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MONTHLY INDUSTRIAL SUPPLEMENTARY

INDUSTRIAL OUTLOOK™

AN INSIGHT ON INDUSTRIAL MANUFACTURING AND ENGINEERING PRODUCTS

MICROGRIDS

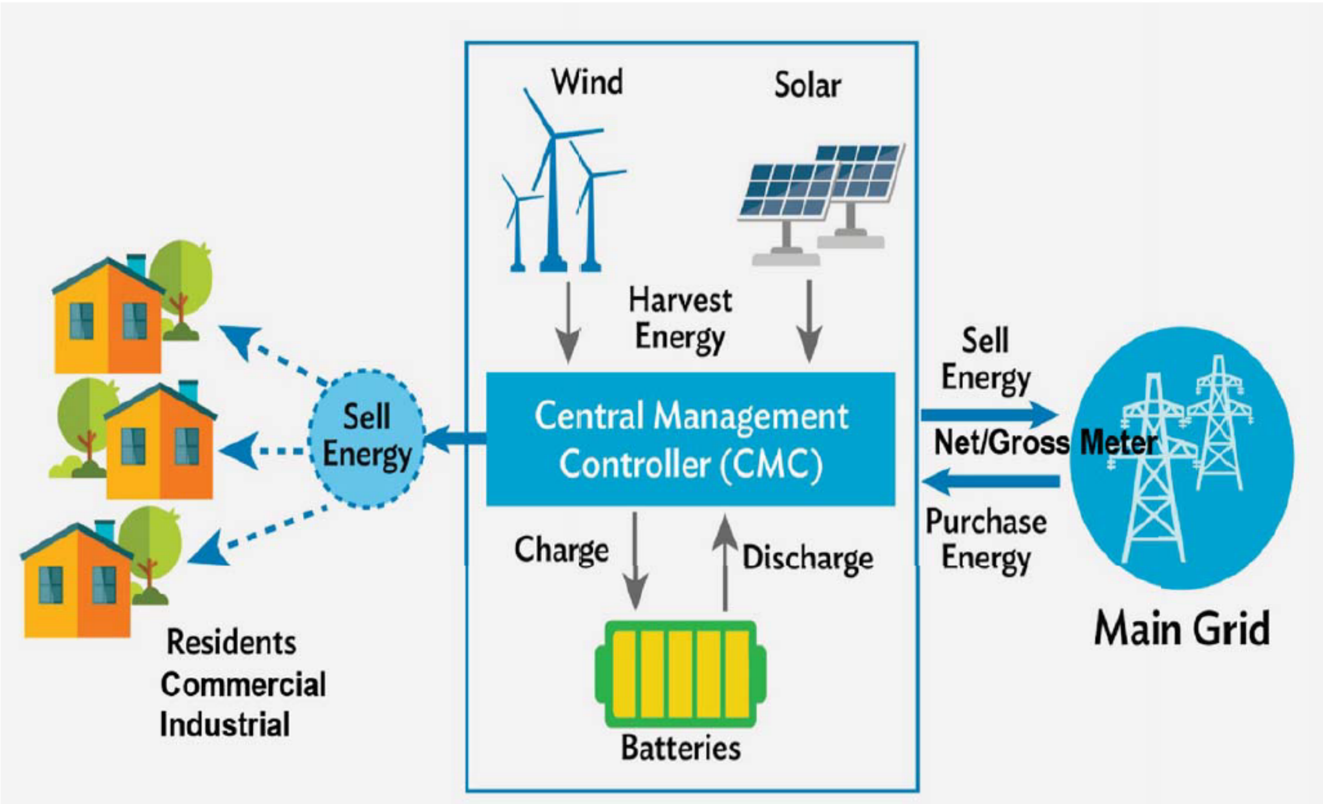

Fig. Typical Layout of a Microgrid, Source: Internet

Key aspect of Sustainable Development Goals (SDG) -7 is achieving energy access, energy efficiency and renewable energy. Energy supply will be greatly decarbonized by embracing renewable energy technologies at a remote rural, agricultural and industrial level. Decentralizing the energy supply and distribution mechanism by adding multiple sources of energy to the electrical grid is the best sustainable alternative to achieve continuous energy access. Such an approach, creating an energy infrastructure that utilizes more than two energy sources but connected to national grid, functioning independently can be termed as a Microgrid. These microgrids can be of any capacity ranging from few kW to few MW's with energy storage as integral part of their system. Microgrids can function as autonomous, stand-alone or Offgrid or anti-islanding mode by acting as an isolated grid. Microgrids can power smaller islands by giving power backup from energy storage and diesel generators can be the part of the microgrid system to meet the peak loads during power outages.

Microgrids can utilize the best of the distributed renewable energy sources (DER) belonging to Distributed Generation (DG). They are usually connected to electric grids below 11kV. Microgrids act as single point control energy supply infrastructure that can run efficiently and in a cost-effective manner.

A microgrid infrastructure consists of power generation, energy storage and power distribution to the utility load points. Steps involved in the implementation of Microgrids are – demand side management, understanding the policy and standards, feasibility & economic analysis, design of sub-systems, power control strategy, grid connectivity management, safety, stability & protection issues and operating & maintenance.

Demand side management is the study that involves monitoring & control of consumption side utilities by paying attention to energy conservation, energy efficiency and backup storage of power. Output of this exercise is to find out the peak load hours, base load and its duration and Net/Gross Meter Commercial Industrial deriving the appropriate tariff mechanism, so as to improve the energy efficiency of the system.

Studying the demand side statistics and meeting the demand with multiple sources of energy based on seasonal and long-term forecasts will be essential to design a microgrid of capacity more than 1 MW. Demand response phenomenon that can provide peak clipping, valley falling, shifting of load, energy conservation practices and the load growth, is an important step in demand side management. After analysing these, multi objective optimization has to be carried out to evaluate the new power tariffs for the microgrid that has multiple energy sources.

Understanding the policies of state and central government authorities becomes crucial in designing a microgrid system. Remote places with minimal access to electricity grid can have easy approvals. But they may require a diesel generator for meeting the peak load demands and energy supply during outages. In some of the African countries where grid availability is a question, solar PV- Battery-Diesel Genset based microgrid is able to supply the required power for each utility point by charging nominal unit rate. The power tariff under the microgrid depends upon the LCOE calculation and the banking of energy units generated by the microgrid.

Standards for the microgrid need to be adhered for the extent of adopting the various renewable energy technologies. As of now, the standards followed for regular conventional electricity grid, are being continued for the DG/DER microgrids as well. P1547-series of IEE standards provide a uniform standard for technical interconnection with test procedures to connect between various DR/ DER networks. It defines the performance, operation, testing, safety considerations and maintenance of interconnection standards. IEE 929-2000 is another important standard which is a recommended practice that has guidelines regarding equipment and functions necessary to ensure compatible operation of photovoltaic (PV) systems, Fuel Cells, Dispersed Generation, and Energy Storage that are connected in parallel with the electric utility. IEEE 519-2014 sets the standards for harmonic control in electric power systems. This specification defines the terms such as Maximum Load current, Point of Common Coupling (PCC) and redefined the terms of short circuit ratio, Total Demand Distortion (TDD), Total Harmonic Distortion (THD), Notch area, Notch depth etc. New and consolidated standards for Microgrids to assess the impact of voltage, frequency, power quality for various scenarios of demand responses needs to be evolved.

Case Studies:

1. A cheap, stable and uninterrupted power supply from the public grid is often unavailable in remote regions. This tends to be either due to a lack of physical grid capacity, or because the grid connection costs are excessively high in relation to the expected demand. Diesel generators then have to step in to fill the gap.

Within this 82-kW system belonging to a Spanish cereal producer, four Victron BlueSolar charge controllers and six inverter chargers (6 Victron Quattro 48/10.000/140-100/100 230 50A) have been installed alongside three Fronius Symo 20kW inverters, which, together with a diesel generator of 60kVA, ensure an uninterrupted power supply. Storage unit is 2X 1550 AH C5 Batteries. The project is implemented in Cereals Torremorell, ES, Spain by Fronius/ Victron in 2018.

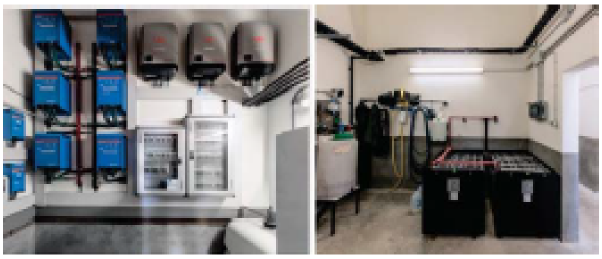

Fig. Photograph of 82 kWp grid-connected Microgrid with Solar PV- Battery –Diesel genset in Spain

2. Reliable and uninterrupted power supply is supplied to a utility load of 6 kW in Uganda, to power the houses with lighting load (TV, Fans, Lighting) where there is no access to electrical grid. The project has been implemented by Sumadhura Technologies, Uganda and is designed by Green Life Energy Solutions, Hyderabad, India. The Solar PV (7.5 kW)-Battery (96V-300AH)-Diesel Genset (30kVA) microgrid is implemented as part of Enable project and is successfully running since 2019. The same company also implemented solar PV water pumping systems for the pure offgrid usage in Uganda.

Fig. Photograph of 7.5 kWp remote microgrid with Solar PV- Battery –Diesel genset in Enable Project in Uganda

Conclusions:

Microgrid projects are most favourable for remote villages even in developing countries. They adopt these technologies for electrifying commercial, industrial and rural communities. Microgrids can also power transportation sector and can be a key energy supplier for Electrical Vehicle industry in future. Remote and grid-connected microgrids provide easy and reliable energy access with affordable pricing and play a major role in achieving the sustainable development goals

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