



BIOFUELS FRAMEWORK & CASE STUDIES IN GHANA

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@ February, 2012

HISTORICAL TRENDS

PART 1

August 2005 : Energy Commission set up a Biofuel Committee (BFC) in August 2005 to prepare a National Biofuel Policy (NBP) that is intended to accelerate the development of a biofuel industry in Ghana.

November 2005 : NATIONAL BIO-FUELS POLICY RECOMMENDATIONS (FINAL DRAFT)

The strategic objectives of Government's biodiesel development programme should focus on the following issues:

- energy security;
- managing the oil import bill;
- reducing poverty and creating wealth for the well-being of the people.

HISTORICAL TRENDS

Policy Objectives for November 2005

i. 20% of national gasoline consumption replaced with bio-diesel by 2015

ii. 30% of national kerosene consumption replaced with jatropha oil by 2015

iii. Removal of institutional barriers

HISTORICAL TRENDS

PART 2

- i. 2006 – Strategic National Energy Plan 2006 – 2020, Adopted the following target

- ii. 10% penetration of liquid fuels by renewable and alternative fuel by 2015, and Expanding to reach 20% by 2020

- iii. To become self-sufficient in petroleum products by 2015 and net exporter by 2020

HISTORICAL TRENDS

The ten (10) broad objectives of the SNEP are as follows (Energy Commission, 2004):

- 1: Stimulate economic development by ensuring that energy plays a catalytic role in Ghana's economic development.
- 2: Consolidate, improve and expand existing energy infrastructure.
- 3: Increase access to modern energy services for poverty reduction in off-grid areas.
- 4: Secure and increase future energy security by diversifying sources of energy supply.
- 5: Accelerate the development and utilization of renewable energy and energy efficiency technologies.
- 6: Enhance private sector participation in energy infrastructure development and service delivery.

HISTORICAL TRENDS

7: Minimize environmental impacts of energy production, supply and utilization.

8: Strengthen institutional and human resource capacity and R & D in energy development.

9: Improve governance of the Energy Sector

10: Sustain and promote commitment to energy integration as part of economic integration of West African states.

HISTORICAL TRENDS

PART 3

February 2010: Energy Sector Strategy And Development Plan

- i. Vision of Energy Sector: Ensure availability of and universal access to energy services and for export by 2020.
- ii. Renewable Energy Sub-Sector of the Plan (Section 4)
 - i. Goals: The goals of the Renewable Energy sub-sector are to increase renewable energy in the total national energy mix and ensure its efficient production and use
 - ii. Under the Renewable Energy Sub-Sector, we have :
 - i. Biomass - Woodfuels,
 - ii. Liquid Biofuels
 - iii. Solar, Wind and Mini-Hydro

HISTORICAL TRENDS

February 2010: Under the Liquid Biomass Fuels, the following objectives and targets are set:

- i. *Balance biofuel development against food security.*
- ii. *Support development of biofuels as a transportation fuel as well as job creation initiative.*
- iii. *Support private sector investments in cultivation of biofuel feedstock, extraction of the bio-oil and refining of bio-oil into secondary products by creating appropriate financial and tax incentives.*

HISTORICAL TRENDS

Feb 2010: Cross-Cutting Issues :

Create favourable regulatory and fiscal regimes as well as attractive pricing incentives

Objectives of the Renewable Sector

- i. Increase the renewable energy supply in national energy mix to 10% by 2020
- ii. Develop legislation to encourage renewable energy technology development and utilisation

HISTORICAL TRENDS

PART 4

DRAFT BIOENERGY POLICY , August 2010

Part 1: WOOD FUEL POLICY

PART 2: BIOFUEL POLICY

PART 3 : BIOMASS WASTE TO ENERGY

Development of biofuel will achieve the following national strategic objectives:

i. Energy Security

ii. Reduce oil import bill and save foreign exchange.

iii. Provide an avenue to reduce poverty and wealth creation through employment generation.

iv. Increase export earning potential.

v. Climate change mitigation

HISTORICAL TRENDS

Policy Objectives:

- i. To substitute national petroleum fuels consumption with biofuel by 10% by 2020 and 20% by 2030.
- ii. To remove institutional barriers in order to promote private sector participation in the biofuel industry.
- iii. To create favourable regulatory climate to ensure development of a competitive market, favourable pricing regime and high quality products.
- iv. To improve the efficiency of production technologies and techniques of biofuel with the aim

HISTORICAL TRENDS

Policy Objectives:

- i. To improve the efficiency of production technologies and techniques of biofuel with the aim of reducing costs and also raising the quality and efficacy of the product through prioritized research and development programmes; in the medium to long term, become a net-exporter of biofuel

- ii. To reduce carbon dioxide emission

HISTORICAL TRENDS

INSTITUTIONAL FRAMEWORK

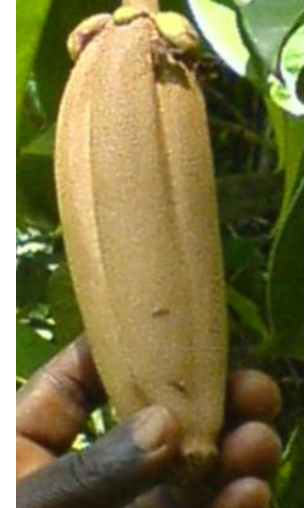
- i. Allocated the requisite mandates to the relevant institutions.
- ii. Framework for clear definition of institutional responsibilities should be established for the biofuel industry.
- iii. Working relationship between industry players and regulating institutions should be facilitated to encourage smooth operations and collaboration in the biofuel industry

SOME BIODIESEL INITIATIVES IN GHANA

Institution	Funding Sources
Anuanom Ventures	Private Funds
B1 Ghana Ltd /	Private Investment
ADRA/UNDP	UNDP-GEF/ADRA
New Energy	Donor Funding
Gbimsi Women Group	UNIFEM/UNDP-GEF
Valley View University	University Funds/ Anuanom Ventures
Tragrimacs	Private Investment
Duampong	Private Investment
Jatropha Africa	Private Investment
Biodiesel Africa	Private Investment
ScanFuel	Private Investment
BIONICS	Private Investment

BIODIESEL FEEDSTOCKS & PRODUCTION

- **STRAIGHT VEGETABLE OIL (SVO) / PURE PLANT OIL (PPO):**
 - Jatropha Oil
 - Castor Oil
 - Allan Blackia
- **(TRANS)ESTERIFICATION:**
 - Sunflower oil
 - Soyabean Oil
 - Jatropha Oil
 - Other Vegetable Oils (Palm, Palm Kernel & Copra Oils)
 - Waste Vegetable Oils



BIODIESEL FEEDSTOCK – CONTINUED

β) Animal Sources:

- Faecal Matter to Biodiesel – Lab. Experimentation
- No full-scale implementation in Ghana yet

B. Waste Vegetable Oils (WVO)

- Hotels, Restaurants & Fast food joints (Local & Urban)
- Institutions (Boarding Houses, Hospitals, Prisons, etc.)
- **Potential Assessment – Energy Commission Sponsored & TEC Fellows – KNUST**
 1. Survey - Completed
 2. Transesterification of Samples – Completed
 3. Biodiesel Tested

Independent Private Company at the Implementation Stage in Accra

BIOGAS

- Potential not fully exploited since 1960s
- Over 240 digesters with total capacity of about 3,680 m³ installed
- Size range = 4 – 800 m³ (*Biggest @ GGBL, Kumasi using UASB*)
- Current implementations by private companies
- **Areas of Applications** include:
 1. **Bio-sanitation** (Domestic & Institutional)
 2. Households cooking,
 3. Direct lighting and
 4. Small power generation (e.g. 12.5 kVa genset @ Appolonia)

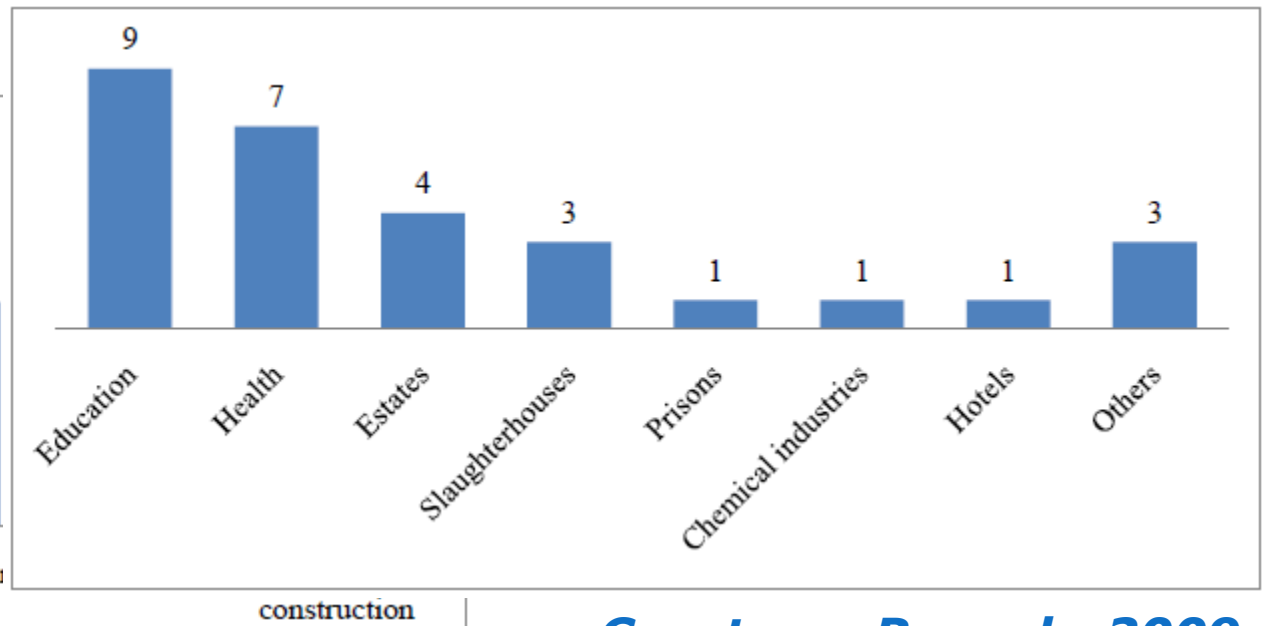
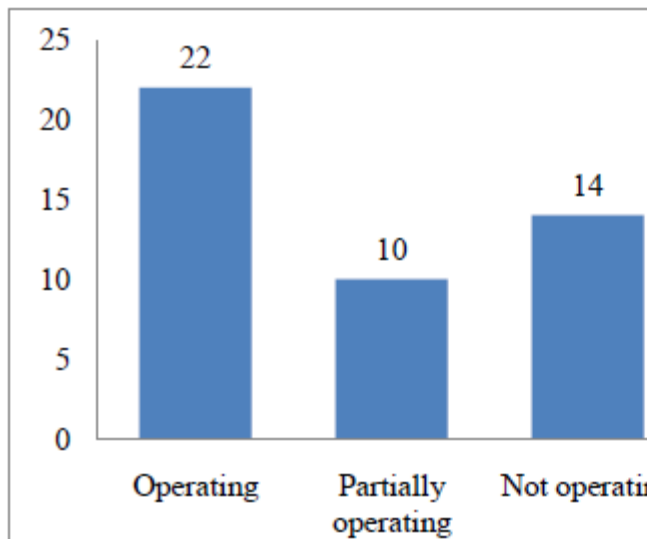
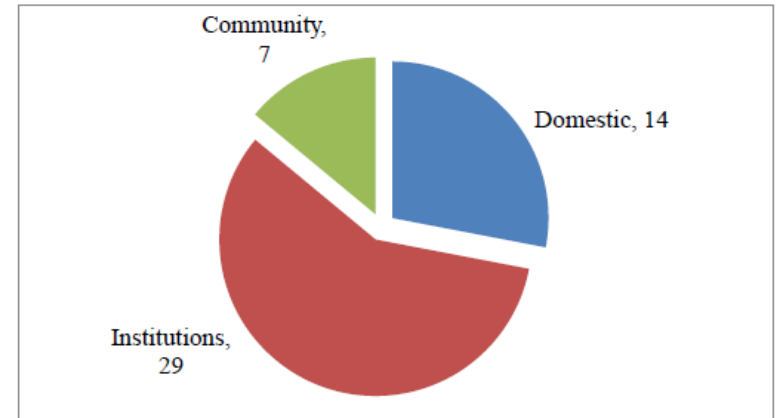
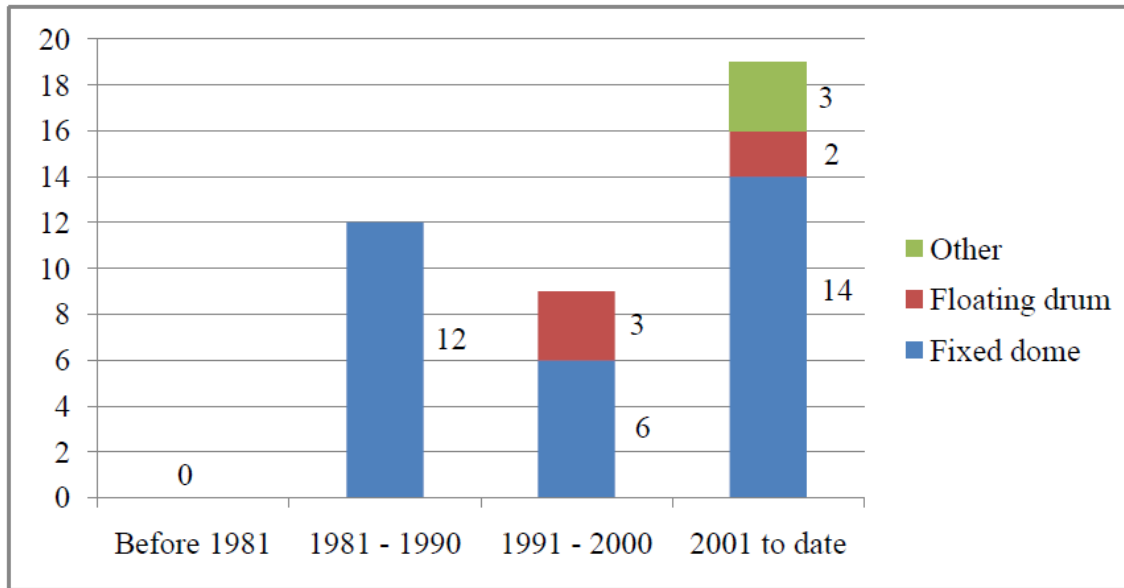
Feedstocks have been:

- a) animal dung,
- b) human excreta and
- c) industrial organic waste.



CASE STUDY - BIOGAS SURVEY

Total Population = 50 (50% of known plants in Ghana)



Courtesy: Bensah, 2009

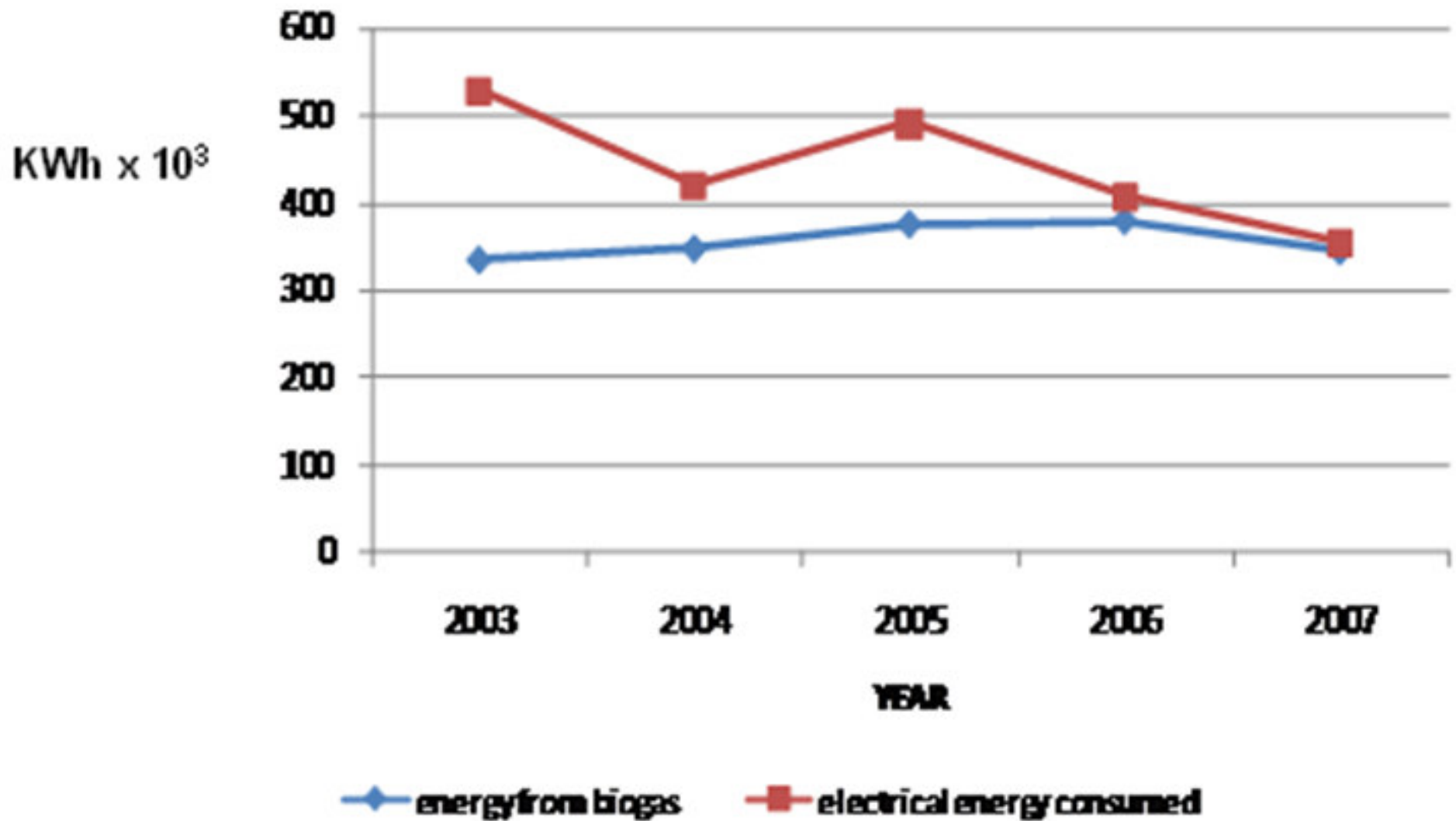
Some Biogas Plants installed in Ghana

Company	Date founded	Number of employees (fulltime)	Type of digester/system installed	No of plants installed
Biogas Engineering Ltd	2000	6	CAMARTEC fixed dome type, and effluent treatment plants	10
Biogas Technologies West African Ltd (BTWAL)	1998	148	Fixed dome and effluent treatment plants	35
RESDEM	1996	-	Mostly bio-latrine digesters	25
Global Renewable Energy Services	1996		Fixed dome digesters	20
Technology for Improved Environment (TIE) / Biogas Engineering Ltd (BEL)	1994 / 2002		Fixed dome digesters, biotoilet	18
Beta Construction Engineers Ltd (BCEL)	1975	25	Puxin Biogas Digesters	12
Research (IIR)	1986		Fixed dome digesters, biotoilets	
UNIRECO	2001	5	Mostly bio-latrine digesters	
Renewable Energy and Environmental Systems (REES)	2002		Fixed dome digesters	

LANDFILL GAS

- Barrier: Not-In-My-Back-Yard sites
- Feedstock : Municipal Solid Waste & Abattoir Waste
- Environment: Engineered Landfill
- Interests:
 - 1. ENDI – AG, least German delegations for Dompouse site near Kumasi
 - 2. CDM Funding: CEESD – TEC (KNUST) MOU for PDD Development
- Technology transfer is needed to back the known principles
- Potential : 1 MW energy per site
- Sites :
 - 1. 4 more other MSW sites in Ghana
 - 2. Abattoirs (District Levels – Failures from Ejura, etc.) – Dr. Aklaku

KUMASI ABATTOIR POTENTIAL



Energy from biogas Potential at the Kumasi Abattoir (Aklaku, 2011)

MSW - BIOGAS POTENTIAL

- Average of 0.45kg/cap/day of municipal solid waste (MSW) (Arthur, Baidoo, & Antwi, 2011)
- Population of approximately 24.2 Million
- Estimated amount of 4 million tons of waste is produced annually
- Feedstock = About 70% of Waste stream is biodegradable (Cofie & Koné, 2009)
- Assuming a yield of 150m³ of methane per every ton of MSW digested (Wilkie, 2011)
- Theoretical potential to obtain 420 million m³ of methane from solid waste feedstocks every year.
- This can be used directly as cooking fuel, transport fuel (after purification) and/or converted to electricity.

BIOGAS

- **New Initiative:**
 - **Biogas Technology and Business for Sustainable Growth**
 - Ghana – Korea – UNIDO Proposal (Preparative Stage)
 - 3 PhDs
 - MSc Graduates
 -

WASTE-TO-ENERGY INITIATIVES

- Feedstock : Agricultural Waste Materials (Corn Cobs, Palm Kernel Shells, Corn Stovers, Corn Sheaves, etc.)
- Interests:
 - 1. Co-generation : a) Juaben Oil Mills b) AG Timbers c) GOPDC
 - 2. Second Generation :
 - Pyrolysis for Biochar Production - Private Companies
 - - KNUST – CSIR Collaboration
 - 3. Research Level :
 - KNUST – IIR (CSIR) – Southampton University – Fast Pyrolysis
 - KNUST – RPI Collaboration – Pyrolysis & BioSolar Pyrolysis
 - KNUST-KITE-UPC – Biomass Gasification (Proposal Stage)
- 3. Waste Enterprises (Ashley Murray's Group) – Liquid Waste
 - Bill & Melinda Gates Funding - KNUST Linkage Research
 - 3. CDM Funding: CEESD – TEC (KNUST) MOU for PDD Development
- Technology transfer Needed to back the known principles

Road Map for implementation of Bioenergy Policy

Year	Activities	Results	Responsibility
September, 2010	Establish Bioenergy Unit within the Energy Commission to organise stakeholder consultation and develop implementation programme	This will provide enhanced institutional focus on bioenergy	Energy Commission
December, 2010	Allocate a portion of the Energy Fund each year to be used for technical assistance to bioenergy producers/equipment manufacturers and R&D	Sustainable funding source for the bioenergy industry created.	Energy Commission
January–March, 2011	Obtain Cabinet Approval for bioenergy policy recommendations	Bioenergy policy for Ghana adopted by the Government	Ministry of Energy
June, 2011	Establish a Technical Committee within the Energy Commission to address issues relating coordination between relevant agencies like MOFA, EPA, NPA, etc.	A dedicated technical committee on bioenergy available.	Energy Commission
July 2011	Organise Biofuel Policy Implementation Forum	Key stakeholders are sensitised on their roles regarding the implementation of the biofuels policy recommendations	Energy Commission
August 2011	Commence full implementation of Biofuel policy recommendations	Implementation of biofuels policy recommendations	All stakeholders
December 2011	Prepare relevant regulations on biofuels for Cabinet approval	Appropriate regulations governing the biofuels sector prepared	NPA and Energy Commission

GHANA'S ROAD MAP FOR INTRODUCING BIOFUELS INTO THE PETROLEUM SUBSECTOR

Year	Activities	Results	Responsibility
2006 - 2007	Set up national committees for Gasohol and Biodiesel	Assembly of key stakeholders	Action to be chaired by the Energy Commission
	Encourage plantations of jatropha (for biodiesel production) and sugarcane, cassava (for alcohol production)	Export produce if local use is not ready	Private sector, the Ministry and Energy Commission initiatives.
	Commission a commercial biodiesel distillation plant	Refined biodiesel is available for use	Private sector initiative
	Develop regulations for gasohol and biodiesel use as transport fuel.	Standard biodiesel and gasohol made available	Action undertaken by Energy Commission and NPA
2008	Re-activate the Komenda and the Asutuare Sugar factories if possible.	Commercial production of alcohol restarts	Joint government-private sector initiative
	Install gasohol and biodiesel blending plants in Tema and Takoradi	Blending centres for the southern sector exist	Joint action by the Ministry of Energy Commission, NPA and the OMCs.
	Introduction of B5 and E10 in the country's oil market	Commercial use of gasohol and biodiesel in the transport sector starts.	Joint action by the Energy Commission, NPA, BOST and the OMCs.
2009 - 2012	Install gasohol and biodiesel blending plants in Kumasi.		Joint action by the Energy Commission, NPA, BOST and the OMCs
	Introduce B10 and E20 with voluntary participation by OMCs		Joint action by the Energy Commission, NPA, BOST and the OMCs
	Install biodiesel blending plants in Tamale and Bolgatanga	Blending centres for the northern sector	Joint action by the Ministry, Energy Commission, NPA, BOST and the OMCs.
2013 - 2020	Install gasohol blending plants in Komenda and Asutuare Introduce gasohols up to E85.	Blending centres for the remaining regional cities	An example of Public-private partnership (PPP) activities.
	Make B5, B10 and E10 mandatory for dispensation at all service stations. Up to E85 voluntary through out the country.	Commercial use of gasohol and biodiesel is sustained.	

CONCLUSION

- Diversified feedstocks & technologies available:
 - Biodiesel
 - Biogas
 - Waste –to–Energy Potential
- Renewable Energy Law at Presidential Accent Stage
- Policy Framework Established
- Lots of lessons learnt:
 - Failures – Biogas & Biodiesel
 - Successes – Biogas
 - Untapped Potential – MSW & Agri-Waste



THANK YOU