Future Urbanization Using Clean Energy Generation Plants

Ar. Chetan Verma,. (Dr.) Jitendra Singh (Dr.) Alok Ranjan

Abstract: Rural areas are not problems of any countries but are origin of urban settlements. It is the basic trend of development by governments around the globe for new settlements. Selecting rural areas such as villages or small towns are start facilitating them in terms of infrastructure to tum them into urban category. This practice not only attracts the immigrant from nearby rural areas but also improves the standard of living for the residents. But for all this a lot of revenue is spent and a huge part of this money is consumed by energy infrastructure and its maintenance which in many cases unexpectedly increases the cost of living in urban areas. This paper is about such options which generates clean energy using renewable sources in economical and portable ways to compensate the energy demands of a settlement and to provide them basic urban facilities in an portable manner. Considering the climatic and environmental conditions we need to focus on this approach of a cleaner fuel for energy generation, this approach depends upon natural resources and multiple technological equipment to provide a solution for green urbanization.

Index Terms: Clean energy, urbanization, energy generation, energy plus, human settlements.

1. INTRODUCTION

Urbanization is typically counted on the amount of infrastructure and numerous facilities related to residential, commercial, industrial and institutional sector. Energy in usable form such as electricity is one of the primary needs to power any of these sectors to provide facilities further. Sourced from UN reports approximately half of the world population lives in rural areas and lacks basic infrastructural facilities as majority of the facilities are dependent on electricity. Most of such rural places are either not connected to the national power supply grid system or if connected are not getting adequate amount of electricity as per demand. This is one of the major issues in the way of growth and development of rural areas. Lack of power supply makes such place inadequate for any industry to set up which results in unemployed youth and leads to immigration of the young population seeking employment and standard of living. This practically disturb the balance of settlements and results in regional level problems of population explosion. Population explosion leads to the price rising of the resources and material necessary for living as the balance of demand and supply gets disturbed. This also leads to various types of pollution resulted form industrial and transportation sectors majorly by using excessive fossils to meet the energy demands of the settlement. To overcome this scenario and balanced urbanization in near future portable clean energy generation plants will be a good approach. Talking about energy generation plants there are various concepts such as thermal power plants, nuclear power plants, hydro power plants, natural gas power plants. All of these run either of some energy source that may be renewable of non renewable. But these are generally located permanently near to such a place where there is easy availability of the energy source. A large chunk of land which as counted as an resource is consumed by such plants. Although they are necessary for large settlements but they costs a lot and are either funded by national governments or national or international bodies and development authorities. Additionally they require a lot of infrastructure for the supply of generated power such as electric stations or sub stations which finally increases the per unit cost of electricity for end user. Such a scenario is sometime a hurdle in growth and development of small scale developments. As in rural settlements unemployed population is unable to pay such prices. Portable clean energy generation plants are solution for maximum of such problems[1].

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2 DESIGN AND WORKING ILLUSTRATION

2.1 PORTABILITY

Portability is the major aspect of this system hence the whole system is required to be designed on an portable platform, such as an trailer or container that can be easily transported from one place to another as per efficient use strategy[2].

2.2 RESOURCE AND INFRASTRUCTURAL REQUIREMENTS

Natural energy resources such as solar and wind power are basic resource requirements which are practically free. Although other compatible designs are also possible depending upon biogas and geothermal energy. Counting on infrastructural requirements a container or trailer is required as basic module, multiple number of panels will be installed with portable frame design, battery units for energy storage capacity with energy converting devices. Additional requirements may occur as per increasing complexity in the design[3].

2.3 EFFICIENT DESIGN AND USE STRATEGY

Efficiency is an much needed factor in every consideration. Design of the model plays an important role by maximizing the number of panels per unit generation plant in limited surface area in case of an solar energy based portable clean energy generation plant. Additional an remote management team is required to analyse the favourable weather conditions in the nearby locations to move plant for maximum output. For eg. Shifting an solar portable clean energy generation plant from place approaching rainy or cloudy season to a nearby place with sunny environment that can be reached overnight or in less then a days time.

2.4 CONCEPTUAL DESIGN

A flatbed trailer or shipping container can be used as the basic module. It is cuboid in shape with 8'6" of width, 9' of height and varying lengths from 20' to 60'. Talking about the basic shape of a cuboid it is open-able on four faces with stable top and base face.

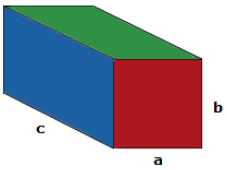

***Fig. 1**. Surfaces of a cuboid*

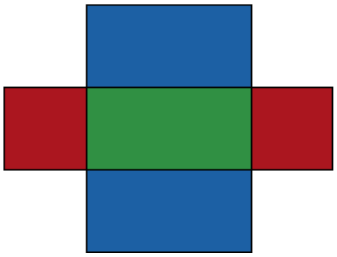

***Fig. 2**. Open-able Surfaces of a cuboid*

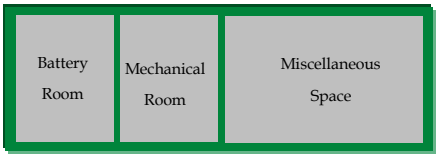

***Fig. 3.** Internal Layout*

The cuboid (shown in fig. 1) above is an representation of a typical container unit. Where a, b & c are width, height and length of the container respectively. The side faces (blue and brown surfaces) are attached through hinges to the roof of the container (green surface in fig. 1). The surfaces are open-able upwards (as shown in fig. 4) and results in an extended roof (as shown in fig. 2) with supported columns below. This roof is fitted with steel frame holding solar panels capable of rotating up to a fixed angle vertically up making it flexible to receive maximum solar gain[4].

***Fig. 4**. Container Prototype Structure*

Further the internal layout (as shown in fig. 3) is having basic design with minimum requirements of battery room with energy storage units. It is supposed to be ventilated and covers 1/4th of the total container, an mechanical room for system infrastructure is provided in the adjacent 1/4th part of the container. This space is also required for the service and maintenance engineers. The rest half unit of the container is left for miscellaneous activities that can be money generating to compensate the cost of infrastructure. Such things which are basic needs and requires power to operate can be added in this space such as, ATM machine, RO water dispenser machine, Internet Wi-Fi hot-spot, Internet cafe, digital library etc. Such things will be helpful for the daily needs of nearby settlements at nominal costs.

2.5 WORKING

The working of this plant is practically simple as shown in fig. 5 below

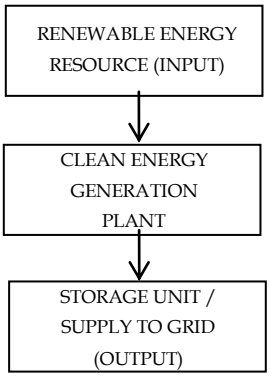

***Fig. 5**. Working Diagram of Clean Energy Generation Plant*

Clean energy generation plant collects the available natural form of energy from source (solar, wind, biogas, geothermal) and the gadgets in the plant harvests the energy into usable form (electricity) and finally it is either stored in battery units for later use or it is supplied to the grid for further consumption. Solar power is the most easily available and abundant source. For places with hot and dry climate where wind is an add on with sun's heat to make the plant more efficient, small wind turbines are added into the design(as shown in fig. 6 below) so that the plant is efficiently harvesting energy during night hours[4].

***Fig. 6**. Small Wind Turbines*

Shown above in fig. 7 below is the working layout for the mechanical room of solar powered cleaned energy generation plant shown in typical design in fig. 3 above.

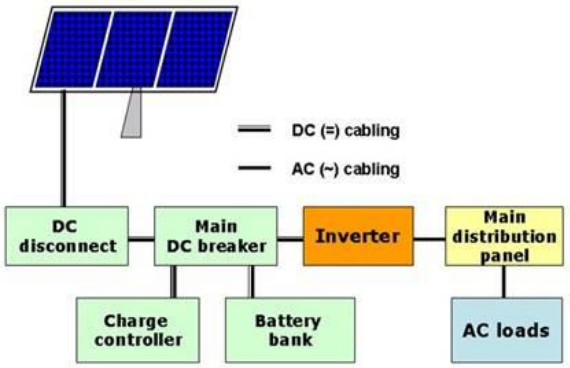

***Fig. 7**. Connecting Solar Panel to Battery & Inverter*

Shown above in fig. 7 is the working layout for the mechanical room of solar powered cleaned energy generation plant shown in typical design in fig. 3.

3 PRACTICAL APPLICATIONS

THIS DESIGN OF CLEAN ENERGY GENERATION POWER PLANT IS VERY PORTABLE HENCE MULTIPLE PRACTICAL APPLICATION ARE POSSIBLE SUCH AS;

- As an clean power generation and supply system for an small rural settlement to meet end user energy demands. Although basic infrastructure power supply will be preference in such a case such as primary school, primary health case centre, clean water RO dispenser, bank, ATM, common meeting hall, library, internet cafe etc. Providing constant power supply. However multiple application can also cater an midsize and large scale human settlement for meed basic end user energy demands.
- Agriculture and farming equipment in the fields in rural area requires electricity to operate such as water motor pumps, clean energy generation plant will provide portable and constant water supply for use.
- It is an viable replacement for use of diesel generator in multistory housing societies where share per head in distributed in large number of people.
- Power supply system on rental basis for parties, functions, exhibition, expo, fest conducted in remote areas using temporary infrastructure.
- Educational campuses for providing constant clean power supply specially to the basic need for comfortable study environment.
- Community town parks requiring energy for landscaping elements and beautification of the surroundings.
- Temporary markets held yearly at many places around the world during festivals and other special days for a duration of week up to month can have access to clean energy using this type of power generation and supply system.

4 ECONOMIC FEASIBILITY

There are different levels of economic feasibility. Considering for individual neither this model is designed nor it will be economically feasible but taking this model to the state, regional or national government level or large scare energy infrastructure development companies then this model is very much economic as it as nil raw fuel and less maintenance cost with compensates the initial infrastructure and equipment cost over a short interval of time. Besides that using this model as an part of urban community living is also an economically viable aspect. Cheaper the energy rates more economically acceptable. As the infrastructure gets older it has already generated it initial cost hence such model is capable of providing low unit rates for electricity in later years.

5 BENEFITS OF CLEAN PORTABLE ENERGY GENERATION PLANTS

As indicated in the name clean energy will be generated from this power generation and supply system using renewable sources of energy. This will lead to zero carbon footprint in the surroundings. Other then air pollution noise pollution is also an major issue. Places experiencing urbanization have undergoing building construction works powered by generators working on fossil fuel. Replacing traditional fuel power generators with portable clean energy generation plants will not only reduce air pollution but also they have no sound while harvesting energy[5]. Besides this less mechanical maintenance is required for portable clean energy generation plants as it has less complex machine infrastructure. Additionally it has no fuel cost as it is running on natural resources. Land is an important resource and in case of this type of power generation plants space acquired is temporary as after packing and moving trailer away to distant place the space can be reused for other required purpose additionally the space used is also very less and strategically managed for maximum efficiency.

6 SOCIAL ACCEPTANCE

Irrespective of urban or rural, society accepts only that thing which benefits all with least negative consequences in future. Current model of energy generation on fossil fuel have already shown a lot of negative consequences such as global warming, climate shift, acidic rain, smog, reduced fertility of land, health hazards and many more thing. But this model is dependent on natural resources for energy generation and has no carbon footprints in the process of harvesting and supply of usable form of electricity. Hence it is an socially acceptable more. Additionally its portability is an positive add on factor making its easy to be adapted[6].

7 APPROACH ORIENTED RESULTS

Despite of the basic infrastructural cost due to zero raw fuel cost it is an economically viable model. This factor leads to cheaper unit rate of usable form of energy (electricity). Additionally, this model is actually not using land permanently hence the resource cost is reduced. This model is capable of moving this dependence for energy requirements for economic, social growth and infrastructural development from non-renewable to renewable sources. This is the most viable model of clean energy generation for futuristic energy plus human settlements considering hot and dry climatic regions.

8 CONCLUSION

Portability is undoubtedly an important aspect of future urban growth. On the other edge, energy is the basic need of future urbanization. Providing a portable source of energy sources from renewable inputs will speed up the urban development process at various levels. Additionally, it will be beneficial for remote areas with reduces energy losses that occurs while supply from the grid. Hence it is an economically and socially viable concept to be used further.

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