



## **Centre for Renewable Energy Sources and Power Quality**

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Faculty of Technical Sciences, University of Novi Sad

Trg Dositeja Obradovica 6, 2100 Novi Sad

tel. 021/485-2503, 485 - 2510, fax. 021 475 - 0572

### **Ee2017, Novi Sad, Serbia – Tutorial Proposal**

#### **Tutorial title:**

**A comprehensive study of photovoltaic power plant operation and maintenance  
- from concept to profitability -**

#### **Lecturers:**

doc. dr Boris Dumnic,  
doc. dr Dragan Milicevic,  
M.Sc Bane Popadic,  
Centre for Renewable Energy Sources and Power Quality  
Faculty of Technical Sciences,  
University of Novi Sad,  
Novi Sad, Serbia

#### **Objectives:**

Renewable energy sources, by their very nature, represent the corner stone of the modern notion - sustainable development. Having faced severe energy and economic crisis, humanity has turned to the development of renewable energy sector. One of the leaders in renewable energy market currently is the photovoltaic energy conversion technology. The increased share of photovoltaic energy in the worldwide energy consumption can have significant positive influence in regard to energy security and environmental concerns. Furthermore, with the development of the technology, private and public sector can often see photovoltaic energy market as a suitable investment opportunity. However, between the notion of photovoltaic power plant and the operational profitable business, there are several key steps to be followed. This tutorial will aim at presenting a comprehensive study to photovoltaic power plant exploitation, covering the basic ideas behind the operating principles, project design and implementation, techno-economic analysis, monitoring and maintenance. During the tutorial, the audience will have a chance to learn the principle behind photovoltaic power plant design, including power plant components selection, technical documentation development, as well as how to recognize the possible hidden costs of the project.



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Building on the acquired knowledge, the detailed analysis of financial indicators for the photovoltaic power plant project will be given and referenced to the operational systems. Lecturers will use their experience in design, installation, operation and maintenance of several photovoltaic power plants with various power levels in order to provide the audience with practical knowledge concerning their exploitation. The regular operational activities and the importance of system monitoring will be shown. In addition, common faults and interruptions in photovoltaic power plant operation will be presented, giving the audience necessary knowledge in system fault diagnosis for future reference.

### Intended Audience:

Since the topic of renewable energy sources, especially photovoltaic power plants is very interesting for a broad audience, a strong interest is expected for the tutorial. Expected audience should include individuals in following areas:

- Bachelor, Master and PhD students (researchers) in the area of renewable energy,
- Industrial engineers in the related sector,
- Individuals from public and private sector interested in investment opportunities.

The tutorial is well adapted to satisfy the need of all interested parties coming from different technical backgrounds. However, some parts of the tutorial could require a basic knowledge background in electrical engineering.

**Tutorial Outline and Proposed Agenda:****Part I (1.5 h – 2 h)**

1. Introduction
  - a. Photovoltaic power plant basic operating principles
  - b. Main elements of the photovoltaic system
  - c. Classification of photovoltaic power plants
2. Photovoltaic power plant project design principles
  - a. Law on planning and construction
  - b. Technical legislation in photovoltaic power plant design
  - c. Requirements and regulation for connection to the distribution network
3. Phases of photovoltaic power plant project implementation
  - a. Technical documentation and project management
  - b. Selection of photovoltaic power plant equipment
  - c. Project implementation and hidden costs
4. Financial indicators of photovoltaic power plant project
  - a. Privileged power producer, incentive measures and limitations
  - b. Influence of electrical energy prices on investment justification
  - c. Techno-economic analysis for different photovoltaic systems

**Part II (1.5 h – 2 h)**

5. Operation of photovoltaic power plant
  - a. Electrical energy production planning
  - b. Analysis of achieved electrical energy production
  - c. Reporting on regular and occasional activities
6. Monitoring of photovoltaic power plant operation
  - a. Software for photovoltaic power plant monitoring
  - b. Main parameters and data representation
  - c. Diagnostic and reporting tools
7. Maintenance of photovoltaic power plant
  - a. Fault analysis in photovoltaic power plants
  - b. Supply interruptions
  - c. Preventive maintenance
8. Summary and Q&A session

**Schedule and Duration:** Tutorial is planned to be half a day long (lasting between 3 and 4 hours), with coffee break provided halfway through.

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### Biographies:



**Dr. Boris Dumnic** received his M.Sc. and Ph.D. degree from the University of Novi Sad, Serbia. Since 2004 he has been working at the, Faculty of Technical Sciences, Department for Power, Electronics and Telecommunications Engineering - DEET, Novi Sad, Serbia. He is appointed for director of faculty Centre - Centre for Renewable Energy Sources and Power Quality - CRESPOQ on 2010, and was promoted to the rank of Associate Prof. in 2013. From 2015 Dumnic is Director of Department for Power, Electronics and Telecommunications Engineering. The focus of his current research is on Electrical Machines and Drives, Power Electronics and Renewable Energy Systems. He has published over 70 scientific papers at main international and national conferences and over 10 papers in international journals. Dumnic participated in the development and managed with a large number of international and national R&D projects. He is IEEE Member and vice-chair of IEEE Serbia and Montenegro Section.



**Dragan Milicevic** received his Ph.D. degree from the University of Novi Sad, Serbia. Since 2004 he has been working at the, Faculty of Technical Sciences, Department for Power, Electronics and Telecommunications Engineering - DEET, Novi Sad, Serbia. He was promoted to the rank of Associate Prof. in 2014. His main research interests are in the area of control, modeling and simulation of multiphase electric drives and renewable energy resources.



**Bane Popadic** was born in Doboje, Bosnia and Herzegovina, in 1988. He received B.Sc. and M.Sc. degrees in Electrical engineering at the University of Novi Sad, Novi Sad, Serbia, in 2011 and 2012 respectively. Since 2012 he is pursuing Ph.D. degree at the Faculty of Technical Sciences, University of Novi Sad. His interest area include electrical drive control, modeling and simulation. He is a student member of the IEEE.