



AgriTech Solutions: Innovating VET for Sustainable Agriculture
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EXPERT CONSULTATIONS

Renewable energy sources

Experts/organizations: ZZ "STUBA", TD DZP KLECHOVCE DOOEL, ADUT GVN, AG FUTURA Technologies, „KAV KOMERC AND AGRO KAV KOMERC", COMPANY „STOJCHEVI and WINERY ARBESKA", INDIVIDUAL FARMER MARJAN TANCHEV, LISA – KOM KAVADARCI, INDIVIDUAL FARMER STEFAN STOJCHEV, AGRIJA DOOEL, Individual farmers groups and individuals, IZ Branko Atanasov, Livestock farm

Engaged teachers: Stefanovski Saso, Milosheva Zaklina, Jovanova Kristina, Doncheva Milica, Nikolov Efremcho, Slavkovic Sonja

Location: Kumanovo, Sveti Nikole, Skopje, Strumica, Kavadarci, Valandovo, Veles

Short description

Agricultural cooperative "STUBA" from the village of Studena Bara near Kumanovo is engaged in the production of vegetables, primarily tomatoes and peppers, on its own land, as well as the sale and distribution of seed materials, fertilizers and plant protection products and other necessary equipment for the needs of individual agricultural producers and agricultural holdings. Regarding the use of renewable energy sources in its own holding, Agricultural cooperative "STUBA" is making efforts to increase their presence in everyday work. Renewable energy sources represent a sustainable and environmentally friendly solution for meeting the energy needs of the agricultural holding. For the needs of the holding for the production of vegetables, primarily for the production of tomatoes and peppers, the following energy sources are particularly useful:

First, Solar Energy

The most suitable option for greenhouses and irrigation systems. Currently, the farm uses solar collectors to heat water to heat the greenhouses. In the near future, it is planned to invest in photovoltaic panels to provide electricity for pumps, fans, lighting and sensors.

Second, Biomass

Plant residues (leaves, stems) are used to produce biogas or as a heating fuel, and as fertilizer. Biogas can also be used to generate electricity and heat.

Third, Geothermal Energy

A very convenient option for heating greenhouses with a stable temperature throughout the year. Something that is certainly planned to be invested in by the "STUBA" greenhouse company, which



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The costs of traditional heating would be significantly reduced and microclimate control in indoor spaces for growing vegetables would be enabled.

Finally, wind energy is also an option, which can be used if the farm is located in an open area. Smaller turbines can be used for energy support.

A group of individual farmers believes that renewable energy sources have an increasing application in agriculture, especially in sustainable production, cost reduction and environmental protection. The increasing increase in energy costs leads producers to implement measures to save and reduce the costs of thermal energy and electricity. However, the lack of information and education of producers that they can make biogas themselves and how they can make it, through animal waste, which would be used for heating, generating electricity and producing organic fertilizer, is an obstacle that many

producers face.

Orangeries DOOEL Sveti Nikole is engaged in the production of vegetables, primarily tomatoes and peppers, on its own land, as well as the sale and distribution of seed materials, fertilizers and plant protection products and other necessary equipment for the needs of individual agricultural producers and agricultural holdings. In terms of using renewable energy sources in its own holding, it makes efforts for a greater presence of them in everyday work.

Petre Temov, is the owner of 2 agricultural companies Kav Komerc and Agro Kav Komerc from Kavadarci, which are export-import oriented and positioned for more than 30 years in the country and abroad in the Republic of Serbia (Belgrade at the Kvanataški Pazar), the Czech Republic, Croatia, Poland and Greece. The companies are engaged in the production, purchase, storage, storage and sale of table grape varieties and the production of table and wine grape varieties with their own intensive and state-of-the-art vineyards, mostly covered with anti-hail nets that they install from April to October, while the vegetation season lasts. By using renewable energy sources, through installed own panels for their own production of electricity, the company enables uninterrupted operation of cold stores in terms of storage and storage of grapes as well as other berries, apples and stone fruits, citrus fruits and early garden products such as cabbage, etc. Renewable energy sources in its companies. The company has its own panels for its own energy production which it uses for its own needs, state-of-the-art new vineyards of construction Odrina,



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covered with anti-hail nets, Italian inox steel construction and digital peronospora service, automatic for measuring all parameters of soil moisture, relative air humidity, temperature and other parameters. The same, through the company Agro Kav Komerc, have installed a drip system on all new modern plantations and the most modern technology with a fertigation process or incorporation of mineral, crystal fertilizers into the vineyards through the drop. They expect an annual production of grapes of over 1 million kg. Of the renewable energy sources, the most significant in the production of wine and table grape varieties are: **Solar energy or photovoltaics**

- Powering drip irrigation systems, which these have at their disposal modern intensive young vineyards,
- Work on pumps, sensors and weather stations,
- Installing solar panels on vineyards to reduce electricity costs.

Solar thermal energy

- Heating water for winery needs or equipment hygiene,
- Support for grape drying (where applicable) **Wind energy**
- Installation of small windmills for electricity production in wine-growing regions where there is a steady or constant wind,

Biomass

- Use of bio-waste from vineyards (vine shoots or rods) which would be used as biomass for heating or energy production.
- Production of organic fertilizer through the composting process as an additional energy benefit).

Conclusion

The integration of renewable energy sources in agricultural production

tomatoes and peppers allows for lower operating costs, greater energy independence and contributes to environmental protection.

The most practical and efficient solution at the "STUBA" Health Resort is the combination of solar energy and biomass.

In order to achieve greater use of renewable energy sources, which are increasingly used in agriculture, and especially in sustainable agriculture, an educated workforce should be created that could help every producer in this area, which would be of great importance for every farmer. Such educated



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persons would be of great help in the area of acquiring knowledge about renewable energy sources and their application. There is a large amount of literature and materials through which they can be integrated into the curricula, through which they can educate and prepare new generations towards energy sources and ecological agriculture. But despite this, some other sources and materials could also serve as material for upgrading the curricula.

courses.

Renewable energy sources in agricultural production provide lower operating costs, greater energy independence and contribute to the protection of the environment.

The integration of renewable energy sources in the agricultural production of wine and table grapes allows for lower operating costs, greater energy independence and contributes to environmental protection.