



## IEEE Power & Energy Society (PES) – Newcastle University in Singapore (NUS) Technical Seminar

**Title:** An Introduction to the Distributed Energy Resource (DER) Management System (DERMS) in View of the High Penetration of Consumer-owned DERs.

**Speaker:** Dr Amir Miragha, Deputy Director, Distributed Energy Resource Management System (DERMS), Energy Research Institute @ NTU (ERI@N).

**Venue:** Classroom 1, Newcastle Research & Innovation Institute (NewRIIS), 80 Jurong East Street 21, Devan Nair Institute for Employment & Employability, Singapore 609607.

**Jointly Organized By:** IEEE Power & Energy Society (PES) Singapore Chapter.

**Event Timings:** 6.45pm to 8pm.

**Date:** 13th May 2019.

**Refreshments:** Light refreshments are available after the seminar.

### **Abstract:**

In the last several years/decade new dimensions of complexity have been added to energy and power systems which have made them even more complicated to operate: 1) these systems are aging, 2) we are faced with higher demands and potentially lower reserve margins, 3) we are experiencing more and more natural disasters, 4) terrorist attacks is a new serious concern, 5) new types of loads sensitive to power quality have emerged (e.g., data centers) and finally 6) at both sides of generation and demand, new types of uncertain and stochastic components are being added (e.g., renewable power sources and plug-in electric vehicles). With the aforementioned complexities and understanding the new realities governing the energy and power system domain, universities/research institutes and industry solution providers have adjusted their focus to seeking proper algorithms/methodologies/tools/devices to achieve higher levels of power system efficiency, reliability, resiliency, security, flexibility and sustainability. Improving these six attributes is embodied in the notion of the Smart Grid. This is the area that has been placed into the limelight particularly in the past decade. Among different layers/levels of energy and power systems, the distribution level is affected the most by the notion of the Smart Grid. The main reason is attributed to the growth of distributed energy resources (DERs) (e.g., renewable power sources). However, the high penetration of DERs, which are oftentimes intermittent, results in reverse power flow along distribution feeders, unacceptable voltage profile and occasional severe voltage fluctuations. Even plug-in electric vehicles, which are spreading throughout the system, due to uncertain demand/generation levels under both G2V and V2G scenarios, contribute to the complexity of the aforementioned distribution system operation. The complexities introduced to the distribution systems as a result of the large deployment of DERs is not only related to the intermittency/variability of these demands/resources but also related to a lack of visibility and controllability of these assets,

which are owned and operated by different entities (i.e., customers and not utilities). In fact, utilities are dealing with a territory that keeps expanding while having limited or no observability and control over this territory. Despite the aforementioned challenges, we are in a stage when consumer-owned DERs are becoming inevitable and unavoidable components of our energy and power systems. The rational question in this situation is: how can utilities take advantage of this emerging territory? Even interconnection standards (e.g., the IEEE 1547) are about to experience substantial changes in favour of this transition. As time passes and more DERs are being introduced to distribution systems, these standards are evolving into a means that dictates how consumer-owned generation can provide capacity or flexibility and assist the grid when it is under stress. In this situation, utilities need efficient tools to help them forecast, optimize and control these new assets so that reliability and stability of the grid is not compromised at any time. Distributed Energy Resource Management System (DERMS) is a platform that has been introduced to enable exact same functions (i.e., DER forecast, optimization and control) that distribution system operators need to retain grid reliability and stability in face of a large deployment of DERs. This seminar will shed light on some major operational and technological issues related to the distribution grid management platforms with a emphasis on the DERMS.