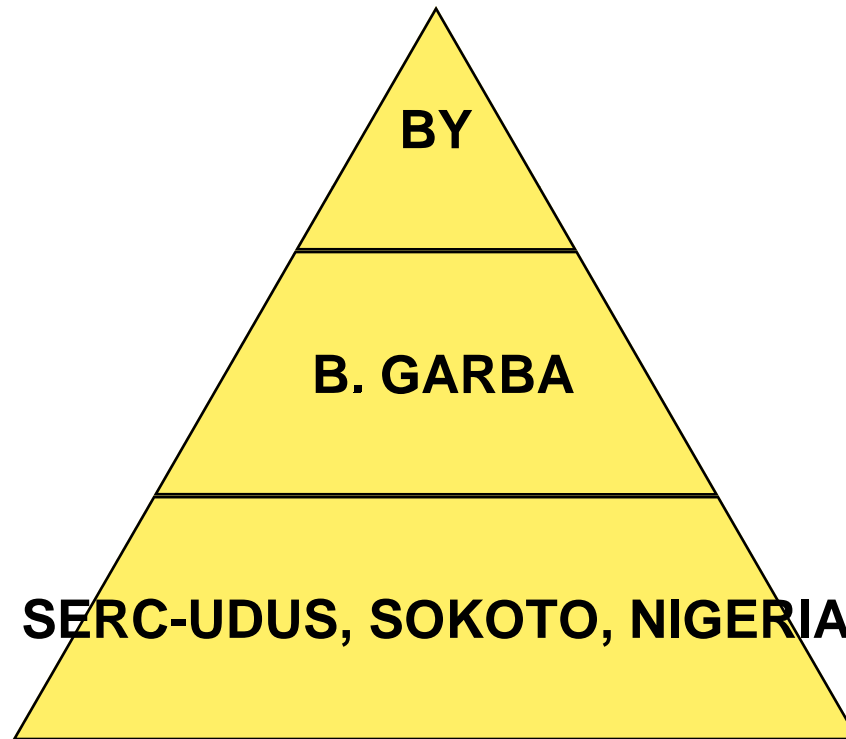
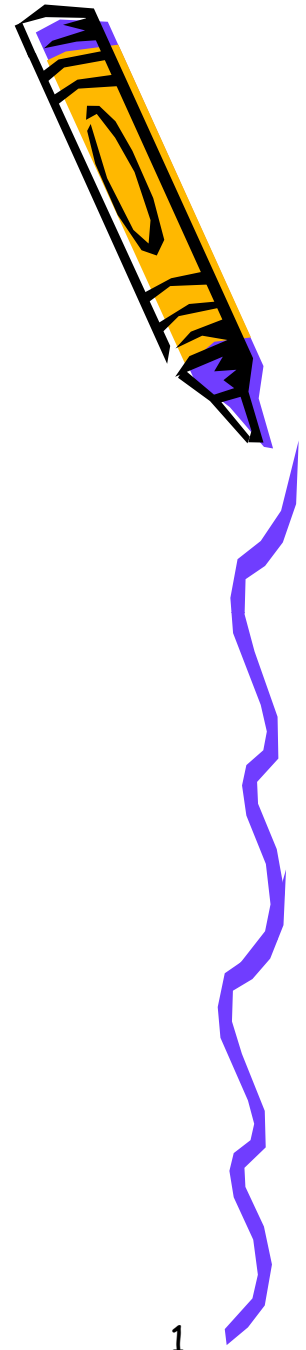


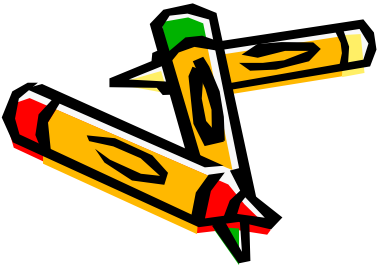


# OVERVIEW OF BIOMASS ENERGY RESOURCES, TECHNOLOGIES AND PROGRAMMES IN NIGERIA



# 1.0 INTRODUCTION

- Nigeria is located on the West Coast of Africa and came into being in 1914, it covers a land area of 923,768 square km. The climate in Nigeria is sub-tropical with an estimated population of about 130 million people. The political structure is Federation with 36 states and the capital city is Abuja. Nigeria gained her independence on October 1<sup>st</sup> 1960 and became a republic state in 1963. The official language is English.



# INTRODUCTION ( Cont. )

- Energy is the mainstay of Nigeria's economic growth and development. It plays a significant role in the nation's international diplomacy. It serves as a tradable commodity for the earning of national income, which is used to support government's development programmes.
- Energy serves as an input into the production of goods and services in the nation's industry, transport, agriculture, health and education sectors.

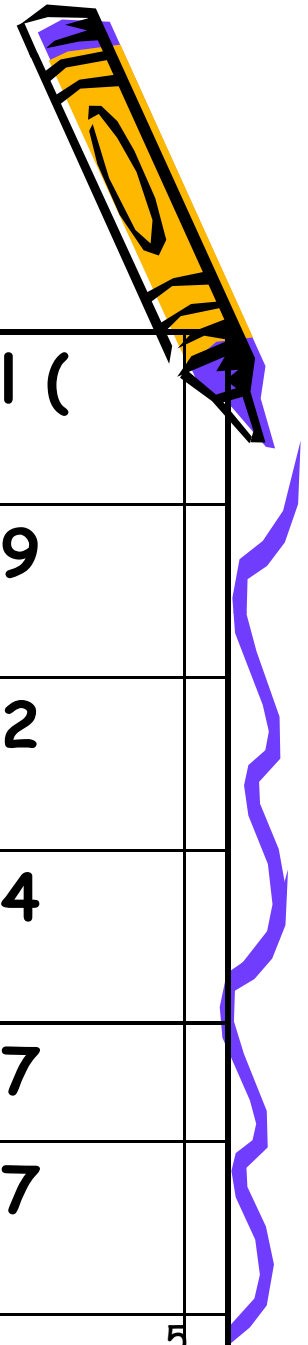


# INTRODUCTION (Cont.)

- Oil and gas has continued to contribute more than 70% of Nigeria's income.
- Crude oil has over the last five years contributed an average of 13.5% to Nigeria's Gross Domestic Product (GDP), representing the highest contributor after crop production.
- The contribution of energy to GDP is expected to be higher when we take into account Renewable Energy Utilization, especially biomass which contribute about 90% of the energy used by the rural dwellers.



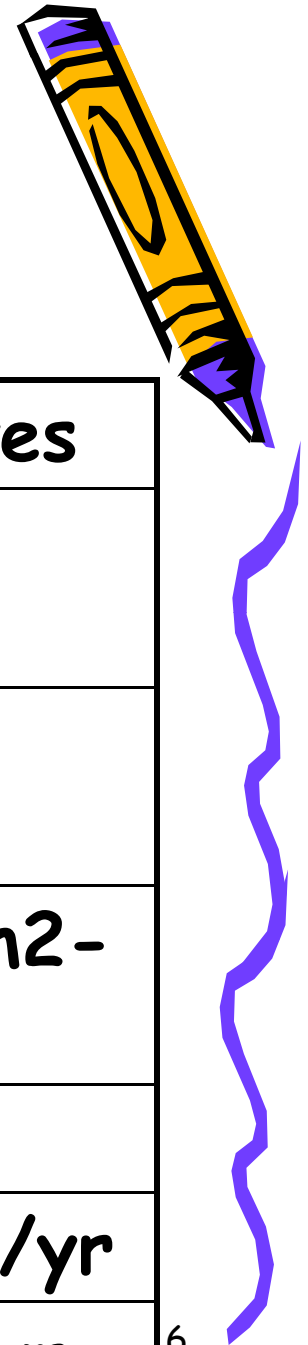
# 2.0 NIGERIA'S CONVENTIONAL ENERGY RESOURCES



Resource Type	Reserves (Nat. Unit)	Energy Unit (billion toe)	Total (%)
Crude oil	31.5 billion barrels	4.284	26.69
Natural gas	159 trillion cu. ft	3.679	22.92
Coal lignite	2.75 billion tonnes	1.917	11.94
Tar sands	31 billion boe	4.216	26.27
Hydropower	10,000 Mw	1.954	12.17
Nuclear	Not available	-	-



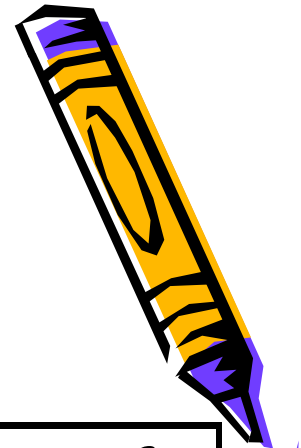
# 3.0 RENEWABLE ENERGY RESOURCE ENDOWMENT IN NIGERIA



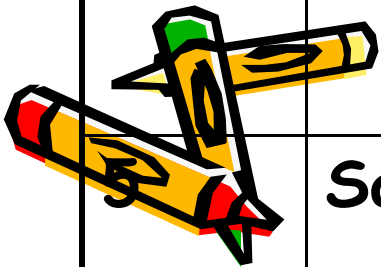
Type	Estimated Reserves
Large Scale Hydropower	10,000MW
Small Scale Hydropower	734MW
Solar Radiation	3.5-7.0 KWh/m <sup>2</sup> -day
Wind	2-4 m/s
Telwood	43.3 x 10 <sup>6</sup> tonnes/yr
Animal waste	61 x 10 <sup>6</sup> tonnes/yr



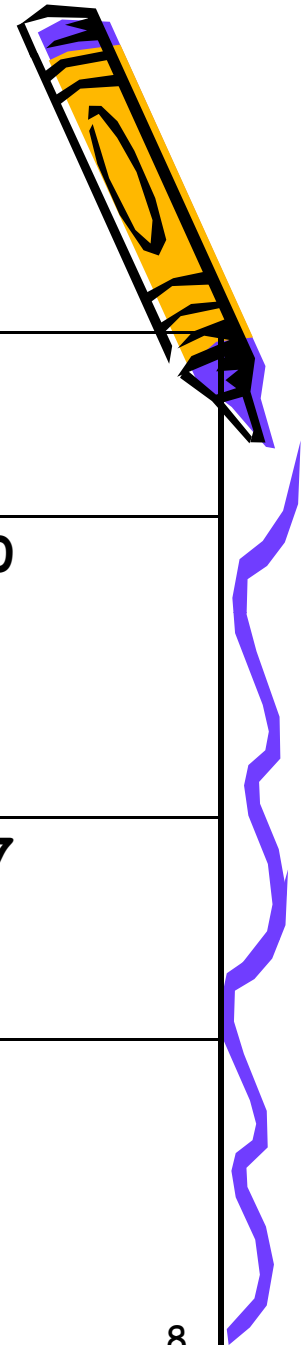
# 4.0 ELECTRIC POWER STATIONS IN NIGERIA



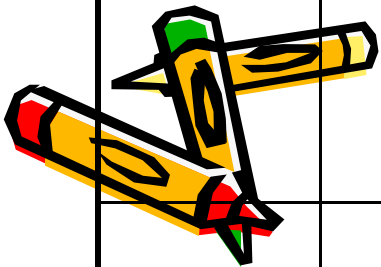
S/N	Plant	Year Comm.	Type/Fuel used	Installed Capacity (MW)	No. of Turbines
1	Kainji	1968	Hydro	760	8
2	Jebba	1986	Hydro	578	6
3	Shiroro	1990	Hydro	600	4
4	Egbim	1985	Thermal Steam/Natural Gas	1320	6
5	Sapele	i) 1978 ii) 1981	i) Thermal Steam	720 300	10 7



# ELECTRIC POWER STATIONS IN NIGERIA (Cont.)

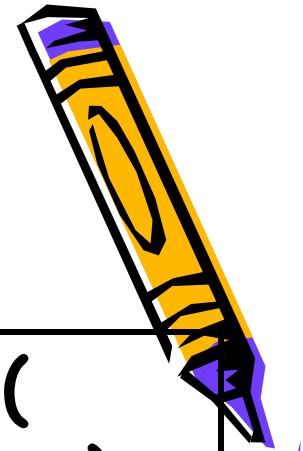


6	Ijora	1978	Thermal gas turbine/ NG	600	3
7	Delta	1975	Thermal gas turbine/ NG	912	20
8	Afam	1963	Thermal gas turbine/ NG	711	17
9	Oji		Thermal gas turbine/ NG	30	
			TOTAL	5,991	8

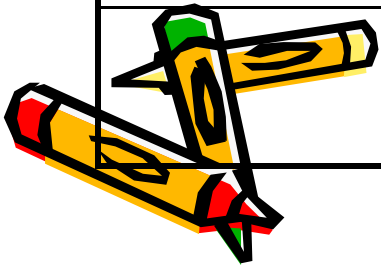




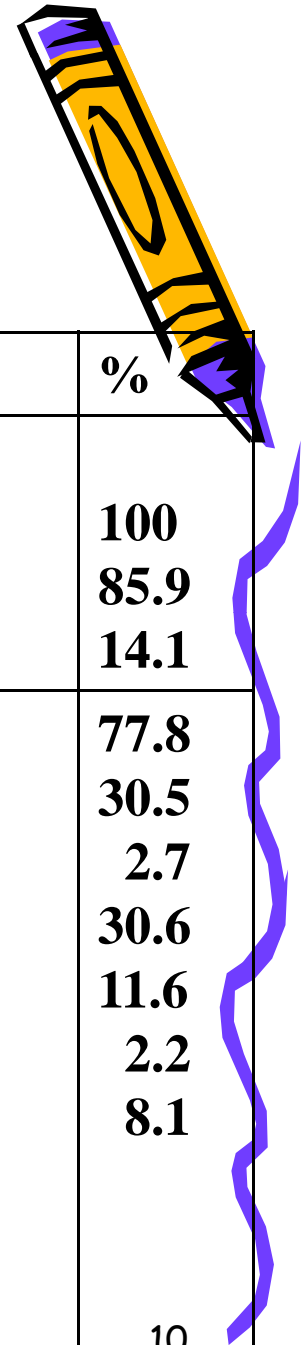
# 5.0 NIGERIA'S REFINERIES WITH INSTALLED CAPACITY



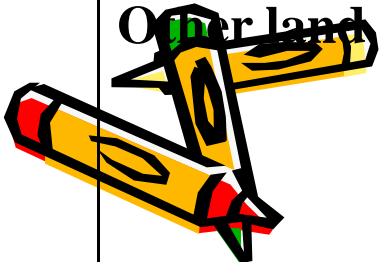
Refinery	Year Commissioned	Capacity (barrels/day)
Old P/H	1965	60,000
New P/H	1989	150,000
Warri	1978	125,000
Kaduna	1980	110,000
	TOTAL	445,000



# 6.0 : Nigeria's Size and Land use Parameters



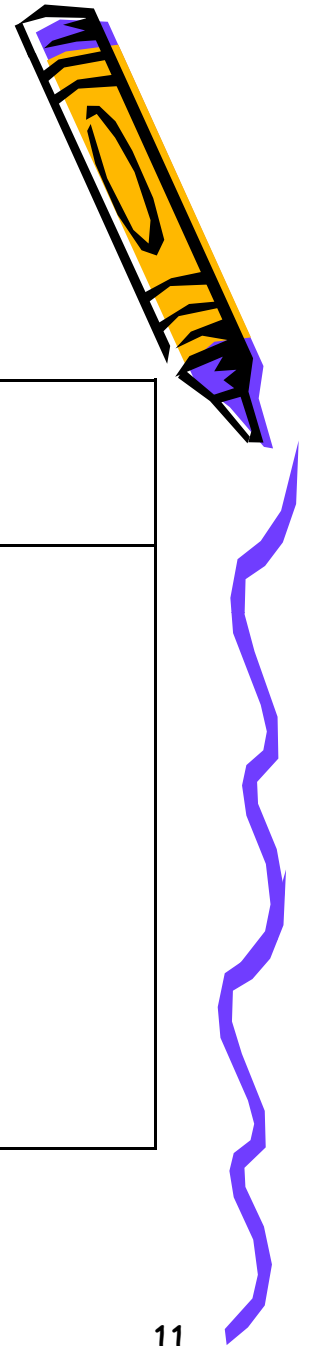
Nigeria	Quantity (Million ha)	%
<b>A. SIZE</b>		
Total Area	92.4	100
Land area	79.4	85.9
Water bodies (rivers, lakes etc)	13.0	14.1
<b>B. LAND USE</b>	71.9	77.8
Agricultural land	28.2	30.5
Arable cropland	2.5	2.7
Permanent cropland	28.3	30.6
Pasture land	10.9	11.6
Forest and woodland	2.0	2.2
Fadama	7.5	8.1
Other land		10



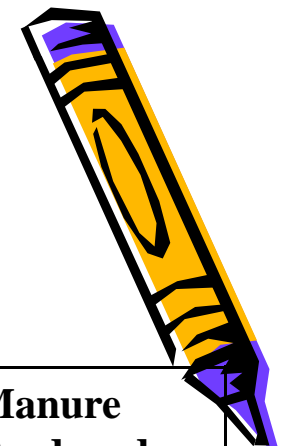
Source: Federal Ministry of Agriculture

## 7.0 : Nigeria's Livestock Population (in millions)

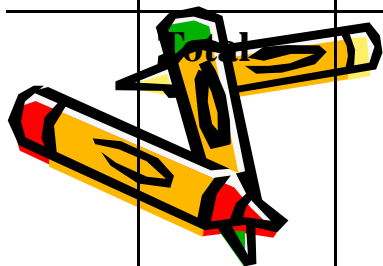
Livestock	1995	1996	2001
Cattle	17.6	18.1	21.0
Sheep	32.4	33.2	38.5
Goat	51.5	53.8	62.4
Pig	6.7	8.3	9.6
Poultry	96.1	97.3	112.9



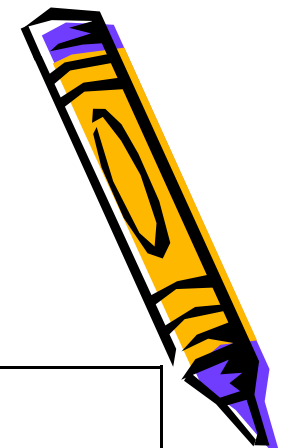
# 8.0 : Calculated manure production of Nigeria's livestock



S/No	Livestock	England		Nigeria			Manure Produced
		Population (millions)	Manure produced (million tones)	FMA (1997) population (million)	Manure produced (calculated figures) (million tones)	Population based on FMA (1997) figures (millions)	2001 (Calculated figures) (million tones)
1.	Cattle	85	80	18.1	170.4	21.0	197.6
2.	Sheep	28	11	33.2	13.0	38.5	15.1
3.	Goat			53.8	21.1	62.4	24.5
4.	Pig	69	11	8.3	13.2	9.6	15.3
5.	Poultry	104	30	97.3	28.1	112.9	32.6
			132		245.9		285.1

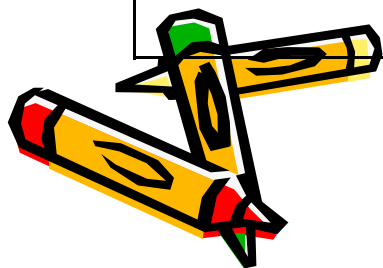


# 9.0 : Nigeria's Production of Major Crops (Million Tones)



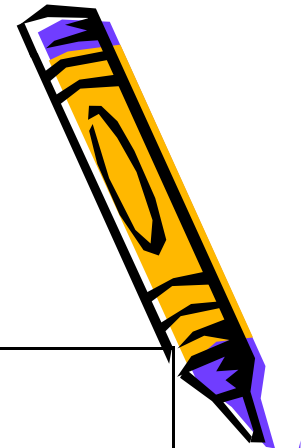
S/N	Crop	1995	1996
1.	Cereal grains	22.9	21.7
2.	Tubers	56.7	57.4
3.	Pulses	2.0	2.2
4.	Plantain	1.6	1.7
5.	Vegetables	2.6	3.5
6.	Industrial crops	3.7	6.8
	<b>Total</b>	<b>89.5</b>	<b>93.3</b>

Source Federal Ministry of Agriculture

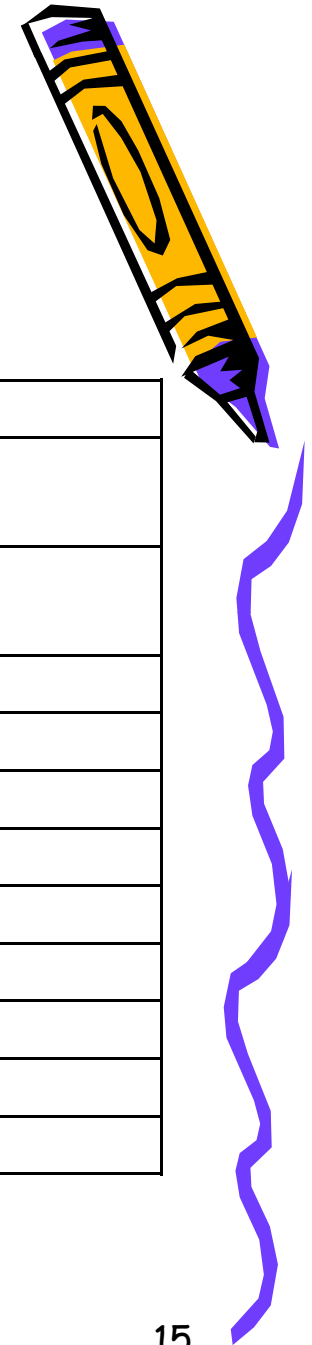


# 10.0 : Estimated Nigeria's Wood Requirements (in '000 m<sup>3</sup>)

	1993	2000	2010
<b>Fuelwood</b>	<b>103,474</b>	<b>109,966</b>	<b>111,102</b>
<b>Utility Wood</b>	<b>2,514</b>	<b>2,874</b>	<b>3,441</b>
<b>Sawlogs</b>	<b>6,182</b>	<b>8,398</b>	<b>12,864</b>
<b>Veneer logs</b>	<b>618</b>	<b>857</b>	<b>1,359</b>
<b>Particleboard</b>	<b>69</b>	<b>111</b>	<b>230</b>
<b>Softwood</b>	<b>640</b>	<b>540</b>	<b>958</b>
<b>TOTAL</b>	<b>113,497</b>	<b>122,746</b>	<b>129,954</b>



# 11.0: Summary of Forest Plantation Resources in Nigeria

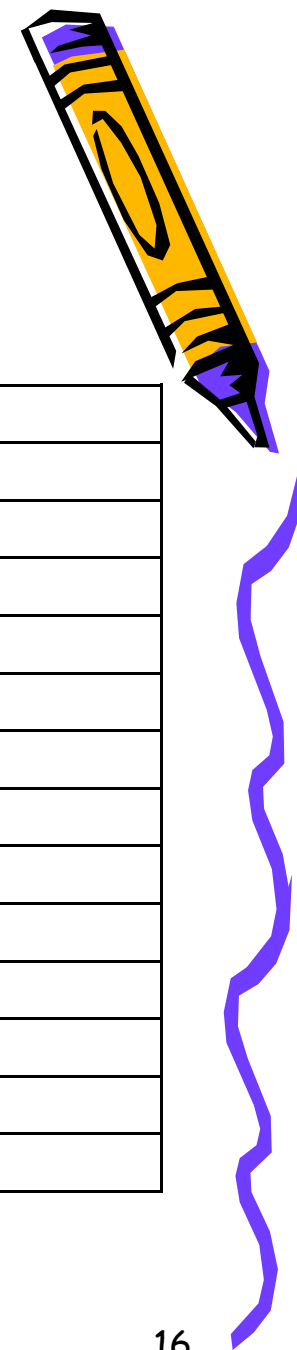


STATE	Gmelina Sp.	Others	Total
	Area	Area	Area
	(ha)	(ha)	(ha)
AKWA IBOM	1,000	2,000	3,000
ANAMBRA	12,000	3,000	15,000
BAUCHI	-	1,000	1,000
BENDEL	6,000	14,000	20,000
BENUE	-	5,000	5,000
BORNO	-	9,000	9,000
CROSS RIVER	15,000	4,000	19,000
GONGOLA	-	3,000	3,000
IMO	3,000	-	3,000



# Summary of Forest Plantation Resources in Nigeria(Cont.)

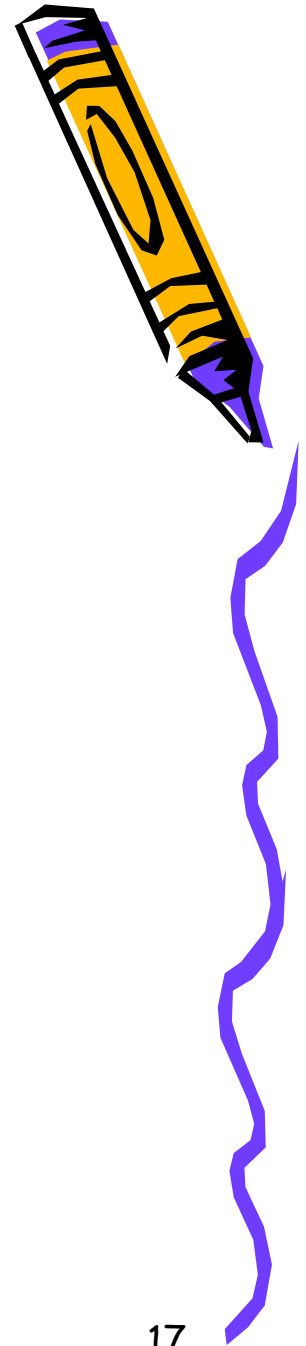
KADUNA	-	6,000	6,000
KANO	1,000	10,000	11,000
KATSINA	-	4,000	4,000
KWARA	4,000	2,000	6,000
LAGOS	-	1,000	1,000
NIGER	2,000	3,000	5,000
OGUN	20,000	10,000	30,000
ONDO	20,000	21,000	41,000
OYO	3,000	15,000	18,000
PLATEAU	2,000	4,000	6,000
RIVERS	-	-	-
SOKOTO	-	9,000	9,000
ABUJA	-	-	-
<b>TOTAL</b>	<b>89,000</b>	<b>126,000</b>	<b>215,000</b>





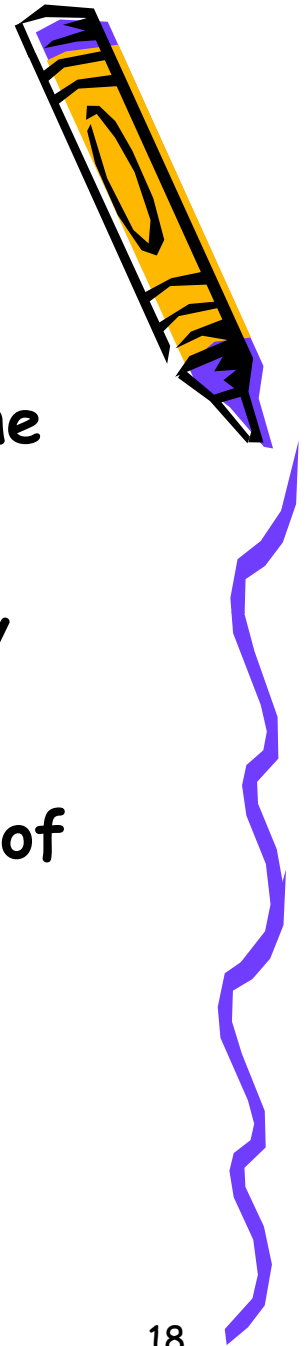
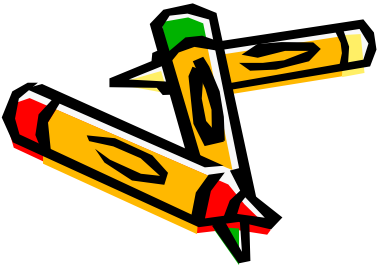
# 12.0 :BIOMASS TECHNOLOGY IN NIGERIA

- ✓ Of the technologies for conversion of biomass into gaseous, liquid and solid fuels and electricity only direct combustion (for heat ), biomass briquetting and anaerobic digestion ( biogas production) have received attention in Nigeria. Modern biomass conversion technologies such as gasification, pyrolysis etc are still at planning stage in Nigeria.



# BIOMASS TECHNOLOGY IN NIGERIA ( Cont. )

- ✓ In Nigeria, work on biogas started after the Federal Government established the two Renewable Energy Centres at Sokoto and Nsukka. These two Centres along with many tertiary institutions have been involved in biogas research activities. Some pilot demonstration plants with a capacity range of between 10 and 20m<sup>3</sup> have already being established in different locations of the country.



# BIOMASS TECHNOLOGY IN NIGERIA ( Cont. )

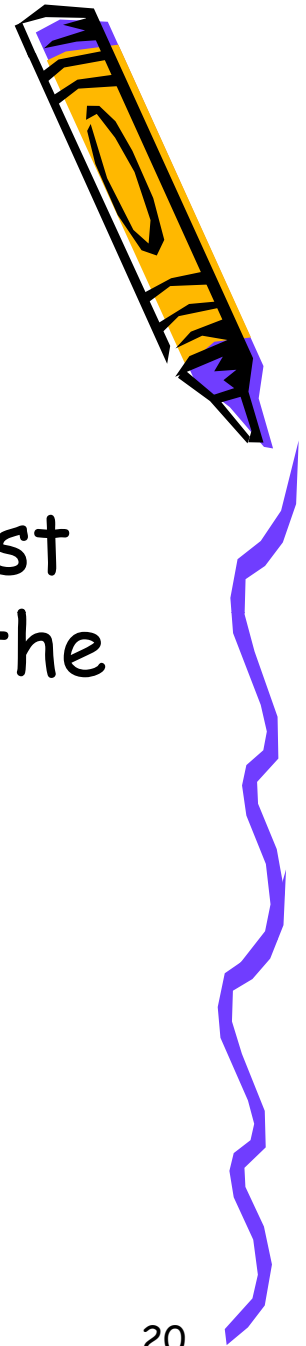


- ✓ In Nigeria, several machines have been developed for briquettes production, these include:
  - ❖ Single cylinder extrusion machine that transform rice, millet husk and sawdust to briquettes ( Developed by SERC ).
  - ❖ Screw press machine for sawdust briquetting (OAU Ile Ife).
  - ❖ Simple tabletop close-end piston process fitted with both pressure and dial gauge has been developed by Univ. of Ibadan for briquetting using rattan furniture waste.
  - ❖ The latest development is the briquetting machine developed by the Centre for Industrial Studies of the ATBU Bauchi in collaboration with RMRDC Abuja. This machine has four pistons and cylinders, a hopper with four feed holes, cover and locking device and a crank arrangement as the major operating parts.



# BIOMASS TECHNOLOGY IN NIGERIA ( Cont. )

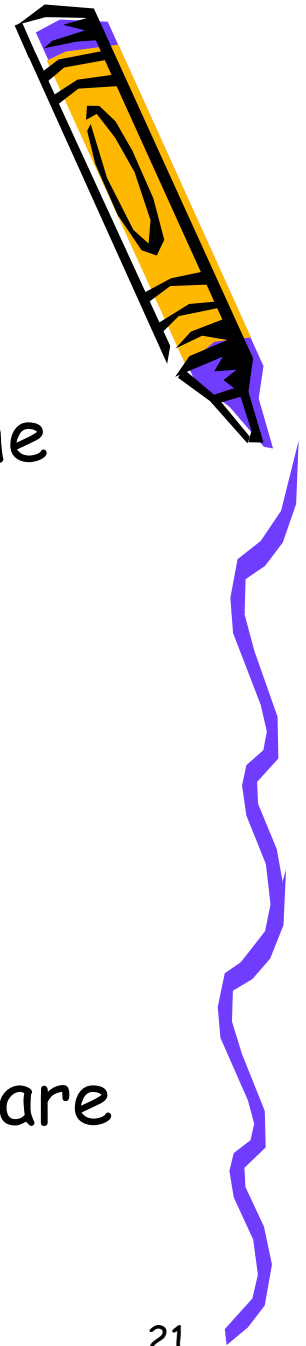
- ✓ **Commercial briquetting machines:**  
only two small-scale companies exist in Nigeria, one in Ogun State and the other one in Kaduna State which produce and market sawdust briquettes.



## *13.0 Nigerian Biomass Energy Programme*

- Planned activities and milestones for the Nigerian Biomass Programme will be carried out under two activity areas, namely: Biogas and Other Biomass Resources as well as Improved Woodstoves and Biomass Briquetting.

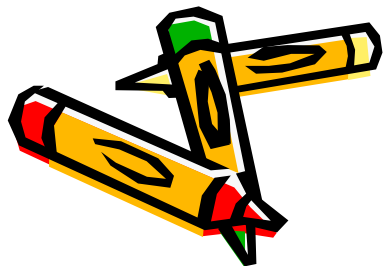
- The following activities and milestones are to be carried out under the Nigerian Biomass Programme:



# 14. Short Term Planned Activities and Milestones for Biogas and other Biomass Resource (2005-2007)

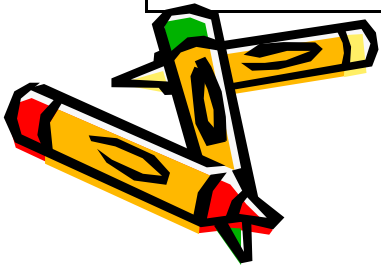
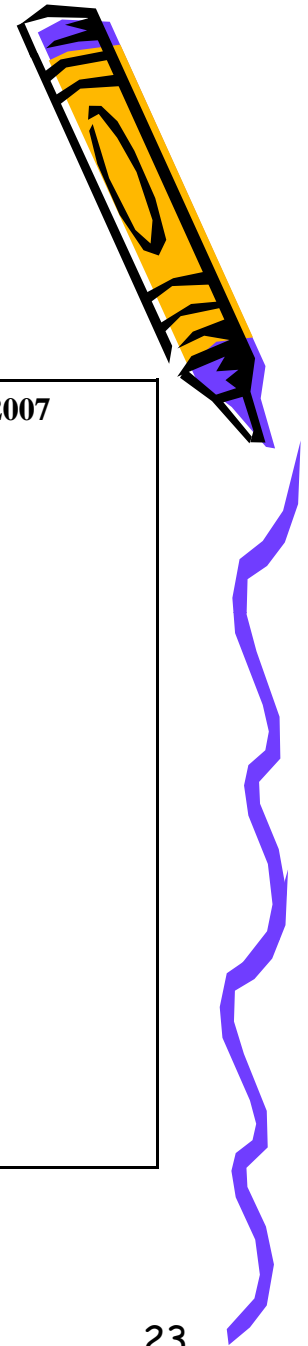


<u>Activities</u>	<u>Description of Activities</u>	<u>Year</u>
Sites Identification	-Identify all potential project sites in the Country and available biomass resources in each area.	2005 – 2006
Technology Assessment and Reviews	-Assess and review necessary levels of utilization of biomass energy resources in the country in order to promote the utilization of biomass resources. Developed countries should be approached to promote the transfer of energy technology and training to lift the nation to higher standards of living to benefit the entire nation.	2006 -2007
Biogas Technology/Diffusion Programme	-To make biogas technology popular among Nigerians, there is the need for all three tiers of government to embark upon distribution of biogas plants to a greater extent in order to promote its utilization especially in the rural areas. Biogas plants, if correctly operated and maintained, would improve the technical abilities and economic capacity of Nigerian farmers and rural people. Government should plan to propagate biogas technology in Nigeria.	2006 – 2007



## Short Term Planned Activities and Milestones for Biogas ...( Cont.)

<p><b>Intensive Plantation of fast Growing Trees</b></p>	<p>-Although there have been several tree planting projects in different parts of the Country, the aims have mostly not been geared towards fuel wood production, but for such purposes as afforestation for timber and pulp. Thus, the species and varieties of trees chosen by foresters almost never considered their potentials for fuel wood production. Fuel wood planting can use species with crooked trunks or wood that warps or splits at it dries because these features are not as detrimental to fuel wood as to timber or pulp production. Trees most likely to be useful for fuel wood plantations are those termed “pioneers”, which in nature are the first to colonized deforested areas. These species withstand degraded solids as well as exposure to wind and drought. Many are rapid growing.</p> <p>Suggested qualities that need to be taken into account in the selection of tree and shrub species for fuelwood cultivation include the following;</p> <ul style="list-style-type: none"> <li>-Species that can be found in similar ecological zones</li> <li>-Ability to produce wood of high-calorific value that burns without sparks or toxic smoke.</li> <li>-Multipurpose plants that have other uses in addition to providing fuel, e.g. Azadirachta India (Neem), Leucaena Leucocephala, and Derris indica (Pongam).</li> </ul>	<p>2007</p>
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# 15. Medium Term Planned Activities and Milestones for Biogas and Other Biomass (2008-2015)

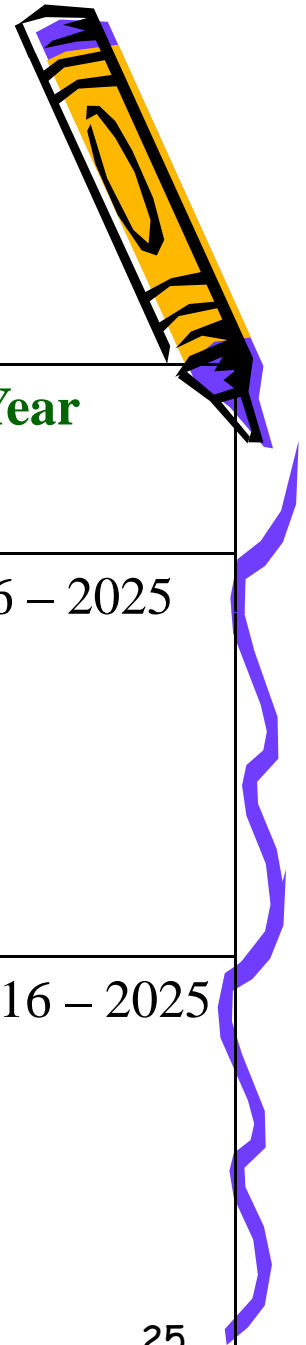


<u>Activities</u>	<u>Description of Activities</u>	<u>Year</u>
Establishment of Wood Farm Lands	-Woodlands, forest and on-farm trees are currently the major sources of fuel wood in many countries. The world's tropical forests and woodlands are currently being destroyed at an alarming rate. Annual rate of deforestation varies from country to country and replanting does not keep pace with the deforestation. For production of fuel wood for local consumption, village forestry or community woodlots should be the ideal. However, there is need to establish woodlands across the country to serve as the sources of raw materials for the future biomass energy industries. Government should establish about 100,000 hectares of woodland by the year 2015.	2008 - 2015
Domestic Biomass Energy Conversion Strategies	-The direct combustion of biomass to produce heat is the simplest route of utilizing biomass material. However, this method misses advantages of the conversion process, such as moisture reduction, increase of thermal value and ease of handling. As a result, direct combustion of unconverted biomass is relatively inefficient. There is therefore the need to develop appropriate biomass conversion systems for domestic application. These strategies include, anaerobic digestion, chipping, chopping, grinding, briquetting and drying.	2008 - 2015

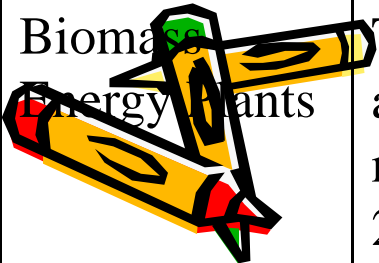




## 16.0 Long Term Planned Activities and Milestones for Biogas and Other Biomass (2016-2025)



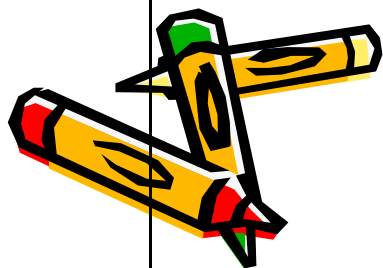
Activities	Description of Activities	Year
Feed Biomass Power into National Grid.	- Power generated from Biomass can be supplied to the National grid. The long-term aim is to increase the nation's overall electric power generation by 35% from biomass and to reduce the reliance on conventional sources for electricity generation.	2016 – 2025
Establishment of Decentralized Biomass Energy Plants	- Government should encourage through incentives the establishment of decentralized biomass power plants for use in the industries. The initial phase of development would involve a number of power plants that can generate as much as 2,500MW of electricity by the year 2025.	2016 – 2025



## 17.0 Short-Term Planned Activities and Milestones for Woodstoves and Biomass Briquetting ( 2005 - 2007)

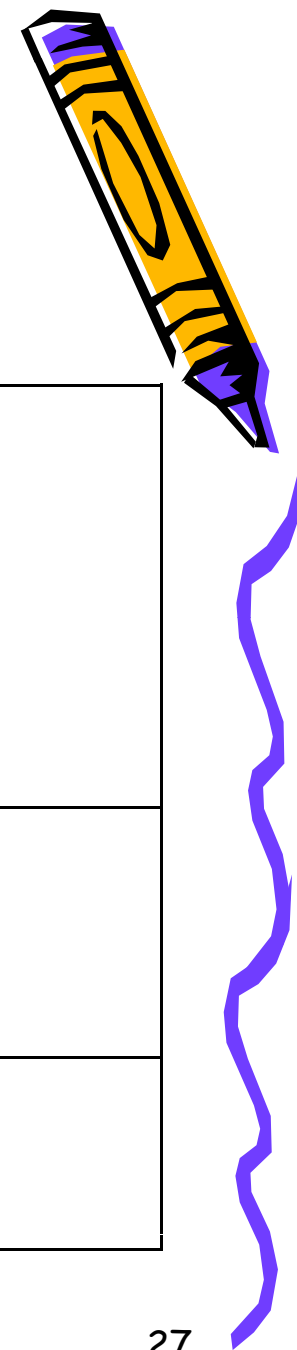


Activities	Description of Activities	Year
<p><b>Publicity / Enlightenment</b></p>	<p>-Aggressive country – wide campaign on the dissemination and implementation of biomass stoves and briquettes.                      -Launching of National Programme on biomass briquettes and stoves.                      -Mass Production of biomass briquettes and improved wood stoves (200,000 stoves, 36 Biomass briquetting plants)</p>	<p>2005 – 2007 2005-2007</p>
<p><b>Survey on resources and data bank</b></p>	<p>-National survey on biomass resources and technologies for biomass briquetting and stoves.                      -Establishment of biomass data bank                      Standardization of stoves designs to cater for Nation’s cooking Habit / Culture through R&amp;D.</p>	<p>Late 2005 – end 2006</p>



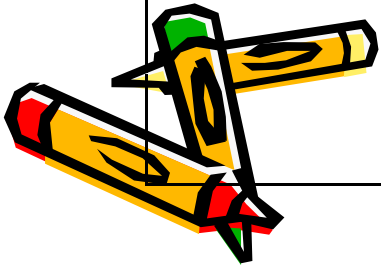
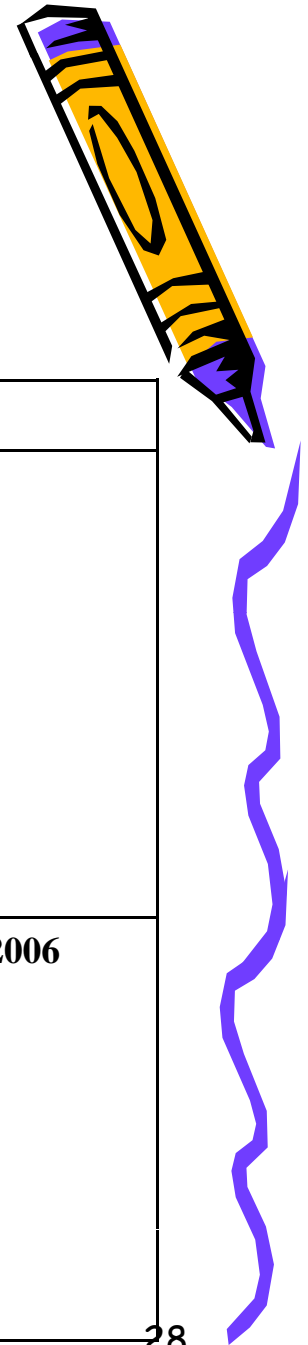
## 18.0 Short-Term Planned Activities and Milestones for Woodstoves and Biomass Briquetting ( Cont.)

Capacity building	<ul style="list-style-type: none"> <li>-Organized National Training workshop on biomass briquetting / biomass improved wood stoves</li> <li>-Train the trainers workshop on biomass efficient wood stoves for potters and artisan for the 6 – geopolitical zones</li> </ul>	2006 –2007
Technology development and production	<ul style="list-style-type: none"> <li>- Aggressive Mass production of</li> <li>-Improved biomass stoves.</li> <li>-Establishment of fast growing trees (wood lot) Nation - wide</li> </ul>	2006 – 2007
Institutional Arrangement	<ul style="list-style-type: none"> <li>-Establishment of machinery for biomass briquetting in each State of the Federation (36 States)</li> </ul>	2006 - 2007



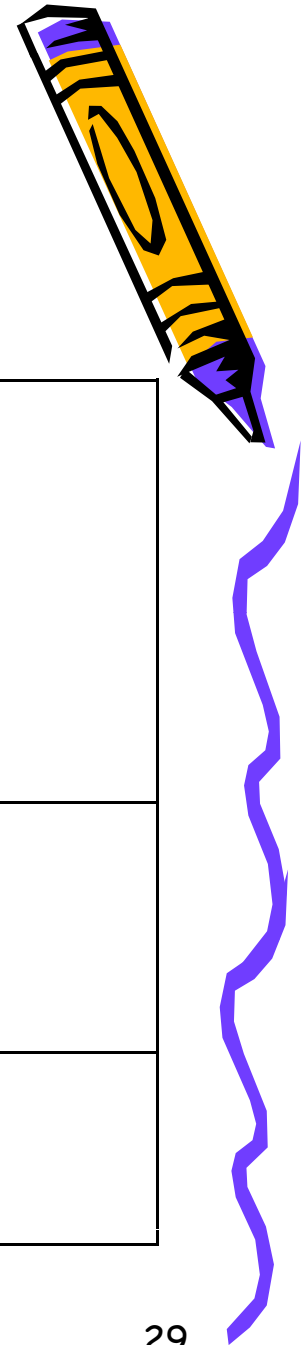
## Short-Term Planned Activities and Milestones for Woodstoves and Biomass Briquetting ( Cont.)

Activities	Description of Activities	Year
Publicity / Enlightenment	<ul style="list-style-type: none"> <li>-Aggressive country – wide campaign on the dissemination and implementation of biomass stoves and briquettes.</li> <li>-Launching of National Programme on biomass briquettes and stoves.</li> <li>-Mass Production of biomass briquettes and improved wood stoves (200,000 stoves, 36 Biomass briquetting plants)</li> </ul>	2005 – 2007 2005-2007
Survey on resources and data bank	<ul style="list-style-type: none"> <li>-National survey on biomass resources and technologies for biomass briquetting and stoves.</li> <li>-Establishment of biomass data bank</li> <li>Standardization of stoves designs to cater for Nation’s cooking Habit / Culture through R&amp;D.</li> </ul>	Late 2005 – end 2006



## Short-Term Planned Activities and Milestones for Woodstoves and Biomass Briquetting ( Cont.)

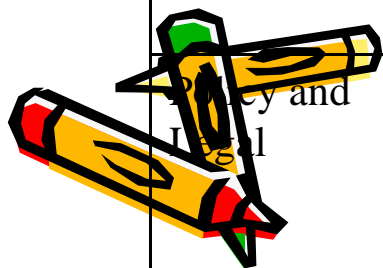
<p><b>Capacity building</b></p>	<p><b>-Organized National Training workshop on biomass briquetting / biomass improved wood stoves</b>  <b>-Train the trainers workshop on biomass efficient wood stoves for potters and artisan for the 6 – geopolitical zones</b></p>	<p><b>2006 –2007</b></p>
<p><b>Technology development and production</b></p>	<p><b>- Aggressive Mass production of</b>  <b>-Improved biomass stoves.</b>  <b>-Establishment of fast growing trees (wood lot) Nation - wide</b></p>	<p><b>2006 – 2007</b></p>
<p><b>Institutional Arrangement</b></p>	<p><b>-Establishment of machinery for biomass briquetting in each State of the Federation (36 States)</b></p>	<p><b>2006 - 2007</b></p>



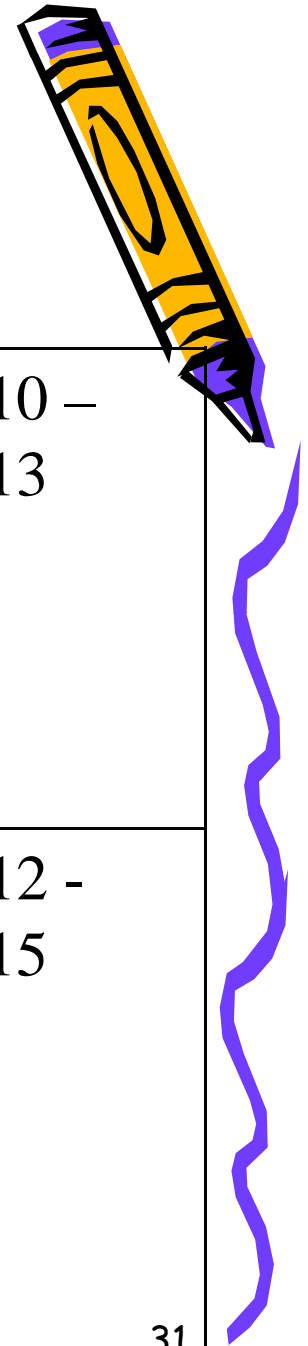
## 19.0 Medium-term Planned Activities and Milestones for Woodstoves and Biomass Briquetting 2007 - 2015



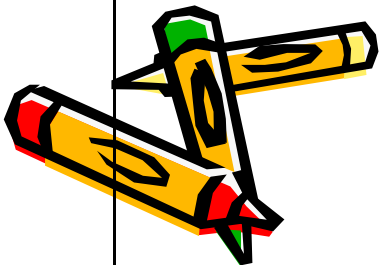
Activities	Description Of Activities	Year
Institutional arrangement	<ul style="list-style-type: none"> <li>-Establishment of six regional offices in each geopolitical zone, Local State Government and NGO's for biomass briquettes / efficient biomass stoves dissemination</li> <li>-Additional mass production of wood stove and biomass (500,000 wood stoves, 70 briquetting plant)</li> <li>-Strengthening R &amp; D facilities on biomass briquetting and stoves</li> </ul>	2007 – 2008
Manpower development / Institutional Arrangement	<ul style="list-style-type: none"> <li>-Establishment of special program on biomass briquetting and efficient biomass stoves</li> <li>-Increased production of biomass briquette to replaced wood consumption by 7-10%</li> <li>-Increased production of biomass efficient stoves through train the trainer's workshops.</li> </ul>	2008 – 2010
Policy and Legal	<ul style="list-style-type: none"> <li>-Provision of 50% subsidy to all house hold purchasing improved wood stoves</li> <li>-Tax – free on the importation of biomass briquetting machines</li> </ul>	2008 – 2012



## Medium-term Planned Activities and Milestones for Woodstoves and Biomass Briquetting ( Cont. )



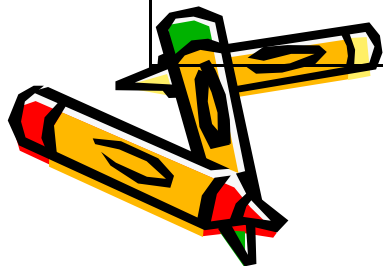
Policy	<p>-20 – 30% gradual shift from wood to other alternative energy sources</p> <p>-categorization of biomass for briquette production and for land use as fertilizer</p>	2010 – 2013
Monitoring and evaluation	<p>-Coordination and information sharing on biomass energy network</p> <p>-Establishment of monitoring unit to ensure the sustainability of design objective on biomass briquettes and stoves</p>	2012 - 2015



## 20.0: Long-term Planned Activities and Milestone for Woodstoves and Biomass

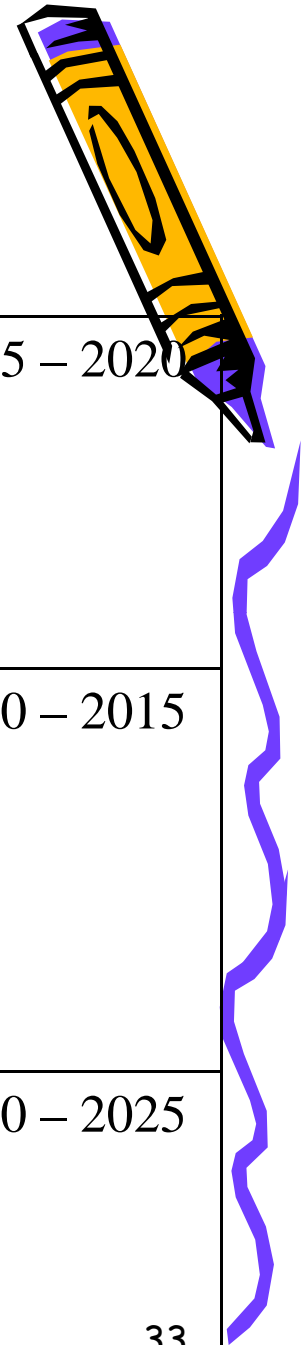
### Briquetting (2015 - 2025)

Activities	Description Of Activities	Year
Capacity monitoring and evaluation	<ul style="list-style-type: none"><li>-Systematic substitution of biomass based fuels to gas fired, solar and kerosene by 30 – 40%</li><li>-Studying on the human health hazards of smoke associated with combustion of biomass fuel</li><li>-Additional mass production of improved biomass stoves (1,000,000 stoves and 150 briquetting plants for briquettes production)</li></ul>	2015 – 2017





## Long-term Planned Activities and Milestone for Woodstoves and Biomass Briquetting (Cont.)

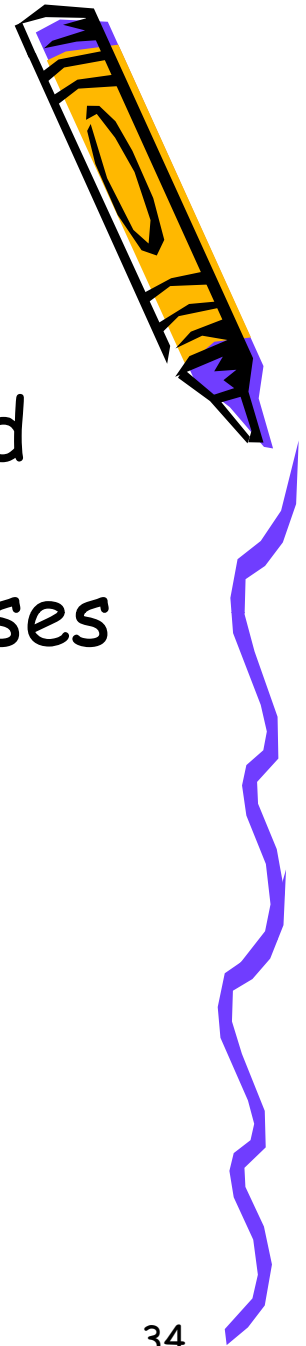


<p>Institutional and Capacity development</p>	<ul style="list-style-type: none"> <li>-Establishment of biomass energy Networks for co-ordination and dissemination of biomass fuels</li> <li>-Mass Production biomass stoves and briquettes continue with proper monitoring and evaluation.</li> </ul>	<p>2015 – 2020</p>
<p>Technology development, Monitoring and Evaluation</p>	<ul style="list-style-type: none"> <li>-Complete Transfer of biomass briquetting and efficient biomass stoves production, marketing and sales to private sectors.</li> <li>-Replacement of improved biomass stoves to the existing inefficient once by 40%</li> <li>-Monitoring and evaluation continues</li> </ul>	<p>2020 – 2015</p>
<p>Technology legal and policy monitoring and evaluation</p>	<ul style="list-style-type: none"> <li>-Localization of expertise to manufacture and operate briquetting plants</li> <li>-Monitoring and Evaluation of the set objectives continued.</li> </ul>	<p>2020 – 2025</p>

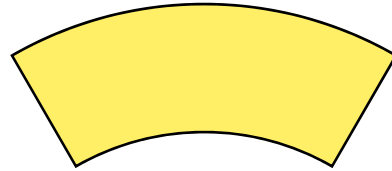


## 21.0 : CONCLUSION

- The conversion of biomass fuel and electricity appears to be economically attractive in most cases and Nigeria with vast biomass resources must do every thing possible to develop and use her abundant biomass resources more effectively.

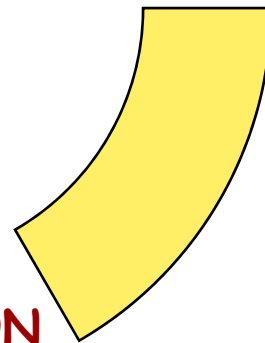
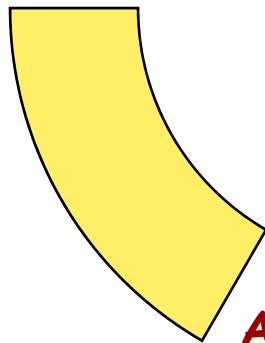


# THE END



THANK YOU

FOR YOUR



ATTENTION

