

POWER DIGEST

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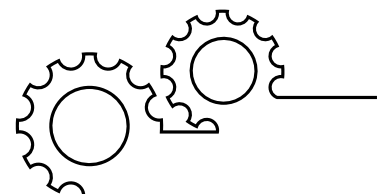
Smart Grid Researchers end Loadshedding in Electrical Power Engineering Department

The Smart Grid Research Group, led by Prof Innocent E Davidson, has achieved another milestone by successfully designing and installing a hybrid solar-PV grid-tied inverter with deep-cycle battery energy storage system (BESS) to ensure an uninterruptible and sustainable power supply to essential and sensitive loads in the Department of Electrical Power Engineering (EPE). Solar-PV installation in university campuses, offices, and industries is not new, with either an off-grid or grid-connected option to meet or augment energy requirements. However, the Smart Grid Researchers innovatively crafted a third option - a sophisticated hybrid solar-PV system that combines the best of off-grid and grid-connected solar-PV systems. Thus, EPE has constant access to electricity, even during power outages occasioned by national load shedding and poor weather affecting solar power production. Since the commissioning and testing of the new 10kW solar-PV system with a hybrid inverter and battery energy storage system, there is no more load shedding in the Department of Electrical Power Engineering at any time going forward, even if the entire DUT campus or grid is down.

A feasibility study was earlier conducted to determine the essential critical load requirement of all EPE offices, and the research group members came up with a design not just to provide uninterruptible power but also to serve the students' teaching and research purpose. Thus, the

system is equipped with a computer-based user interface for remote monitoring and data acquisition system and analysis for research purposes. Furthermore, the EPE Department now runs off-grid, and during power outage on the Eskom network, it can feed back into the grid after meeting local EPE critical load demand, thus diminishing consumption from Eskom and saving DUT lots of money. Since this system is capable of feeding power to the grid, this portends the possibility of reducing the cost of electricity through the solar feed-in tariff. Thus, it does not only reduced DUT's energy bill, but the university can earn money or credit for feeding processed solar-PV electricity to the grid.

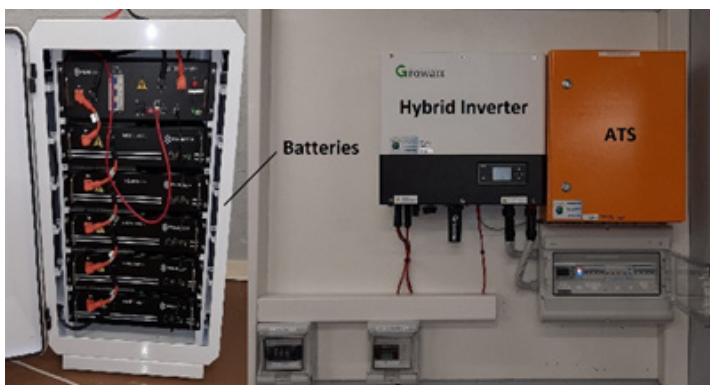
Industrial partners and contractors conducted the installation in conjunction with postgrad researchers affiliated with the Smart Grid Centre, undergraduate BEngTech project students and technical staff. The installed hybrid solar system can generate 10kW power in the same way as a commonly known grid-tied solar system but uses special hybrid inverters and batteries to store energy for later use. This introduces some level of uniqueness to the EPE installed system which





Photographer: Dr Elutunji Buraimoh

therefore has the ability to store energy and operate as a backup power supply during different events of load shedding. Thus, power supply, especially for lighting and administrative offices is uninterrupted during load shedding, ensuring smooth operation.



Photographer: Dr Elutunji Buraimoh

The Smart Grid Research Centre is committed to reducing DUT's carbon footprint and greenhouse gas (GHG) emissions by decreasing DUT's dependence on fossil-fuel based electricity production and promoting clean, green and renewable energy usage, in support of ENVISION2030 and the United Nations Sustainable Development Goals (SDGs).



Thus, Power Engineering Dept and the Smart Grid Research RFA have demonstrated the commitment through this pilot installation. Earlier, a similar 5-kW hybrid system was designed and installed for use in the new Smart Grid Laboratory. The system is modular and scalable. A Large-scale implementation of this innovative hybrid solar-PV system can provide up to 75% of the electricity needs of DUT campuses, and lower DUT's carbon footprint and GHG emissions derived from fossil fuel usage. Cost recovery is typically less than 3 but not exceeding 5 years, after which the bulk of our electricity bills can be eliminated.





Smart Grid is a Research Focus Area at DUT, led by Dr IE Davidson, Full Professor and Chair, Power Engineering Department. The centre engages in research pertaining to the design and development of smart microgrids, innovative renewable energy technologies, and fullscale modernization of the existing electrical power grids - transmission and distribution networks.

The Research Leader is of the opinion that recurring and persistent load-shedding by the national electric utility company Eskom would have an adverse effect on academic activities leading to loss of staff productivity. In his remark, Prof IE Davidson proposes that more DUT loads should be taken off the Eskom grid with a campus-wide and large-scale installation of the hybrid PV system. He welcomes the replication of this legacy service and solution initiative of EPE to the Faculty of Engineering and the Built Environment, the new Student Hub and the entire DUT community.

The next phase is the retrofitting inefficient loads with energy-efficient alternatives, without compromising on the quality of service at DUT, thus reducing overall load drastically. Further plans will entail community outreach and rural areas, after planning out the associated challenges - safety, security, social stability, project financing, metering and revenue collection, in collaboration with other DUT Centres, such as Urban Futures, Energy Centre and Green Engineering RFA.

RESEARCH PUBLICATIONS

Keynote Address and Invited Presentations

- [1] Innocent E Davidson, "Activities at the Durban University of Technology: Design and Implementation of a 10kW Solar-PV Grid-tie Inverter System and Battery Energy Storage", In, HEPSSA Project: Enhancing the Role of Engineers in Translational Research and Entrepreneurship", Final Knowledge Sharing Workshop, Jose Eduardo Dos Santos Campus, Ongwediva, Namibia. 2 – 3rd December 2021.
- [2] Innocent E Davidson, "Durban University of Technology Space Research Program - Global Network of Satellite Systems Research and Applications", Workshop on "BDS/GNSS Applications in China and South Africa", Science Forum South Africa 2021, 1-3 December 2021.
- [3] Innocent E Davidson, "Smart Infrastructures for Sustainable Cities", Invited Guest Lecture at the "International Conference on Sustainable Development", Zimbali Capital, Ballito, KZN, South Africa, 7 – 9 December 2021.

Books and Book Reviews

- [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] Elutunji Buraimoh and Innocent E. Davidson, "Modeling and Fault Ride-Through Control of a Photovoltaic-Based Grid Supporting Microgrid Using a Secondary Control DSC Algorithm". NEIS 2021 - BÜCHER - VDE VERLAG. Conference on Sustainable Energy Supply and Energy Storage Systems Hamburg, 13 – 14 September 2021. 2021, 294 Seiten, Din A4, Broschur ISBN 978-3-8007-5651-3, E-Book: ISBN 978-3-8007-5652-0, www.vde-verlag.de. E-Book Available at: <https://www.vde-verlag.de/buecher/565651/neis-2021.html>

Refereed Journal Papers

- [1] Mekhla Sharma; Jaiteg Singh, Ankur Gupta, Sudeep Tanwar, Gulshan Sharma and Innocent E. Davidson. "Intercloud Resource Discovery using Blockchain". IEEE Access. Nov 30, 2021. DOI: 10.1109/ACCESS.2021.3131515
- [2] Adhirath Kapoor, Ankur Gupta, Rajesh Gupta, Sudeep Tanwar, Gulshan Sharma, and Innocent E. Davidson, Ransomware Detection, Avoidance, and Mitigation Scheme: A Review and Future Directions. Sustainability, Vol. 14, No. 1. <https://doi.org/10.3390/su14010008>.
- [3] Pronaya Bhattacharya, Deepti Saraswat, Amit Dave, Mohak Acharya, Sudeep Tanwar, Gulshan Sharma, and Innocent E. Davidson, "Coalition of 6G and Blockchain in AR/VR Space: Challenges and Future Directions", IEEE Access, pp. 1-30, Online ISSN: 2169-3536, 2021, DOI: 10.1109/ACCESS.2021.3136860.
- [4] Vishakha K Ralegankar, Jagruti Bagul, Bhaumikkumar Thakkar, Rajesh Gupta, Sudeep Tanwar, Gulshan Sharma, and Innocent E. Davidson, "Quantum Cryptography-as-a-Service for Secure UAV Communication: Applications, Challenges, and Case Study", IEEE Access, Vol. 10, 2022, pp. 1475-1492, Print ISSN: 2169-3536, Online ISSN: 2169-3536, DOI: 10.1109/ACCESS.2021.3138753



30th SAUPEC CONFERENCE



It is with great pleasure to announce the 30th Southern Africa Universities Power Engineering Conference (SAUPEC), will be hosted by DUT's Department of Electrical Power Engineering, under the General Chair, Prof IE Davidson. This IEEE conference will be held at the Durban International Convention Centre Complex. The conference will run for 3 days, from the 25th to the 27th of January 2022. <https://www.dut.ac.za/saupec-2022-conference-2/>



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