



Report

Guest-Lecture

on

"Role of Static Power Conversion in Current and Future Power Systems"

Organised by

Department of Electrical & Electronics Engineering

Date: 21.01.2023

Organized in association with: IEEE student chapter and ISTE, MITS Madanapalle.

Submitted by: Dr. Gumpu Sreenivasulu, Assistant Professor, Dept. of EEE.

Attendance: 30 participants (Internal)

The programme is started at 2:30 PM with a welcome address to all the audience by the **Dr. A V Pavan Kumar**, H.O.D, EEE, MITS, Madanapalle. The resource person **Mr. Dawood Ali Mirza** R&D Engineer, Fluence India, was introduced by **Dr. Gumpu Sreenivasulu**, Assistant Professor, Dept. of EEE.

The resource person started the session by extending his hearty thanks to the participants, IEEE coordinators, executive members, HoD, Principal and Management of MITS Madanapalle for giving him opportunity to share his knowledge and experience in "Role of Static Power Conversion in Current and Future Power Systems".

The resource person highlighted the various types of renewable energy and the integration of renewable energy into the grid. Also, he focused on the various challenges in the integration of renewable energy into the grid and various converters. Besides, the growth in market and opportunities in the renewable energy sector are being discussed during the session. The distinguished speaker discussed various renewable energy models. Also, the basic architecture of solar and wind are elaborated by Mr. Dawood Ali Mirza. During the session, the major opportunities, power converters and controllers design are being focused by the speaker. Besides, the prominent resource person pointed that there are huge number of opportunities for the engineering graduates in recent decades. Moreover, possibilities and innovations in solar sector are being highlighted during the session. At the end, the prominent speaker underlined the career opportunities for graduates. Also, speaker assured to help the participants/students for any kind of research guidance.

The session was concluded followed by a vote of thanks, given by Dr. Gumpu Sreenivasulu, Assistant Professor, Department of EEE (IEEE Coordinator) MITS, Madanapalle.



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Photos:

The collage consists of three screenshots from a presentation, each with a WhatsApp chat interface on the right side.

- Top Screenshot:** A screenshot of the Fluence website. The main heading is "Our Energy Storage Products". Below it, there are four product categories: Gridstack, Ultrastack, Sunstack, and Edgestack, each with a "LEARN MORE" button. The website also features a navigation menu and a search bar.
- Middle Screenshot:** A screenshot of a presentation slide titled "Present Vs Future Power Grid". The slide compares the "Present" power grid (reliant on fossil fuels and generators) with the "Future" power grid (reliant on renewable energy and inverters). It includes statistics: "Present installed capacity of Indian power grid is 409GW", "Observed Peak load is 215GW", and "Present Renewable installed capacity is around 166GW (inc. Hydro)". It also mentions that "By 2030 India is targeting to reach 500GW renewable capacity".
- Bottom Screenshot:** A screenshot of a presentation slide titled "Understanding of Power Conversion System". It shows a circuit diagram of a power conversion system with components like LCL filter, Grid/PCU, and DC link. Below the diagram is a photograph of a physical "Power Stack" hardware unit with components like Air Blower, IGBT, Current sensor, and Heat sink. The slide also includes "Switching characteristics" graphs and a list of specifications for the "Battery Inverter": "SAVA-@600/1850Vdc", "DC Voltage 1500V", and "Efficiency >98%".



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Simulation Results based Renewable (RE) Penetration

Assumption: Power shown in below figures are at steady state condition

0% RE Penetration

50% RE Penetration with GFL

50% RE Penetration with GFL +GFM

System frequency response based on Renewable (RE) penetration

Frequency (Hz) vs Time (seconds)

SM dynamics

$$J \frac{d\omega}{dt} = T_m - T_e - k_d \omega$$

$$\frac{df}{dt} = \frac{T_m - T_e - k_d \omega}{2\pi H} = \text{RoCoF}$$

Frequency relay start disconnecting the load based on frequency and RoCoF

Conclusion / Future Challenges

- Reduction in Power system inertia (Synchronous generators) causes frequency stability issues and reduction in system reliability issues.
- High penetration of inverter base resources leads to power system protection issues due to low fault and this can be overcome connecting static/dynamic synchronous condensers.

Signature of the Coordinator

Signature of HoD, EEE