analysis of this project*

<b>Strength</b>	<b>Weakness</b>
Availability of renewable energy sources in the municipality of Strpce Guaranteed placement produced electricity	- Taking a large area of land for the development of some renewable energy project

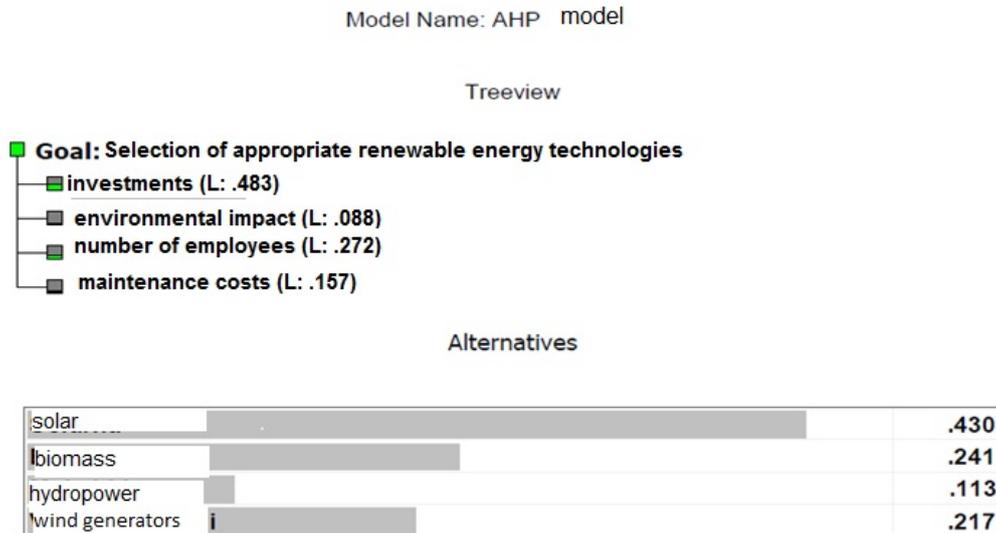
<p>Political and Logistic Support to Local Self-Government          Lifespan of technology          The utilization of agricultural, forest and municipal waste          The possibility of installing plants near the place where there is the greatest need for it          The possibility of using different raw materials to produce energy          Increase the energy efficiency of the existing network</p>	<ul style="list-style-type: none"> <li>- Potential distance from the existing network (transmission line, substation ...) and consequently the need for additional investment</li> <li>- Costs of exploitation and maintenance of different RES technologies</li> <li>- Periodicity of availability of resources,</li> <li>- Increased costs due to resource allocation for energy production</li> <li>- Observation of supply through different RES technologies</li> <li>- Low level of economic development of society and the region</li> <li>- Lack of local knowledge and experience in the renewable energy field</li> </ul>
<p style="text-align: center;"><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>- Contribution to the energy security of the municipality</li> <li>- Employing a large number of people for the purpose of supplying the necessary resources</li> <li>- favorable feed-in tariffs</li> <li>- Encouraging local infrastructure and economy             <ul style="list-style-type: none"> <li>- Generating revenue into the municipal budget</li> </ul> </li> <li>- Reduction or elimination of restrictions of electricity for the population of the municipality             <ul style="list-style-type: none"> <li>- Increasing political stability of the region</li> </ul> </li> <li>- The availability of cheap and skilled labor force</li> <li>- Existence of municipal land for RES projects</li> <li>- Competitiveness in relation to other electricity suppliers</li> <li>- Political support of the Republic of Serbia and local self-government</li> <li>- Large quantities of waste resulting from unplanned felling forest</li> <li>- Bringing the municipality of Strpce in the group of 'green and sustainable' cities</li> </ul>	<p style="text-align: center;"><b>Threats</b></p> <ul style="list-style-type: none"> <li>- Incomplete research on renewable energy resources in the municipality of Strpce</li> <li>- Insufficient cooperation of the local population during waste collection</li> <li>- Poor and outdated power grid</li> <li>- Possible terrorist attacks</li> <li>- Prohibition of licensing and execution of works by certain Kosovo institutions</li> <li>- A lack of investors due to the high risk of investing in this territory</li> <li>- The difficulty or impossibility of financing projects RES             <ul style="list-style-type: none"> <li>- Political instability in the region</li> </ul> </li> <li>- Non-compliance of legal regulations between the Serbian and Albanian institutions</li> <li>- Potential negative attitude to the project by the Albanian community in the municipality</li> <li>- The political deadlock by existing institutions in Kosovo</li> <li>- Lack of funds for development and improvement of infrastructure</li> <li>- Duality law (whether the project was implemented by Serbian and Kosovo law)</li> </ul>

#### **4. SELECTION OF APPROPRIATE RENEWABLE ENERGY TECHNOLOGIES**

To select the appropriate technology of obtaining electricity from renewable sources was used Analytic Hierarchy Process (AHP) method. Here are ranked four alternatives solar, biomass, small hydro power plants and wind turbines. The criteria for the ranking made investments, environmental impact, number of employees and maintenance costs. The goal

is that by comparing pairs of criteria and total alternative to the criteria given weight coefficients on the basis of which it is possible to make a ranking of technologies for electricity generation from renewable energy sources and choose the best technology.

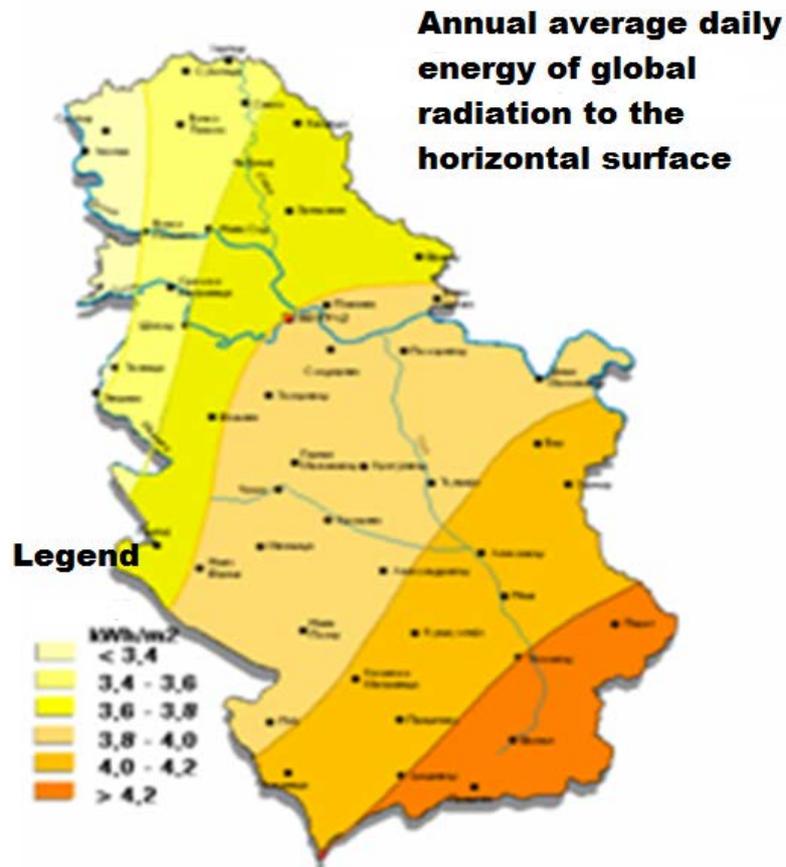
The results presented in Figure 1 show that the weight criteria in determining the focus is on investment volume (weight coefficient is 0.483) and the number of employees (0.272 weight ratio). The results obtained using this methodology to give priority to the first place in solar technology which is having a coefficient of 0.43 by weight and the biomass with weight coefficient 0.241. [2]



**Figure 1.** Selection of appropriate renewable energy technologies- AHP process

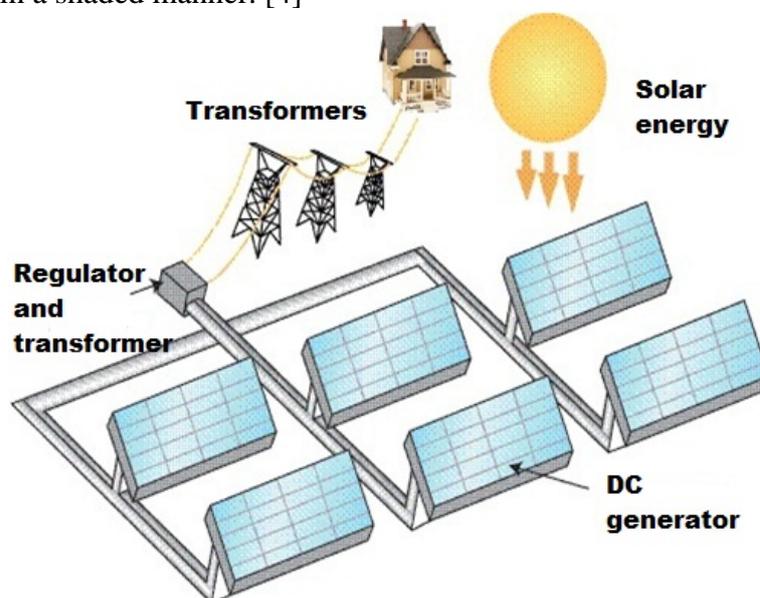
## **5. THE POTENTIAL USE OF SOLAR ENERGY IN THE MUNICIPALITY OF STRPCE**

The municipality of Strpce has relatively good climate with enough sunny days there is a possibility of electricity produced by photovoltaic panels. In this regard, the use of the roof or similar surface for the purpose of saving the free land area (stimulation of those who build facilities and use solar energy for heating as a percentage of release of the fees and charges for building permits). Figure 2 shows that the territory of Southern Serbia has great potential when it comes to solar energy, suggesting that solar energy can be used to produce energy.[3]



*Figure 2.* Annual average daily energy of global radiation for Serbia (kWh/m<sup>2</sup>)[3]

To meet the needs, 160 panels with a power of 40 kW are to be installed, which will be installed under a 60 ° angle, which will produce 48 MWh / year energy. The required surface for the installation of the panel is 40 ares. Figure 3 shows the electricity production by solar panels in a shaded manner. [4]



**Figure 3.** Solar pannels [10]

## 6. THE POTENTIAL USE OF BIOMASS IN THE MUNICIPALITY OF STRPCE

In rural areas that have a high level of agricultural and forestry production should encourage the use of biomass in order to increase opportunities for energy production. In this direction is very often count on the energy that can be extracted from municipal waste, which is the amount, when it comes to this municipality, on a monthly basis and significant amounts to about 150 tons. The use of forest waste that could be used for electricity generation stands out as one of the best options. Based on the research leads to the data that the municipality of Strpce has 5000-5500 m<sup>3</sup> of forest waste, which can be regarded as sufficient input for the sustainable production of electricity using biomass. One of the principles of energy production using biomass is long-term sustainability and benefits in terms of environmental and wood resource conservation, given that scrap wood waste is exclusively used. The amount of energy that could be produced by this input capacity is approximately 12, 9 gWh per year. [7]

For now, forests are mostly (in a large number of cases unsympathetic) for sale without any prior processing, which, in the long term, has no major economic impact for this municipality.

For agricultural production in the municipality of Strpce (according to the Surveying and Mapping Authority) used a total of 13,649.7 ha. From these surfaces the social sector benefits 7,019.0 ha (51.4%), and private 6633.7 ha, therefore, there is the additional possibility of using agricultural residues.[3]

Is seen and the possibility of utilization cuts fast growing trees in a short period of time can provide a sufficient amount of inputs for continuous energy production. According to an analysis of available data, the energy plant that will best meet local conditions is *Miscanthus giganteus* or energy cane. The plants to be planted in plots after harvest of plants on one plot, immediately committed to new planting, which would allow a continuous flow of inputs (Figure 4). The first cut is possible after only two years. Another advantage of cultivated forests in relation to those that have occurred naturally lies in the fact that in the cultivated forest trees that are less developed can cut and immediately use, allowing other trees that faster progress, as opposed to natural forests in which less tree trunks 'strangled' by advanced and dying. [3]



**Figure 4.** Cyclically cutting energy forests to ensure the sustainable production [11]

*Miscanthus giganteus*, wood that is considered the most efficient, cleanest and cheapest in the world, can be used in cake or briquette. By one hectare, the plant gives 20 to 40 tons of genus which is most commonly used to convey the briquette without any bark and has extremely high heat energy.

For example, for the purpose of settlement of 15,000 inhabitants (Strpce municipality has 13 900) should be planted around 7-8 hectares which is an investment of EUR 12,000 to 13,000, which brings the net income of 6400 euros or 800-900 EUR per hectare. Plants per hectare give 20-40 tonnes of fruit which is mostly used for briquetting / pelleting, while briquettes have extremely high heat. One hectare planted plants gives enough briquettes / pellets for 7-8 flats, while the amount of released carbon monoxide 0. In addition to the favorable environmental dimension, the possibility of planting energy crops would enable the recruitment of large number of workers who work on matters of growing plants and collecting biomass.[3]

## **7. PRESENTING PROJECTS TO LOCAL SELF-GOVERNMENT**

Local self-government should first of all be emphasized that the benefits this project will bring the municipality of Strpce, the local Serbian and Albanian population, which is primarily related to an increase in energy stability and eliminate the need for restrictions which have very negative effects on the local population. In a conversation with representatives of local self-government, the results of the research have to be demonstrated, suggesting that solar energy is very favorable in the territory of southern Serbia and the municipality itself, and presented to them the plan to use solar energy as an inexhaustible source for energy production. In addition they should be presented to specific resources when it comes to the possibility of using large amounts of available forest waste as a sustainable resource for the plant which will operate a biomass which will certainly suit a large number of residents who own forest areas, as well as a large number of those who will find employment when the maintenance of the plant and the collection and biomass. [5]

## **8. PRESENTATION OF THE PROSPECTIVE OWNERS OF FOREST AND AGRICULTURAL LAND**

At this stage of the promotional campaign, it is necessary to animate as many forest owners as possible and to clearly justify the great benefits of using this natural wealth for new purposes, instead of the usual dense forests and the use or sale of the woodcock.[5]

The potential for the production of electricity and thermal energy in biomass is huge, so that with a higher felling trees and could get more sources of renewable energy. One of the most important benefits is the improvement of forest roads and infrastructure in the underdeveloped region, which will provide permanent access to daylight wooden biomass resources. Given the very low level of utilization of forests in the municipality of Strpce, those forest owners who perhaps had never had any financial benefit from them to acquire new sources of income in the long period of time. [5]

In addition, launching a drive to biomass opens up the possibility of hiring a large number of workers who will be engaged on plantations of energy plants, on the affairs of growing plants, collection and processing of biomass. Land owners who are not able to cultivate the cultivated varieties of vegetables and fruits that require intense maintenance, can take advantage of their agricultural land for planting energy plants with minimal involvement give huge returns from about 800 to 900 EUR per hectare. [5]

The development of the energy sector by relying on renewable energy means eminently improve the quality of life of local people, which is one of the key social dimension, especially in the municipality of Strpce in which there is an obvious polarity between the

two communities, as well as rational use of natural resources and reduce pressure on the environment which is a dimension environment. [5]

The significance of this project was recognized and supported by the municipality of Strpce. Support of the municipality of Strpce will greatly contribute to the successful implementation of the project. [5]

The realization of this project would contribute to achieving the goal which refers to the efforts of the Republic of Serbia that by 2020 the participation of RES in gross final energy reaches 27%. Also, the project is also in line with the goals of the so-called. Republic of Kosovo regarding the use of renewable energy.[5]

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## **9. BENCHMARKING PARTNERS**

One of the possible benchmarking partners is the solar power plant in Velesnica village in Kladovo municipality, built on 4.5 hectares of land, with a total area of solar panels of 13,600 m<sup>2</sup>. Miloš Kostić, Director and co-owner of the company Solaris Energy that is the wearer of this investment, stated that the construction of the first and second blocks were engaged by 30 people and as significant number of domestic companies, subcontractors, and stated that the four professional workers be permanently employed in this solar plant. The Municipality of Kladovo is quickly reacted and recognized the importance of this project and allow investors to quickly finish the job. We hope that the municipality of Strpce realize all the positive effects of this project.[10]

For the realization of a biomass power plant project, a possible biomarking partner is a biomass power plant, which was commissioned in the village of Dragacica, near Guca. This construction project was run by engineers Milan Filipović.[8]

## **10. GANTT CHART ACTIVITY**

It is anticipated that the project to build solar power plants realized for 14.5 months after which they will be put into operation. The projected payback period of investment is 5.5 years. After expiration of this period will be the second phase of the project that involves the construction of a biomass. This phase of the project is planned to last for 20 months. Due to the fact of doing two separate projects that have a common goal of electricity production, and increasing the energy security of the municipality of Strpce, in Figure 5 shows a Gantt chart of activities for realization of the project on the principle multi project management.

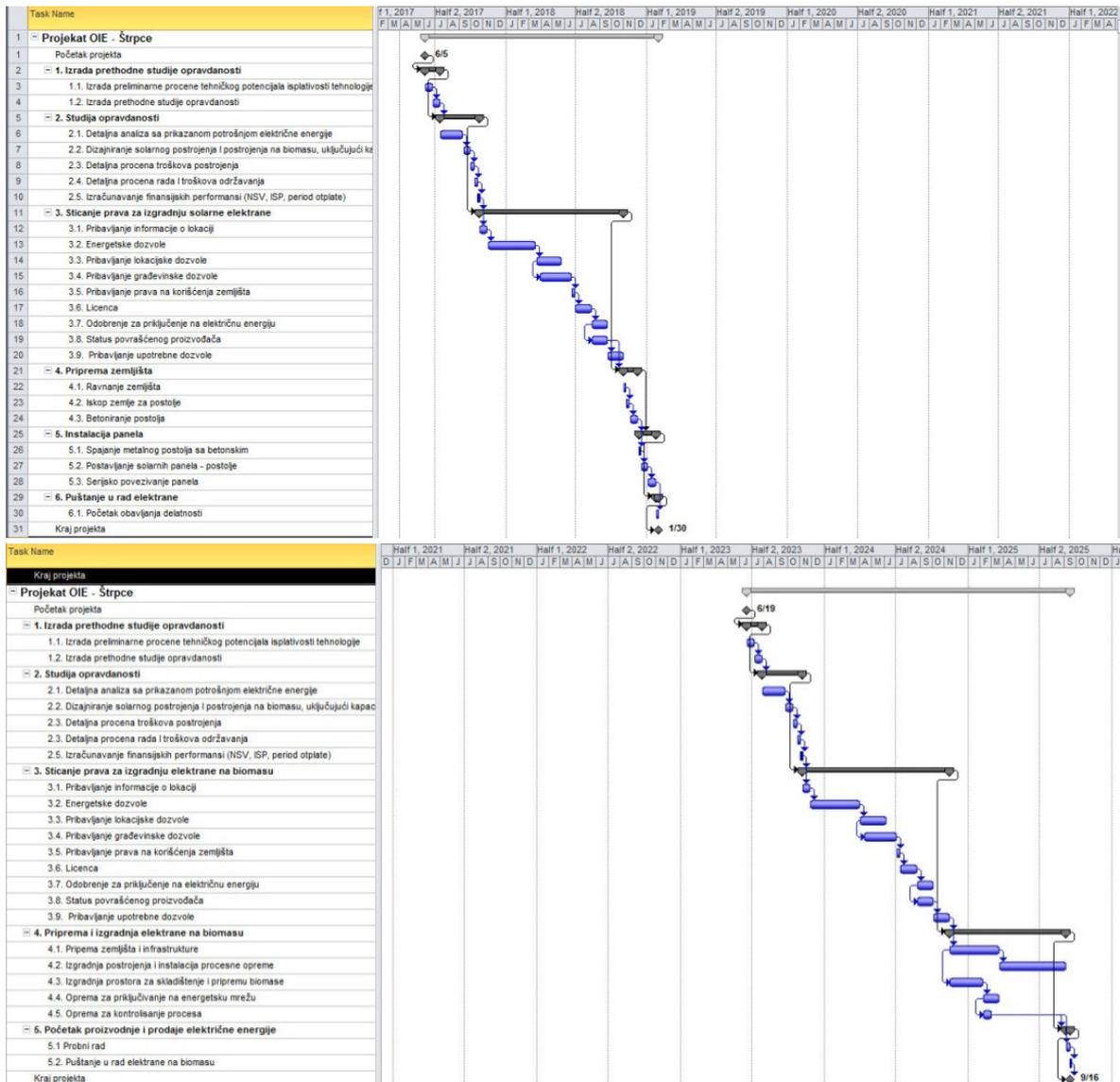


Figure 5. Gantt Chart activity- multi project [6]

## 11. CONCLUSION

For the successful realization of this idea to be addressed to the population of the municipality itself in the fact that the potential realization of the project has a very positive impact on local economic development. Promotion of the project will be carried out by the mass media (TV, print, Internet, radio). The focus of the campaign will be emphasizing the benefits that will bring the potential realization of this project, which will primarily achieved by creating new jobs, the decentralization of the energy sector, scientific and technical innovation, reducing macroeconomic instability, increasing social solidarity, etc. Local self-government should first of all be emphasized that the benefits this project will bring the municipality of Štrpce, the local Serbian and Albanian population, which is primarily related to an increase in energy stability and eliminate the need for restrictions which have very negative effects on the local population.

It is necessary to demonstrate the results indicate its research that suggests that solar energy is very favorable in the territory of southern Serbia and the Municipality itself and present a plan for using solar energy as an inexhaustible source of energy production. In

addition to this should be presented to specific resources when it comes to the possibility of using large amounts of available forest waste as a sustainable resource for the plant which will operate a biomass which will certainly suit a large number of residents who own forest areas, as well as a large number of those who will find employment when maintenance of the plant concerned and the collection and biomass.

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