Improvement of Electrical Power Quality with Distributed Generation System

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Abstract - *A combination of public policy, incentives and economics is driving a rapid growth of distributed generation in the electric power system. The majority of states/provinces now have renewable portfolio standards, with many requiring that over 20% of electricity sales by generated by renewable energy sources within the next five to fifteen years. The majority of these requirements will be addressed by adding significant amounts of wind energy and growing amounts of solar energy to the bulk power system.*
Distribution generation also includes more than wind resources: both established types, like run-of-river hydro and emerging varieties, such as wave energy. While the majority of attention in this report is on wind and solar generation, most varieties of distribution generation share similar characteristics (though to a different extent) since the variability is largely driven by weather or other non-anthropogenic phenomena. Similar optimization and integration approaches are also likely to apply to these distribution generation resources as well. In fact, because load is also influenced by the weather, demand and generation optimization may eventually come.

Key Words: distributed Generation system, Reciprocating Engines, Photovoltaic system, wind Energy, Traditional /New Concept of power system.

1. INTRODUCTION

The distributed generation uses smaller-sized generators than dose the typical central station plant. They are distributed throughout the power system closer to the loads. The normal distribution systems deliver electric energy via wires from a single source of power to a more than one of loads. Thus, several power quality issues arise when there are multiple sources. Will Distributed Generation improve the quality or will it degrade the service end users have come to expect.

The most electrical power system having of relatively small generators configured in isolated, used Distribution Generation. That model gave a way to present centralized system largely because of economies of scale. Also, there was the desire to sequester electricity generation facilities away from population Centre for environmental reasons to locate them closer to the source of fuel and water.[2]

So we can say that Distributed generation is:

- Use of small generating units installed close to load centres
- Other terms:
  - Decentralized generation
  - Embedded generation
  - Disperse generation

2. Types of DG

The different types of traditional and non-traditional DGs are classified and described from the constructional, technological, size, and power time duration point of view. The DGs may also be grouped into four major types based on terminal characteristics in terms of real and reactive power delivering capability .Four major types are considered for comparative studies which are described as follows:[16] [19]

- **Type 1**: This type DG is capable of delivering only active power such as photovoltaic, micro turbines, fuel cells, which are integrated to the main grid with the help of converters/inverters.
- **Type 2**: DG capable of delivering both active and reactive power. DG units based on synchronous machines (cogeneration, gas turbine, etc.) come under this type.
- **Type 3**: DG capable of delivering only reactive power. Synchronous compensators such as gas turbines are the example of this type and operate at zero power factors.
- **Type 4**: DG capable of delivering active power but consuming Reactive Power. Mainly induction generators, which are used in wind farms, come under this category.

3. Merit & demerits:-

3.1. Benefits of DG:[12]

- RES: Reduce fossil fuel consumption (emissions)

- Efficiency
- CHP
- Reduction of T & D electrical losses
- Deferral investments in T & D systems (enhance network capacity)
- Network support and ancillary services
- Continuity, Reliability and Security of supply
- Improve competitiveness and Market opportunities
- Flexibility and locality (resources, business, employment

3.2. Some drawbacks:

- High level of dependence on imported fossil fuels– fossil fuels running out
- environmental impact of greenhouse gases and other pollutants
- security of supply under threat
- Transmission losses
- Necessity for continuous upgrading and replacement of transmission and distribution facilities
- Load demand is continuously growing

4. Applications of DG:

In general terms, Distributed Generation (DG) is any type of electrical generator or static inverter producing alternating current that has the capability of parallel operation with the utility distribution system,

Is designed to operate separately from the utility system and can feed a load that can also be fed by the utility electrical system. A distributed generator is sometimes referred to simply as "generator".

5. Technologies For DG System:

a. Reciprocating Engines
b. Gas Turbines
c. Micro turbines
d. Fuel Cells
e. Photovoltaic Systems
f. Wind Energy
g. Biomass
h. Hydro-electric resources
i. New network technologies

5.1. Solar photovoltaic (PV) systems

We've seen, or maybe own, photocell-powered devices such as night lights, car coolers, and toys. These generally consist of a small solar panel and a small light or motor. Typically, these drive on less than 12V dc and required few currents. These kinds of devices are very different from a system that can power a house or interconnect with a utility to offset a building's energy consumption.

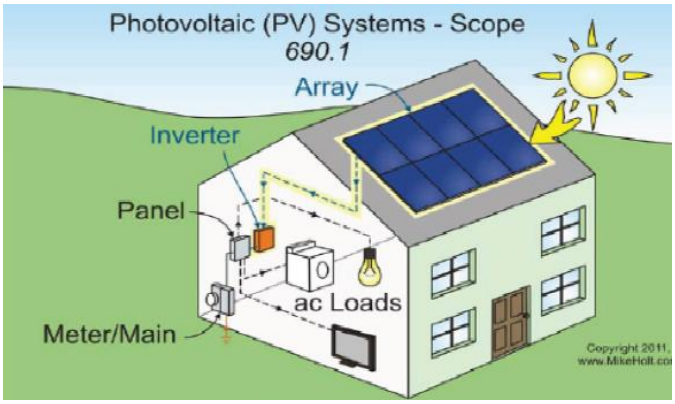
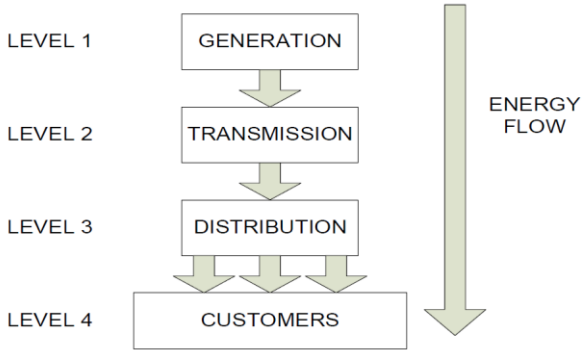


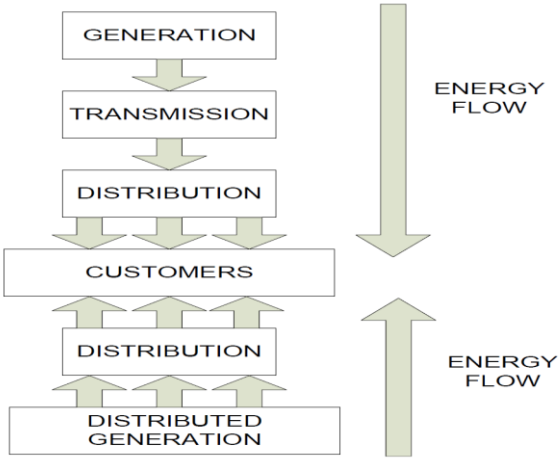
Fig. 1 Solar photovoltaic (PV) systems

6. IMPACT OF DISTRIBUTED GENERATION ON DISTRIBUTION SYSTEMS:

6.1 .Traditional Concept of Power Systems



6.2. New Concept of Power Systems

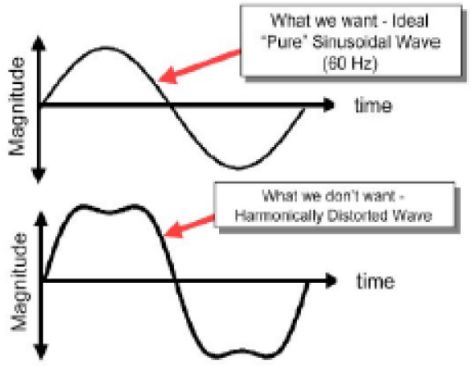


6.3. Impact of Distributed Generation on Power System Grids.

6.4. Impact of DG on Voltage Regulation.

6.5 .Impact of DG on Harmonics:

A wave that does not follow a "pure" sinusoidal wave is regarded as harmonically distorted. This is shown in Fig



7. POWER QUALITY RELATED ISSUES TO DGs

Major issue related to interconnection of distributed resources onto the power grid is the potential impacts on the quality of power provided to other customers connected to the grid.

a**)Voltage Regulation**

b**) DG Grounding Issue:**

c) **Harmonic Distortion**

d**) Flicker**

e) Islanding

CONCLUSIONS:-

Distributed generation is the need of fulfil the requirement of Electrical supply in present time because of Continuity, Reliability and Security of supply. Improve competitiveness and Market opportunities, flexibility and locality (resources, business, employment. Distributed generation systems are smaller in size & can't design of any required rating with low cost. Most of the Distributed systems are based on natural resources.

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