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# Autonomous Domicile

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**ABSTRACT**
"AUTONOMOUS DOMICILE" stands for self-reliant structure or net zero energy building. An autonomous domicile can be defined as a building in which renewable energy is created on the structure itself and same is used for the meeting energy requirements of the structure. This project is mainly constant rated on promotion and optimum use of five components such as Solar Energy, Wind Energy, Rainwater Harvesting, Biogas and Green Building on the structures or buildings to meet their energy requirements and at the same time to reduce the use of non-renewable energy. The installation and orientation of these five components in the structure in such an integrated way so that maximum output can be obtained from the each component have been studied in this project. We have studied in detail about each and every component us as their installation method, the process of energy production, how much input is needed to produce the optimum amount of output from the components and also about their charges of installation.
***Keywords:*** Cost Effective, Easy to Use, Eco-Friendly, Low Carbon Emission, Low Maintenance, Renewable Energy Resources, Self Reliable

## I. INTRODUCTION

As we are working on different aspects of net zero energy building we have reviewed different kinds of literature which are as below:

❖ **Solar Energy**:-

In the literature dedicated to Zero Energy Building, the authors frequently emphasise theLack of common understanding of what should be equal to 'zero'. This issue has been widely discussed in numerous publications, however, the question: should "zero" refer to the energy, the energy or the $CO_2$ emissions or maybe energy costs, still has not been Unambiguously answered.

Furthermore, in the paper authors indicate that the definition of Zero Energy Building can be constructed in several ways, depending on the project goals, intentions of the investor, concern about the climate changes and greenhouse gas emissions or finally the energy costs.

- Net Zero Site Energy: A site ZEB produces at least as much energy as it uses in a
- To calculate a building's total source energy, imported and exported energy is multiplied by the appropriate site-to-source conversion multipliers.
- Net Zero Energy Costs: In a cost ZEB, the amount of money the utility pays the

Building owner for the energy the building exports to the grid is at least equal to the amount the owner pays the utility for the energy services and energy used over the year.

- Net Zero Energy Emissions: A net-zero emissions building produces at least as much emissions-free renewable energy as it uses from emissions-producing energy Sources.

❖ **WIND ENERGY**

Wind Power The variability of wind is sometimes cited as a barrier to the proliferation of wind power, but no energy source produces at 100% capacity all of the time.

Capacity factor is commonly discussed when referring to electricity generation techniques. It is the actual output of a generating facility over the theoretical output if generation was at the maximum level all the time.

For example, a power plant working at 100% capacity 50% of the time would have a capacity factor of 50% the same as a power plant working at 50% capacity 100% of the time.

Manufacturers estimate the cost of generating electricity from wind turbines will fall 3-5 % for each new generation of turbines developed.

It has been estimated that if the environmental externalities associated with generating electricity from fossil fuels was included in their cost, the price of electricity generated from coal and oil would double, and the cost of electricity generated from gas would rise 30%.

Wind power has the advantage of not being land intensive. Wind farms generally require 0.08- 0.13km2 /MW of generation capacity.

Many of the materials wind turbines are made of can be recycled, and no decommissioning issues are associated with wind turbines.

❖ **BIOGAS PLANT:-**

Biogas, the metabolic product of anaerobic digestion, is a mixture of methane and carbon dioxide with small quantities of other gases such as hydrogen sulphide.

Methane, the desired component of biogas, is a colourless, blue burning gas used for cooking, heating, and lighting. Biogas is a clean, efficient, and renewable source of energy, which can be used as a substitute for other fuels in order to save energy in rural areas.

In anaerobic digestion, organic materials are degraded by bacteria, in the absence of oxygen, converting it into a methane and carbon dioxide mixture.

The digested or slurry from the digester is rich in ammonium and other nutrients used as an organic fertiliser. Methane formation in anaerobic digestion involves four different steps, including hydrolysis, acetogenesis, acetogenesis, and methanogenesis.

Some of these parameters are pH, temperature, mixing, substrate, and hydraulic retention time (HRT).

Digestion is a slow process and it takes at a minimum of three weeks for the microorganisms to adapt to a new condition when there is a change in substrate or temperature.

❖ **RAIN WATER HARVESTING**:-

Rainwater harvesting is the accumulation and deposition of rainwater for reuse on-site, rather than allowing it to run off this water.

Rainwater on coming on the roof top can be stored in the sub ground's tank. Which can be used later.

- **Materials/Tools:-**

Following materials and tools can be used for this project:

✓ Construction materials
✓ Solar Panels
✓ Small Wind Mills
✓ Biogas plant
✓ Green Building Material (i.e.; Fabric, Wood, Aluminium, Rock, etc...)

- **Problem Summary**

Today our earth is facing many environmental problems which are a major concern of the whole world.

Following are the environmental problems which are currently faced by our planets:

- Global Warming
- Instability of Energy consumption
- Water Problems
- Waste Generation
- Increased demand for Liquefied Petroleum Gas
- High amount of carbon emission
- Air Pollution
- Waste Management
- Ozone Layer Depletion
- Costing

We have analysed such problems and to solve these we have worked on different technologies and designed a unit which will cover 5 different aspects. i.e., Solar Energy, Wind Energy, Rain Water Harvesting, Biogas System, and Green Building. This whole assembly is known as "NET ZERO ENERGY BUILDING" we have named it as "AUTONOMOUS DOMICILE".

## II. RESULTS AND CONCLUSIONS

❖ **SOLAR ENERGY:**

As we are installing solar panels to the structure, we need to decide first that how much energy is required by per person for a residential unit.

Average energy (Electricity) required by a person is 903 kWh per month.

If we want to find per day consumption then by dividing it by 30 so we' ll get the figure.

i.e.; 30 kWh per capita per day.

Now let us talk about sun's intensity if we are getting sunlight for 5-6 hours then to generate that 30 kWh we use per day then, so by dividing like 30/5=6KW of AC output needed to cover 100% of your energy usage.

In simple,

**AC rating** = Average kWh per month / 30 days / average sun hours per day

Eg. : 903 kWh per month / 30 days / 5 hours = 6.02 kW AC

**DC rating** = AC rating / derate factor (.8 is conservative, but a range would be .8 – .85)

Eg. : 6.02 kW AC / .8 = 7.53 kW DC

**Number of panels** = DC rating / Panel Rating (e.g. 25o W) *note this is important b/c panels are rated in watts, and the systems are rated in kilowatts (1000 watts). So a 7.53 kW system = 7530 Watts and a 250 watt panel = .250 kW

Eg.: 7.53 kW x 1000 / 250 watt = 30.12 panels, so roughly 30 250 panels (30 x 250W = 7500 Watts = 7.5 kW)

The amount of electricity a solar panel produces is not only proportional to the sun's intensity but also depends on 3 factors:

which are solar cell efficiency, solar panel size and the amount of sunlight directly hitting the panel.

❖ **Wind Energy:**

✓ **Wind Resources:**

If you live in complex terrain, take care in selecting the site. It's obvious that you will have a high wind speed at high altitude than thelower one.
High altitude means that you will have high output produced.
All future obstructions need to be considered before installing windmills. i.e.; Tall Trees

✓ **System Considerations:**

Be sure to leave enough room to raise and lower the tower for maintenance. If your tower is guyed, you must allow room for the guy wires.
If we are providing long wire run between turbine and load then the loss will be more as well as cost will be increased.
DC current will have more loss compared to AC current so it is advisable to convert the mode from DC to AC for long run wires.

**Sizing of small wind turbines**:

Small wind turbines used in residential units ranges in size from 400 watts to 20 kilowatts, depending on the amount of electricity you want to generate.
A typical home uses 10,932 kilowatt-hours (approx.) of electricity per year
Depending on the average wind speed a wind turbine rated in the range of 5–15 kilowatts would be required to make a sufficient contribution to this demand.
A 1.5-kilowatt wind turbine will meet the needs of a home requiring 300 kilowatt-hours per month in a location with a 14 mile-per-hour (6.26 meters-per-second) annual average wind speed.
The formula which is used is,

✓ $AEO= 0.01328\ D^2\ V^3$

Where, AEO = Annual energy output (kilowatt-hours/year), D = Rotor diameter, feet, V = Annual average wind speed, miles-per-hour (mph), at your site

❖ **BIOGAS :**

It is generally impossible to calculate the gas required making particular food or recipe, we can use the general thumb rule which is,
A well-managed generator may produce approximately its own volume of biogas each day. To put this in terms of energy production, a bit of math is required:

- A 55-gallon drum has a volume of about 7.35 cubic feet.
- One cubic foot of methane contains 1,000 Btus of energy.
- Biogas containing 60 percent methane offers 600 Btus of energy for each cubic foot.
- 7.35 cubic feet x 600 Btus per cubic foot = 4,410 Btus.

A typical gas cook stove might burn through 15,000 Btus of fuel per hour on maximum heat. At this rate, a 55-gallon methane generator can potentially produce enough gas in a day to supply the burner for about 18 minutes, 2 gallons of water can be boiled.

This might be enough in some cases, but in a practical sense, a small family for cooking needs will require the output of a warm, well-fed, 200-gallon (27-cubic-foot) methane generator at a minimum. This much biogas represents about 16,000 BTUs and offers about one hour of cooking time, or enough energy to boil around 8 gallons of water.

The quantity and quality of methane you make depend on the nutrient value of the feedstock and how well the microbes convert the available nutrients into methane. For practical purposes, biogas production and quality are functions of your specific recipe and generator management.
( BTU = BRITISH THERMAL UNIT i.e.; 1 CUBIC FEET OF NATURAL GAS = 1000 BTU)
It is also depended on:

- Solids, and liquids
- digestible quality
- Temperature
- Feeding rate
- Retention time
- pH
- Mixing

❖ **Rainwater harvesting:**

Rain Water harvesting is a system which can be provided to store the rain water into thepitandprevent it from draining.
Rainwater harvesting can be done in two different ways:

(1) Surface Rainwater Harvesting
(2) Roof Top Rainwater Harvesting

☞ How Much water can be collected is depended on following:

✓ 1" of rain on ft^2 of roof area produces 0.52 imperial gallons of water or 1 mm of rain on 1 m^2 of roof area produces 1 litre of water.
✓ So we can say that it is dependent on rain intensity and time of rain too.
✓ Rainwater harvesting system is not 100% efficient, most sources have estimated efficiency between 70% to 90%.
✓ All Rain water coming in catchment area may lose some amount of water to gutters or any other pits.

## III. CONCLUSION

- By Using Solar energy and wind energy in autonomous Domicile building theself-dependency of thepower supply is increased.
- By providing Rainwater harvesting system water supply can be minimised.
- By Providing biogas tank and putrescible waste as its fuel LPG gas can be generated.
- By using theRecyclable material as a construction material the cost of construction is minimised.
- By providing clean energy congestion of power supply cable can be minimised.
- By Using Green Building Concept Structure will be eco-friendly and it will create aless bad impact on theenvironment.
- The Long run cost will be reduced as well as the carbon emission.Use of Nonrenewable energy resources will be reduced.

HENCE, by making this structure we are making a building self-reliant, which is notdependent on any external sources partially.

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