Literature Survey of DGs System

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***Abstract*: DG System means Distributed Generation system that is the a small-sized generation system that generate the electricity through like solar energy, wind energy, biomass energy etc. at the end of secondary distribution grid and these generated electric energy is combined to grid by either directly or indirectly.**

Wind and solar power plants exhibit greater variability and uncertainty because of the nature of their "fuel" sources. Optimization is one of the tools that can be used to address concerns and costs around this variability and uncertainty. This thesis discusses operational and optimal system impacts, provides background on what can be realistically expected from distributed generation power-output.

Index Terms: Fuel cells, Reciprocating Engines, Gas Turbines, Micro turbines, Renewable sources

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1. INTRODUCTION

The distributed generation uses smaller-sized generators at the end of consume side than the large typical central station plant.

Today's economic environment changes rapidly for utilities and capacity options are expanding. Distributed generation (DG) is one new option being promoted for solving utility distribution system capacity problems

So we can say that Distributed generation is:

Trend: Generators sized from KW to MW at consume end renewed interest for DG IEA lists, there are five major factors are:

- Advancements in distributed generation technologies,
- Limitation on the construction of new transmission lines,
- Requirement of customer maximum demand for highly reliable electricity,

2. Impact of Distributed Generation on Power System Grids :-

The objective of this research paper is to describe the technical impact that the integration of DG have on the protection, co-ordination of distributed power systems. A method to asses this impact, is based on investigate the behavior of an electric system, with and without the presence of DG.

The main problems exist when integrate of DG to the distributed network is presented.

2.1. Impact of DG on Voltage Regulation:-

The connection of DG may result in changes in voltage direction and magnitude of real and reactive power flows. Nevertheless, DG impact on voltage regulation may either be positive or negative depending on

a. Distribution system
b. Distributed generator characteristics
c. DG location.

The DG reduces the load on large sized generation system and regulates equal voltage profile to the load. This phenomenon has the opposite effect to which is expected with the introduction of DG.

For any small scale DG unit less than 10MW , the impact on the primary feeder is negligible. Nonetheless, if the aggregate capacity increases until critical thresholds, then voltage regulation analysis is necessary to make sure that the feeder voltage will be fixed within suitable limits.

2.2. Impact of DG on Losses:-

One of the major impacts of Distributed generation is on the losses in a feeder. Locating the DG units is an important criterion that has to be analyzed to be able to achieve a better reliability of the system with reduced losses.

According to locating DG units to minimize losses is similar to locating capacitor banks to reduce losses. The main difference between both situations is that DG may contribute with active power (P) and reactive power (Q). On the other hand, capacitor banks only contribute with reactive power flow (Q). Mainly, generators in the system operate with a power factor range between 0.85 lagging and unity, but the presence of inverters and synchronous generators provides a contribution to reactive power compensation.

2.3. Impact of DG on Harmonics:

Harmonic order	Allowed Level Relative to fundamental (odd harmonics)*
< 11th	4%
< 11th to 17th	2%
< 17th to 23rd	1.5 %
< 23rd to 35th	0.6 %
Total Harmonic Distortion	5%

Table 1.1 Harmonic current for distributed generators per IEEE

3. Technologies used for distributed generation:

3.1. Reciprocating Engine :

This is technology of compressed air and fuel. The mixture is ignited by a spark to move a piston. The mechanical energy is then converted into electrical energy. Reciprocating engines are a mature technology and largely spread because have

a) Low capital investment requirement,
b) Fast start-up capabilities and
c) High energy efficiency

when all above these combined with heat recovery systems. Most reciprocating engines run either on fuel or natural gas with an increasing number of engines running on biogas produced from biomass and waste.

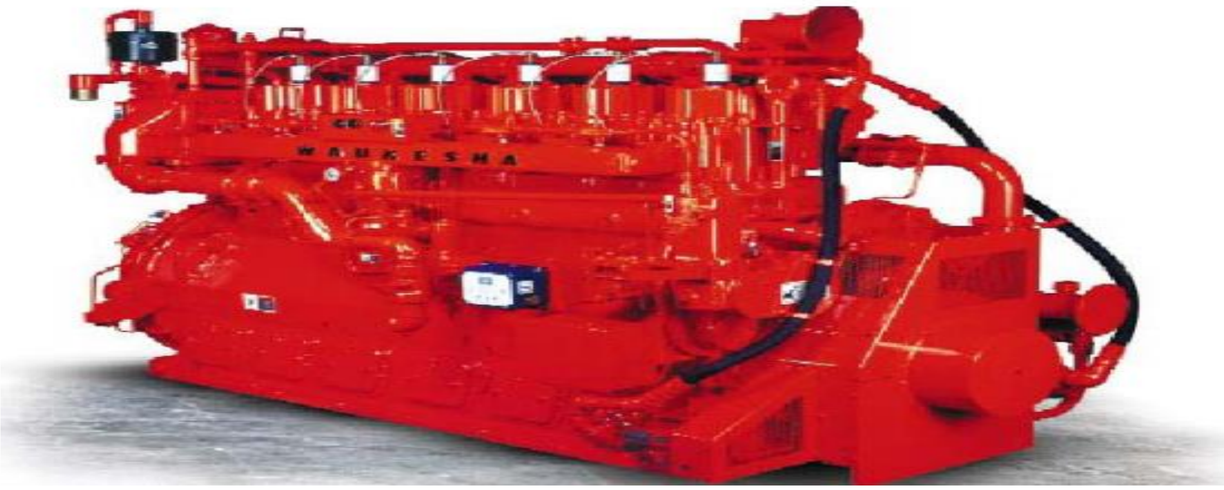

Fig. 3.1. Reciprocating Engine

3.2. Gas Turbine:

Gas turbines are widely used for electricity generation thanks to the regulatory incentives induced to favors fuel diversification towards natural gas and thanks to their low emission levels. Conversely to reciprocating engines, gas turbines ordered over the period covered by the survey were widely used as continuous generators (58%), 18% were used as standby generators and 24% as peaking generators (DGTW, 2008). Gas turbines are widely used in cogeneration.

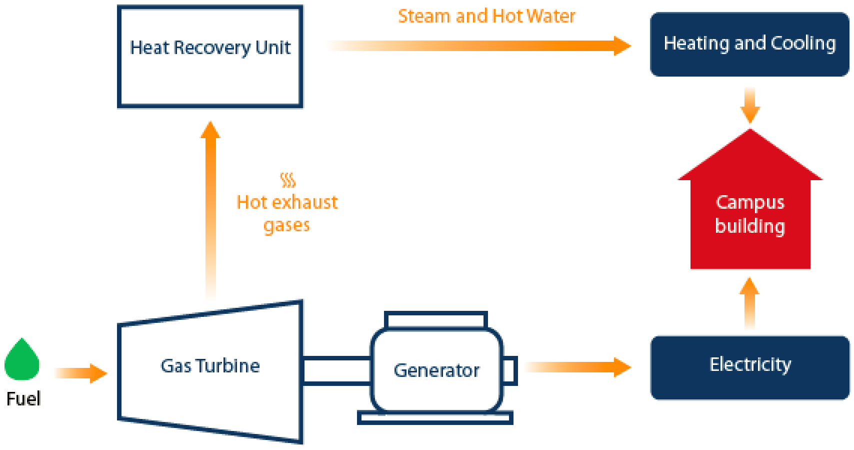

Fig.3.2. Gas turbine cogeneration

3.3. Micro turbines:

Micro turbines are built with the same characteristics than gas turbines but with lower capacities and higher operating speed;

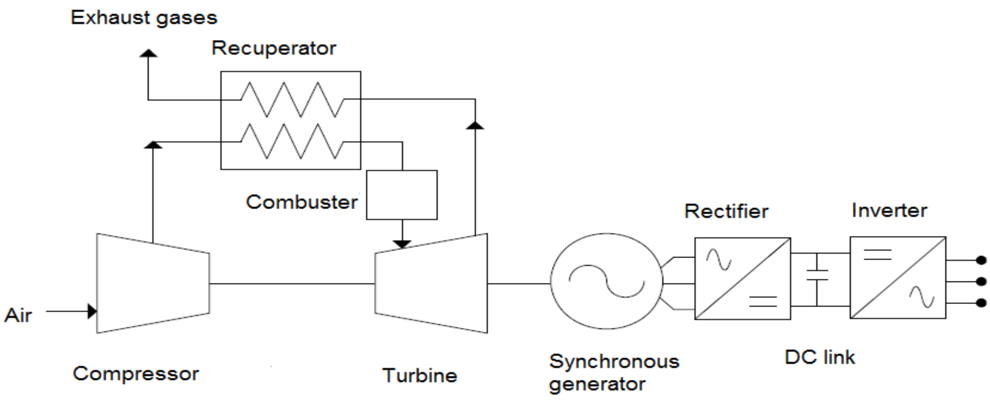

Fig. 3.3 Layout of Micro-Turbine

3.4. Fuel cells:

Instead of converting mechanical energy into electrical energy, fuel cells are built to convert chemical energy of a fuel into electricity. The fuel used is generally natural gas or hydrogen. Fuel cells are a major field of research and significant effort is put in reducing capital costs and increasing efficiency which are the two main drawback of this technology;

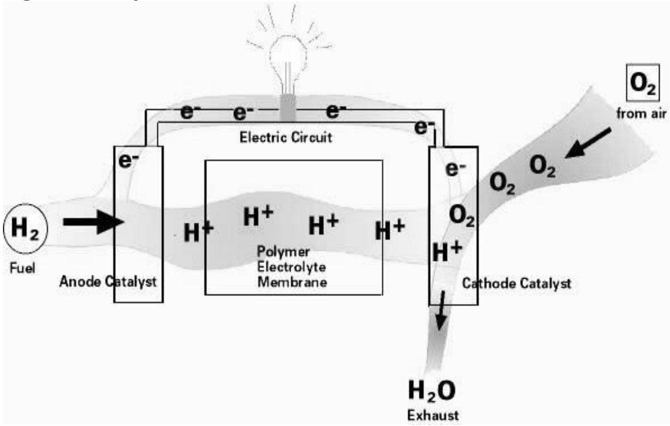

Fig. 3.4 Fuel cells Systems

3.5. Renewable sources:

Renewable technologies have been used as a way to produce distributed energy. Renewable sources range from photovoltaic technologies, wind energy, thermal energy etc. These sources qualify as distributed generation only if they meet the criteria of the definition which is not always the case. Distributed generation is therefore clearly distinct from renewable energy. For example, offshore wind farms do not qualify as distributed generation.

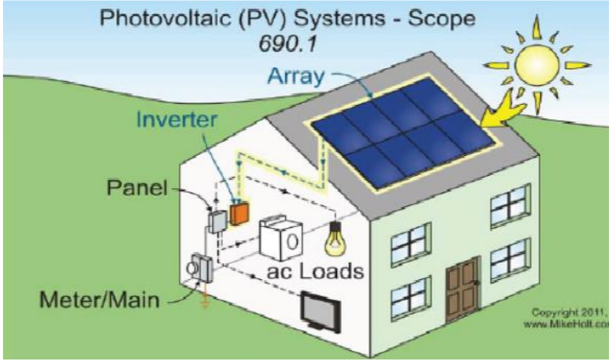

Fig. 3.5 Solar Photovoltaic (PV) systems

CONCLUSIONS:-

Comparative analysis for penetration of distributed generation (DG) from the perspective of a distribution company (Disco). Penetration of distributed generator (Size and location) is obtained through different approaches: Cost minimization and System Energy loss minimization. The methodology adopted permits the planner to decide optimal location and size of DG with compromise between System cost and System energy loss. GA based approaches for penetration of DG in power systems in different loading conditions with time varying loads is explained. Minimization of the functions is performed under voltage and line loading constraints. Proposed strategy is applied to power distribution systems and its effectiveness is verified through simulation results on 38-bus systems with typical load.

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