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**PLANIRANJE SOLARNIH ELEKTRANA  
I ŽIVOTNA SREDINA**

**SOLAR POWER PLANT PLANNING  
AND THE ENVIRONMENT**

| **Boško Josimović**



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## **PREDGOVOR**

Nakon knjige „Prostorni aspekti uticaja vetroelektrana na životnu sredinu“ (2017, engl. izdanje 2020), prve koju sam posvetio „zelenoj“ energiji, a usled ekspanzije u korišćenju obnovljivih izvora energije (OIE), osetio sam potrebu i želju da napišem knjigu čija tema će biti solarna energetika. Sagledavanju ovog aspekta primene OIE posvetio sam mnogo pažnje i vremena u prethodnih nekoliko godina, primenjujući naučna i stručna znanja u realizaciji nekoliko velikih projekata solarnih, agrosolarnih i tzv. hibridnih elektrana u Republici Srbiji. Zato je moja želja bila da svoja iskustva kroz ovu knjigu podelim sa svima kojima je ova oblast predmet interesovanja. Iskustva se baziraju na prostornim (planerskim) aspektima realizacije solarnih elektrana i njihovom uticaju na životnu sredinu.

U duhu predgovora iz knjige posvećene vetroenergetici, ovu knjigu takođe započinjem citatima poznatih, u kojima se ističe značaj primene energije sunca za dobijanje energije.

Autor

## **FOREWORD**

After my previous book, *The Spatial Aspects of the Impact of Wind Farms on the Environment* (2017, Eng. 2020), the first one dedicated to “green” energy, and due to the expansion in the use of renewable energy sources (RES), I felt the need and desire to write a book on the topic of solar energy. I have devoted much attention and time to examining this aspect of RES application over the past few years, applying scientific and professional knowledge in the implementation of several large solar, agro-solar, and so-called hybrid power plant projects in the Republic of Serbia. Therefore, my desire was to expand my experiences through this book to all those interested in this field. The experiences are based on spatial (planning) aspects of solar power plant implementation and their impact on the environment, which is analyzed through the process of Strategic Environmental Assessment.

In the spirit of the preface from the previous book, which was dedicated to wind energy, I also begin this book with quotes from renowned figures emphasizing the importance of solar energy application for energy production.

The Author

„Sunce održava sav ljudski rod i daje svu ljudsku energiju.“

(Nikola Tesla)

“The sun maintains all human life and supplies all human energy“

(Nikola Tesla)

„Treba znati iskoristiti prirodne sile i na taj način dobiti potrebnu energiju. Sunčevi zraci su oblik energije, vetar i morske struje su takođe energija. Koristimo li ih? O, ne! Palimo šume i ugaj, kao što podstanari pale ulazna vrata gazdinske kuće da bi se ogrejali. Živimo kao divlji doseljenici koji ne shvataju da ova bogatstva pripadaju svima nama.“

(Tomas A. Edison)

“We should utilize natural forces and thus get all of our power. Sunshine is a form of energy, and the winds and the tides are manifestations of energy. Do we use them? Oh, no; we burn up wood and coal, as renters burn up the front fence for fuel. We live like squatters, not as if we owned the property.“

(Thomas Edison)

„Mi smo kao farmeri koji seku ogradu oko kuće da bi dobili gorivo umesto da koristimo nepresušne prirodne izvore energije – sunce, vetar i plimu... Ja bih svoj novac stavio na sunce i sunčevu energiju. Kakav izvor snage! Nadam se da nećemo čekati da nafta i ugaj nestanu pre nego što se pozabavimo tim.“

(Tomas A. Edison)

“We are like tenant farmers, chopping down the fence around our house for fuel, when we should be using nature’s inexhaustible sources of energy—sun, wind, and tide. I’d put my money on the sun and solar energy. What a source of power! I hope we don’t have to wait till oil and coal run out before we tackle that..“

(Thomas Edison)

„Pošto nam ponestaje gasa i nafte, moramo se brzo pripremiti za treću promenu, striktno očuvanje i korišćenje uglja i trajnih obnovljivih izvora energije, poput solarne energije.“

(Džimi Karter)

“Because we are now running out of gas and oil, we must prepare quickly for a third change—to strict conservation and to the renewed use of coal and to permanent renewable energy sources like solar power.“

(Jimmy Carter)

„Upotreba solarne energije ima ogroman potencijal za očuvanje prirodnih resursa i klime, kao i za širu upotrebu obnovljivih izvora energije ako želimo snabdevanje energijom okrenuto ka budućnosti.“

(Margareta Vulf)

“The use of solar energy offers huge potential for natural resource and climate protection, and for the expansion of renewable energies on the road to a future-oriented energy supply.“

(Margareta Wolf)

„Svaka 24 sata na Zemlju stiže dovoljno sunčeve svetlosti da energijom opskrbi planetu za naredne 24 godine.“

(Marta Maeda)

“Every 24 hours, enough sunlight touches the Earth to provide energy for the entire planet for 24 years.”

(Martha Maeda)

„Imamo taj zgodan fuzioni reaktor na nebu koji se zove sunce – ne moramo ništa da radimo, on radi sam. Izgreva svaki dan.“

(Ilon Mask)

“We have this handy fusion reactor in the sky called the sun, you don’t have to do anything, it just works. It shows up every day.”

(Elon Musk)

„Budućnost će biti zelena ili je neće ni biti.“

(Bob Braun)

“The future will either be green or not at all.”

(Bob Brown)

„Sva energija se na kraju dobija od sunca, a njeno direktno prikupljanje u vidu solarne energije izgleda da je najbolji način za prelazak na obnovljive izvore.“

(Piter Rajv)

“All energy is ultimately derived from the sun, and harvesting it directly through solar power seems to be the best way to transition to renewable energy.”

(Peter Rive)

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## REZIME

Globalni trend smanjenja ugljeničnog otiska uticao je na dinamičan razvoj projekata koji koriste OIE, uključujući i razvoj solarne energetike u velikim solarnim elektranama, zbog čega se javila potreba za sagledavanjem uticaja koje ovi projekti imaju na prostor i životnu sredinu.

U knjizi je konstatovano da uticaji projekata koji koriste OIE, uključujući i solarne elektrane, mogu imati i pozitivne i negativne uticaje na prostor i životnu sredinu, a koje neizostavno treba utvrditi u cilju izbora optimalnih prostornih/teritorijalnih rešenja kojima se obezbeđuje preventivna planska i aktivna zaštita životne sredine. U tom procesu do izražaja dolazi primena strateške procene uticaja na životnu sredinu (SPU) u planiranju i prostornoj organizaciji solarnih elektrana.

SPU karakteriše holistički pristup, u kom je u najranijoj fazi razvoja projekta (u procesu planiranja) moguće sagledati kompleksne interakcije i korelacije u prostoru u kom se planira realizacija solarne elektrane, a zatim primeniti princip preventivne zaštite kako bi se negativni uticaji eliminisali ili umanjili, a pozitivni uticaji utvrdili. Na taj način moguće je preduprediti sve potencijalne rizike koji mogu nastati u kasnijim fazama realizacije projekta, što je povoljno i sa aspekta efikasne zaštite životne sredine i iz ugla investitora koji ulažu u projekte solarnih elektrana.

Optimalna rešenja kojim se ostvaruje osnovna uloga SPU traže se prvenstveno u analizi prostornih odnosa solarne elektrane prema zemljištu, biodiverzitetu, predelu i osnovnim činiocima životne sredine. Kako je u knjizi prikazano, ovaj proces se, u metodološkom smislu, ostvaruje kombinacijom različitih metodoloških pristupa i metoda za procenu uticaja, kao deo jedinstvenog semikvantitativnog metoda višekriterijumske evaluacije planskih rešenja.

Teorijska saznanja primenjena su u knjizi na studiji slučaja kompleksa solarne elektrane Brebeks, što je prikazano u drugom (aplikativnom) delu knjige, na osnovu čega je zaključeno da primenjeni pristup SPU predstavlja pogodnu podršku u proceni uticaja solarne elektrane na životnu sredinu, preventivnoj zaštiti životne sredine na području na kom se planira izgradnja solarne elektrane i procesu donošenja optimalnih odluka o prostornom razvoju na području planirane solarne elektrane.

## SUMMARY

The global trend of reducing the “carbon footprint” has influenced the dynamic development of projects utilizing renewable energy sources (RES), including the expansion of solar energy in large-scale solar power plants. This has led to the need for assessing the impacts these projects have on the space and the environment.

The book notes that projects using RES, including solar power plants, can have both positive and negative impacts on the space and the environment, which must be determined to choose optimal spatial/territorial solutions ensuring preventive planning and active environmental protection. In this process, the application of Strategic Environmental Assessment (SEA) in the planning and spatial organization of solar power plants becomes significant.

SEA involves a holistic approach where complex interactions and correlations in the space where the solar power plant is planned for implementation can be considered in the earliest stages of project development (in the planning process). The principle of preventive protection can then be applied to eliminate or mitigate negative impacts and ascertain positive impacts. This approach enables the anticipation of all potential risks that may arise in later stages of project implementation, which is beneficial both in terms of efficient environmental protection and from the perspective of investors investing in solar power projects.

Optimal solutions to fulfill the primary role of SEA are primarily sought in the analysis of spatial relationships of the solar power plant with land, biodiversity, landscape, and basic environmental factors. As demonstrated in the book, this process, methodologically, is achieved through a combination of various methodological approaches and impact assessment methods, as part of a unified semi-quantitative method of multicriteria evaluation of planning solutions.

Theoretical knowledge applied in the book is exemplified in a case study of the “Brebex” solar power plant complex, as shown in the second (applicative) part of the book. It is concluded based on this case study that the applied SEA approach provides suitable support in: assessing the impact of the solar power plant on the environment; preventive environmental protection in the area where the construction of the solar power plant is planned; and the process of making optimal decisions on spatial development in the area of the planned solar power plant.

## BIOGRAFIJA AUTORA

Boško Josimović rođen je 1974. godine u Zemu u gde je završio osnovnu i srednju školu. Diplomirao je 2000. godine na Geografskom fakultetu Univerziteta u Beogradu, na odseku za prostorno planiranje. Magistrirao je 2003. godine, a doktorirao 2008. godine takođe na Geografskom fakultetu Univerziteta u Beogradu, na smeru istraživanje i planiranje prostora.

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Uža naučnoistraživačka specijalnost usmerena je na razvoj metodološkog pristupa u proceni uticaja strateških razvojnih politika i projekata na životnu sredinu u oblastima: prostornog i urbanističkog planiranja, energetike (posebno vetroenergetike i solarne energetike), upravljanja vodama, itd. U okviru navedenih tema objavio je preko 100 naučnih radova od kojih značajan broj u vrhunskim međunarodnim časopisima. Autor je i prvi koautor u tri naučne monografije. Pored toga, bio je učesnik u realizaciji: 7 naučnoistraživačkih projekata koji su finansirani od strane resornog Ministarstva za oblast nauke; rukovodilac (ispred IAUS-a) jednog međunarodnog naučnog projekta (HORIZON 2020); autor preko 20 tehnoloških razvojnih rešenja koja su verifikovana od strane nadležnog Matičnog naučnog odbora Ministarstva nauke, tehnološkog razvoja i inovacija Republike Srbije.

Profesionalna aktivnost Boška Josimovića usmerena je na rukovođenje u izradi: strateških procena uticaja razvojnih sektorskih politika na životnu sredinu; studija o proceni uticaja projekata na životnu sredinu; priloga o zaštiti životne sredine u prostornim planovima; itd. Značajno je i njegovo angažovanje kao konsultanta na projektima u oblasti infrastrukture koji se realizuju u Republici Srbiji, a finansiraju se iz sredstava Evropske unije.

Član je: Skupštine Alumnija Univerziteta u Beogradu, međunarodne naučne asocijacije SCIYO-a, organizacije SEEFED; nekoliko strukovnih udruženja; republičke Tehničke komisije za ocenu studija o proceni uticaja na životnu sredinu pri Ministarstvu za zaštitu životne sredine Republike Srbije; Naučnog veća i Izdavačkog saveta IAUS-a; Uredništva časopisa Arhitektura i urbanizam.

Oženjen je i ima dvoje dece.

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Boško Josimović was born in 1974 in Zemun, where he completed his elementary and high school education. He graduated in 2000 from the Faculty of Geography, University of Belgrade, Department of Spatial Planning. He obtained his master's degree in 2003 and his Ph.D. in 2008, also at the Faculty of Geography, University of Belgrade, specializing in spatial research and planning.

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In terms of scientific research, he specializes in developing a methodological approach to assessing the impacts of strategic development policies and projects on the environment in the fields of spatial and urban planning, energy (particularly wind and solar energy), water management, etc. He has published over 100 scientific papers about these topics, many of which in top-tier international journals. He is the author and co-author of three scientific monographs. Additionally, he participated in the implementation of seven research projects funded by the Ministry of Science; he led (on behalf of IAUS) an international scientific project (HORIZON 2020); he authored over 20 technological development solutions verified by the relevant Principal Scientific Committee of the Ministry of Science, Technological Development, and Innovation of the Republic of Serbia.

Boško Josimović's professional activities focus on leading the development of strategic environmental impact assessments of sectoral development policies, project environmental impact assessment studies, contributions to environmental protection in spatial plans, etc. His involvement as a consultant on infrastructure projects implemented in the Republic of Serbia and funded by the European Union is also significant.

He is a member of the Alumni Assembly of the University of Belgrade, the international scientific association SCIYO, the SEEFED organization, several professional associations, the State Technical Commission for Environmental Impact Assessment Studies at the Ministry of Environmental Protection of the Republic of Serbia, the Scientific Council and the Editorial Board of IAUS, and the Editorial Board of the journal Architecture and Urbanism.

He is married and has two children.

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