

# **NIGERIA’S COUNTRY REPORT ON COAL MINE METHANE RECOVERY AND USE.**

## **1.0 INTRODUCTION**

The Nigerian arm of the Methane to Markets Partnership is anchored on Coal Production since independence. This coal availability is predominant in several mine sites and this coal are located in Enugu, Imo, Kogi, Delta, Anambra, Bauchi, Adamawa, Ondo and Edo States of Nigeria. The Coal is mostly sub-bituminous with large out put, and quite deep in the ground.

In Nigerian coal is mainly used for the generation of electricity that the country needs. The coal mines are predominantly safe with minimal pollution concerns. As a way to discourage community agitation, environmental impact assessment is usually carried out before coal extraction is done.

## **2.0 NIGERIAN COAL MINE INDUSTRY**

The Methane – to – Markets Partnership will help Nigeria pursue its own goals in the area of technical acquisition, shared experience and expertise. Partner countries will sign a Terms of Reference that outlines the purpose, organization and functions of the Partnership. The core activities are likely to include:

- Identifying and promoting areas of bilateral, multilateral, and private sector collaboration on methane recovery and use.

- Developing improved emissions estimates and identifying the largest relevant emission sources to facilitate project development.
- Identifying cost-effective opportunities to recover methane emissions for energy production and potential financing mechanisms to encourage investment.
- Improving the legal, regulatory, financial, and institutional and other conditions necessary to attract investment in methane recovery and utilization projects.
- Identifying and implementing collaborative projects aimed at addressing specific challenges to methane recovery, such as raising awareness in key industries, removing barriers to project development implementation, identifying project opportunities, and demonstrating technologies.
- Developing collaborative action plans that outline a series of concrete activities and actions that directly support the core goals and functions of the Partnership.
- Developing and implementing a process for evaluating progress and reporting results.

### **3.0 REDUCTION OPPORTUNITIES:**

3.1 Methane emission sources vary in Nigeria as compared to other developed countries. Emission of methane in Nigeria comes mainly from gas and oil systems.

3.2 Below are some of the methane recoveries and use option for some key emission sources in Nigeria:

- Coal Mines – Methane is removed from underground mines either in advance of mining activities, or after mining has occurred to reduce explosion hazards. Instead of releasing this methane to the atmosphere, profitable uses can be identified and implemented. Some of these options include natural gas pipeline injection, power production, co-firing in boilers, district heating, coal drying, and vehicle fuel.
- Natural Gas and Oil Systems – Current opportunities for reducing methane emissions include both procedural and hardware improvements. Methane emission reduction opportunities generally fall into one of three categories: (1) technologies or equipment upgrades that reduce or eliminate equipment venting or fugitive emissions; (2) improvements in management practices and operational procedures; or (3) enhanced management practices that take advantage of improved technology. In all cases, reducing methane emissions makes additional gas available for sale and use.

#### **4.0 WAYS TO DISCOURAGE BARRIERS IN NIGERIA**

4.1 In Nigeria the following important issues would be resolved:

- Recognizing that methane is a commodity with a practical and profitable use rather than a nuisance and safety hazard,
- Ensuring that coal mines and project developers have access to modern methane drainage and use technologies and appropriate training to make use of this valuable resource,

- Establishing an appropriate mechanism for the collection and dissemination of credible and unbiased data including technical and market information,
- Providing access to capital markets
- Serious advocacy and public enlightenment

Nigeria will require technology transfer, market development and other resources to enjoy the participation in the partnership and work together to:

- Engage all facets of the coal industry to improve awareness of emission reduction opportunities and the value of the recovered methane.
- Advance technology transfer to ensure the broad adoption of emission reduction technologies and management practices.
- Improve and facilitate access to capital to support project investment, and
- Cooperate with country partners to improve markets and provide legal and regulatory frameworks that encourage project development.

In a bid to establish areas of cooperation in the Methane to Market Partnership in Nigeria, bold initiatives will include:

- Assisting with solid waste management capacity building,
- Identifying potential landfill resources,
- Performing initial gas generation feasibility studies,

- Technology transfer through demonstration, training and workshops, and
- Creating an environment for sound investment.

## **5.0 WHAT ARE THE BARRIERS IN NIGERIA?**

Some of the noticeable barriers in Nigeria include:

- Identifying cost-effective opportunities to recover methane emissions for energy production and potential financing mechanisms to encourage investment.
- Improving the legal, regulatory, financial, and institutional and other conditions necessary to attract investment in methane recovery and utilization projects.
- Enhanced public enlightenment
- Discourage community agitation
- Provide incentives to the local community and encourage grass root participation.
- Provide infrastructure to the community.

# STATISTICAL DATA ON COAL MINE METHANE RECOVERY AND USE IN NIGERIA

## (i) Current Coal Production In Nigeria

The current/potential levels of coal utilization in the country are as follows:

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(i)	<p>Cement Manufacture</p> <ul style="list-style-type: none"> <li>- <u>Nigerian Cement Company (Nigercem), Nkalagu:</u></li> </ul> <p>Installed Coal capacity utilization for 6 kilns ...</p> <p>Current Coal Capacity utilization for 1 Kiln</p> <p>Prospect of expanding current capacity utilization.....</p> <ul style="list-style-type: none"> <li>- <u>Ashaka Cement Company, Gombe:</u></li> </ul> <p>Installed Coal Capacity utilization .....</p> <p>Current Coal Capacity utilization .....</p> <p>Prospect of expanding current capacity utilization .....</p> <ul style="list-style-type: none"> <li>- <u>Proposed Kogi Cement Company Abajina, Kogi State:</u></li> </ul> <p>Current Coal Capacity utilization .....</p> <p>Prospect of expanding current capacity Utilization .....</p>	<p>Tones Per Annum(Tpa)</p> <p>140,000 Tpa</p> <p>20,000 Tpa</p> <p>Yes</p> <p>300,000Tpa</p> <p>None</p> <p>Yes</p> <p>None</p> <p>Yes(3000,000Tpa)</p>
(ii)	<p>Other industrial users:</p> <ul style="list-style-type: none"> <li>- <u>West African Batteries Ltd (Exide) Ibadan</u></li> </ul> <p>Installed Coal Capacity utilization .....</p> <p>Current Coal Capacity Utilization .....</p> <p>Prospect of expanding current capacity</p>	<p>2,000 Tpa</p> <p>None</p> <p>Yes.</p>

	utilization	
(iii)	<u>Metallurgical use by Ajaokuta Steel Plant:</u> <ul style="list-style-type: none"> <li>- Installed Coal capacity utilization as blend with imported coking coal .....</li> <li>Current Coal capacity utilization .....</li> <li>Prospect of expanding current capacity utilization .....</li> </ul>	200,000 Tpa None Yes(1,000,000 Tpa)
(iv)	<u>Coal Carbonization/Briquetting plants</u> <ul style="list-style-type: none"> <li>- Installed coal capacity utilization .....</li> <li>Prospect of installing plants for Coal Utilization for replacement of fuel wood ....</li> </ul> <u>Proposed Abajina/Makurdi Power Stations in Kogi and Benue respectively:</u> <ul style="list-style-type: none"> <li>- Installed Coal Capacity utilization .....</li> <li>Prospect of installing Plants .....</li> </ul>	None Yes(2,000,000 Tpa)  None Yes(300,000 Tpa)

**(ii) Existing Potential Coal Mines Sites With Reserves In Nigeria**

S/N	MINE LOCATION	STATE	TYPE OF COAL	ESTIMATED RESERVES (MIL.T)	PROVEN RESERVES (MIL.T)	BOREHOLE RECORDS	COAL OUTCROP AND SEAM THICKNESS (M) DEPT OF COAL (M)	DEPTH OF COAL (M)	MINING METHODS
1.	Okpara Mine	Enugu	Sub-Bituminous	100	24	20	Many (1.5m)	180	Underground
2.	Onyeama Mine	Enugu	Sub-Bituminous	150	40	Many	Many (1.5m)	180	Underground
3.	Ihioma	Imo	Lignite	40	N.A	Nil	Many	20-80	Open Cast
4.	Ogboyoga	Kogi	Sub-Bituminous	427	107	31	17(0.0-2.3m)	20-100	Open Cast and Underground
5.	Ogwashi Azagba Obomkpa	Delta	Lignite	250	63	7	4(3.5m)	15-100	Open Cast and Underground
6.	Ezimo	Enugu	Sub Bituminous	156	56	4	10(0.6-2.0m)	30-45	Open Cast and Underground
7.	Inyi	Enugu	Sub Bituminous	50	20	4	(0.9-2.0m)	25-78	Open and Underground
8.	Lafia/Obi	Nassarawa	Bituminous (cokable)	156	21.42	123	(1-3m)	80	Underground
9.	Oba/Nnewi	Anambra	Lignite	30	N.A.	2	14(0.3-4.5m)	18-38	Underground
10.	Afikpo/Okigwe	Ebonyi/Imo	Sub Bituminous	50	N.A.	Nil	N.A	20-100	Underground
11.	Amasiodo	Enugu	Bituminous	1000	N.A	3	N.A	563	Underground
12.	Okaba	Kogi	Sub-Bituminous	75	57	Many	(0.8-2.3m)	20-100	Open Cast and Underground
13.	Owukpa	Benue	Sub-Bituminous	75	57	Many	(0.8-2.3m)	20-100	Open Cast and Underground
14.	Ogugu/Awgu	Enugu	Sub-Bituminous	N.A.	N.A.	Nil	N.A.	N.A.	Underground
15.	Afuji	Edo	Sub-Bituminous	N.A.	N.A	Nil	N.A.	N.A.	Underground
16.	Ute	Ondo	Sub-Bituminous	N.A.	N.A.	Nil	N.A.	N.A.	Underground
17.	Duho	Bauchi	Sub-Bituminous	N.A.	N.A.	Nil	N.A.	N.A.	Underground
18.	Kurumu	Bauchi	Sub-Bituminous	N.A.	N.A.	Nil	N.A.	N.A.	Underground
19.	Lamja	Adamawa	Sub-Bituminous	N.A.	N.A.	Nil	N.A.	N.A.	Underground



20.	Garin Maigunga	Bauchi	Sub- Bituminous	N.A.	N.A.	Nil	N.A.	N.A.	Underground
21.	Gindi Akwati	Plateau	Sub- Bituminous	N.A.	N.A.	Nil	N.A.	N.A.	Underground
22.	Jamata Koji	Kwara	Sub- Bituminous	N.A.	N.A.	Nil	N.A.	N.A.	Underground

**(iii) Comparison Of Typical And Prime Coking Coal Analysis With Lafia-Obi Raw And Washed Coals**

<b>Quality Parameter</b>	<b>Typical Coking Coal</b>	<b>Prime Coking Coal/Blend</b>	<b>Lafia Unwashed</b>	<b>Lafia Washed</b>
Ash (% , d.b)	56.	7	28.8-46.0	14.7
vd.matter (% d.af)	22.1	28-32	48.4	31.7
Gross SE(MJ/Kg d.a.f)	34.3		27.8	31.95
Carbon (% d.a.f)	89.2	88-92	37.6	58.0
Hydrogen (% , d.a.f)	5.1	-	4.5	5.6
Total Sulphur (% , d.b)	0.80	1.0	1.1-6.83	1.0-3.5
Sulphate Sulphur (% ,d.b)	0.07	-	0.06	0.01
Pyritic Sulphure (% , d.b)	0.62	-	6.52	1.39
Organic Sulphur (% ,d.b)	0.11	-	0.29	0.07
Free Swelling Index	9	9	6	9
Dilatometer Test				
Softening point (°C)	370	-	389	375
Reconsol. Point (°C)	469	-	441	426
Softening range (°C)	95	-	148	149
Contraction (%)	27	-	17	30
Dilation (%)	75	50-200	12	190
Gray-king Coke type	G8	-	64	G9
Plasticity				
Maximum thridity (ddpm)	2575	60 -1000	23.4	27.600
At temperature °C)	461	-	-	400
Petrography				
Vitrinite (%)	83.5	-	79.7	98
Liptinite (%)	6.6	-	0.4	-
Inertinite (%)	9.9	-	19.1	2.0
Mean max Reflectance (Ro%)	1.12	1.15-1.25	0.99	1.00
The mecum indices				
Micum M40(%)	-	70	-	47
Micum M10(%)	-	9	-	18

(iv) **Comparative Prices Of Some Energy Fuels On Heat Equivalent Basis In Urban Areas In Nigeria 2000**

<b>Fuel</b>	<b>Retail Price</b>	<b>Unit</b>	<b>Gross Calorific value (Keal/Kg)</b>	<b>Avg. End use efficiency (%)</b>	<b>Avg. Net Usable Heat (Kcal/Kg)</b>	<b>Fuel Price per 10<sup>3</sup> Kcal (Naira)</b>
<b>(a)</b>	<b>(b)</b>	<b>©</b>	<b>(d)</b>	<b>(e)</b>	<b>F=(dxe)</b>	<b>G=(b/f)x10<sup>3</sup></b>
Wood (use of tripod)	10.00	Kg	3,500	7.5	262.5	38.10
Wood (use of stove)	10.00	Kg	3,500	20	700	14.29
Ordinary Charcoal	6.00	Kg	6,000	20	1,200	6.70
Carbonised Wood Charcoal	15.00	Kg	6,000	20	1,200	12.50
Electricity (industrial)	8.60	Kwh	860	75	645	7.35
Electricity (Domestic)	8.60	Kwh	860	75	645	4.12
Kerosene (DPK)	20.00	Kg	10,102	35	3,536	5.85
Diesel (AGO)	22.17	Kg	9,983	35	3,494	6.35
LPG	50.00	Kg	11,700	52.5	6,142.5	8.14
LPG (Scarcity)	167.00	Kg	11,700	52.5	6,142.5	27.19
Smokeless Coal Briquette	10.00	Kg	11,214	50	5,607	1.78

## **POSSIBLE PROJECT SITES AND OPPORTUNITIES**

S/No.	Sites	Needs	Legal Issues to be resolved	Technology Required
1.	Onyeama Mine	None	Environmental Impact Assessment must be carried out.	Regular mining operation technology
2.	Ogboyoga	None	Environmental Impact Assessment must be carried out.	Regular mining operation technology
3.	Ogwashi Azagba Obomkpa	None	Environmental Impact Assessment must be carried out.	Regular mining operation technology
4.	Ezimo	None	Environmental Impact Assessment must be carried out.	Regular mining operation technology
5.	Amasiodo	None	Environmental Impact Assessment must be carried out.	Regular mining operation technology

## **CBM/CMM POTENTIAL IN NIGERIA**

The CBM/CMM potential in Nigeria is presently low. Nigeria will like to cooperate with developed partners in this area: The chart below indicates some of the existing coal mine sites in Nigeria. Perhaps collaboration with partner countries can develop the CBM/CMM potential in Nigeria. Currently, there is no production since the emissions is low and capture minimal and unattractive.

**CBM/CMM POTENTIAL PROJECT OPPORTUNITIES IN NIGERIA**

S/No.	Sites	Production/Production Plans
1.	Onyeama Mine	None at the moment however, investors would be welcome
2.	Ogboyoga	None at the moment however, investors would be welcome
3.	Ogwashi Azagba Obomkpa	None at the moment however, investors would be welcome
4.	Ezimo	None at the moment however, investors would be welcome
5.	Amasiado	None at the moment however, investors would be welcome

