

# MICROGRIDS: TECHNOLOGY-LED DISRUPTION & HYBRIDISATION TO LEAD TO CONSUMERISATION AND NEW MARKET MODELS

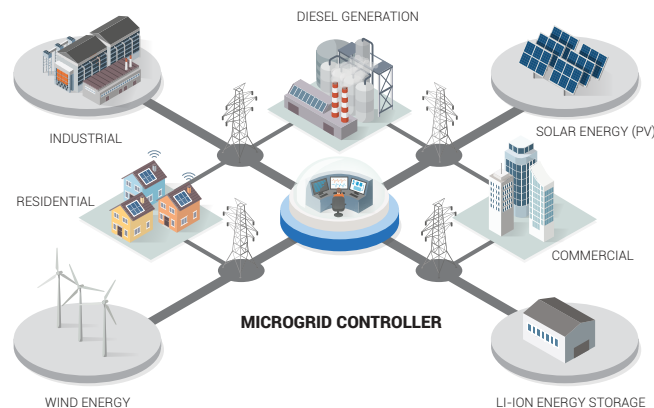
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## Introduction

The energy sector is witnessing unprecedented transformation in energy production & consumption, driven by the 4Ds - De-carbonisation, De-centralisation, Democratisation and Digitalisation. The impact of climate change on energy sector is not only limited to harnessing cleaner energy but it is further churning the energy-mix with ongoing electrification of automobiles. According to BP Energy Outlook 2019, around three-quarters of the increase in primary energy demand shall be met by power sector. One such renewable led, technology driven, and energy storage supported innovative model transforming the energy sector is Microgrids.

## Understanding Microgrids

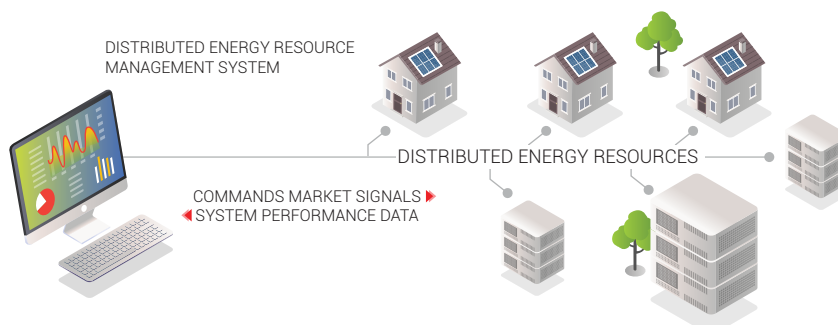
Unlike the conventional power system with large centralised generation system interacting with a centralised distribution load through a transmission network, Microgrid is a small isolated system consisting of distributed RE generations in and around the load centre (consumers) itself. Microgrids are leading example of decentralisation of power system by integrating the distributed micro-generation units with the nearby demand minimising the requirement of transmission & distribution network. The Microgrids can be grid interactive and off-grid (island mode) depending upon capacity of micro-generation units, local demand pattern & grid dependency.



Microgrids can be grid connected or off-grid

## Smart Microgrids

Distributed RE generation in grid interactive Microgrids is connected at Low/Medium voltage level in distribution system. A Microgrid becomes "smart" when it can intelligently integrate, interact on real time and manage the actions of all the users connected to it – generators, consumers & prosumers by use of system integrated IT & communication system.

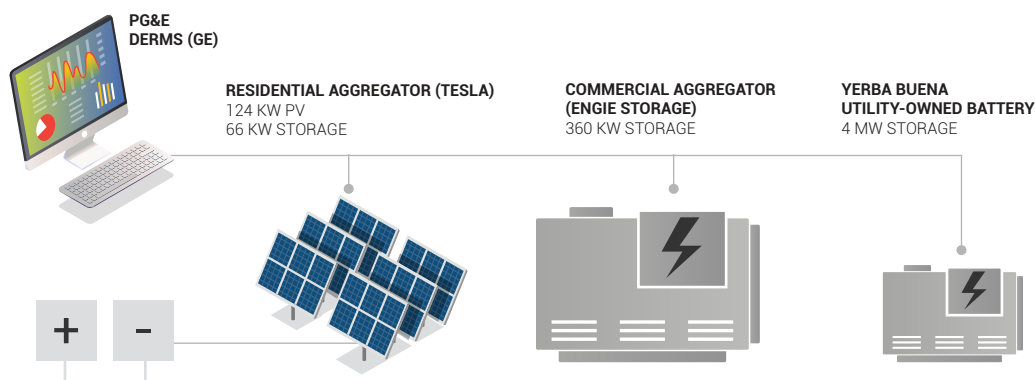


## Global Developments

Globally Microgrids are emerging as a second layer of energy provider for grid connected customers & primary source of energy in transmission averse topography. Microgrids are global phenomenon wherein Asia Pacific is expected to be a dominant shareholder of 41.3% of total installed capacity followed by North America with 32.5%.



In terms of technology, various discoveries in smart IT & communication system facilitating real time integration & management of Smart Microgrids, have accelerated acceptability of Microgrids. One such technology developed by GE Grid Solutions and Pacific Gas & Electric called Distributed Energy Resources Management System (DERMS) is a centralised software with smart integration options for distributed solar & energy storage.



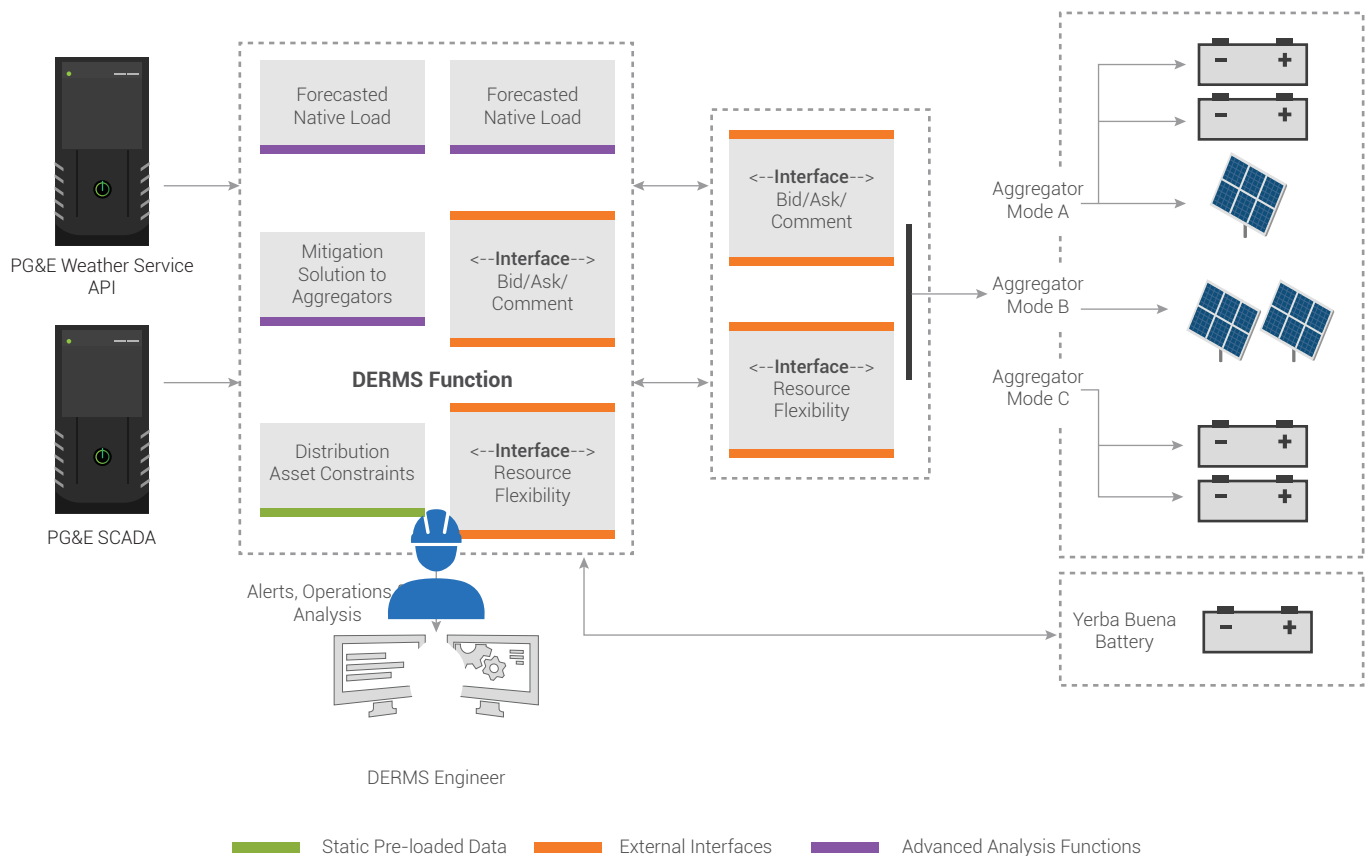
Such technology platform multiplies value offering of Smart Grids by a range of DER benefits such as deferral of generation, transmission, and distribution capacity investments; voltage control or VAR (reactive power) supply, ancillary services, environmental emissions benefits, reduction in system losses, energy production savings, enhanced reliability, power quality improvement, combined heat and power, demand reduction, and standby generation.

The DERMS is well designed to interact with the DERs on a real time basis and facilitates range of innovative energy services options such as facilitating DERs to participate in Power Exchanges and offer grid support services: Vehicle to Grid & Grid to Vehicle and energy storage devices. The projected decline in ESS cost shall further accelerate growth of Smart Microgrids. Therefore, Smart Microgrids are emerging as a secondary layer of power distribution complementing & supporting the DISCOMs and grid operations, thereby facilitating transition towards 4D's.

## Aggregator of Smart Microgrids

Moving beyond the stand-alone smart microgrids, the recent advancements in the technology facilitates smart integration & aggregation of Smart Microgrids through a centralised DERMS. The concept of aggregator is evolving faster than ever with two major offerings: Distributed Resources Aggregation & Demand Response.

Aggregation of DERs creates larger resources for negotiation, optimises scheduling options to aggregators to accrue maximum value for DERs by scheduling in line with grid conditions. The aggregation of Smart Microgrids further improves demand response/grid support services such as Vehicle to Grid, Grid to Vehicle, Optimisation of charging & discharging pattern of energy storage systems.



Aggregation of Smart Microgrids

## Relevance of Microgrids in Indian context

### Benefits of Smart Microgrids

- Facilitates consumerisation of electricity
- Aligns with Government's policy of solarisation of Agriculture (KUSUM)
- Reduce dependence on transmission & distribution network resulting in cheaper power
- Helps Discoms to smoothen the load curve & reduce peak power procurement cost
- Helps Discoms in frequency & voltage regulation and improves the islanding capacity of the utilities

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