



IEEE Sweden PE/PEL Chapter

## IEEE Seminar on “ Microgrids: Swedish and International Perspectives”

Time: 12:45-16:45, CET, May 26, 2021 (Wednesday)

Registration link: <https://events.vtools.ieee.org/m/271513>

May 26 (Wednesday) 12:45 - 16:45 CET Time		
Time	Title of presentation	Speaker
12:45-12:55	Opening speech by Peiyuan Chen on behalf of organization team	
12:55-13:00	Opening speech by Qianwen Xu on behalf of IEEE PES/PELS Sweden	
13:00-14:30	<b>Session 1</b> Chair: Peiyuan Chen	
13:00-13:30	Microgrids – Changing the Way of Thinking Energy Systems	Josep M. Guerrero, Aalborg University
13:30-14:00	Microgrid Business Cases	Ritwik Majumder, Hitachi Power Grid
14:00-14:30	Grid storage solutions	Fredrik Carlsson Vattenfall Eldistribution AB
14:30-14:45	<i>break with virtual fika</i>	
14:45-16:15	<b>Session 2</b> Chair: Qianwen Xu	
14:45-15:15	Microgrid Lessons Learned at Duke Energy	Stuart Laval Duke energy
15:15-15:45	Adaptive integrated hybrid AC/DC microgrid communities	Qianwen Xu KTH
15:45-16:15	Interconnected Microgrid through Multiport Converter	Peiyuan Chen Chalmers University of Technology
16:15-16:45	Panel discussion	

## Detailed information:

### **Presentation 1:** Microgrids – Changing the Way of Thinking Energy Systems, by Josep M. Guerrero

#### **Abstract**

A microgrid can be defined as a part of the grid with elements like distributed energy sources, power electronics converters, energy storage devices and controllable local loads that can operate autonomously in islanded mode but also interacting with the main power network in a controlled, coordinated way. Following the introduction of distributed control of these elements, cooperative control and hierarchical control schemes for coordination of power electronics converters in order to control the power flow and to enhance the power quality will be elaborated. Different technologies are combined together, such as power converters, control, communications, optimization, and so on. This way, energy can be generated and stored near to the consumption points, improving stability and reducing losses produced by large power lines. In distributed energy systems like microgrids, multi-agent systems technologies will be presented, including distributed control.

Previous experiences in the Danish electrical system like the Cell Controller project used these technologies to balance dispersed energy generation and consumption. The focus of this presentation will be on the analysis, modelling and control design of power electronics-based microgrids, as well as power electronics control and communications. Further, the interconnection of microgrid clusters will be emphasized as an important step towards utilization of the smart grid concept. In this talk examples of research and projects in real sites including conventional islanded systems installed in islands and rural remote areas, low-voltage distribution systems and DC microgrids for residential applications and homes electrical vehicle charging stations, ships, vessels, and ferries, and seaports will be shown. .

#### **Biography**

Josep M. Guerrero (S'01-M'04-SM'08-FM'15) received the B.S. degree in telecommunications engineering, the M.S. degree in electronics engineering, and the Ph.D. degree in power electronics from the Technical University of Catalonia, Barcelona, in 1997, 2000 and 2003, respectively. Since 2011, he has been a Full Professor with the Department of Energy Technology, Aalborg University, Denmark, where he is responsible for the Microgrid Research Program ([www.microgrids.et.aau.dk](http://www.microgrids.et.aau.dk)). From 2014 he is chair Professor in Shandong University; from 2015 he is a distinguished guest Professor in Hunan University; and from 2016 he is a visiting professor fellow at Aston University, UK, and a guest Professor at the Nanjing University of Posts and Telecommunications. From 2019, he became a Villum Investigator by The Villum Fonden, which supports the Centre for Research on Microgrids (CROM) at Aalborg University, being Prof. Guerrero the founder and Director of the same centre.

His research interests is oriented to different microgrid aspects, including power electronics, distributed energy-storage systems, hierarchical and cooperative control, energy management systems, smart metering and the internet of things for AC/DC microgrid clusters and islanded minigrids. Specially focused on maritime microgrids for electrical ships, vessels, ferries and seaports. Prof. Guerrero is an Associate Editor for a number of IEEE TRANSACTIONS. He has published more than 500 journal papers in the fields of microgrids and renewable energy systems, which are cited more than 40,000 times. He received the best paper award of the IEEE Transactions on Energy Conversion for the period 2014-2015, and the best paper prize of IEEE-PES in 2015. As well, he received the best paper award of the Journal of Power Electronics in 2016. During six consecutive years, from 2014 to 2019, he was awarded by Clarivate Analytics (former Thomson Reuters) as Highly Cited Researcher. In 2015 he was elevated as IEEE Fellow for his contributions on “distributed power systems and microgrids.”

### **Presentation 2:** Microgrid Business Cases, by Ritwik Majumder

#### **Abstract**

The presentation covers the grid edge solutions for microgrids. Starting from, how grid edge solution can enable the future of energy, the digital solutions for distributed energy resources are described. The business cases for microgrid in Utility, commercial & industrial, off grid and renewable integration are explained. Some interesting reference cases, from around the globe, are shown as successful implementation of grid edge solutions in microgrid.

**Biography**

Ritwik Majumder received the Ph.D. degree from Queensland University of Technology, Brisbane, Australia. He is working with Hitachi ABB PowerGrid (before ABB Corporate Research) as R&D Principal engineer, Västerås, Sweden. From 2004 to 2007, he worked with Siemens and ABB Corporate Research Centre, India. His interests are in power systems dynamics, distributed generation, and power electronics applications.

**Presentation 3: Grid storage solutions, by Fredrik Carlsson****Abstract**

The energy landscape is changing; more intermittent energy resources drives the increasing need for flexibility services, urbanization and industrialization drives the need for capacity management, local e-mobility chargers and solar panels drives voltages and peak shaving. These and many more drivers can be solved with energy storages as stand-alone or stacked services. Vattenfall solutions in this area will be presented.

**Biography**

Fredrik Carlsson received his M.Sc. degree 1999 in Electrical Engineering from KTH, Royal Institute of Technology in Stockholm, Sweden. He got his Ph.D. degree in January 2004 with the title "On impacts and ride-through of voltage sags exposing line-operated AC-machines". He has then worked as a researcher at the department of Electrical engineering, KTH, Stockholm, Sweden. Research was done in the fields of diagnostics, traction applications, and hybrid vehicles. Since 2008, he is working as a senior R&D engineer at Vattenfall Research & Development, Sweden within smart grids and wind power. He is now R&D portfolio manager for Distribution.

**Presentation 4: Microgrid Lessons Learned at Duke Energy, by Stuart Laval****Abstract**

Advances in digital control and communications technologies during the past decade have resulted in the creation of utility-owned microgrid test beds that integrate a variety distributed energy resources, such as solar or energy storage. Since 2016, Duke Energy's Emerging Technologies Office has developed, installed, and commissioned several operational microgrids in the Charlotte, North Carolina area with the objective of trying to uncover and understand the engineering issues and distributed intelligence platform capabilities associated with microgrids. This presentation will cover lessons learned from the design, implementation, and operation of its most comprehensive distribution system connected microgrid, and how the implementation of a standardized North American energy interoperability framework, known as Open Field Message Bus (OpenFMB), has enabled sub-second responses from field devices.

**Biography**

Dr. Stuart Laval is a member of Duke Energy's Emerging Technology office, where he leads the development of grid-edge operational technologies and pioneering utility interoperability standards. Dr. Laval has over 17 years of experience in electric utility power systems, telecommunications, and power electronics. He holds Bachelor's and Master's degrees in Electrical Engineering & Computer Science from MIT, a MBA from Rollins College, and a Ph.D. in Industrial Engineering from the University of Central Florida

**Presentation 5: Adaptive integrated hybrid AC/DC microgrid communities, by Qianwen Xu****Abstract**

Microgrids are building blocks of future smart grids, as the key enabler for renewable energy integration, energy communities and enhanced grid resiliency. Networked microgrid communities are recognized as operation paradigm for future distribution systems. In this presentation, a standardized hybrid AC/DC microgrid module solution is presented for energy communities, consisting of universal hardware module design, real-time power management system, distributed energy management system as well as systematic stability analysis and reliability evaluation tools. The solution is demonstrated in CleanTech Building in Singapore.

### **Biography**

Qianwen Xu received the B.Sc. degree from Tianjin University, China in 2014, and PhD degree from Nanyang Technological University, Singapore in 2018, both in electrical engineering. Then she worked as a postdoc research fellow in Aalborg University in Denmark and a Wallenberg-NTU Presidential Postdoc Fellow in Nanyang Technological University in Singapore. She was also a visiting researcher with Imperial College London during March 2020 to June 2020. She was awarded Humboldt Research Fellowship, Excellent Doctorate Research Work in Nanyang Technological University, Best paper award in IEEE PEDG 2020, etc.

Currently she is an assistant professor in Department of Electric Power and Energy Systems, KTH Royal Institute of Technology, Sweden. Her research interests include advanced control, optimization, stability and reliability of microgrids and vehicular power systems. She has published over 40 technical papers, with 15 first-authored journal papers in top IEEE Transactions. She serves as Vice Chair in IEEE Power and Energy Society & Power Electronics Society, Sweden Chapter, and an Associate Editor for IEEE Transactions on Smart Grid.

### **Presentation 6: Interconnected Microgrid through Multiport Converter, by Peiyuan Chen**

#### **Abstract**

The grid users of a distribution grid is evolving from a passive role of merely consuming/producing energy to taking a much more active one by providing flexibility and ancillary services for tackling grid issues. Reliability is one of the most critical grid issues in electricity supply. In Sweden, instead of microgrid solutions to allow island operation of local grid in case of interruption in the main grid, overhead lines have been replaced by underground cables to improve the resiliency of the distribution grid. This has proven to be too expensive especially in low-population density areas. This presentation will first review different drivers and barriers of microgrid application in the Swedish context. Then, the research questions addressed in the ongoing ERAnet SES MultiportGrid project will be presented and discussed. The project aims to evaluate and develop a cost-effective solution to interconnect local grid users through a multiport converter for harvesting flexibility resources during grid-connected conditions and enabling island operation when the upstream grid is not available.

#### **Biography**

Peiyuan Chen received his B.Eng. degree in electrical engineering from Zhejiang University, Hangzhou, China, in 2004, the M.Sc. degree in electric power engineering from Chalmers University of Technology, Gothenburg, Sweden, in 2006, and the Ph.D. degree from Aalborg University, Aalborg, Denmark, in 2010. He is currently an Associate Professor at Chalmers University of Technology. His research interests include design, operation, and control of power system with renewable generation.