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UTILIZATION OF RENEWABLE ENERGY FOR ELECTRICITY AND HEAT GENERATION

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Abstract

The biggest task arising from power developments of the twentieth century is to minimize the economic impacts of power consumption, especially with possibly worrisome worldwide effects. Wind, biofuels, solar heat and photovoltaic renewable power techniques are eventually mature and the ultimate guarantee of price competitiveness. Nigeria is growing quickly and strongly on demand for electricity and power from costly imported fossils that put a heavy strain on the country's industry, as well as environmental pollution. Nigeria coal dioxide emissions have increased in conjunction with its power usage in relation to worldwide economic concerns. In decreasing greenhouse gas pollution, States have performed a major position in environmental protection. In this respect, renewable power resources seem to be one of Nigeria's most effective and efficient alternatives for the growth of clean and viable electricity. This research showed that renewables, particularly hydro, biomass, geothermal, solar and wind power, are highly likely to

exist in Nigeria. Financial approach would be described. The system's price assessment and awareness assessment would be carried out, and the hybrid system would be validated when the above assessment is compared with the HOMER technology that is commercially accessible.

Keywords: Energy, Homer, Hybrid, Renewable and Solar

1.0 Introduction

For the financial and social growth of all nations, energy is vital and for improving lives quality[1]. However, many of the electricity produced and distributed in the world presently is not by the continuing use of technology and by significantly increase in general quantities [2]. Efficiency in nation power manufacturing, transmission, distributor and usage will progressively require monitoring of atmospheric pollution of greenhouse gases and other substances [1]. In many emerging nations, electricity supplies infrastructures are expanding quickly with increasing awareness of the key position of the electricity industry in enhancing norms of living and maintaining growth [1] by policymakers and shareholders world-wide.

In less than 10 centuries, the World Energy Forum has anticipated that supplies of fossil fuel, carbon and gas will become exhausted [2]. More than 79% of the world's main electricity produced by fossil fuels is spent in the shipping industry and 57.7% is spent quickly decreasing [3]. Natural resource depletion and the increasing demand for standard electricity have obliged promoters and policy-makers to search for alternatives. Renewable power is electricity obtained from renewable supplies and time-efficient resources [4]. In latest years there have been considerably increasing concerns about the growth and learning of renewable energies [5]. The use of renewable power assets and changes to the efficiency of the scheme of power transmission are increasing emphasis in modern society [6]. Sustainable and tidy power sources deriving from nature are renewable power. In terms of fossil power scarcity, environmental effects and viable power use, the use and growth of renewable electricity is prosperous [7].

Alternative power has a primary role in eradicating environmental pollution and warming issues [7]. The global economic problem, like global warming, has been increasing by exhausting carbon dioxide [2]. Production and utilization of earth power assets and hazardous greenhouse gas emissions are a severe problem [5]. The issues with production and use of electricity relate not just to worldwide warming but also to eco-pollution, acid rainfall, degradation of ozone, devastation of forests and emissions of radioactive substances [2]. The main responsibility for human operations is the significant CO_2 release. Global CO_2 emissions from human operations in 2009 amounted to over EUR 2.8 billion tonnes and is anticipated to achieve EUR 4.2 billion per year in 2030 [2]. In order to avoid these impacts, some possible alternatives, such as power saving, have developed through better power effectiveness, reducing the use of fossil fuels and increasing power resources that are eco-friendly [7].

2.1 Hydropower

Hydropower is probably a major cause of electricity in Nigeria [9]. The hydropower potential of Nigeria can fulfill up to 46% of its electricity needs by 2020 and this potential can be created economically and simply [3]. In contrast, 678 crop locations, of which 135 are already being established and are spread over 26 principal areas of the watershed [1] are accessible for hydro power plant building. These locations have a complete net potential of almost 37 GW and a complete power output of 127 TWh / yr. At present, only 35% (approximately 13,000 MW) of the complete hydropower capacity is in operation. This is to be increased by 100 per cent by

2020 in the National Development Plan. Small hydropower crops are projected to be 5.1 percent of the complete energy production [3].

2.2 Bioenergy

Biomass, despite a fall from 20% in 1980 to 8% in 2009, is also a major part of Nigeria's overall power usage [1-2]. Bioenergy accounts for approximately two thirds of Nigeria's manufacturing of renewable energy [3-7]. The primary source of electricity for biomass is a number of agricultural residues, including grain powder, wheat straw and hazelnut containers. Fuel timber appears to be one of the most exciting components of biomass electric power. In Nigeria, the use of vegetable oils as fuel alternatives gives economic, social and energy benefits. Approximately 90 per cent of the thermal content of vegetable oils is diesel Their very elevated viscosities almost ten times that of diesel petrol are a significant barrier to their application in the direct-injection motor. The general assessment of the outcomes showed that the fuel can be suggested for these oils and biodiesel as potential applicants.

2.3 Geothermal energy

Nigeria has considerable geothermal power capacity and may have about 2,000 MW of geothermal power available to generate electricity in high-enthalpy areas [2]. The complete heating capability of Nigeria is approximately 31,500 MW. Heating power is equal to 120,000 homes in Nigeria at 983 MW. According to information from the Nigeria Energy Ministry, about 18 per cent of Nigeria's electricity requirements are encountered by renewables. Renewable energy sources and hydroelectric installations have a significant 95% share at a pace. Nigeria has very great capacity as a sector for PV because its insolation and big soil for solar farms are highly accessible.

2.4 Wind energy

Some towns with relative wind rates are present in Nigeria [2]. The wind areas are about 3.5 m / s small and 5 m / s big at an elevation of 10 m which corresponds to a power production of 1000 to 3000 kWh/(m2 yr) theoretically. The Marmara, Mediterranean, Agean and Anatolian seaside are the most appealing places. The first Nigeria wind plant was launched in 1998, having an output of 1.5 MW. Capacity will probably expand quickly as plans for a further 600 MW of autonomous installations have been presented. In early 2009, as shown in the Fig. 6, Nigeria's complete installed wind power capability was just 800 GWh.

3.0 Methodology

The system flows would be calculated to obtain a mathematical model of each part of the suggested hybrid scheme. The evaluation of parts in the hybrid renewable solar power schemes uses the Particle Swarm Algorithm (PSO) to determine the HRES setup with the lowest life cycle. Using the mixed dispatch approach, a real-time financial dispatch scheme control algorithm would eventually be created.

An overview of Figure 3.1 approach.

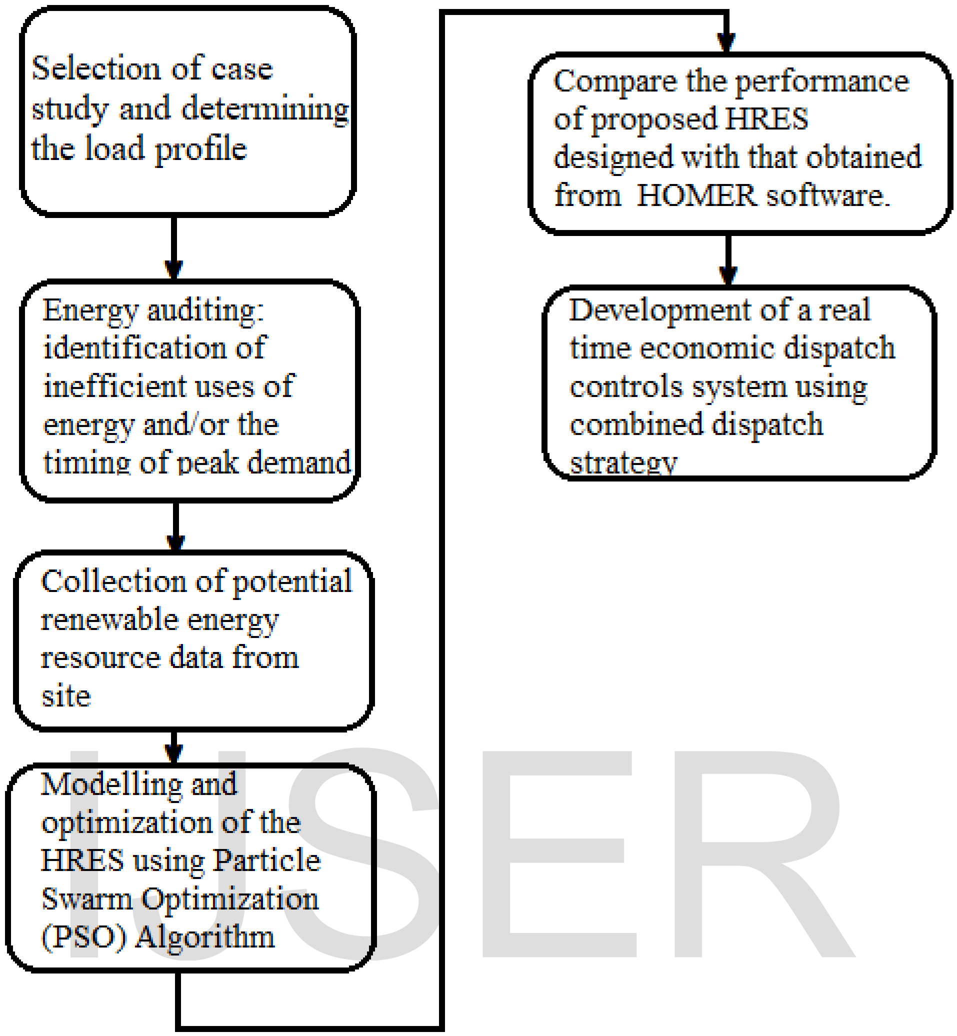

Figure 3.1: Methodology flowchart

3.1 Site study and configuration of proposed HRES

This research would begin with a case study and then the hourly requirement for electric power and Thermal Energy for a everyday of the year would be measured by means of a measuring instrument (multimeter and energy meter), which would establish the daily charge profile of the farm site. The site would then undergo an adequate power inspection taking into account the effectiveness of the machinery used and the power governance of employees. Next the collection, taking account of the annual change of source, of renewable power sources (solar irradiation, wind velocity, organic waste and sewage runoff) for a year. The data would come from trustworthy metrological websites, like the Nigeria Meteorservice, the SSE, semi-formal interviews and physical surveys of the suggested research paper site, and NIMET. the NASA Surface Meteorology and Solar Energy.

In the DC-bus, AC-bus or in the hybrid DC / AC-bus, renewable energies can be linked together. For most generation and load the suitable device setup relies on the sort of input energy (AC or DC). Without necessarily converting from one type to another, it is more effective to use the output directly since the converters (inverters/rectifiers) are usually not 100% efficient (80% to 90%). Therefore, when it is transformed, a percentage of the input energy is wasted. This makes DC-bus coupling more suitable if the majority of energy production and batteries are DC and for primarily AC generation and loading use of AC-bus couplings. If a combination of AC and DC power is generated from the main energy sources of the HRES, then a mixed bus system layout is beneficial as provided in this case in Figure 3.1.

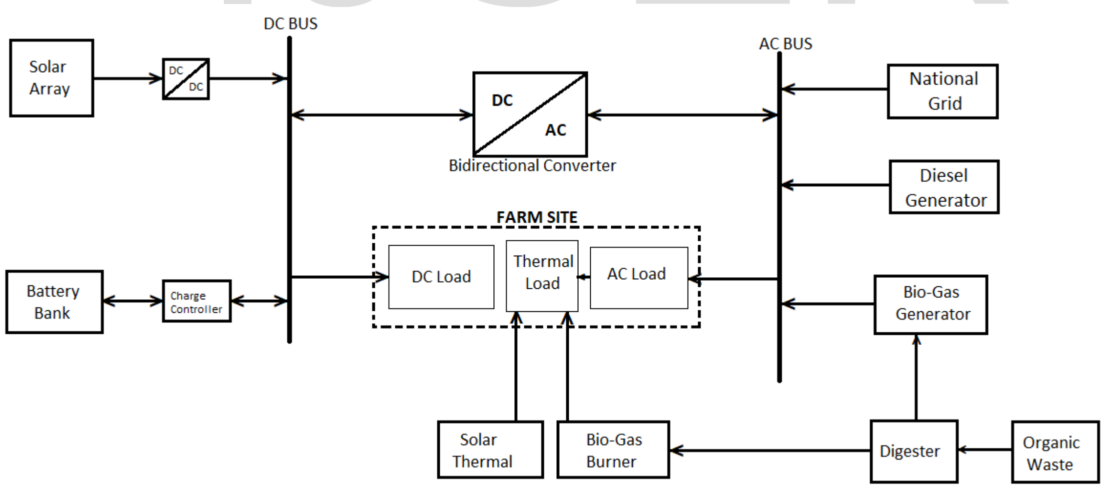

Figure 3.2: Configuration of proposed hybrid energy system

The scheme comprises of the biogas generator (BGG), photovoltaic (PVG), solar thermal (STH) and battery fund storage scheme (BAT), Diesel Power Generator (DPG). Conversion of the AC supply to DC is done via electronic converters, and vice versa. Electric power can either be generated by renewable engines and diesel engines straight or indirectly from the stored electricity in the battery store to supply the load. Equation (3.1) to Equation (3.5) expresses the connection between electricity produced and the power provided.

$$E_{BGG}(t) = E_{BGG,DC\ load}(t) + E_{BGG,AC\ load}(t) + E_{BGG,BAT}(t) + E_{BGG,dump}(t) \quad (3.1)$$

$$E_{PVG}(t) = E_{PVG,DC\ load}(t) + E_{PVG,AC\ load}(t) + E_{PVG,BAT}(t) + E_{PVG,dump}(t) \quad (3.2)$$

$$E_{DPG}(t) = E_{DPG,DC\ load}(t) + E_{DPG,AC\ load}(t) + E_{DPG,BAT}(t) \quad (3.3)$$

$$E_{STH}(t) = E_{STH,Thermal\ load}(t) + E_{STH,dump} \quad (3.4)$$

$$E_{Grid}(t) = E_{Grid,DC\ load}(t) + E_{Grid,AC\ load}(t)$$

(3.5)

Equation (3.6) expresses the power required for the battery reserve (BAT) to run at any hour, and battery power is provided in equation (3.7).

$$E_{BAT,IN}(t) = \eta_{CHG} \times \eta_{CC} \times [E_{PVG,BAT}(t) + \eta_{REC} \times (E_{BGG,BAT}(t) + E_{DPG,BAT}(t))] \quad (3.6)$$

$$E_{BAT,load}(t) = \eta_{DCHG} \times E_{BAT,IN}(t)$$

(3.7)

In Equation (3.8), Equation (3.9), and Equation (3.10) illustrate the complete power required to supply the AC load, DC load, and the thersmal load.

$$E_{AC\ load}(t) = E_{BGG,AC\ load}(t) + E_{DPG,AC\ load}(t) + [\eta_{INV} \times (E_{PVG,AC\ load}$$

$+ E_{BAT,load}(t))]$

(3.8)

$E_{DC\ load}(t) = E_{PVG,AC\ load}(t) + E_{BAT,load}(t)[\eta_{REC} \times (E_{BGG,AC\ load}(t)$

$+ E_{DPG,AC\ load}(t))]$

(3.9)

$E_{Thermal\ load}(t) = E_{STH,Thermal\ load}(t)$

(3.10)

$E_{Load-Total}(t) = E_{AC\ load}(t) + E_{DC\ load}(t) + E_{Thermal\ load}(t)$

(3.11)

Where $E_j(t)$ is the energy output from technology j $E_{j,AC\ load}(t)$ energy output from technology j fed to AC load, $E_{j,DC\ load}(t)$ energy output from technology j channeled to DC load, $E_{j,Thermal\ load}(t)$ energy output from technology j directed to load, $E_{j,dump}(t)$ is excess energy output from technology j directed to dump load. $E_{BAT,IN}(t)$ energy stored in battery, $E_{j,BAT}(t)$ is the energy output from technology j directed to battery and j stands for STH, BGG, PVG, DPG, and BAT.

4.1 Barriers to developing renewable energy

Failure to provide economic and credit funds, especially to initiatives of a small scale [8]. Lack of thorough evaluations of renewable power resources and Nigeria databases [5]. In Nigeria, however, there is no great challenge to absence of consciousness and understanding [9]. The ability of renewable electricity to produce native, clean electricity is recognized. Nigeria bureaucracy is the biggest obstacle for overseas shareholders. Permits from overseas buyers may take up to one year, with the involvement of various officials. This license method was undertaken by the current government [4-9] to be simplified. For many years the nation has used hydro-electric production, wood production, solar power to dry grain and heat water, and geothermal energy [3]. The main effective solar technology is household water heating [4]. Since the 1980s there have been about 30 000 installations in Nigeria of solar water storage units [1]. This is a small part of its overall capacity, with approximately 50% of current homes efficiently equipped with a solar water heater.

4.2 Essential reforms

In light of electricity costs and investment costs, Nigeria can not create a definite approach with regard to its renewable sources of energy. The government has urged the private industry to invest in combined-use natural gas power plants and to ensure a small and unique buy-in of energy. Nigeria is involved in and devotes attempts to the sustainable use of natural power resource. With regard to geothermal power, the government promoted the municipal officials and granted them autonomous authority in this respect [2]. In Nigeria, power effectiveness has not yet exceeded the level of European effectiveness. In all renewable power sources, the government calls upon the private industry to complement credits from the World Bank. In order to satisfy their own power requirements, the government decided to behave as the guarantor of 30,40% of private industry investment costs. The private industry may sell the surplus energy generated by these crops if they discover a customer.

5.1 Conclusion

There are highly complicated connections between power production and use, financial activity, human growth and climate. Increased use of electricity is both a source of growth and financial growth. For most financial operations, energy is vital. Transporting commodities and personnel, heating house and offices power trains and equipment, and running stores and factories, industrialized countries depend on business power. The wealth produced through financial growth in turn stimulates demand for power facilities of greater and better quality, particularly at the beginning of financial growth. However, power manufacturing, transport and use can have a significant detrimental impact on the atmosphere and on the well-being and health of present and future generations.

5.2 **Recommendation**

Nigeria has been one of the world's quick increasing power economies for the past two centuries, with its youthful inhabitants and increasing energy requirement per individual, its quick increasing urbanization and its financial growth. Nigeria is highly dependent on costly power supplies imported that position excellent economic burdens and air pollution in the nation is becoming a major ecological problem. Renewable power supplies seem to be one of Nigeria clean and viable power production alternatives that are most efficient and effective. The Nigeria production of hydropower and biomass is dominated by renewables, but worries about the environment and the lack of production contributed to declines in the utilization of bio-mass for housing heating. Nigeria has significant reserves of renewable electricity, including around 1% of global hydropower capacity. The potential for wind energy growth is also substantial. Nigeria ranks seventh globally as geothermal potential, but only a tiny part is regarded as economically viable.

Governments are not enough to promote the creation of techniques for renewable electricity. They must also promote their trade in the nation. In Nigeria, because of certain technological and financial limitations, renewable power funds do not have broad apps. However, renewable power use is projected to boost year after year by state and private businesses, as Nigeria is an electricity importing nation and the country's national fossil fuels are restricted and financial circumstances are not favorable.

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