

## **Tutorial T-12: Energy Efficient Broadband Access**

**Presenter:** Nirwan Ansari (New Jersey Institute of Technology, Newark, NJ 07102, USA)

### **Tutorial Overview**

A variety of bandwidth-hungry applications and services such as high-definition television, video streaming, and social networking are being deployed rapidly, thus leading to a continuous surge in bandwidth demand across networking infrastructure, notably the access portion (last-hop access). Therefore, both wireline and wireless telecommunications operators are driven to upgrade their access networks to provide broader bandwidth for their subscribers. Upgrading the provisioning capacity of access networks leads to a dramatic increase of energy consumption. The network energy consumption contributes to part of its operational expenditure, and high power consumption exerts high requirements on performances of the backup battery at network terminal devices. Moreover, owing to the direct impact of greenhouse gases on the earth environment and the climate change, the energy consumption is becoming an environmental and thus social and economic issue. Therefore, it is important to design and build energy efficient high capacity access networks. This tutorial will discuss the roadmap in designing energy efficient access networks, cover the state of the art on greening wireline and wireless access networks, present the research challenges on achieving energy efficient high capacity access networks, and provide a discussion alluding to the 5G development.

1. Vision on future energy efficient high capacity access networks
2. Broadband access technologies
  - a. Wire line access technologies
  - b. Wireless access technologies
3. Challenges in designing energy efficient access networks
4. Energy efficient wire line access networks
  - a. Evolution of PON technologies
  - b. Capacity adaptive access network design
  - c. Capacity adaptive access network control
  - d. Energy efficient resource allocation and traffic scheduling
5. Energy efficient wireless access networks
  - a. Energy efficient network capacity upgrade
  - b. Greening cellular networks via multicell cooperation
  - c. Energy efficient mobile traffic offloading
  - d. Powering mobile networking with green energy
6. Challenges for further investigation
7. 5G Implications

### **Presenter Biography**

Nirwan Ansari is Distinguished Professor of Electrical and Computer Engineering at the New Jersey Institute of Technology (NJIT). He has also been a visiting (chair) professor at several universities such as High-level Visiting Scientist at Beijing University of Posts and Telecommunications.

Professor Ansari is authoring *Green Mobile Networks: A Networking Perspective* (John Wiley, 2016) with T. Han, and co-authored two other books. He has also (co-)authored over 500 technical publications,

over one third published in widely cited journals/magazines. He has guest-edited a number of special issues covering various emerging topics in communications and networking. He has served on the editorial/advisory board of over ten journals. His current research focuses on green communications and networking, cloud computing, and various aspects of broadband networks.

Professor Ansari was elected to serve in the IEEE Communications Society (ComSoc) Board of Governors as a member-at-large, has chaired ComSoc technical committees, and has been actively organizing numerous IEEE International Conferences/Symposia/Workshops. He has frequently delivered keynote addresses, distinguished lectures, tutorials, and invited talks. Some of his recognitions include IEEE Fellow, several Excellence in Teaching Awards, a couple of best paper awards, the NCE Excellence in Research Award, the ComSoc AHSN TC Outstanding Service Recognition Award, the NJ Inventors Hall of Fame Inventor of the Year Award, the Thomas Alva Edison Patent Award, Purdue University Outstanding Electrical and Computer Engineer Award, and designation as a COMSOC Distinguished Lecturer. He has also been granted over 25 U.S. patents.

He received a Ph.D. from Purdue University in 1988, an MSEE from the University of Michigan in 1983, and a BSEE (summa cum laude with a perfect GPA) from NJIT in 1982.