

**IEEE Distinguished Lecturer Program  
Presentation to IEEE IAS/PELS/PES Benelux Chapter**



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## ***Future Electronic Power Distribution Systems***

### **– A contemplative view –**

Although it has long been argued that electronic power converters can help improve system controllability, reliability, size, and efficiency, their penetration in power systems is still quite low. The often-cited barriers of higher cost and lower reliability of the power converters are quite high if power electronics is used as direct, one-to-one, replacement for the existing electromechanical equipment. However, if the whole power distribution system were designed as a system of controllable converters, the overall system cost and reliability could actually improve, as is currently the case at low power levels within computer and telecom equipment.

Starting from the example of a computer power system, the paper contemplates possible future ac and dc electronic power distribution system architectures, especially in the presence of renewable energy sources. The proposed nanogrid–microgrid–...–grid structure achieves hierarchical dynamic decoupling of generation, distribution, and consumption by using bidirectional converters as energy control centers. This is illustrated by the description and simulation of static and dynamic operation of a dc nanogrid in a hypothetical future sustainable home. Several ideas for modeling, analysis, and system-level design of such systems, including power flow control, protection, stability, and subsystem interactions, are presented.



### ***by Dushan Boroyevich***

Dushan Boroyevich received his Dipl. Ing. degree from the University of Belgrade in 1976 and his M.S. degree from the University of Novi Sad in 1982, in what then used to be Yugoslavia. He received his Ph.D. degree in 1986 from Virginia Polytechnic Institute and State University (Virginia Tech), Blacksburg, USA.

From 1986 to 1990, he was an assistant professor and director of the Power and Industrial Electronics Research Program in the Institute for Power and Electronic Engineering, at the University of Novi Sad. He then joined the Bradley Department of Electrical and Computer Engineering at Virginia Tech as associate professor. He is now American Electric Power Professor at the department and co-director of the Center for Power Electronics Systems (CPES). Prof. Boroyevich is Fellow of

IEEE and recipient of the IEEE William E. Newell Power Electronics Technical Field Award. He is 2011-12 president of the IEEE Power Electronics Society.

Prof. Boroyevich's research interests include multi-phase power conversion, electronic power distribution systems, power electronics systems modeling and control, and integrated design of power converters.