Covenant University
Canaaland, Km. 10, Idiroko Road, Ota, Ogun State. Tel: +234-1-7900724,7901081, 7913282,7913283

Public Lecture Series
Volume 8. September, 2006.

The Destruction Of The Black Gold, Its Offspring And Human Development

Churchill T. Ako

Public Lecture Series Volume 8. 28th September, 2006

PUBLIC LECTURE SERIES

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Churchill T. Ako
Professor of Chemical Engineering
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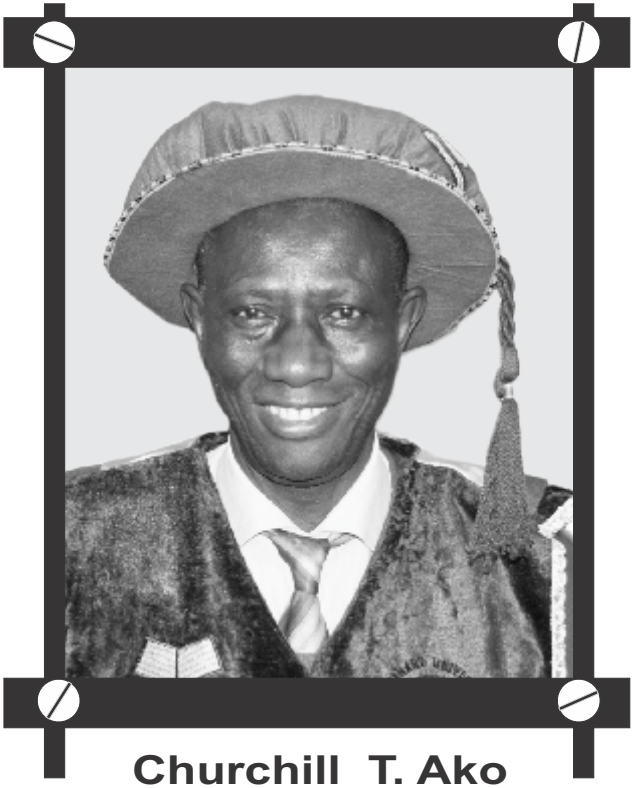

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1.0 . INTRODUCTION.

In its ordinary sense, the term destruction usually has the under current of sadness. Why then would destruction in this context be beneficial to the socio-economic well being of the human race? The reasons will crystallize out. I hope, as I discuss this topic. The black gold simply refers to crude oil or petroleum, its offspring are the products resulting from its destructive physical separation. One may then ask why the name "black gold"?

Gold as we know is a very expensive metal. From ancient times to now, it had always been, it is still a very precious commodity. It is so important that most major world currencies are tied to it. Gold had always been sought after.

The rush for gold led nations to wars and individuals to battles. It made nations that had it to be the super powers of that era. Spain was such a nation between the 16th and 17th centuries.

One cannot easily forget the forays of the Spanish conquistadors into Latin (South) and Central America. The conquest of the Inca empire of Peru and the execution of the Inca himself by the Spanish General Pizzaro was to acquire

the huge gold owned by the "Inca and his people. Another Spanish general Albuquerque[123] exploited Mexico for the same reason. And one of the remote reasons for the Mexican American wars[3] in the 19th century was to control the vast gold that abound in California aka The golden State) and present state of New Mexico, both of which are now part of the United States of America. That abound in California aka The golden State) and present state of New Mexico, both of which are now part of the United States of America.

Coming back home, the various battles of the British with the Ashanti of present day Ghana[4] then the Gold Coast was also to grab the gold that abounds in this West African country. Furthermore, the Boer wars in South Africa between the British and Dutch settlers in the late 19th and early part of the 20th centuries was also to control the vast gold reserves in the Kimberly and Witwatersrand areas of South Africa.

The Congo Logjam of the early sixties which pitched the Western world against the Soviet Union and which resulted in the murder of Congo's first Prime Minister, Patrice Lumumba and the suspicious crash of the plane of then Secretary General of the United nations Daag Hammerzold[4] was to control the rich mineral reserves including gold.

Indeed, gold was (is) so important that even the alchemists of the 16th, 17th and 18th centuries attempted to synthesize it from Carbon.[5]

This historical excursion is to illustrate the very importance of gold. What then is the relevance of pure gold to crude oil or Petroleum.

All of us depend upon crude oil. Everything we do involves oil. World consumption of oil in 2001 was 77 million barrels per day. Only 5 million per day were consumed by OPEC (Organization of Petroleum Exporting Countries). The world's gross Domestic Product is 4o trillion U.S. dollars, out of which the U.S GDP is 10 trillion dollars. The U.S. defense budget is about 0.5 trillion dollars and a lot of this is spent safeguarding oil sources. (Organization of Petroleum Exporting Countries). The world's gross Domestic Product is 4o trillion U.S. dollars, out of which the U.S GDP is 10 trillion dollars. The U.S. defense budget is about 0.5 trillion dollars and a lot of this is spent safeguarding oil sources.

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Exporting Countries). The world's gross Domestic Product is 4o trillion U.S. dollars, out of which the U.S GDP is 10 trillion dollars. The U.S. defense budget is about 0.5 trillion dollars and a lot of this is spent safeguarding oil sources.

It is no wonder, then, that battles have also been fought for crude oil because of its seeming importance or else, how can one explain that a country like United States, whose constitution is based on Christian principles is the strongest supporter of Saudi Arabia (The Muslim headquarters) and all middle eastern countries that possess the commodity? Can any one imagine why the U.S. would "liberate" Kuwait and Iraq with the blood of their citizens? Mr. chancellor Sir, my humble submission is that all these conflicts are mainly to control and safeguard the vast crude oil resources in that part of the world. What may we say about the sustained Scottish Nationalism? It is all about North Sea oil.

We, in Nigeria must count ourselves lucky. We must be thankful to the advent of the Second World War, which suspended the search for oil by Shell D'Arcy, the forerunner of Shell Petroleum Development Company; for if the black gold had been discovered then, I am not too sure we would have had our independence from Britain easily

Before I go into the main ingredients of this presentation, it

may be pertinent to present the spread of the black gold around the world; producers, exporters, consumers and importers in 2004.7 See tables 1.0 and 2.0

Table 1.0 - Greatest oil Reserves by Country, 2006

RANK	COUNTRY	PROVED RESERVES BILLION BARRELS
1	Saudi Arabia	264.3
2	Canada	178.8
3	Iran	132.5
4	Iraq	115
5	Kuwait	101.5
6	United Arab Emirates	97.8
7	Venezuela	79.7
8	Russia	60
9	Libya	39.1
10	Nigeria	35.9
11	United States	21.4
12	China	18.3
13	Qatar	15.2
14	Mexico	12.9
15	Algeria	11.4
16	Brazil	11.2

17	Kazakhstan	9
18	Norway	7.7
19	Azerbaijan	7
20	India	5.8
	Top 20 countries	1034.5
	Rest of the world	68.1
	World total	1,112.6

* Includes reserves from Tar sands

** Excluding strategic reserves.

Table 2.0

TOP WORLD OIL PRODUCERS, EXPORTERS, CONSUMERS, AND IMPORTERS 2004

MILLIONS OF BARRELS PER DAY.

1	Producers[1]	Total Production	Exporters[2]	Net oil Exports	Consumers[3]	Total consumption	Importers[4]	Net oil imports
2	Saudi Arabia	10.37	1. Saudi Arabia	8.73	1. United	20.5	1. United	11.8
3	Russia	9.27	2. Russia	6.67	2. Japan	5.5	2. Japan	5.3
4	United states	8.69	3. Norway	2.91	3. China	5.4	3. China	2.9
5	Iran	4.09	4. Iran	2.55	4. Germany	2.6	4. Germany	2.6
6	Mexico	3.83	5. Venezuela	2.36	5. South Korea	2.6	5. South Korea	2.1
7	China	3.62	6. United Arab Emirates	2.33	6. France	2.3	6. France	2.0
8	Norway	3.16	7. Kuwait	2.20	7. Italy	2.3	7. Italy	1.7
9	Canada	3.14	8. Nigeria	2.19	8. Spain	2.2	8. Spain	1.6
10	Venezuela	2.86	9. South Korea	1.80	9. India	2.1	9. India	1.5
11	United Arab Emirates	2.76	10. France	1.68	10. Taiwan	2.0	10. Taiwan	1.0
12	Kuwait	2.51	11. Mexico	1.48		2.0		

13	Nigeria	2.51		1.34				
14	United Kingdom	2.08		1.06				
15	Iraq	2.03		1.02				

1 Table includes all countries with total oil production exceeding 2 million barrels per day in 2004. Includes Crude oil, natural gas liquids, condensate, refinery gain and other liquids

2 Includes all countries with net exports exceeding 1 million barrels per day in 2004.

3 Includes all countries that consumed more than 2 million barrels per day in 2004

4 Includes all countries that imported more than 1 million barrels per day in 2004.

Source: Energy Information Administration www.eia.doe.gov/emeu/cabs/

Table 1.0 illustrates the spread of proven oil reserves by countries. The observation here is that Canada is ranked second. The Canadian crude reserves include the vast reserves of tap sands. Also observe the position of the United her strategic reserves are not included.

Observe, too, the ranking of top world oil producers, exporters, consumers and importers as at 2004. As illustrated in table 2.0. Notice the relationship between human development and consumption.

The United States of America is clearly the leader. See the position of china whose economy is growing as the fastest in the world. Indeed, all eleven countries have very developed economy.

Finally, the black colour of crude oil is due to the elements present in it; these are mainly sulphur iron and cadmium.

1.0 . DESTRUCTIVE PROCESSES.

Crude oil is not just consumed in that state. It has to be processed, and these processes are what I term "destruction".

The impetuous development of Industrial Chemistry whose laboratory investigations were transformed to the large scale manufacture of chemical products impacted tremendously on human development. What part, therefore has the black gold played? The answer to this question now brings me to the destructive processes. But before I dwell on this, it is important to have a little knowledge on the composition of the black gold.

therefore has the black gold played? The answer to this question now brings me to the destructive processes. But before I dwell on this, it is important to have a little knowledge on the composition of the black gold.

The black gold actually exists in three physical states namely, gaseous, liquid and solid. In this presentation, however, I shall limit myself to both the gaseous and liquid

states.

In all states, crude oil consists of Carbon and hydrogen linked by chemical reactions to form compounds represented by: In all states, crude oil consists of Carbon and hydrogen linked by chemical reactions to form compounds represented by:

1.1 **PARAFFINS**

The paraffin simplest compound (root) is methane. More compounds that have this root are either straight chained or branched. In other words from methane (CH_4, four hydrogen atoms attached to one carbon) are formed, ethane (C_2H_6) i.e. CH_4 "PLUS" CH_2 and so on. However, from C_4H_8 butane, (part of our cooking gas), these compounds assume different branched configurations called isomers. They possess the same physical properties but different chemical properties because of their different structures.

1.2 THE CYCLOPARAFFINS

These exist as closed rings; the simpliest of which is cydopropane C_3H_6 (represented as)It is this paraffin that constitutes wax for the candle industry.

1.3 THE AROMATICS.

This has its root in benzene C_6H_6 which is a closed double bond compound. The next to it is toluene C_7H_9 that is C_6H_6 "plus" CH_3; ethyl benzene C_8H_{11} comes next and so on. The name aromatic may have come from the pleasant smell these compounds exhibit.

1.4 THE PROCESSES

Destructive processes were embarked upon about 90 years ago, because of the many properties of the off springs (fractions) obtained from crude oil, and their potentials to impact on human development. Destructive processes permit the transformation of the diverse fractions (off springs) into diverse products that find end use in energy and provide raw materials for the petrochemical industries.
The advert of the internal combustion engine (automobiles), jet engines and so on has, therefore made it necessary for these processes to be developed further. Further more these processes have been applied to the modification of the chemical composition of all fractions of the black gold including the light ones like ethane and propane for human development. Gold including the light ones like ethane and propane for human development.

This destruction takes the form of Catalytic reforming

Catalytic cracking Low pressure cracking deep cracking and viscosity breaking depending on the products' we seek.

Usually Petroleum fractions are made up of several large molecular weight compounds. These can be destroyed by thermal cracking to produce lighter compounds. For instance butane can be destroyed to produce propylene and methane.

$$C_4H_{10} \xrightarrow[\text{at high temperature}]{\text{"destroy"}} C_3H_6 + CH_4$$

Propylene methane

The importance of propylene (an Olefin) in the development of human economic progress cannot be over emphasized.

The last twenty years has witnessed the development of Catalytic cracking; this along with catalytic reforming ensures the production of quality petrol that we use today. Catalytic cracking also ensures the production of the Butane-Butene fraction, an extremely important precursor for the petrochemical industry.

It is these products that are destroyed into new indispensable substances for the production of motor fuels of high quality and production of raw materials for the petrochemical industry.

Permit me, now to summarize these destructive processes.

THE GASSES (METHANE, ETHANE, PROPANE BUTAN)

Methane is a principal raw material for the petrochemical industry. It is also used as energy source for electric power

TABLE 3.0

2.5 CLASSIFICATION OF DESTRUCTIVE PROCESSES.

NAME OF PROCESS	NATURE OF PREPONDERANT REACTION	DETERMINANT PARAMETERS AND PRODUCTS
Thermal Cracking	Non catalytic decomposition	High pressures above 15 atoms polymerization reactions are secondary. Low pressure, pressure below 5 atmospheres. No secondary reaction (pyrolysis). Formation of Olefins for petrochemical industry large deep conversion for coke formation (coking)
Catalytic Cracking	Catalytic decomposition	Cracking Catalysts.

plant.

The Eleme petrochemical plant uses wet methane as raw material. However, it is yet to produce some products that are essential to industrial growth.

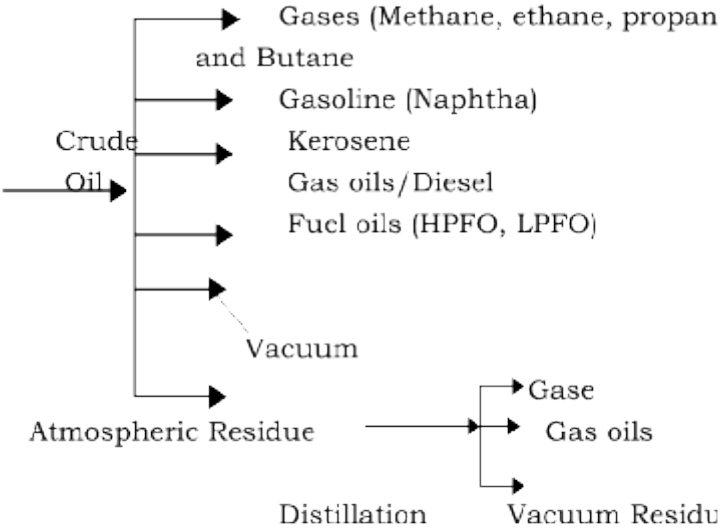

Fig. 1 Products (offspring) from atmospheric and vacuum distillation

The other principal raw materials for the petrochemical industry are:

I. A mixture of ethane and propane

II. Normal butane and Iso butane.

I should state here, too that the propane, butane mixture constitutes our cooking gas (LPG).

Ethane ¾¾¾® ethylene + hydrogen
"destroy"

The sources of the Olefins needed for the petrochemical industry are ethane, propane and the butanes. For example if ethane is destroyed, ethylene and hydrogen will be formed.

Industry are ethane, propane and the butanes. For example if ethane is destroyed, ethylene and hydrogen will be formed.

The destruction of the higher homologens will give us higher Olefins. For example:

Propane ¾¾¾® ethylene + Methane
"destroy"

Propane ¾¾¾® Propylene + Hydrogen
"destroy"

NAPHATHA (Raw Gasoline)

In most refineries, this is the most important fraction. Most motor fuels are made from this by destructive processes.

The destructive processes here take the form of catalytic reforming; in order to upgrade the quality of the naphtha.

This will increase the so-called octane number; a number that measures the anti knock properties of internal combustion engines. The naphtha which is low in aromatic content but high in paraffin and cycloparaffin contents undergo some reactions, mainly isomerization cylclization and dehydrocyclization in which the aromatic contents are highly increased.

The product from this process known as platformate is further blended with naphtha and some other chemicals like alcohol to produce five star, premium and regular petrol for our automobiles.
Kerosene.

This is another important “offspring” of the black gold. In most third world countries this product is used as fuel for domestic cooking. Furthermore when refined it becomes aviation fuel. The shortage of this fuel means that air transportation is limited.

However the demand for petroleum products which has shifted to high ratios of petrol and jet fuel compared with the usages of diesel fuel and home heating oils is now responsible for kerosene to be destroyed by hydro cracking. Also, product, hydrogen which is an important product is

obtained at low cost. Modern hydro cracking units were developed and operated commercially first by Chevron in 1958.

ATMOSPHERIC Gas Oil [9]

Again, the demand for petrol, jet fuel and diesel, and lubricating oil has made it necessary to destroy gas oils., Gas oils from atmospheric distillation and
vacuum distillation are subjected to catalytic cracking and hydro cracking to produce improved naphtha, jet fuel, diesel and lube oil table 4 illustrates the various products obtained by this destruction.

FEED	PRODUCTS
Kerosene	Naphtha + Hydrogen
Straight-run diesel	Naphtha and/or jet fuel
Atmospheric Gas oil	Naphtha and/or jet fuel and/or diesel
Light FCC cycle gas oil	Naphtha.

Table 4: Typical Hdrocracker Feedstocks (9), (10), (11), (12).

Catalytic cracking (destruction) of the gas-oils has as its primary aim, the conversion of gas oils to high octane number naphtha (gasoline). The gasoline obtained has

research octane number ranging form 92 to 99. Let me clarify here the term gasoline or naphtha. In the U.S., Canada and South America Petrol is known as gasoline. In continental Europe Petrol is known as “Benzina”

The table below shows world gasoline consumption in 2005 and it underscores the importance of gasoline (petrol) as far as transportation is concerned.

COUNTRY	% CONSUMPTION
U.S.A	43
Asia and Oceanic	17
Western Europe	14
Central & South America	7
Canada	6
Eastern Europe including former Soviet Union	6
Middle East	4
Africa.	3

The world Gasoline (Petrol) consumption 2001.

This table suggests indirectly the inter relationship between developed economies and gasoline consumption observe the figures for the U.S., Asia mainly Japan, South Korea, china, India and Singapore and Europe. Notice also the position of Canada. As usual the seriously underdeveloped

economy of Africa is clearly illustrated here.

Indeed, the consumption of Petrol and other oil products is growing around the world especially in rapidly developing countries such as India and China. China is now the second largest energy user after the U.S. mainly owning to the largest demand for petrol, global black gold demand grew by 3.2 percent in 2004 or by more than 2400 million liters a day and it continues to climb in 2005 and 2006.

FUEL OILS.

Historically, heavy residual fuel oils have been burned to produce electric power and to supply energy needs of heavy industry, but more severe environmental restrictions have caused many of these users to switch to natural gas.

These fuels can be destroyed by coking units. These units convert heavy feed stocks into a solid coke and lower boiling hydrocarbon products. From a chemical reaction view point, coking can be considered as a severe thermal cracking process in which one of the end products is carbon.

Coking is also used to produce a high quality needle coke" and coal far pitch. The coke is used as electrodes, synthetic graphite, aluminum anodes, carbon raiser, silicon carbide, foundaries, space heating in Europe/Japan. Industrial boilses, cogeneration and cement plants.

I have somehow, summarized the major products obtained by the destructive processing of crude oil and its primary products.

However, this exercise will not be complete without the discussion of Petrochemical products. As I had earlier mentioned, the Olefins, benzenes, Toluene and Xylenes (BTX) and ethyl benzene form the basis of the petrochemical industry. The butylenes resulting from the destruction of isobutene by way of catalytic dehydrogenation finally results in formation of butyric rubber and Polyisobutylic plastics. Similarly cyclohexane forms adipic acid which in turn is processed to synthetic fibres e.g. Nylon 66 Perlon T, Perlon U or igamide, all materials for the textile industries.
The aromatics resulting from the destruction of naphtha by catalytic reforming results in the production of many compounds.

For instance ethyl Benzenes is processed further to produce synthetic rubber. Ethyl benzene is also processed further to linear alkyl benzene and hence to detergents (Kaduna refinery and Petrochemical company phase 1) Paraxylene is also processed to textile materials (Polyesters)

Orth-oxylene undergoes oxidation to form numerous dye

products for the textile industry. Toluene and paraxylene undergo destruction to therephthatic acid and thence to synthetic fibres (Terylene, Dacron and Teron) again for the textile industries.

It is clear that the consumption of these products bears some relationship with the development of the human race.

Take the example of India whose growth rate is comparable with that of China and which is predicted to become the 5th largest economy in twenty years time. The domestic petrochemical industry is growing at a rate of 14-15%. The consumption of the commodity plastics and synthetic fibers during 2001 02 was 3.8 million tones and 1.65 million tones respectfully. This has reduced import dependency of petrochemicals. Indeed, at present India is exporting polyethylene and polypropylene and Polystyrene.

Nigeria started well in the late seventies ad early eighties by building a petrochemical plant in Kaduna refinery to produce linear Alkyl Benzene for the manufacture of detergents; another in Warri Refinery and Petrochemical company to produce carbon black, Poly Venyl Chloride (PVC) and a near comprehensive company at Eleme whose aim was to produce plastics PVC's therepthalic acid, a precursor for the

production of synthetic fibres, like terylene, Dacron and Teron. Unfortunately, these objectives could not be met because of bad management!! The aromatics resulting from the destruction of naphtha by catalytic reforming results in the production of many compounds. Produce linear Alkyl Benzene for the manufacture of detergents; another in Warri Refinery and Petrochemical company to produce carbon black, Poly Venyl Chloride (PVC) and a near comprehensive company at Eleme whose aim was to produce plastics PVC's therepthalic acid, a precursor for the production of synthetic fibres, like terylene, Dacron and Teron. Unfortunately, these objectives could not be met because of bad management!!

It is my hope, be as it may that the present domestic petrochemical industry will have a sustained growth by giving it proper direction and support. The plastics, fibers and rubber industry could also provide an impetus to the development of the downstream processing sector so as to provide employment opportunities for our youths.

In order to keep the aforementioned objectives, one hopes that in the next 15 years or so, our aim would be.

I. To bear in mind global competitiveness in the regime of reduced tariffs.

II. Quality consciousness
III. Environmental responsibility.
IV. Research and Development

COVENANT UNIVERSITY CONNECTION

The setting up of any of the units is capital intensive and runs into hundreds of million of dollars.

The aromatics resulting from the destruction of naphtha by catalytic reforming results in the production of many compounds.

However, there are simple products which the Chemical/Mechanical engineering and Chemistry departments can look into.

These are formulation of lubricating oils and the manufacture of candles. The starting point is simply the base oil from atmospheric and vacuum distillation unit. In addition there are the apparatuses to measure the various properties of lubricating oils like viscosity, viscosity index, pour point, oxidation resistance, flash point, boiling temperature and acidity (neutralization number).

CONCLUSIONS

I have reviewed the importance of materials resulting from the destructive processing of crude oil and its products. I have attempted to draw the relationship between these and human developments. The world economy is predicted on these products mainly.

Te table below illustrates for the sake of emphasis the relationship between oil consumption and per capita. For some selected countries.

S/N	COUNTRY	OIL CONSUMPTION PER CAPITA
1	Singapore	1.593
2	United states	0.672
3	Saudi Arabia	0.672
4	Canada	0.668
5	Belgium	0.602
6	Netherlands	0.561
7	Norway	0.56
8	South Korea	0.446
9	Japan	0.438
10	Israel	0.43
11	Germany	0.325
12	Italy	0.323
13	United Kingdom	0.285
14	Russia	0.195
15	South Africa	0.109
16	Egypt	0.073
17	Nigeria	0.024
18	Zimbabwe	0.019
19	Ghana	0.018
20	Togo	0.016

Oil consumption per capita.

There has been suggestion as regards the partial, if not total independence of crude oil as energy source. Nobody has spoken about how the precursors of the petrochemical industry will be obtained.

In any case, I attended a conference of the American Institute of chemical Engineers in 1974 in Los Angeles as a graduate student representative of the University of Southern California. There, project 2000 was enunciated. This project was a policy statement by the U.S. to be independent of imported oil especially from the then considered hostile Arab countries. We are in 2006. We know that the U.S. still depends mainly on imported oil as was observed in one of the tables earlier discussed.

Just recently, in February 2006, in his state of the Nation message, the U.S. president launched another project that will curtail the dependence on foreign oil by sourcing energy from agricultural, solar, wind, hydrogen, thermal and coal. Let me draw the attention of this august audience, that alcohol is already an additive in the production of petrol. Mr. Chancellor Sir, and Madam, Vice Chancellor, Ma; my humble submission, therefore is that as lofty as these targets are, they will take another fifty years to meet if it is possible at all. What is likely to happen will be the development of new

advanced technology to find more black gold wherever they exist and improve on new methods of producing the vast reserves in places like Canada.

Mr. Chancellor Sir, Madam Vice Chancellor, Ma. I rest my humble case.

Thank you all for being a wonderful audience.

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Produced by:
Corporate & Public Affairs Unit
Covenant University
Canaaland, Km. 10, Idiroko Road, Ota, Ogun State, Nigeria
Tel: +234-1-7900724,7901081, 7913282,7913283