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MATRIC NO: 15/ENG01/007

CHE 574 ALTERNATIVE ENERGY SOURCES ASSIGNMENT

ASSIGNMENT 1:

1. (a) With adequate mathematical relations, explain the various forms of energy
   (b) Distinguish between the sustainable energy and resources and non-sustainable energy and resources.
2. With the aid of appropriate pie chart or bar chart briefly discuss the typical energy resource mix for sustainable energy development and provide your own view the case for the Nigerian environment.

ANSWERS:

1. (a) Although there are many specific types of energy, the two major forms are Kinetic Energy and Potential Energy.
   i. Kinetic Energy: This is the energy in moving objects or mass.
   Mathematically:

$$E_k = \frac{1}{2}mv^2$$

   Where
   E_k = Kinetic Energy
   m = mass of object
   v = speed of object

   Examples of kinetic energy include;
   a. Mechanical Energy
   b. Electrical Energy

ii. Potential Energy: This is any form of energy that has stored potential that can be put to future use.

Mathematically:

$$E_p = mgh$$

Where

E_p = Potential Energy

m = mass

g = acceleration due to gravity

h = height

Examples of potential energy include;

a. Nuclear Energy
b. Chemical Energy

1. (b) SUSTAINABLE ENERGY: This refers to a form or source of energy that meets our today's demand of energy without putting them in danger of getting expired or depleted and can be used over and over again. This means that sustainable energy is power which is able to be replenished within a human lifetime and so cause no long-term damage to the environment. Sustainable energy includes all renewable energy sources, such as hydroelectricity, biomass, geothermal, wind, wave, tidal and solar energies as they are stable and available in plenty. Sustainable energy does not include any sources that are derived from fossil fuels or waste products.
   NON-SUSTAINABLE ENERGY: This refers to energy which over time and duration of its use, will expire or become unusable, have harmful effect to the environment, and ultimately run out and be depleted before a time frame relevant to the human race. If

we are going to use fossil fuels at a steady rate, they will expire soon and have an adverse effect to our planet during its use.

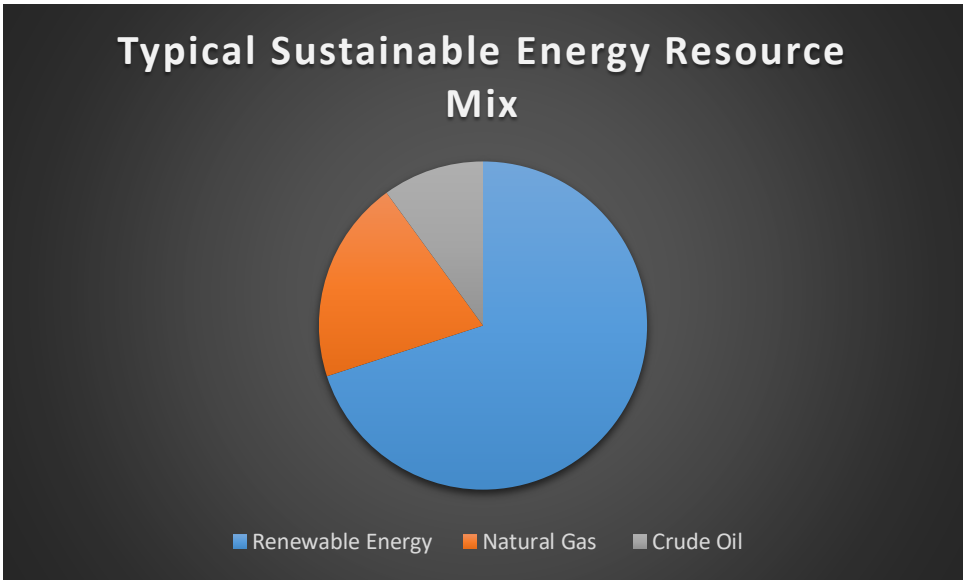


Figure 1: Typical Sustainable Nigerian Energy Resource Pie Chart

2. Nigeria is highly abundant in fossil fuels: crude oil and natural gas which are typically non-sustainable. While sustainable energy resources typically refer to renewable cleaner energy, there are not many facilities in Nigeria to harness these renewable energy and convert them into useful energy in abundant quantities. Therefore, it is in my opinion that to establish a sustainable source of energy in Nigeria, it would have to consist of these renewable and non-renewable energy sources as seen in the pie chart above. The chart depicts that the renewable clean energy would be the dominant energy source while the fossil fuels serve as “support” in meeting the energy demands of the Country.

ASSIGNMENT 3:

1. Monitor the average ambient temperature between on Monday, 17th and Friday, 21st of February 2020 and estimate the average daily thermal energy from the sun reaching land
2. With the aid of a beautiful diagram ONLY, describe anemometer.

ANSWERS:

3.

Day	Average Ambient Temperature	
	Day	Night
Monday 17/02/2020	35 °C	25°C
Tuesday 18/02/2020	36 °C	25°C
Wednesday 19/02/2020	35 °C	25°C
Thursday 20/02/2020	36 °C	25°C
Friday 21/02/2020	37 °C	25°C

solns

$P = \frac{\Delta Q}{\Delta t}$; $P = \frac{K \cdot A \cdot \Delta T}{L}$; $Q = P \times \Delta t$

where P = rate of energy transfer (in Watts)

Q = energy transfer (J)

Δt = change in time (s)

k = thermal conductivity

A = area

L = thickness of material

ΔT = difference in temperature

Assumptions

K_{air} at (35°C – 37°C) = 1.4

A_{land} = area of land in Ibadan = 130,0000 m^2

L = average thickness of air = 0.991m

ΔT =

for Monday = ΔT = 35 – 25 = 10°C

Tuesday = ΔT = 36 – 25 = 11°C

Wednesday ΔT = 35 – 25 = 10°C

Thursday ΔT = 36 – 25 = 11°C

Friday ΔT = 37 – 25 = 12°C

Monday $P = \frac{1.4 \times 1300000 \times 10}{0.991} = 18365287.59W$

$Q = P \times \Delta t$

$\Delta t = 6hrs = 6 \times 3600 = 21600s$

$Q = 18365287.59 \times 21600 = 396700\ MJ$

Tuesday $P = \frac{1.4 \times 1300000 \times 11}{0.991} = 20201816.35W$

$Q = 20201816.35 \times 21600$

$= 436300MJ$

Wednesday $P = \frac{1.4 \times 1300000 \times 10}{0.991} = 18365287.59W$

$Q = 18365287.59 \times 21600 = 396700MJ$

Thursday $P = \frac{1.4 \times 1300000 \times 11}{0.991} = 20201816.35W$

$Q = 20201816.35 \times 21600 = 436300MJ$

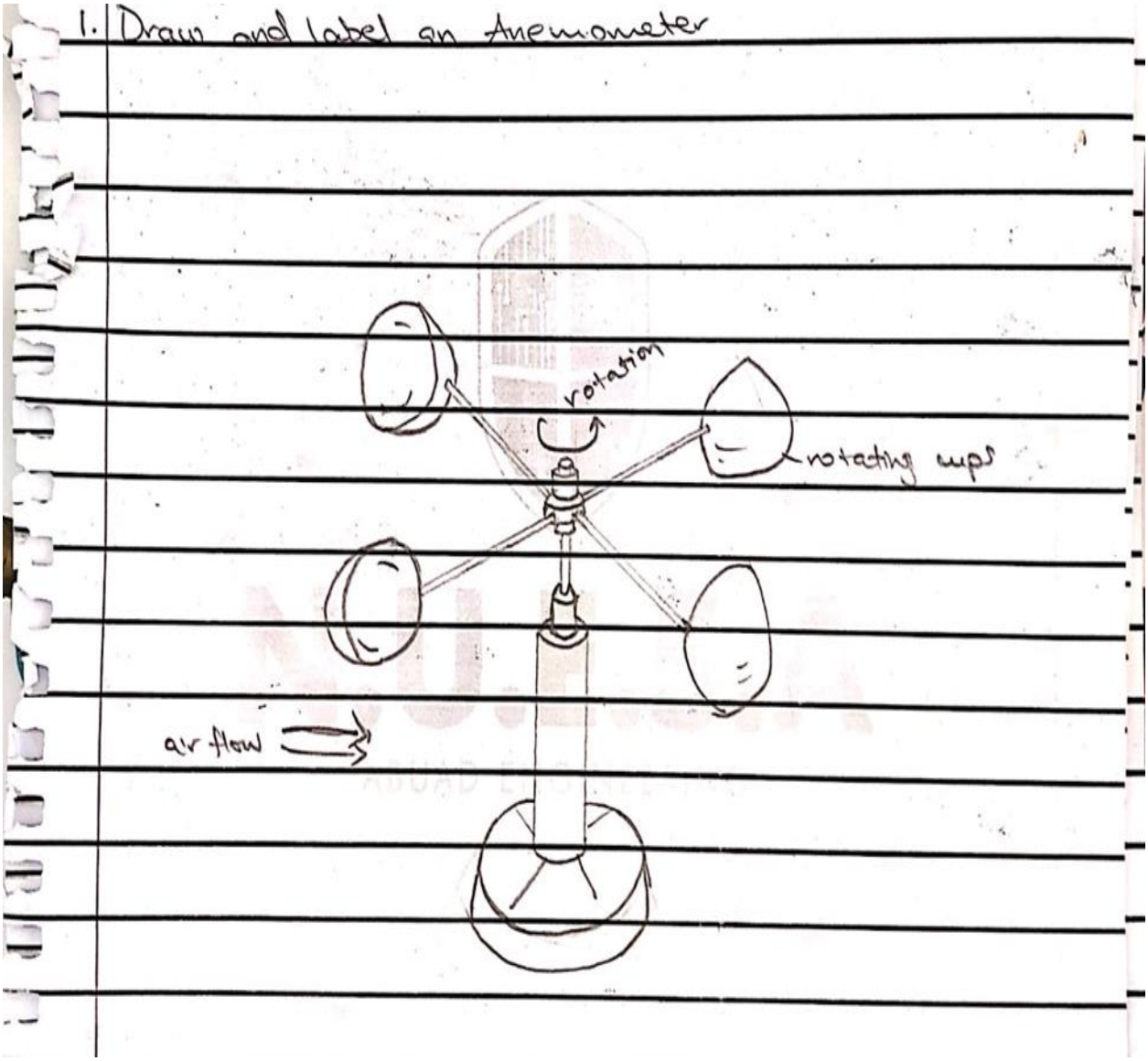
∴ The average daily thermal energy from the sun reading ABUAD is 420460 MJ

Friday $P = \frac{1.4 \times 1300000 \times 12}{0.991} = 22038345.11W$

$Q = 22038345.11 \times 21600 = 476000\ MJ$

Average $= \frac{396700 + 436300 + 396700 + 436300 + 436300}{5}$

$= 420460MJ$



ASSIGNMENT 4:

1. How much energy is being produced from the dams in Nigeria? Compare with the energy produced from crude.

ANSWER:

Table 1: ENERGY GENERATED FROM CRUDE IN NIGERIA

NAME	FUEL TYPE	YEAR COMPLETED	INSTALLED CAPACITY (MW)	INSTALLED AVAILABLE CAPACITY (MW)	ACTUAL GENERATION CAPACITY (MW)
AES	Gas	2001	270	267	0
AFAM IV-V	Gas	1982	580	98	0
AFAM VI	Gas	2009	980	559	523
ALAOJI NIPP	Gas	2015	335	127	110
DELTA	Gas	1990	740	453	300
EGBIN	Gas	1985	1320	931	502
GEREGU	Gas	2007	414	282	138
GEREGU NIPP	Gas	2012	434	424	90
IBOM POWER	Gas	2009	142	115	92
IHOVBOR NIPP	Gas	2012	450	327	225
OKPAI	Gas	2005	480	424	391
OLORUNSOGO	Gas	2007	335	244	232
OLORUNSOGO NIPP	Gas	2012	675	356	87
OMOKU	Gas	2005	150	0	0
OMOTOSHO	Gas	2005	335	242	178
OMOTOSHO NIPP	Gas	2012	450	318	90
RIVERS IPP	Gas	2009	136	166	0
SAPELE	Gas	1978	900	145	81
SAPELE NIPP	Gas	2012	450	205	116
ODUKPANI	Gas	2013	561	70	0
TOTAL			**10,137**	**5,753**	**3,155**

Table 2: ENERGY GENERATED FROM DAMS IN NIGERIA

NAME	FUEL TYPE	YEAR COMPLETED	INSTALLED CAPACITY (MW)	INSTALLED AVAILABLE CAPACITY (MW)	ACTUAL GENERATION CAPACITY (MW)
JEBBA	Hydro	1986	570	427	255
KAINJI	Hydro	1968	760	180	181
SHIRORO	Hydro	1989	600	480	350
TOTAL			**1,930**	**1,087**	**786**

The actual energy generated from dams in Nigeria is about **786 MW** while that actually generated from crude is about **3155MW**.