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Determining The Electrical Energy Potentials of Otamiri River for Effective Harnessing and Sustainable Economic Development

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Abstract - Energy demand is increasing geometrically all over the world and equating demand and supply of energy has become a burden to inhabitants especially the developing countries like Nigeria. Nigeria is blessed with enormous resources that could make life easy if properly harnessed. Renewable energy technology is gaining tremendous break through all over the world. Many are coming through Solar, Wind, tidal, River etc. Many rural communities are endowed with these natural resources which cannot be depleted either due to their geographical location or access to where they situated. Otamiri river is one of the rivers located in Imo state of Nigeria and its potential has not been tapped. This study was carried out to see how Otamiri potential could be discover for electrical energy production. The method used is floating method. This comprise s using a floater, stop watch, canoe or flying boat, measuring devices, calculation of the depts., width and noting the time the floater reached a specific measured distance. The values obtained are used to calculate the flow rate of the river. Having known the flow rate, water head etc then the total energy that could be obtained from the river was calculated and this came to be 80.58 KW and an annual value of 670.6 MW. In conclusion, the research successfully achieved its objectives by discovering the power level Otamiri can generate through mini hydro technology hourly, daily and yearly.

Key Words: Otamiri, Floater, River, Nigeria, Renewable, Energy,

1. INTRODUCTION:

In the past Nigeria has attempted to reach rural areas through so many techniques of rural electrification programs. In most cases, these projects based on grid extension or diesel generated electrification programs have failed to reach the targeted customers. The percentage of population receiving electricity in all rural areas does not exceed 5% of the total population. It is thus evident that alternative approaches to rural electrification schemes have to be found.

Decentralized electricity supplies using renewable energy technologies, particularly small hydropower stations, Photovoltaic solar energy systems, wind power and biomass based power systems can often provide remote communities and businesses with the most reliable and affordable sources of electricity.

Although all these renewable energy resources are available in abundance in the country, many rural areas in Nigeria have not benefited from the technologies which is now available in the market to ensure their sustainable development to meet the energy needs of their rural population.

The terrain in most parts of the country and the settlement pattern are such that distributed generation seems to be the only

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viable option to increase the level of electrification in any significant manner. Many rural areas are ideally placed in terms of resource - base for such a strategy. Large parts of the rural areas receive sufficient solar radiation throughout the year. The average wind velocity in many regions is known to be large enough for electric power generation. The mini/micro hydropower resource base, can be conveniently developed in a river like Otamiri river, Imo river, River Null and many more.

Otamiri River as one of the sources of renewable that has great potential for hydro energy generation that can provide energy sustenance to the communities close to where is situated. The provision of adequate and affordable rural energy in general and electricity in particular, especially renewable energy-based, have direct synergy with poverty reduction strategies that many African countries are now implementing. An affordable source of electrical as well as mechanical and thermal energy could encourage the establishment of agro-processing and cottage industries, which would create employment opportunities in rural areas and increase disposable income. In addition, it would enhance the development prospects of many local areas by increasing their exchange earning through export of agricultural products.

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2 LITTERATURE REVIEW

According to [2], they researched on Climate and vegetation of Otamiri river. They inferred that the Otamiri river is one of the major rivers in Imo state, Nigeria, the river runs south from Egbu past Owerri and through Nekede, Ihiagwa, Eziobodo, Olokwu Umuisi, Mgirichi and Umuagwo to Ozuzu in Etche in Rivers state from where it meets or flows to the Atlantic Ocean. The length of the river from its source to its confluence at Emeabiam with Oramiriukwa river is 30 km. The watershed covers about 10,000 km^2 with annual rainfall of about 2250-2750 mm. The watershed is mostly covered by depleted rain forest, having thick under brushes, creeping vines and deep green vegetation which is as a result of heavy decay of plant droppings and foliage. The mean temperature of about 25 degrees centigrade and relative humidity of about 75-85% is experienced within the region throughout the year. The study area is in the rainforest belt region having peak rainfall during the months of June, July and September and low rains in December and January [3].

Organic nature and type of soil: In their research, they found that the otamiri watershed is dominated by sandy soil with little percentages of clay, loam and silt. The area is acidic with pH of between 4.67-5.6 for upper and lower layers and 5.0-5.6 at the crest and valley bottom and lower at mid slope [4]. The watershed also in addition has low organic carbon ranging between 0.676-3.764 meq/100 g for upper soil layer, 5.34-4.27 meq/100 g for lower soil layer and lower at the midslope, low nitrogen concentration range of 0.008 - 0.068% and 0.018-0.048% for upper and lower soil layers [4]. The general slope of the Otamiri watershed is 0.016. The soil type belongs to ferralic. The soil profile is remarkably uniform throughout the area, deeply weathered and intensely leached [3].

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Geology and position: In geological position, the study showed that the area is located within south eastern Nigeria sedimentary basin. The study area consisted of Owerri metropolis and environs. It is bounded by latitudes 5°15″-5° 35″N and longitude 6°55″-7°15″E. The study area is within the subequatorial region which is characterized by two major seasons namely, the rainy season and the dry season [5].. The average thickness of the formation at the study area is 800 m. The terrain of the study area is characterized by two types of land forms; highly undulating ridges and nearly flat topography.

The ridges trend in the north-south direction and have an average elevation of about 122 m [6]. In between those ridges are valleys of the Otamiri River, Oramiriukwa River and their tributaries.

Hydrogeology: Their paper revealed that the study area is drained by two rivers, namely the Otamiri and Nworie. The Otamiri River has maximum average flow of 10.7 m^3/s in the rainy season (September-October) and a minimum average flow of about 3.4 m^3/s in the dry season (November-February). The total annual discharge of the Otamiri is about 1.7×108 m^3 and 22% of this (3.74×l07 m^3) comes from direct runoff from rainwater and constitutes the safe yield of the river [7].

According to [8] their study was based on the assessment of heavy metal concentration of Otamiri River in Imo State, Nigeria. Standard sampling and analytical methods were employed during the study.The result shows that in all eleven (11) surface water samples collected, mercury (Hg) and cadmium (Cd) have the least concentrations which are below 0.0001mg/l and below the World Health Organization limits of 0.001mg/l for mercury and 0.003mg/l for cadmium. Copper (Cu) showed a very low concentration of less than

0.0001mg/l in sample1 collected at the river source in Egbu and also anomalously very low concentration of less than 0.0001mg/l in sample 5 collected at Umuoma

Nekede. The highest concentration of copper (Cu) (0.0271mg/l) is noticed in sample 8 collected within FUTO community which is likely to have been introduced by domestic waste water from the University hostels that drain into the Otamiri river. The concentration of copper (Cu) in the other eight samples falls within the range of 0.0032mg/l - 0.0271mg/l and the average concentration of copper (Cu) in all the eleven (11) surface water samples is 0.0039mg/l and all these levels of copper (Cu)

concentrations in Otamiri river were below the World Health Organization (WHO) limit of 2mg/l for copper (Cu) in surface water. Also the concentration of zinc (Zn) ranges from 0.0033mg/l in sample 1 to 0.1377mg/l in sample 7. Samples 7, 10 and 11

collected at Umuchima secondary school, Imo State polytechnic Umuagwo and Ohaji Egbema community showed the highest concentration of 0.1377mg/l, 0.1143mg/l and

0.1039mg/l respectively and the average zinc (Zn) concentration in all eleven (11) samples is 0.0513mg/l. The concentration of iron (Fe) in all eleven (11) surface water

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samples are above 0.20mg/l which shows that the river has a high concentration of iron (Fe) .

[9] analysed and identified microbial constituents in the water and sediment samples with comparison of the River to World Health Organisation (WHO, 2011) standard for drinking water and Federal Ministry of Environment (FME, 2006) and their public health implications with respect to water quality. The microbial assay of Otamiri River was investigated using Standard plate count. The result indicates that microbial constituents ofOtamiri river obtained at five strategic gauge stations designated SSWS1 (Egbu), SSWS2 (Timber Market), SSWS3 (FUTO), DOWNSTREAM (Mbirichi) and CONTROL POINT with mean Total coliform Count of 3.0 × 102, 3.0 × 103, 4.1 × 103 and 1.0 × 103 cfu/100ml with control point value of 0.5 × 103 respectively. The mean Total Bacteria Count was 3.0 × 104, 2.1 × 103, 1.1 × 103 and 0.8 × 103 cfu/100ml respectively with control point value of 0.2 × 103 while the mean values for Total E. coli Count were 1.1 × 102, 3.0 × 102, 4 × 103 and 2.0 × 103 cfu/100ml with control point value of 0.2 × 103. The biochemical identification of some organisms in water was Escherichia coli, Vibro spp. Klebsiella spp., and Entrobacteria spp. The result of stream sediment samples indicates that the mean Total Bacterial Count was 3.5 × 104, 5.0 × 104, 6.5 × 104 and 2.0 × 104 cfu/g respectively with 1.5 × 102 as control point value and that of Total Coliform Count was 6.5 × 103, 2.0 × 103, 2.5 × 103 and 0.8 × 103 cfu/g respectively with control point value of 0.5 × 102. While for the total Ecoli Count, the values were 2.5 × 103 , 1.0 × 103 , 2.5 × 103 and 0.5 × 105 cfu/g respective with control as 0.5 × 102. Biochemical identification of some organisms in sediments includes: Escherichia coli, Vibro spp., Klebsiella spp. Entro bacteria spp. and Bacillus spp. The mean total bacterial count, total coliform count and total E. coli, were not in conformity with both World Health Organisation (WHO).

According to [10] the effect of human activities on the physicochemical parameters and microbiological quality of Otamiri River was studied. Parameters studied were pH (5.40± 0.11 6.55± 0.15), temperature (26.67± 0.47 28.00± 2.58 oC), turbidity (1.00± 0.00 3.00± 0.00 NTU), total solid (200.00± 16.33 450.00± 40.82 mg/L), total dissolved solid (49.00±2.58370.00±0.00 mg/L), total suspended solid (49.67±19.15207.00±.10.61 mg/L), conductivity (98.40± 1.31 592.00± 0.00 µscm-1), total hardness (4.00± 0.50 6.60± 1.50 mg/L), dissolved oxygen (8.15±2.15 12-59±1.00 mg/L), Biological oxygen demand (0.74± 0.02 2.96± 0.05 mg/L), chemical oxygen demand (3.11± 0.10 28.92± 3.32 mg/L), total organic carbon (0.002± 0.00 0.021± 0.005 mg/L), total alkalinity (10.00± 2.20 18.00± 1.10 mg/L), sulphate (0.49± 0.006 0.55± 0.02 mg/L), chloride (48.39± 2.13 145.17± 7.21 mg/L), phosphate (4.84± 0.05 5.49± 0.14 mg/L), and nitrate (0.05± 0.01 - 0.32± 0.02 mg/L). All the metals and most physicochemical parameters investigated fall below the WHO accepted standards. Microbiological quality studies on the river also revealed total heterotrophic bacteria

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count (6.8x104 6 - 5.2x10 cfu/ml), total coliform count (2.8x103 4 - 4.2x10 4 4 cfu/ml), Total viable bacteria count (1.0x10 - 3.7x10 cfu/ml), and total fungi count (3.1 x104 4 - 3.7x10 cfu/ml). Colour, taste, odour, total hydrocarbon, and heavy metals were not detected in the river. Some of these parameters studied were significantly ($p<0.05$) affected among the sampling points. The present study has revealed that though otamiri river is not heavily polluted, but the observed fluctuation of the investigated parameters along the sampling points could be as a result of human activities

Study on the Ichthyofaunal composition of Otamiri River, Imo State by [11] was carried out from June 2016 to March 2017. A total of 2,453 fishes belonging to 5 orders, 18 families, 46 genera, and 79 species were sampled from 5 landing sites by artisanal fishermen using different fishing gears. Mormyridae had the highest percentage in terms of species (20.6%) while Pantodontidae had the least percentage (0.9%). Mormyridae also recorded the highest percentage weight (18.2%) while Pantodontidae had the least fish weight (0.2%). Mormyridae was the most abundant with 19 species and 505 samples. Pantodontidae, Gymnarchidae, Arapaimidae and Hepsetidae were the least families having a single species and 21, 34, 38 and 41 fish samples respectively. Hemichromis fasciatus was the most dominant fish species (2.5%) while Petrocephalus banebane was the least with 0.3%. Parachanna obscura had the highest index of preponderance value of 11.8% while Ctenopoma kingsleyae, Petrocephalus bane bane, Petrocephalus soudanensis, Pollimyrus isidori isidori, Bryconaethiops quiquesquamae and Rhabdalestes septentrionalis had the least value (0.1%). The values of Simpson dominant and index were 0.01 and 0.99 respectively. Monthly catch records revealed the highest fish catch in the month of January with 12.7% of total catch while the months of October and March had the least percentage at 7.8% each.

[12] carried a study on the bacteriological assessment of water from Otamiri River . Three sites of the Otamiri river: Akachi Road, Emmanuel college and mechanic village were selected for water collection points from the river based on effluent discharge. Analyzed water samples collected from the river showed that the river was highly contaminated. The temperature ranged from 290C to 300C while pH was 5.28 to 6.01 and the conductivity was 0.03-0.61. The total visible count ranged from 1.2x105 to 9.0x105 CFU/ml while the total coliform count was from 5.0x105 to 9.0x105 CFU/ml which revealed high level of contamination. The bacterial isolates were staphylococcus aureus, Escherichia Coli, Klebsiella Sp, Enterobacter. Sp, Bacillus Sp, Pseudomonas sp, Streptococcus sp, proteus SP, and Salmonella sp. The coliforms were dominant occurring in all the water samples and are indicators of faecal contamination.

It is recommended that people using the water especially for drinking and other domestic activities should purify it properly to avoid possible health hazards associated with the identified microbes.

In his research, [13] inferred that Nigeria, as in many developing countries, providing

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energy to rural and urban areas has proved to be a great challenge. The country has an enormous renewable energy potential of hundreds of Mega Watts, which is mostly untapped. Considerations have been put in place to ensure that these large reserves of energy are put into good use to provide continuous supply of energy to the nation. Using Ihiagwa village as a case study, some renewable energy sources are considered such as solar, hydro (due to the presence of Otammiri River) and biogas from students suck away pits (as the village is host to the federal University of technology) for the firing of gas turbine. This paper presents a feasibility analysis of the hybrid renewable energy system (hydro, solarPV, and biomass) as a viable means of maximizing power generation through alternative sources to the ICT building. The power produced by this hybrid renewable energy system will serve as an off-grid system to supply electrical energy to the loads of a new ICT building within the institution. The load demand of the building is presently about 64Kw at peak, which was obtained based on the load survey carried out.

He concluded that from the result obtained, The renewable energy potential and economic analysis of electricity generation with a hybrid RET system using the new ICT building has been performed using HOMER. Different scenarios have been considered and the costs for RET have also been taken into account. The sizing of the various components paid regard to the necessity of an operation reserve to enable the system to provide reliable energy supply and also allows for a rising energy demand in the future.

Calculations have been carried out and the COE per kWh has been ascertained for different
possible configurations. A combination of hydro, PV, biogas generator and battery has been
identified as the cheapest and most dependable solution with a COE of $0.131/kWh. Another finding of this study is that a combination of different RETs is better suited for the back-up electrification of the ICT center than the use of one single RES.

3 METHODOLOGY

In order to obtain the potentials of the study area for hydropower generation the flow characteristics and pattern of the river have to be, surveyed, calculated or obtained from the hydrological year book of River Basin Authorities or Meteorological Service Centers with stations located along the study area

The Method adopted for the field work is FLOATING METHOD (Flow Method)

Procedures:

a Measured section one, the distance of the work vicinity chosen for the experiment D with measuring tape. Measurement of a distance of 20 meters from the initial mark within the already measured distance D to form two section (section A and section B).

b Measurement of the width of the river four different places at each of the sections section

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c A calibrated Iron to measure the depth of each of the divided portions in the two sections. This is to enable one to calculate the area of the river at each section apart from the velocity of the river that will be calculated

d The floating material flow to the 20 meters mark where second section started.

e A stop watch was used to note the time it took the flow material to get to the marked point

WATER VELOCITY

Average time is the result of the division between the total measurement time and the number of repeat measurements.

$$T_{AVERAGE} = \frac{\sum Time}{n} \quad (1)$$

Where:
Average T = Average time (in seconds)

Σ Time = Total Measurement Time

N = Number of measurement Repeated

FLOW RATE (V)

Velocity (V) was calculated by using the mean cross-sectional area variable (A) and the mean time (T) according to the formula. Speed (V) is the result of the division between channel length / current (P) divided by the mean time (T*average*)

$$V = \frac{P}{T_{AVERAGE}}\ m/s \quad (2)$$

The cross-sectional area of the river (A) was determined .

To calculate cross section area (A), the following equation was used

$$A = \square L\ x\ D\ (m) \quad (3)$$

Where: :

A = cross-sectional area of river (m^2)

L = width river (meters)

D = average water depth (meters)

Calculation of water discharge (Q)

The water debit (Q) is the result of multiplication between the cross-sectional area (A) of the stream and the flow rate of water (V).

$$Q = V \times A \quad (4)$$

Where :

Q = Debit flow (m^3 / sec)

A = Area of cross section (m^2)

V = Water flow rate (m / sec)

MEASUREMENT OF WIDTHS OF THE RIVER IN SECTION "A"

(a) DECEMBER, 15TH, 2021

Table 1: Field Measurement of the Width of Otamiri in section A

S/N	WIDTHS MEASURED	VALUE OF WIDTHS OBTAINED IN METERS

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1	W1	16.50
2	W2	18.70
3	W3	21.00
4	W4	23.40
5	W5	19.5

Where W1……W5 = Various number of widts measured in section A

Average width from table 1:

$A = \frac{16.5+18.7+21.0+23.4+19.5}{5} = \frac{99.1}{5} =$ 19.84Meters (5)

Where A = Average

Measurement of Depths of the River in Section "A"

Table 2: Field Measurement of the Depth of Otamiri River in section A

S/N	DEPTH MEASURED	VALUE OF DEPTHS OBTAINED IN METERS
1	H1	28.9
2	H2	29.5
3	H3	31.0
4	H4	30.0
5	H5	32.9

Where H1……H5 = Various number of depths measured in section A

$A = \frac{28.9+29.5+31.0+30.0+32.9}{5} = \frac{152}{5} =$ 30.46Meters (6)

Area of section A is:

Average width multiplied by the depth (W_A X H_A)

Where W_A = Average Value of the Width

H_A = Average Value of the depth

Thus Area becomes

$19.82x30.46 = 603.72\ M^2$ (7)

MEASUREMENT OF TIME OF FLOAT

Table 3: Field Measurement of the Time of float of Yellow Orange on Otamiri River in section A

S/N	TIME RECORDED	VALUE OF TIME OBTAINED IN SECONDS
1	T1	12.2
2	T2	11.9
3	T3	10.6
4	T4	10.3
5	T5	10.2

Average time from table 3:

$A = \frac{12.2+11.9+10.6+10.3+10.2}{5} = \frac{55.2}{5} =$ 11.04 Seconds (8)

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SECTION B

Table 4 Field Measurement of the Width of Otamiri in section B

S/N	WIDTHS MEASURED	VALUE OF WIDTHS OBTAINED IN METERS
1	W1	19.8
2	W2	20.5
3	W3	23.4
4	W4	18.8
5	W5	21.6

Average width from table 4:

$A = \frac{19.8+20.5+23.4+18.8+21.6}{5} = \frac{104.1}{5} =$ 20.82 Meters (9)

Measurement of Depths of the River in Section "B"

Table 5: Field Measurement of the Depth of Otamiri River in section B

S/N	DEPTH MEASURED	VALUE OF DEPTHS OBTAINED IN METERS
1	H1	27.4
2	H2	29.5
3	H3	32.6
4	H4	31.8
5	H5	32.2

Average height from table 5:

$A = \frac{27.4+29.5+32.6+31.8+32.2}{5} = \frac{153}{5} =$ 30.7Meters (10)

Area of section B = Average width x Average height ie.

W_A X H_A = 20.82 X 30.7 = 638.56 M^2 (11)

MEASUREMENT OF TIME OF FLOAT

Table 6: Field Measurement of the Time of float of Yellow Orange on Otamiri River in section B

S/N	TIME RECORDED	VALUE OF TIME OBTAINED IN SECONDS
1	T1	11.3
2	T2	11.8
3	T3	11.9
4	T4	10.3
5	T5	10.8

Average time from table 6:

$A = \frac{11.3+11.8+11.9+10.9+10.8}{5} = \frac{56.7}{5} =$ 11.34 Seconds (12)

Total area from sectors A and B = 603.72+638.56 = 1242.28 M^2 (13)

Cubic sector of measurement = 1242.28x 120 (Distance) = 149073.6 M^3 = (14)

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Total time = 11.04 +11.34 =22.38 Seconds (15)

Discharge or Flow rate = $\frac{149073..6}{22.38} =$

$6.661.02\ X\ 0.8 = 5328.82\ M^3/S$ (16)

NOTE: 0.8 is a correction factor if the river has a moddy embedded soil

(b) JANUARY, 20TH, 2022

Table 7: Field Measurement of the Width of Otamiri in section A

S/N	WIDTHS MEASURED	VALUE OF WIDTHS OBTAINED IN METERS
1	W1	15
2	W2	17.6
3	W3	19.9
4	W4	16.5
5	W5	21.4

Average width from table 7:

$A = \frac{15+17.6+19.9+16.5+21.4}{5} = \frac{90.4}{5} =$

18.08Meters (17)

Where A = Average

Measurement of Depths of the River in Section "A"

Table 8: Field Measurement of the Depth of Otamiri River in section A

S/N	DEPTH MEASURED	VALUE OF DEPTHS OBTAINED IN METERS
1	H1	29.6
2	H2	30.2
3	H3	31.3
4	H4	30.5
5	H5	32.8

Where H1……H5 = Various number of depths measured in section A

$A = \frac{29.6+30.2+31.3+30.5+32.8}{5} = \frac{154}{5} =$ 30.88 Meters (18)

Area of section A is:

Average width multiplied by the depth (W_A X H_A)

Where W_A = Average Value of the Width

H_A = Average Value of the depth

Thus Area becomes

$18.08x30.88 = 558.31\ M^2$ (19)

Table 9: Field Measurement of the Time of float of Yellow Orange on Otamiri River in section A

S/N	TIME RECORDED	VALUE OF TIME OBTAINED IN SECONDS
1	T1	10.5

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2	T2	10.2
3	T3	10.8
4	T4	10.9
5	T5	11.2

Average time from table 9:

$$A = \frac{10.5+10.2+10.8+10.9+11.2}{5} = \frac{53.6}{5} =$$

10.72seconds (20)

SECTION B

Table 10: Field Measurement of the Width of Otamiri in section B

S/N	WIDTHS MEASURED	VALUE OF WIDTHS OBTAINED IN METERS
1	W1	21.5
2	W2	18.2
3	W3	18.7
4	W4	16.4
5	W5	17.6

Average width from table 10:

$$A = \frac{21.5+18.2+18.7+16.4+17.6}{5} = \frac{92.4}{5} = 18.48$$

Meters (21)

Measurement of Depths of the River in Section "B"

Table 11: Field Measurement of the Depth of Otamiri River in section B

S/N	DEPTH MEASURED	VALUE OF DEPTHS OBTAINED IN METERS
1	H1	30.1
2	H2	29.5
3	H3	30.9
4	H4	31.8
5	H5	29.6

Average height from table 11:

$$A = \frac{30.1+29.5+30.9+31.8+29.6}{5} = \frac{151.9}{5} = 30.38$$

Meters (22)

Area of section B = Average width x Average height ie.

W_A X H_A = 18.48 X 30.38 =561.42 M^2

(23)

MEASUREMENT OF TIME OF FLOAT

Table 12: Field Measurement of the Time of float of Yellow Orange on Otamiri River in section B

S/N	TIME RECORDED	VALUE OF TIME OBTAINED IN SECONDS
1	T1	11.2
2	T2	10.0
3	T3	10.9
4	T4	10.5
5	T5	10.8

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Average time from table 12:

$A = \frac{11.2+10.0+10.9+10.5+10.8}{5} = \frac{53.4}{5} =$ 10.68seconds (24)

Total area from sectors A and B = 558.31 + 561.42 = 1119.73 M^2 (25)

Cubic sector of measurement = 1119.73 X 120 (Distance) = 134367.6 m^3 = (26)

Total time = 10.72+10.68 = 21.40

Discharge or Flow rate = $\frac{134367.6}{21.40} = 6728.86x0.8 = 5383.088\ M^3/S$ (27) ‘

(c) TABULATION OF AVERAGE WIDTHS OF OTAMIRI RIVER FROM FIELD WORK

Table 13: Various field measurement of the width of the river at different months

S/N	MONTH	SECTION A	SECTION B	AVERAGE VALUE
1	DECEMBER 2021	19.82M	20.82M	20.32M
2	JANUARY 2022	18.08M	18.48M	18.28M
3	FEBRUARY 2022	21.52M	22.96M	22.24M
4	MARCH 2022	32.74 M	32.44 M	32.59 M
5	APRIL 2022	34.70 M	35.20 M	34.95 M
6	MAY 2022	35.4 M	35.85 M	35.63 M

Where M = Meters

Net Average width becomes:

$\frac{20.32+18.28+22.24+32.59+34.95+35.63}{6} = \frac{222.42}{6} =$ 37.07M (28)

Table 14: Various field measurement of the Depth of the river at different months

S/N	MONTH	SECTION A	SECTION B	AVERAGE VALUE
1	DECEMBER 2021	30.46M	30.70M	30.58M
2	JANUARY 2022	30.88M	30.38M	30.63M
3	FEBRUARY 2022	34.66M	35.76M	35.21M
4	MARCH 2022	35.56M	36.88M	36.22M
5	APRIL 2022	37.76M	37.50M	37.63M
6	MAY 2022	36.92M	37.92M	37.40M

Where M = Meters

Net Average Depth becomes:

$\frac{30.58+30.60+35.21+36.22+37.63+37.40}{6} = \frac{207}{6} =$ 34.61M (29)

(d) TABLE 15 DISCHARGES OF OTAMIRI RIVER FROM FIELD WORK

S/N	**MONTH**	**RESULTS M^3/S**
1	December, 2021	5.33
2	January 2022	5.23
3	February, 2022	7.10
4	March, 2022	11.00
5	April, 2022	12.44
6	May, 2022	12.18

$\frac{5.33+5.23+7.10+11.00+12.44+12.18}{6} = \frac{53.28}{6} =$ 8.88M^3S (30)

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(e) CALCULATION OF HEAD

DECEMBER RIVER HEAD CALULATIONS:

Up to Down hill measurement : 2.13 Meters

Down hill: 0.98 Meters

Effective Head = 2.13 – 0.98 = 1.15 Meters (31)

JANUARY 2022 HEAD CALULATIONS:

Up to Down hill measurement : 2.06 Meters

Down hill: 0.96 meters

Effective Head = 2.06 – 0.96 = 1.10 Meters (32)

FEBRUARY 2022 HEAD CALULATIONS:

Up to Down hill measurement : **2**..16 Meters

Down hill: 0.99 meters

Effective Head = 2.16 – 0.99 = 1.17 Meters (33)

MARCH 2022 HEAD CALULATIONS:

Up to Down hill measurement : 2.02 Meters

Down hill: 0.87 meters

Effective Head = 2.02 – 0.87 = 1.15 Meters (34)

APRIL 2022 HEAD CALULATIONS:

Up to Down hill measurement : 2.26 Meters

Down hill: 0.99 meters

Effective Head = 2.26 – 0.99 = 1.27 Meters (35)

MAY 2022 HEAD CALULATIONS:

Up to Down hill measurement : 2.28 Meters

Down hill: 1.2 meters

Effective Head = 2.28 – 1.2 = 1.08 Meters (36)

AVERAGE VALUE OF HEAD:

$\frac{1.15+1.10+1.17+1.15+1.27+1.08}{6} = \frac{6.92}{6} =$ 1.15Meters (37)

If we assume head loss of 0.05,

The river effective Head becomes 1.15 – 0.05 = 1.1 Meters (38)

(f) CALCULATION OF ENERGY THAT COULD BE OBTAINED FROM OTAMIRI RIVER.

The energy that could be delivered from Otamiri river can be calculated as

$$\boldsymbol{P_t(KW) = 9.81\ X\ Q_{net}\ X\ H_{net}\ X\ \eta_t}$$ (37)

Where

$\mathbf{P_t}$ = Turbine output power

9.81 = Acceleration due to gravity

$\mathbf{H_{net}}$ = Net available Water head in Meters

$\mathbf{Q_{net}}$ = Water discharge or flow rate in M^3/s

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η_t = Turbine efficiency

CALCULATION OF THE OUT PUT POWER FROM OTAMIRI RIVER

$$P_t(KW) = 9.81\ X\ Q_{net}\ X\ H_{net}\ X\ \eta_t \quad (38)$$

Q_{net} = 8.88M^3/S from equation 3.74

H_{net} = 1.1M from equation 3.82

η_t = 92.5% (Most kinetic Turbines have efficiency ranging from 90-95 percent)

$$P_t = 9.81x\ 8.88x1.1x.0.925 = 80.58KW \quad (39)$$

Annual generation n, we have:

P X Hr X CF

(40)

Where :

P_t = Turbine out put power (Installed capacity)

Hr = Hourly generating period 24 hours in a day, 8760 for a year (24 x 365)

CF = Plant capacity factor usually assumed to be 90-95 percent for run-off type of river system

This implies that:

80.58 KW X 8760 X 0.95 = 670,586. 76 KW = 670.6 MW (41)

4 CONCLUSION

In conclusion, the research has been able to assess Otamiri and discover its energy potentials that can sustain the communities around the river. Steady power supply can be achieved if properly harnessed. In addition, the research has shown the depts and widths of the river at various months and different years.

Averagely, the study shows that Otamiri river can generate upto 80.85 KW of electricity and on yearly basis, it can generate up to 670.6 MW. This energy can be tapped through building of small hydro dam. As a source of renewable energy, the environment will be protected unlike the fossil fuel technology, or source of energy. Harnessing this energy potential of Otamiri will certainly attract economic sustenance and boost productivity of the area. In the area of research, this will also aid Federal University of Technology Owerri bounded by the river to enhance their research and other academic activities.

REFERENCES

[1] Akwukwaegbu, I O, Anumaka, M C, Agubor, C N, Illo, F U, Olubiwe M, Obichere J-K C '' evaluation of photovoltaic system irradiation for efficiency and varying temperature effect via measurement'' International Journal of Electrical Engineering and

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

Technology (IJEET) Volume 12, Issue 6, June 2021, pp. 29-46, Article ID: IJEET_12_06_004

[2] Okorafor O.O, Egwuonwu C., and Okereke N. ‘‘Evaluation of the hydropower potential of otammiri river for electric power generation. A Review of Literature on Hydro power’’,2013 ,pp 2031-240

[3] Ibe , K and Uzoukwu, S C ‘‘An Appraisal of Subsurface Geology and Groundwater Resources of Owerri and Environs Based on Electrical Resistivity Survey and Borehole Data Evaluation’’ September, 2001

[4] Simmers ‘‘General Slobe of the Otamiri Water-Shed in Owerri,Imo State Nigeria’’, (2018)

[5] Lory M P “ Microhydro Power Plant Future Energy Source Paperback’’ lap lambert academic publishing, August 18, 2018

[6] Egbomuche R C,. Ekwenye U N, . Udofia G E, Egbomuche R C, ‘‘Physicochemical and Bacteriological Analyses of Eniong River Water and Sediment in Southern Nigeria’’ Asian Journal of Environment & Ecology 23(5):48-63 DOI: 10.9734/ajee/2024/v23i5547 April 2024

[7] Ukagwu, J. I., 1orgi, M. C. and Ohaturuonye, S. ‘‘Assessment of fish distribution, composition and abundance in Otamiri River, Imo State, Nigeria’’, Journal of Aquatic Sciences 38(1), June, 2023

[8] Onyekuru, S O, Nwankwoala, H O, Uzor I, ‘‘ Heavy metal analysis of Otamiri River in Imo state, South-Eastern Nigeria’’, Biodiversity Int J. 2017;1(5):172-175. DOI: 10.15406/bij. 2017 .01.00024, November 30, 2017

[9] Víctor V, Jesus C, Sebastià O, Jonny R, and Lyesse L , ‘‘Induced seismicity in geologic carbon storage’’, https://doi.org/10.5194/se-10-871-2019, Articles Volume 10, issue 3

[10] Ohaturuonye S O, Nwuka C. N, Ukagwu J I Current Ichthyofaunal Survey of Otamiri River, Imo State, Nigeria’’, ournal / Journal of Aquatic Sciences / Vol. 33 No. 1 2018 / Articles

[11] Okechi Reuben Nwoye, Chukwura Edna Ifeyinwa Physicochemical and Bacteriological Qualities of Otamiri River Water and Sediment in South Eastern Nigeria,’’ Frontiers in Environmental Microbiology, http://www.sciencepublishinggroup.com/j/fem doi: 10.11648/j.fem.20200602.12 ISSN: 2469-7869 (Print); ISSN: 2469-8067 (Online) 2020; 6(2): 18-26

[12] Ogah, J. O. Ogah R. O. Ubaka, K. G. ‘‘Bacterioloigical Assesment of Water from Otamiri River in Owerri Imo State,’’ International Journal of Chemistry and Chemical Processes Vol. 4 No. 2 2018 ISSN 2545 – 5265 www.iiardpub.org, 2018

[13] Onojo O J. Chukwudebe G A, Okafor E.N.C., Ogbogu S.O.E, ‘‘Feasibility Investigation of a Hybrid Renewable Energy System as a Back up Power Supply for an ICT Building in Nigeria’’_SAVAP International September 2018, www.savap.org.pk

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