

POWER DIGEST.

A NEWSLETTER PUBLICATION

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SEMINARS HOSTED BY THE DEPARTMENT OF ELECTRICAL ENGINEERING

The Electrical Power Engineering Department hosted a blended seminar-workshop with a lecture titled “Scalable and Distributed Demand Response Management”, on 21st January 2022, delivered by Prof GK Venayagamoorthy of Clemson University.



Prof. Kumar Venayagamoorthy

Prof Kumar Venayagamoorthy is the Duke Energy Distinguished Professor of Power Engineering and Professor of Electrical and Computer Engineering at Clemson University since January 2012. Prior to that, he was a Professor of Electrical and Computer Engineering at the Missouri University of Science and Technology (Missouri S&T), Rolla, the USA where he was from 2002 to 2011. Prof Venayagamoorthy was a Senior Lecturer in the Department of Electronic Engineering, Durban University of Technology, Durban, South Africa, where he was from 1996 to 2002. He was the BTech/MTech program coordinator for the Electronic Engineering Dept. and the Chair of the Faculty of Engineering Research Committee.

DR CASE STUDIES, RESULTS, AND ANALYSIS

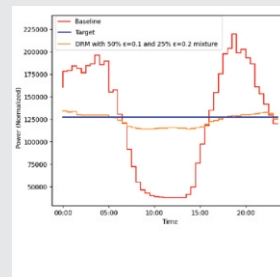
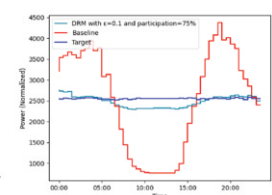


FIGURE 8. Total power demand for a population of 50% of $\epsilon = 0.1$ and 25% of $\epsilon = 0.2$ and rest non-contributing.

FIGURE 9. Results for the substation 34 for $\epsilon = 0.1$ and 75% participation. This specific substation had 70.52% participation.





Prof Venayagamoorthy is the Founder and Director of the Real-Time Power and Intelligent Systems Laboratory at Missouri S&T and Clemson University. He received his Ph.D. and MScEng degrees in Electrical Engineering from Natal University (now University of KwaZulu-Natal), Durban, South Africa, in April 2002 and April 1999, respectively. He received his BEng degree with a First-Class Honors in Electrical and Electronics Engineering from Abubakar Tafawa Balewa University, Bauchi, Nigeria in March 1994. He holds an MBA degree in Entrepreneurship and Innovation from Clemson University, SC (August 2016).

The speaker presented an energy management strategy that is based on the Demand Response (DR) of the consumers. The lecture highlighted the following:

- A scalable framework for demand response optimization.
- The hierarchical architecture was centric to the framework and allowed additional participants to the DR program without slowing down the optimization.
- New metrics to quantify the success and effectiveness of the DR program, as well as the stress on the DR participant.
- The application of these metrics in the explored case study (one million homes) indicated that incorporating all possible participants might not be the best case for an electric utility.
- The results illustrated that a DR aggregator needs to know the behaviors of the consumers in the population before involving them into the DR program.



The EPE Department Seminar Attendees

Prof Ilhami Colak gave a virtual lecture on the “Impacts of Digital Transformation on Alternative and Green Energies”. This took place on the 4th of February 2022.



Prof Ilham Colak

Prof Ilham Colak was born in Turkey. He received his diploma in Electrical Engineering from Gazi University, Turkey in 1985. He carried out MSc studies in Electrical Engineering in the field of Speed Control of Wound Rotor Induction Machines Using Semiconductor Devices at Gazi University in 1991. Thereafter, he did his MPhil at Birmingham University in England by preparing a thesis on High-Frequency Resonant DC Link Inverters in 1991. He obtained the Ph.D. degree at Aston University, England on Mixed Frequency Testing of Induction Machines Using Inverters in 1994. He became an Assistant



Professor, an Associate Professor, and a Full Professor in 1995, 1999, and 2005 respectively.

He has published over 98 journal articles, 220 peer-reviewed conference papers, and 7 books in different subjects including electrical machines, drive systems, machine learning, reactive power compensation, inverter, converter, artificial neural networks, distance learning automation, and alternating energy sources.

In his lecture, Prof Colak emphasized that Digital transformation is a new concept of integrating today's digital technology into our lives in all areas of a business including social, science, production, education, energy, and culture. The presentation focused on the effects of digital transformation on alternatives and Green (Renewable) energy systems.

The seminar highlighted the following:

- Digitalization describes the growing application of information and communication technologies (ICT) across the economy, including renewable energy systems.
- The trend towards greater digitalization is enabled by advances in data analytics, and connectivity:
 - which includes increasing volumes of data through a declining cost of sensors and data storage
 - rapid progress in advanced analytics, such as machine learning.
 - greater connectivity of people and devices as well as faster and cheaper data transmission
- Digitalization encompasses arrangement of digital technologies, concepts, and trends, such as artificial intelligence, the "Internet of Things" (IoT), and the Fourth Industrial Revolution (Industry 4.0).



New energy ecosystem of the world via digital transformation

RESEARCH PUBLICATIONS

Book Chapters

- [1] Sanjeeth Sewchurran, Innocent E Davidson, and Elutunji Buraimoh, Comparative Analysis of Solar PV Production in Durban to Other Cities in South Africa. In: Subramani C., Vijayakumar K., Dakyo B., Dash S.S. (eds) Proceedings of International Conference on Power Electronics and Renewable Energy Systems. Lecture Notes in Electrical Engineering, vol 795. 2022. Springer, Singapore. https://doi.org/10.1007/978-981-16-4943-1_39
- [2] Patrobers Robert Simiyu, Elutunji Buraimoh and, Innocent Ewean Davidson, Fostering Research Integrity in African HEIs. In: Suresh Babu Naidu Krishna, Jamila Adam, and Sibusiso Moyo (eds) Research Integrity and Ethical Challenges in African Higher Education. Chapter 39, pages 411-425, African Sun Media. African Journal of Inter/Multidisciplinary Studies, Vol. 3 (2021a Special Issue), 97 -109. DOI: <https://doi.org/10.51415/ajims.v3i1.980> **Journal Articles**

Journal Articles

- [3] Elutunji Buraimoh and Innocent E. Davidson, "Modelling of Double Stage Photovoltaic Inverter System with Fast Delayed Signal Cancellation for Fault Ride-Through Control Application in Microgrids", *Energies* 2022, 15(3), 701; <https://doi.org/10.3390/en15030701>.
- [4] Upendra Singh; Aditya Ramaswamy; Amit Dua; Neeraj Kumar; Sudeep Tanwar, Gulshan Sharma, Innocent E. Davidson, and Ravi Sharma, "Coalition Games for Performance Evaluation in 5G and Beyond Networks: A Survey", *IEEE Access*, Vol. 10, pp. 15393-15420, Print ISSN: 2169-3536, Online ISSN: 2169-3536, DOI: 10.1109/ACCESS.2022.3146158.

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