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A Comparative Study on Distribution Generation & Centralized Electricity Generation

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ABSTRACT

In this paper we deal with distribution generation and their advantages over centralized electricity generation. This paper presents a simplified method to determine the value of deferring electric utility capacity investments using distributed generation. Also through this paper we move through the technologies used in the distribution generation and also the problems and solutions associated with it. Also we show that how the distributed generation overcome significant technical, economic and regulatory hurdles.

Keywords: Electrical Utility, Distributed Generation

I. INTRODUCTION

Traditionally, power system distribution networks have been passive networks with a unidirectional power flow from the high voltage levels to customers at lower voltages. The presence of distributed generation makes the distribution networks active networks, with the possibility of power production at local level. Distributed generation is an approach that employs small scale power generation located on the distribution system close to the point of consumption. Distributed generation technologies often consist of renewable energy generators and offer a number of potential benefits. In comparison to distributed generation, centralized power models require distribution from the center to outlying consumers. This requires transmission across the distance. This system has many disadvantages such as emission of greenhouse gases, production of nuclear waste, inefficiency, power losses etc. Many of these issues can be mediated through distributed energies.

II. METHODS AND MATERIAL

A. Electricity Generation

- Recent quest for energy efficiency, reliability & reduction of greenhouse gas emission alternate current generation.
- Main candidate to complement and replace existing paradigm is Distributed Generators.
- Its compliment to centralized generator.
- Deregulation theoretically enabled distributed generators to enter the electricity market through market price S/G & fewer barrier to entry.
- Environmental problem free by cogeneration

B. Barriers For Distributed Generators

- Current distribution System has to be redesigned, to have incorporated. The control & protection hardware & software should be used.
- Price competitiveness to build new centralized plant.
- Significant work has to be taken to alter the regulatory environment.
- Diesel reciprocating engine are usually used, it will lead to greenhouse gas emission although etc .the cleanest technology.
- The concerns over fossil fuel depletion, greenhouse gas emission etc. are the major challenge for the years to come.

- So an alternative to the current centralized system can be used distributed generators. It is also known as Decentralized Generators, Dispersed generators, Distributed energy resources etc.
- It is an electric power source connected directly to the distribution network or on the customer site of meter.

C. Centralized Paradigm

- Economic scale: Steam turbine increase in size decrease in marginal cost of electricity generation
- Efficiency where achieved by the facility to handle higher pressure & temperature in electricity generation
- Usage of AC instead of DC help to transmit electricity over long distance with loss reduction.
- To increase reliability electricity production facility were connected to transmission network.
- Pooling helps to avoid the concentration of consumer to a particular generation by using other generation and help to compensate loss.
- By the help of transmission network the generation station will be far from city centers & there by help in reducing pollution.
- Overall look: Electricity generated long distance transported through transmission network and medium distance by network to the consumer.
- High cost for transmission and distribution from generating station.
- Time loss of electricity while flowing through transmission and distribution line.
- Conversion losses ie. Changing the voltage while flowing from the transmission network to the distribution network.
- Rural electrification is challenging.
- Capital expenditure: cost for large amount of transmission & distribution line.
- As the distance increases the loss also increases.
- Large investment is needed in distribution network in future to upgrade the current network. it can be avoided by distributed generation
- Compared to centralized generation the distributed generation diversity away from coal, fuel & nature gas.
- They also prevent operational failures in case of network problem.
- The electrical industry with the centralized system is responsible for ¼ of no emission &$^1/_3$ of CO_2& of SO_2 emissions.


A man stands on a stepladder to fix tangled overhead electric power cables at a residential area in Noida, India, June 1, 2011 (Parivartan Sharma/Courtesy Reuters).

Figure 1: A man standing on a step ladder to fix tangled overhead electric power cables at a residential area in Noida, India

Advantages of Distributed Generation

- They were able to move in the markets & exploit failures of the centralized generation.
- Small in size, quicker to build.
- Geographical & operational flexibility.
- It can be used only during consumption peak.
- Here wide range of fuel can be used, also help to reduce pollution and also help in preserving natural fuel in nonrenewable fuel.

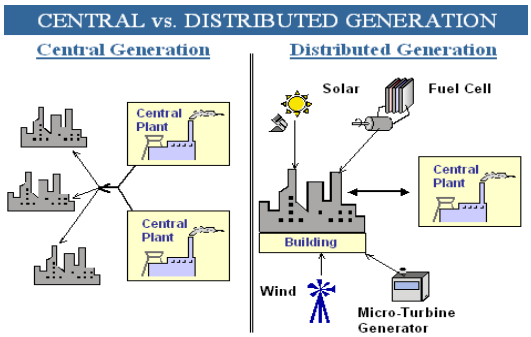

Figure 2: Comparison of Central Vs Distributed generation

D. Technologies Used In Distributed Generation

1. **Reciprocating Engine**
   Compressed air & fuel ignited by spark to move piston mechanical energy convert to electrical they have fast startup higher efficiency.
2. **Gas Turbines**
   Widely used in cogeneration fuel diversity
3. **Micro Turbine**
   Similar to gas turbine but with low capacity & higher operating speed.
4. **Fuel Cells**
   Chemical energy to electricity fuel used natural gas/hydrogen reduced capital cost higher efficiency.
5. **Renewable Source**
   Such as thermal, wind energy only it satisfy as the definition says. So etc rarely use.

III. RESULTS AND DISCUSSION

A. Potential Problems & Solutions Associated With Distribution Generation

- Developing small scale power plant close to end user distribution generator
- Higher efficiency through waste heat recovery, loss power reduction & easier access to backup power during power shortage.
- They can be classified into renewable energy source & cleaner than centralized plant.
- While placing distribution generator we therefore consider the need of voltage support for both optimizing distribution loss & for ensuring feasibility of the power flow.
- For loss minimization placement of distribution generator.
- In earlier/ centralized method placing capacitor bank to minimize distribution loss.
- Now it can be assigned by distribution generator. It also helps in reducing delivery loss. Dependence of feasible locations for distribution generators on system wide voltage profile.
- Not having convergent power flow transportation facility insufficient voltage.

Distributed Generation

Distribution generator refers to power generation at the point of consumption. Generating power on site eliminates the cost, complexity & inefficiencies associated with transmission & distribution. In other words distribution generator is an approach that employs small scale technologies to produce electricity close to the end users of power.

Examples of Distribution Generation Technologies

Distribution generation takes place in two levels – local level & the end point level. Local level power generation include renewable energy technologies. They are efficient, reliable, cost effective & cause less environmental damage. On distribution generator technology employed by end point users is the modular combustion engine. These can be used as a backup to RVs & home.

Figure 3: Distributed generation

Why We Prefer Distribution Generation

Traditional electricity transmission model involves large power generators sited at considerable distance from the majority of the powers end consumers. That is all the generation is at one end of the chain and all the consumption at the other end.

In distribution generator that arrangement is broken. It requires hundreds or thousands of smaller capacity generators. As more of the power consumed in an area is generated nearby, the need for expensive transmission lines is reduced. Long distance transmission brings inefficiencies called line losses and is about 7% of the power generated, but can be high as 20% if the line is

long, and the temperature high generating power closer to its point if use reduces transmission line loss.

Effects

Effects of DG are short circuit levels are increased:

- Load losses change.
- Voltage profile change along the D/W.
- Voltage transients will appear.
- Power quality & reliability may be affected.

Technical Impact

- Impact of DG affects voltage profile, S/M losses, power quality & reliability.
- Proper placement and size of DG units can have a significant impact on the S/M loss reduction. This is also crucial to accommodate their increasing penetration level on distribution network.
- DG units with reactive power control are found to provide better voltage profile and lower losses.

Benefits

Here are few reasons why distributed energy generation will soon begin to play a larger role in the overall electricity market.

- **Reliability**
  A distributed generation S/M with micro grids can localize the impact of storms, falling tree branches, brownouts, reducing the number of people affected.
- **Flexibility**
  Big power plants are expensive to build and have very long pay back periods. That means the utilities are slower to adopt new technologies. If build several smaller plants based on renewable resources, it can easily decommission them a little at a time and adopt new technologies.
- **Upgradability**
  Suppose we build a large wind farm with turbines that have an expected life of 30 years. Turbine efficiency is likely to improve over the next few years, but it is too costly to replace an entire farm at once. Smaller wind farms in more locations would allow us to adopt newer turbines in one or two of the farms, gradually increasing production without making a major investment in equipment.
- **Economy of Scale**

Large power plants are expensive to build. So few of them are built – it is a highly specialized market. If lots of smaller power plants were building, the mass production effect will drive down the cost.

B. Efficiency & Cost Issues

US energy information administration reports that 7% of the electricity generated is lost in transmission and distribution. Decrease the distance that it travels and decrease the amount that is lost.

As the grid continues to determinate, energy demands keep rising & corporations focus on short term profits, the need for distributed generation will increase. We will see smart micro grids and small power plants hopefully using renewable energy appearing on our landscape.
Increased DG could produce a revenue short fall for utilities. DG costumers are compensated when they provide excess power to the grid. Other retailed customers could subsidize the customs with distributed generations.

Challenges to Be Faced

Technical Constraints

To ensure high system reliability with distributed generation technical improvements are necessary. The classification and description from a study can be classified follows:

Capacity

Adding distributed generators affect the amount of power to be handled by the equipment.

- Reinforcement work will have to undertake to avoid overload problems.
- If power generated exceeds by far consumption, power will have to flow back from the low voltage network to the medium voltage N/W. the T/F will have to be able to handle this reverse flow. This Is the major issue at peak hours.

Voltage: DG are connected to low voltage networks.
Protection: Additional Protection S/M s are required to avoid internal faults, defective distributed N/W etc.,
It can be useful to operate the N/W in such a way to ensure steady supply of consumers with critical need for electricity or ensure that the majority of the N/W is still operating while a section is under maintenance.

Voltage & Current Transients: The result of short term abnormal voltage or current oscillation can have a destabilizing effect on the N/W.

C. Cost Competitiveness

- Cost competitiveness of distributed generation is the key hurdle to overcome in a deregulated power market.
- Age of technology and its current state of development is the main reasons for the differences in the technologies.
- Cost competitiveness of DG is heavily impacted by the capacity of the regulation to price its impact on the electricity network and on its ability to provide specific services to the end consumer.

IV. CONCLUSION

This paper discusses the relevant issues in centralized paradigm and provides a general definition for distributed power generation. In general, DG can be defined as electric power generation within distribution networks or on the customer side of the network. Potential benefits of distributed generation are presented, too. The purpose of distributed generation is to provide a source of active electric power. Distributed generation is not the cleanest and the most efficient source of generation, at least for non-renewable generators. The best solution to increase its performance is to use if for cogeneration which implies a greater integration on electricity heat and cooling network .Therefore, further research is required regarding the analysis of the impact of distributed generation on the reliable and economic operation of distribution systems. Thereby it is important to consider the benefits of distributed generation, e.g. reduction of network losses, as well as additional costs, etc.

V. REFERENCES

[1] International Energy Agency,(2002),Distributed Generation in a liberalized energy market . Jouve : France
[2] Martin-Arnedo, J. A. (2009, October). Impacts of Distributed Generation on Protection and Power Quality.
[3] Khan, U. N. (2008). Impact of Distributed Generation on Distributed Network. Wroclav, University of Technology, Poland
[4] https://www.ferc.gov/legal/fed-sta/exp-study.pdf
[5] https://en.wikipedia.org/wiki/Distributed_generation