

Dr Željko V.Despotović, dipl.el.inž., Institut „Mihajlo Pupin“, Univerzitet u Beogradu

**Kratak sadržaj predavanja po pozivu IEEE PES Srbija, u Institutu Nikola Tesla
28.04.2022.**

OFF-GRID“ SISTEMI NAPAJANJA KAO INOVATIVNA REŠENJA ZA UNAPREĐENJE AGROTEHNIČKIH MERA NAVODNJAVANJA: TEHNIČKI ASPEKTI i PRAKTIČNE REALIZACIJE

Porast broja stanovništva na Zemlji, uticaj klimatskih promena, sve veće industrijsko i komunalno zagađenje sa jedne strane i razvoj naučnih i tehnoloških dostignuća u poljoprivredi sa druge strane, uslovljavaju dinamičan razvoj ovog sektora. Rast svetske populacije i shodno tome porast zahteva za hranom i prehrambenim proizvodima su u suprotnosti sa činjenicama da se zbog klimatskih promena i njihovih neposrednih posledica (suše i poplave, zagađenja zemljišta, vode i vazduha), obradivo poljoprivredno zemljište stalno smanjuje. Pored ovoga demografska kretanja su takvog karaktera da značajnije raste broj stanovnika u urbanim sredinama, dok je u ruralnim i seoskim sredinama naseljenost veoma mala. Ove činjenice dovode do disproporcije između zahteva i mogućnosti poljoprivredne proizvodnje. Poljoprivreda je jedna od ključnih komponenti ekonomskog razvoja Republike Srbije jer, osim ekonomskog, ima i izražen socijalni i ekološki značaj. Međutim, poljoprivreda u Srbiji se još uvek u značajnoj meri odvija na tradicionalan način, bez uvođenja savremenih znanja i agrotehničkih mera primerenih razvijenim i ekološki-svesnim državama. Tamo gde se i primenjuju agrotehničke mere, to se radi na neracionalan i ekonomski neodrživ način. Kao primer može se navesti mera navodnjavanja useva, koja je u uslovima klimatskih promena ključna karika u lancu proizvodnje. Iako se u Srbiji navodnjava samo oko 2% korisnog poljoprivrednog zemljišta, ova agrotehnička mera se izvodi mahom uz primenu agregata na fosilna goriva (benzin i dizel), koji sagorevanjem oslobađaju štetne gasove koji odlaze u atmosferu i pojačavaju efekte staklene bašte, zagađuju ekosistem i na taj način uzrokuju značajne ekonomske gubitke.

U ovom predavanju će biti predstavljene konkretne realizacije sistema hibridnog napajanja pretežno baziranog na obnovljivim izvorima energije (OIE), prvenstveno na energiji sunca i vetra, koji su korišćene za navodnjavanje povrtarskih kultura i za pametno upravljanje poljoprivrednog zemljišta na nekoliko lokacija u okolini Beograda. Na osnovu projektantskog iskustva predavača u oblasti projektovanja OFF-GRID sistema, u okviru predavanja će biti predstavljeni specifičnosti i metode projektovanja ovih sistema napajanja, kao i upravljačkih struktura, sa akcentom na primenu u sistemima navodnjavanja. Specijalno mesto u ovim sistemima uzimaju svi tipovi elektroenergetske konverzije DC/DC, DC/AC, AC/DC i kao takvi u mnogome određuju ponašanje celokupnog OFF-GRID sistema. U predavanju će biti predstavljene najnovije topologije pretvarača koji se koriste u ovim sistemima, kao i neki eksploatacioni problemi i tehnički aspekti praktične realizacije. Na kraju će biti dati pravci daljeg razvoja OFF-GRID sistema za unapređenje agrotehničkih mera navodnjavanja, kao i pravci daljeg razvoja pretvaračkih topologija koji se primenjuju u ovim sistemima.

Ključne reči: Obnovljivi izvori energije, hibridno napajanje, OFF-Grid, energetski pretvarači, poljoprivreda, sistemi navodnjavanja

Željko V.Despotović, PhD.E.E, Mihajlo Pupin Institute, University of Belgrade

Summary of the lecture by invitation of IEEE PES Serbia, at the Nikola Tesla Institute on April 28, 2022.

"OFF-GRID" POWER SUPPLY SYSTEMS AS INNOVATIVE SOLUTIONS FOR IMPROVING AGROTECHNICAL IRRIGATION MEASURES: TECHNICAL ASPECTS AND PRACTICAL IMPLEMENTATIONS

The growth of the population on Earth, the impact of climate change, increasing industrial and communal pollution on the one hand and the development of scientific and technological achievements in agriculture on the other hand, determine the dynamic development of this sector. The growth of the world's population and, consequently, the increase in demand for food and food products are in contradiction with the fact that due to climate change and its immediate consequences (drought and floods, pollution of land, water and air), arable agricultural land is constantly decreasing. In addition to this, demographic trends are of such a character that the number of inhabitants in urban areas is growing significantly, while in rural areas the population is very small. These facts lead to a disproportion between the requirements and the possibilities of agricultural production. Agriculture is one of the key components of the economic development of the Republic of Serbia because, in addition to economic, it also has a pronounced social and environmental significance. However, agriculture in Serbia is still significantly carried out in the traditional way, without the introduction of modern knowledge and agro-technical measures appropriate to developed and environmentally-conscious countries. Where agro-technical measures are applied, it is done in an irrational and economically unsustainable way. An example is the measure of crop irrigation, which is a key link in the production chain in the conditions of climate change. Although only about 2% of usable agricultural land is irrigated in Serbia, this agro-technical measure is carried out mostly with the use of fossil fuel aggregates (petrol and diesel), which release harmful gases that go into the atmosphere and intensify the greenhouse effects, polluting the ecosystem and thus causing significant economic losses.

This lecture will present concrete realizations of a hybrid power supply systems mainly based on renewable energy sources (RES), primarily solar and wind energy, which were used for irrigation of vegetable crops and for smart management of agricultural land in several locations around Belgrade. Based on the design experience of lecturer in the field of OFF-GRID systems design, the lecture will present the specifics and methods of designing these power supply systems, as well as control structures, with emphasis on application in irrigation systems. All types of power conversion DC / DC, DC / AC, AC / DC take a special place in these systems and as such largely determine the behavior of the entire OFF-GRID system. The lecture will present the latest topologies of converters used in these systems, as well as some exploitation problems and technical aspects of practical implementation. Finally, directions for further development of OFF-GRID systems for the improvement of agrotechnical irrigation measures will be given, as well as directions for further development of power converter topologies applied in these systems.

Key words: Renewable energy sources, hybrid power supply, OFF-Grid, power converter, agriculture, irrigation system