



EVOLUTION OF FUEL SPECIFICATIONS AND REFINERY DEVELOPMENT IN AFRICA



CONFERENCE REPORT

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Organised by: The Ministry of Energy and Mineral Development,
United Nations Environment Programme and
Africa Refineries Association

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LIST OF ABBREVIATIONS

ARA	Africa Refiners Association
EAC	East African Commission
IOC	Inter Oil Corporation
KPRL	Kenya Petroleum Refineries Limited
MEMD	Ministry of Energy and Mineral Development
NNPC	Nigeria National Petroleum Corporation
OEM	Original Equipment Manufacturers
PCFV	Partnership for Clean Fuels and Vehicles
SAPIA	South African Petroleum Industry Association
SIR	Société Ivoirienne de Raffinage
SONANGOL	National Petroleum Society of Angola
UNEP	United Nations Environment Programme

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EXECUTIVE SUMMARY

The Ministry of Energy and Mineral Development in partnership with the United Nations Environment Programme (UNEP) and the African Refiners Association (ARA) organised a two days conference on fuel specifications and refinery development in Africa. The meeting was part of ARA's efforts to increase the knowledge on fuel specifications in Africa and also as a follow up activity on the recommendations of United Nations Environment Programme African Regional Agreements on Air Quality.

The meeting discussed regional differences in product quality, their evolution and the impact on refinery and logistic investment and planning. The participants shared knowledge on fuel specifications in Africa and how to meet the recommendations of UNEP Regional agreements on Air Quality. The conclusions of the joint ARA/World Bank Sub-Saharan Africa Refinery and Health Study were also discussed showing how investment in refinery upgrading, vehicle maintenance and inspection programmes and phasing out of two-stroked motorcycles can result in potentially significant financial benefits from the improved health of the population due to the consequent improvement in air quality.

The meeting was held on the 24 ó 25 September 2009, at the Common Wealth Speke Resort in Munyonyo, Kampala with a theme: *Evolution of Product specifications in Africa*. The meeting drew participants from Cameroon, Ivory Coast, Nigeria, Kenya, Sudan, Angola, South Africa, Gabon, Tanzania, Democratic Republic of Congo, Ethiopia, Ghana Uganda, France, Canada, Greece, USA, UK and India. The participants included refiners, marketers, regulators and promoters from the oil and gas sector. The conference was officially opened by Hon. Simon D'Ujanga the Minister of State for Energy ó MEMD, Uganda who gave a key note address. This report highlights the presentations made by several participants and the discussions conducted during the different sessions. It further gives recommendations and timelines to the ARA board, agreed upon by the participants under the guidance of the ARA Specifications working group to enable Africa reach its goals in achieving set fuel specifications.

It was recommended that Governments should ensure that official fuel specifications reflect AFRI-2 or better by end 2010. They should also ensure that official fuel specifications reflect AFRI-4 or better by 2020. It was suggested that ARA members establish constructive dialogue with respective Regional Communities of States (eg. EAC), Government, Ministries and other stakeholders to establish specification changes within a firm timetable and a durable regulatory environment. Finally, that outcomes from such dialogues be communicated to governments so that they are adopted and enforced.

1.0 BACKGROUND

The Ministry of Energy and Mineral Development in partnership with the United Nations Environment Programme (UNEP) and the African Refiners Association (ARA) organised a two days conference on fuel specifications and refinery development in Africa. The meeting was part of ARA's efforts to increase the knowledge on fuel specifications in Africa and also as a follow up activity on the recommendations of United Nations Environment Programme African Regional Agreements on Air Quality.

In March 2006, refiners from all over Africa voted to create an NGO named the African Refiners Association, to represent their interests and to address issues that impact the African downstream oil industry. Its membership comprises of importers, terminal operators, regulators, major marketers, shippers, etc. The membership in ARA has continued to grow with 21 of the 25 refining companies in Africa being paid up members. Its major sponsors include NNPC, SONANGOL, Total, BNP Paribas, PetroSA and SIR.

The role of the African Refiners Association has evolved to give a voice not to only African refiners but also to independent importers, distributors and marketers across Africa. Today the ARA's principal aims and objectives come to represent the needs of all downstream oil activity on the African continent. ARA's main objectives include;

- ✓ To promote the exchange of positive experiences between Members, as well as improve their technical and economic performance.
- ✓ To improve communication and cooperation between its Members and the international oil market.
- ✓ To achieve this, ARA cooperates with the relevant industry groups, governments, regulatory bodies, international agencies, academic institutions and non-governmental organisations.

ARA partnered with the Ministry of Energy and Mineral Development, Uganda and UNEP to conduct a two day meeting to discuss regional differences in product quality, their evolution and the impact on refinery and logistic investment and planning.

1.1 Purpose of the conference

The conference was organized to enable major refiners, marketers and other relevant stakeholders to discuss the evolution of fuel specifications and refinery development to arrive at key conclusions on the way forward in the development and implementation of product specifications in Africa.

1.2 Participants

Several organizations, companies, institutions and government bodies were represented at the conference. The participants included leading refiners, marketers, regulators and promoters from the oil and gas sector. The participants came from Ivory Coast, Kenya, Nigeria, Angola, Sudan, France, South Africa, Ghana, United Kingdom, Gabon, Democratic Republic of Congo, Ethiopia, Tanzania, Uganda, France, Greece, USA, UK and Canada. The main refineries in Africa that participated include SIR (Ivory Coast), SONANGOL (Angola) and Kenya Petroleum Refineries Limited. The number of participants was 65 with majority participation from Africa.

2.0 CONFERENCE PRESENTATIONS

The conference commenced on Thursday 24th September 2009 with a key note address on *Evolution of Oil Product Specifications* by Hon. Simon DøUjanga, the State Minister of Energy - MEMD, Uganda who officially opened the conference. Several presentations were made by representatives of different organisations and institutions. Below are highlights of each of the presentations and the ensuing discussions.

2.1 General ARA presentation – Joel Dervain (President, ARA)

Mr. Dervain gave an overview of the role of ARA. He presented the Association's workgroup structure, the members and associate members along with the objectives of the association. He highlighted the benefits of being a member of ARA and they included;

- Invitations to join workgroups
- Invitations to attend seminars
- ARA newsletter/ bulletin
- ARA cocktail invitation
- Company profile in ARA show guide
- Link on ARA website
- Attendance at AGM
- Access to database
- Participation in regional studies
- CITAC workshop 25% fee reduction

2.2 AFRI specifications – Emmanuel Quartey (Consultant)

He gave a background about the specifications. The 2001 Dakar Declaration called for the elimination of lead in Sub Saharan Africa by 2005. Afterwards international attention turns to the sulphur content in fuel and suggestions on reduction are mentioned. After the reduction has been implemented, a road map is drawn to ensure that the lead and sulphur levels are kept at a minimum. ARA designed a specification to suit African market and environment.

- AFRI-1 the start point with unleaded gasoline
- AFRI-2 lowering sulphur

- AFRI-3 lower sulphur again, plus lubricity and benzene specifications introduced
- AFRI-4 sulphur 50ppm diesel, 150ppm gasoline. Benzene 1%, density constraints on diesel

He also went on to talk about what the AFRI categories were consisting of;

- AFRI 1 & 2 was designed to reduce Sulphate particulate in the early stages: many 'typical' Diesel Sulphur levels are in fact much better than the actual specification and AFRI 2 was designed to reflect that.
- AFRI 3 & 4 was designed to enable vehicle technology.

The table below shows the concentrations of the various elements in the AFRI specifications

GASOLINE		AFRI-1	AFRI-2	AFRI-3	AFRI-4
Ron, min*		91	91	91	91
MON, min		81	81	81	81
Lead content**		Unleaded	Unleaded	Unleaded	Unleaded
Sulphur content, % mass, max		0.1	0.05	0.03	0.015
Benzene content, % vol, max		to be reported	to be reported	5	1
DIESEL		AFRI-1	AFRI-2	AFRI-3	AFRI-4
Sulphur content, % mass, max		0.8	0.35	0.05	0.005
Density at 15°C, kg/litre (min/max)		800/890	800/890	800/890	820/880
Cetane index (calculated), min		42	45	45	45
Lubricity (HFRR @ 60°C), micron, min		to be reported	to be reported	460	460

*A higher grade of gasoline may be marketed if required

**'Unleaded' means <0.013g of lead per litre

The recent developments in South and East region were presented;

- Kenya Bureau of Standards has announced plans to tighten gasoil specification to a maximum of 500ppm Sulphur (0.05%).
- Tanzania's Energy & Water Utilities Regulatory Agency has announced similar plans to restrict gasoil imports to a maximum of 500ppm Sulphur (0.05%).
- Madagascar's Office Malgache des Hydrocarbures has stated that 91 RON gasoline will be banned from November 2009, the new minimum RON being 95.
- Zambia's Bureau of Standards has published a consultation document regarding a reduction of gasoil sulphur from 7500ppm (0.75%) to 5000ppm (0.5%).

The official specifications of South and East region countries performed fairly well in the AFRI scale with the following results for gasoline official specs and gasoil official specs respectively; 37% below AFRI-1, 42% at AFRI-1, 21% at AFRI-2 and none at AFRI-3 or 4 and 8% below AFRI-1, 54% at AFRI-1, 8% at AFRI-2, 30% at AFRI-3 and none at AFRI-4

He also talked about regional harmonization and the benefits such a step would be to the continent;

- To match fuel quality with vehicle technology.
- Provides a reference point for step-wise approach to improvements.
- Economic advantages for supply chain and security of supply.

There is need for road and rail and infrastructure development to supply different fuels to meet the market's needs. The recommendations put forward were;

- Need to improve the fuel quality to AFRI-4.
- Governments improve vehicle fleets.
- African refineries need to develop plans to meet the AFRI-4 specifications by 2020.

2.3 World Bank/ARA Sub Saharan Africa Health and refinery study – John Mruttu, KPRL

In his presentation John Mruttu of KPRL talked about the Sub-Saharan Africa Refinery Project by the World Bank. It consists of three categories i.e. the health study, the refinery sector study and the regional analysis.

The Health Study;

- The estimated decreases in air emissions and health impacts are because of:
 - The use of better quality transport fuels.
 - The use of vehicles with emission controls, an I&M program, and controls on 2-stroke engines.
- There is an increase in the monetary benefits associated with the decrease in air pollution-related health impacts.

The Refinery Sector Study;

- The changes in the Sub-Saharan (SSA) Africa refining sector are highlighted that are needed to respond to the global trend of clean transportation fuels.
- The costs are also noted that are necessary for clean transportation fuels in SSA.
- The competitiveness of SSA refining sector in the global market was evaluated.

The Regional Analysis;

- Here a comparative study was carried out in the West, East and South parts of Africa in terms of costs and health benefits.

He also talked about the key results in the three categories of the SSA refinery project;

The Health Sector;

- There was a decrease in the air-pollution-related mortality rate and less disease cases reported.
- There monetary benefits are expected to increase.

The Refinery Sector Study;

- SSA refineries that are efficient and complex with access to markets and good quality local crude oils, can economically supply AFRI-4 products. This will improve their margins and most likely cause them to expand.
- SSA refineries that are small and/or inefficient will face growing challenges or worse could be shut down. They will not be able to hold out against the bigger and better equipped refineries.

The Regional Analysis;

- There were greater benefits than costs in West Africa compared to East Africa. South Africa already has improved fuel quality and less diesel vehicles.

He discusses the results of improved fuels and transportation. There is an increase in the saving of lives since there is less particulate matter and emissions. Less money goes into health care and is able to be channeled into other important matters concerning the respective regions.

A global refining model was employed to answer the questions of investment, delivered product costs, health benefits value and also the outlook of SSA refineries given regional demand growth, competitive world market developments and large, modern refineries in the Middle East and India.

The results were as follows;

- There are several SSA regions that have the advantage of local and good quality crude oil supply coupled with a good local product demand.
- Larger, more complex and efficient refineries have the ability to supply AFRI-4 products and to expand.
- In addition, potential appears to exist for new "world-scale" refinery capacity in West Africa between 200,000 to 400,000 bpd, depending on unfavorable or favorable scenarios.
- Small, simple, inefficient refineries face increasing challenges even when inland and/or with local crude supply.
- Market economics apply. Subsidies duly paid to reward investors.

He gave an outline of recommendations that should be taken into account and considered;

- Governments should instigate a sustained effort to update official fuel specifications to reflect current refineries' actual production.
- Governments should consider upgrading the official fuel specifications in their country to AFRI-4 by 2015.
- SSA refineries that could economically produce transport fuels at AFRI-4 specifications should develop investment plans to meet a 2015 deadline.
- In parallel,
- Governments should adopt and enforce regulatory measures to improve the vehicle fleets such as:
 - All imported gasoline powered cars must have functioning catalytic converters.
 - Establish an inspection and maintenance program.
 - Encourage the phase-out of old, highly polluting vehicles.
 - Encourage the phase-out or banning of 2-stroke engines.

To reduce the uncertainties confronted in this study, Governments and International Agencies should conduct research with respect to:

- Data on emissions in major urban centers (including permanent installations for measuring pollution levels).
- Examination of the appropriate methodology for estimating health costs and benefits in developing nations.
- Improvements of data on product demand.
- The WORLD® model indicates that major expansion will be needed in existing refineries, as well as new regional refineries in the Africa West/Angola region. Lesser growth is expected in Africa East and refining investment will probably be tied to Ugandan crude oil. More focused technical studies should concentrate on these regions.
- Open market policies should be expanded to allow refineries to improve their revenue as they move to AFRI-4 standards and are rewarded for their investment.
- Policy makers need to decide the future of the mainly topping/reforming refiners such as those in Senegal, Congo, Gabon, and Kenya. The study indicates the magnitude of the costs of modernizing and operating these refineries to meet the AFRI-4 specifications vs. importing products

2.4 The evolution of Euro Standards in a European environment and their relevance to Africa – Michel Rouyer, TOTAL

This presentation was handled by Michel Koblavi from TOTAL. He talked about the impact that emissions from petroleum products and combustion plants have on health and the ecosystems and ways to eliminate them;

- Phasing out of lead
- Improved fuel quality
- Acidification strategy and air quality directives

The political and legal driver that started this evolution was the decision to create a market covering the whole European Union-the European Common Market. He also explained why they came up with two directives for gasoline and diesel. The two directives, EN 228 for gasoline and EN 590 for diesel, was to promote commercial trade in the Union and avoid a patchwork of specifications which would make it difficult to sell a product from one country to another in Europe.

A similar approach can also be applied to Africa and can help develop the trading on a regional basis, with a potential bonus to the local refineries and business. There is evidence that such regional markets already exist in some African zones. These directives are beneficial because they brought about the reduction in air emissions by 70% in gasoline and 60% in gasoil. They also improved on the fuel quality. The ban on lead components was justified by the impact of lead on the air quality and the poisonous effect of lead on catalysts. The evolution towards unleaded gasoline has already taken place in most African countries.

Two main standards of cars are available in the world:

- In Europe , cars are designed to run on a RON 95/ MON 85 gasoline
- In the USA, Asia and Africa the standard is mainly on a lower octane level, equivalent to RON 91/ MON 82.

The octane level of the gasoline is improved in the refinery by processing naphtha in a Platformer unit. High octane levels can be reached under more severe conditions or with a continuous regenerative Reformer (CCR). Octane is a measure of the ability of the gasoline to resist auto-ignition which can cause engine knock.

To further increase the octane level, light naphtha has to be processed through an isomerisation unit and, in case of a refinery with FCC, an alkylation unit can be considered.

Finally, the addition of ethanol or other oxygenates increases octane as seen in France, gasoline contains up to 10 % of Ethanol or up to 22 % of ETBE.

The ARA Octane level is similar to the USA quality, that is, RON 91. Generally this level is sufficient but in countries where the vehicle fleet is designed for a higher octane level, another grade can be considered. Most of the African refineries will need heavy investments to produce significant amounts of this higher octane gasoline.

Benzene

He also talked about benzene in gasoline and ways that it can be reduced. However reduction of benzene also leads to reduction in octane and therefore is a challenge to African Hydroskimming refineries. They will need to face major investments. Vapor recovery at truck loading and at service stations could be an efficient alternative to limit benzene exposure. A good maintenance of the vehicle and a catalytic converter reduce NOx & CO emissions but also unburnt hydrocarbons from lean exhaust gases.

Sulphur

Sulphur in gasoline reduces the efficiency of catalysts. A decrease in sulphur levels in the fuel leads to a reduction of emissions from catalyst-equipped vehicles (HC, CO, NOx). Sulphur has also a negative impact on the exhaust gas oxygen sensors. Very low sulphur levels (at least below 150 ppm) are useful to reach stringent emission standards, possible only with Low Emission Vehicles (LEV) or Ultra-LEV.

These benefits of reduced emissions can only be achieved on new technology vehicles. On older vehicles there is no effect. But even with new car technologies, good car maintenance is needed and vehicle emissions controlled on a regular basis.

To avoid unnecessary investments, the planned sulphur reduction must be at the same time as the evolution in the vehicle fleet. Its age, technology and maintenance and standards of car maintenance must be improved prior to implementing a reduction in sulphur.

Sulphur reduction

- Sulphur levels in diesel affects the performance of catalytic systems.
- Reduction in sulphur in diesel results in reduction of particulate matter (PM) and enables use of particulate filters.
- Sulphur in diesel comes from the crude processed. Refineries have to implement new hydrotreatment units (HDS) to lower the sulphur content of diesel and, if the availability in hydrogen is not sufficient, hydrogen plants also.
- A level of 50 ppm can be reached whatever the crude slate is, high sulphur or low sulphur, by processing all the diesel cuts through the HDS.
- As for gasoline, the planned reduction of sulphur in diesel must be in line with the evolution of the fleet of vehicles, its age, technology and maintenance.

Cetane and Density

The cetane is an indication of the compression ignition behaviour of a fuel. An increase in cetane improves cold startability and reduces HC and CO emissions. The cetane of diesel is one of the qualities of a crude oil. Many African crudes, due to their composition (naphthenic crudes), show a high density of the diesel cuts. For the same reason, these cuts have low cetane numbers. The European specification is 46 for Cetane Index and the upper limit for density is 845.

The appliance of the European level for these specifications would lead to a large reduction of diesel production and /or a need for high pressure desulphurisation. A further step for

AFRI specification would be to reduce the upper limit of density

Conclusions

- RON 91 is a realistic approach acceptable by most motors in Africa.
- In some regions a second grade at the European level (RON 95 /MON 95) can be considered.
- Sulphur evolution will need major investments, notably in HDS units.
- The pace for improving products quality must be in line with the evolution of the fleet of vehicles.
- The maintenance of current vehicles and the suppression of two-stroke engines are a simple and efficient step to improve significantly the Air Quality in urban areas.
- The evolution in Europe took almost two decades. Investment spread over a long period gives time to adapt the refining tool

2.5 East African Refinery Development Programme – Mr. Gerald Banaga-Baingi

In this presentation, Mr. G. Banaga-Baingi from MEMD, Kampala talked about the Upstream and Downstream Petroleum industry in East Africa, analysis of the current system, Regional Refinery Development framework and the timeframe.

In the Upstream sector, there are legal frameworks in place, exploration activities being carried out along with development and production, for instance, Songo Songo and Mnazi bay gas production, planned 100000-150000 bpd production in Uganda.

In the downstream sector, there are legal frameworks in place, policies to ensure availability of reliable energy supplies, and institutional framework to implement the existing policies and regulations.

He discussed the growing demand in the oil and gas market which grows at a very fast rate. The estimated amount is 10.2 MT by 2010 and 19.5m MT by 2025. The demand for gas is growing very fast. The demand by 2005 was 69,624MT projected to reach 324,654MT by 2025. 70-90% of the natural gas produced in Songo Songo is used in electricity production and a smaller percentage taken from Mnazi bay.

There are two supply chains i.e. the northern and southern corridor. The northern corridor; Mombasa thru Uganda to Burundi, Rwanda, Eastern DRC and Southern Sudan and the Southern Corridor; Dar-es-Salaam to Uganda, Rwanda, Burundi, Eastern DRC. There are challenges experienced through the routes, for instance;

- Poor road network
- Inefficient railway system
- Underutilization of the Mombasa refinery i.e. high sulfur content fuel (1%)
- Poor or no implementation of better changes along the routes e.g. revenues

He also mentioned the key issues concerning East Africa;

- Oil discovery and potential
- Mombasa refinery improvement
- Infrastructure improvement
- Need to develop a new refinery

The EAC Summit of the Heads of State in June 2007 recognised;

- The importance of boosting refinery capacity in the region
- Recent discoveries of oil and gas
- The need to ensure that resources provide optimal benefits to the region.

He further discussed the development of a refinery in Uganda following the discovery of oil and natural gas reserves in the country. The oil reserves discovered so far are sufficient for commercial development. The Government of Uganda has expressed its determination that the oil should be refined locally and as a result a programme on refinery development has been drawn and commenced on. He also listed the benefits of having a refinery;

- Value addition; to crude oil, connected industries using feed stocks; petrochemical, bitumen
- Supplying the available & potential market
- Employment creation, wealth distribution and knowledge transfer and development through brining in scientific and engineering skills to the region.
- Offsetting import bill (regional dd of \$5.3b)
- Boost the region's refining capacity and thus ssecurity of supplies;
- Contribute to the region's growing energy needs;
- Achieve least cost supply of products;

- Earn revenues to support development in the region including poverty reduction, education, health and other human development;
- Create investment opportunities, industrialisation and contribute to sustainable development in the region;

Refinery development undergoes four stages;

- Feasibility study
- Project design
- Engineering Procurement and Construction (EPC)
- Commissioning and Operation of the refinery

Currently Uganda is in the first stage of development, that is, the feasibility study. The objectives of a feasibility study are;

- To study the viability of developing a refinery in Uganda with required infrastructure in order to achieve optimal benefits from the discovered resources.
- To analyse and document different alternatives with cost estimates for a refinery.
- To analyse the impact that the development of a refinery will have, address and prioritise the specific areas of concern and propose possible mitigation measures.

The timeframe of the refinery development in Uganda was also mentioned in the presentation.

- Advertisement for Expression Of Interest for the Feasibility Study, August 2009
- Short listing of EOI, September 2009
- Request For Proposals (RFP), September/October 2009
- Negotiations/Award, Oct./Nov.2009
- Feasibility Study, Dec 2009 - May 2010
- Overall refinery development 5-6 years, (2010-2015).

The conclusion was that refining in Uganda is going to provide very many benefits to the country and region as a whole. He made a call to ARA to support Uganda in its endeavour to build a refinery.

2.6 Focus on West Africa – Michel Koblavi, SIR

In this presentation Michel Koblavi from SIR touched on the fact that there was a West and Central sub regional workshop on Better Air Quality (BAQ). It developed targets to address air pollution from the following sources;

- Industry and Mining
- Household Pollution
- Waste disposal
- Bush fires, uncontrolled burning and deforestation
- Urban Planning and Management
- National and Regional Environmental Governance.
- Transport

He went on to suggest recommendations to the problems;

Industry and mining recommendations

- Elaborate and adopt policy and legal frameworks to promote adoption of best available industrial establishments including the gradual phase-out of inefficient and environmentally unsustainable industrial technologies by 2012.
- Elaborate and adopt policy and legal framework to facilitate and promote the use of cleaner fuels and efficient utilisation of energy for heavy industrial operations.
- Subject activities that have an impact on air quality to an environmental and social impact assessment and environmental audit process.
- Encourage the synergies and co-benefits of air pollution and climate change mitigation projects.
- Develop and/or use land-use control instruments, such as regulations on zoning, to ensure the appropriate location of industrial establishments.
- Enact emission standards and regulations for the different categories of industries and ensure compliance.
- Build capacity for national monitoring of emissions from industrial and mining activity.
- Harmonise industrial and mining emission standards and regulations to address the effects of trans-boundary air pollution.

Transport sector recommendations

Vehicles standards

- Enact regulations to restrict the age of imported vehicles and to ensure that new and second hand imported gasoline vehicles are equipped with functioning catalytic converters by 2011.
- Establish pilot vehicle emission testing programs immediately in major cities and complete testing by 2012.
- Develop the necessary capacity to enforce the inspection and maintenance programs through public information and training campaigns.
- Establish minimum regionally harmonized emission standards by 2014 for the different categories of motor vehicles as stringent as available fuel quality will allow.
- Explore and adopt modern technologies that promote vehicle fuel efficiency and reduce emissions including diesel retrofits and low emission vehicles.
- Ban the import of two-stroke motorcycle immediately but no later than 2012 and promote the use of cleaner motorcycles.

Fuel standards

- Harmonise fuel standards and practices in the sub-region by 2015 in the relevant regional organizations
- Enforce regulations against the procurement, sale and use of fuels not meeting the set standards
- establish new and reinforce and expand capacity of existing fuel quality analysis laboratories

- Undertake detailed economic, social, and environmental assessments to enable sustainable use of bio-fuels and other cleaner fuels
- Enact regulations to adopt AFRI-2 (3500 ppm max sulphur in diesel and 500ppm in gasoline) or better fuel specifications by the end of 2010 and implement AFRI-4 (50 ppm max sulphur in diesel and 150ppm in gasoline) by 2020
- Develop a refinery investment plan to implement AFRI-4 by 2020

2.7 Focus on East Africa – Willy Musinguzi, EAC

The East African Community (EAC) consists of Uganda, Kenya, Burundi, Rwanda and Tanzania where the headquarters are in Arusha. The EAC was established on 7th July 2007 with its original members as Uganda, Kenya and Tanzania. Rwanda and Burundi became members of the Community on 1st July 2007.

- The EAC aims at widening and deepening co-operation of the Member States in, among others, political, economic and social fields for their mutual benefit.
- The Community also aims at attaining environmental management and improved infrastructure in the region.
- To attain, efficient and standard infrastructure, promote international trade and increase the competitiveness of manufacturers in EAC by 2012.

He went ahead to talk about ways the EAC is harmonizing standards in the region. By striving to categorize commonly traded goods and services, methods of tests, codes of practices and measurement and then assigning them a harmonized standard to facilitate regional and international trade. There is one such law on standards; East African Standardization, Quality Assurance, Metrology and Testing (SQMT) Act, 2006 which is now in force in 5 member states. This law applies to products and services produced and traded in the region and it protects and ensures safety of the society.

SQMT programmes have been implemented to advance compliance in fuel sector such as instituting fuel laboratories in at least 3 Member States, verification of volumes of fuel by NBSs & certification. Harmonization of standards of fuel is usually based on ASTM standards, ISO standards. In order to implement the EAC SQMT Act, 2006, national laws on standards must be synchronized to ensure effective action. At the moment this is an ongoing process in the EAC.

Conclusion

The world is now an obvious small global village that we can not afford to maintain regional differences in product quality. We have to plan together investments we make in this sector, create the energy efficiency improvement schemes and renewable energy, and lowering of carbon emissions.

2.8 Focus on South Africa – Anton Moldan, SAPIA

The South African Petroleum Industry Association (SAPIA) was formed in 1994 to represent the common interests of the petroleum refining and marketing industry in South Africa and now has 7 members. SAPIA's role is to:

- Promote an understanding of the industry's contribution to economic and social progress with all stakeholders,
- Represent the industry in national and international forums,
- Be a source of information on the Industry as a whole,
- Encourage co-operation between members on matters of mutual and/or public concern without inhibiting competition (eg. health, safety and environment).

There are categories of harmful vehicle emissions;

- Toxics
- Green House Gases (GHGs)

Some of the sources of GHGs include;

- By-product of the combustion of hydrocarbon fuels.
- Main sources: electricity generation, industry and motor vehicles.
- The transport sector is viewed as the fastest growing emission source for 2003 ó 2050.

Some of the benefits of lead removal were that;

- Vehicles were fitted with catalytic converters (catcons) and these remove harmful carbon monoxide (CO), nitrous oxide (NO_x) and unburned hydrocarbon (HC) emissions by ~90%,
- Lead emissions into the environment were reduced. Thus atmospheric and marine lead levels were reduced.

And to achieve this reduction in harmful vehicle emissions, all factors must be taken into account without excluding anything. In other words a holistic, integrated approach.

Catcons were introduced in USA and Japan in the 1960s and it has taken 20 years to phase out lead.

Fuel parameters

Japan, Europe and the USA determined that from the perspective of environment, health and vehicle technology enablement, the following fuel parameters were the most important:

- **Petrol**
 - Reducing sulphur
 - Reducing benzene
 - Reducing volatility
- **Diesel**
 - Reducing sulphur
 - Total aromatics, PAH, final boiling point and cetane number

Recommendations

- A multi-stakeholder process is required to ensure general buy-in by all affected parties.
- The decision-making process is made easier for the regulator if the various sectors can speak with one voice and present a common viewpoint.
- The required fuel specifications must be officially promulgated before firm investment decisions for refinery process changes can be made i.e. regulatory certainty is required.
- A practical lead time is required between the time that specification changes are promulgated and implementation takes place.
- Incentives would encourage early / staggered investment. This approach would support energy security of supply.

Conclusions

- Fuel specifications need to be set according to the specific requirements of the particular region.
- A holistic approach needs to be adopted to address the urban air quality issue successfully.
- A multi-stakeholder approach has been found to work well in practice.
- Adequate scientific information is required to make sound decisions on future fuel specs.
- SAPIA is very willing to share results of studies recently carried out in South Africa.

2.9 South Africa's Journey towards the Introduction of Cleaner Fuels by Anton Moldan from SAPIA.

The presenter stated SAPIA's main role which is to promote an understanding of the industry's contribution to economic and social progress with all stakeholders. He then gave an overview on the main vehicular emissions are toxics and Greenhouse Gases. He stated that the transport sector is the fastest growing emission source and hence deliberate efforts have to be made to arrest the growing emissions. In South Africa, efforts have so far been geared towards the elimination of lead and this has resulted in decreased levels of lead in the atmosphere and marine environment. For example, In Cape Town, the lead levels decreased from 15.5 parts per million (ppm) in 1986 to 0.6 ppm in May 1998. From 2006 all new petrol models had to be fitted with catalytic converters (catcons). As from 2008 all new petrol vehicles had to be fitted with catcons to meet Euro 2 emission limits. Catcons remove harmful carbon monoxide (CO), nitrous oxide (NOx) and unburned hydrocarbon (HC) emissions by ~90%. Efforts to reduce on vehicular sulphur emissions are also ongoing.

He stated that a holistic, integrated approach to achieve a reduction in harmful vehicle emissions is the only solution. The effects of fuel quality changes in isolation of changes to vehicles are relatively small compared with reductions achievable from changes to engine technology. The real benefits of fuel quality changes are achieved when they are used to enable improved vehicle technology.

An emission reduction strategy needs to be designed to solve a particular region's specific air quality problem. This is because of difference in vehicle parcs, local air quality differs, unique fuel sources and difference in geographical location. Sound science is needed to form the basis of any air quality management approach, as was adopted in Europe (e.g. Auto/Oil programme). SAPIA is in the process of reviewing the scientific information available on which to base a sound fuel quality strategy.

In order for any emission reduction strategy to be a success, the following key points should be observed;

- A multi-stakeholder process is required to ensure general buy-in by all affected parties.
- The decision-making process is made easier for the regulator if the various sectors can speak with one voice and present a common viewpoint.
- The required fuel specifications must be officially promulgated before firm investment decisions for refinery process changes can be made i.e. regulatory certainty is required.
- A practical lead time is required between the time that specification changes are promulgated and implementation takes place.
- Incentives would encourage early / staggered investment. This approach would support energy security of supply.

2.10 An analysis of the costs of upgrading refineries to meet higher fuel specifications in South Africa was presented by Mike Stead from the South African Petroleum Industry Association (SAPIA).

A cost estimate analysis was done by Foster Wheeler Energy Limited (FWEL) contracted by SAPIA for the implementation of Clean Fuels 2 (CF 2) and Clean Fuels 3 (CF 3) in South Africa. The analysis done on five refineries verified the most likely changes that would be required by each refinery to meet the proposed new clean fuels specifications.

The total capital cost estimates for the implementation of CF2 and CF3 in South Africa were as follows; total Estimated Cost for South Africa for CF1 to CF2 3.3 US\$ Billions and total Estimated Cost for South Africa for CF1 to CF3 3.7 US\$ Billions. These costs estimates do not include any effects that the current downturn in world economy would have on the future costs and are based on trends seen over the last few years. It is however likely that the cost estimate can be reduced by the refineries through good negotiation skills and careful selection of equipment manufacturing companies.

The time required for implementation of all equipment installations as well as precommissioning and commissioning activities until the refinery is at Ready for Start- Up (RFSU) stage is 75 months. This time schedule has a number of risks that can lead to a longer total span. One of the greatest risks is the serious strain on resources that will occur if all 6 refineries in South Africa

commenced with CF2 work simultaneously. The SAPIA member refineries will need to establish an industry wide shut down and turn around strategy to ensure that the fuel supply to the country is not adversely affected by CF2 and CF3 implementation. Other risks include;

- Failure to negotiate licensor agreements
- licensor duty specification in timely manner can lead to delays in schedule, Material, equipment and subcontractor market conditions, which are currently difficult to predict,
- Effect of poorly defined EPC contractor interfaces,
- Inefficient management and Risks and opportunities created by global market condition which are likely to put clients in a strong negotiating position, but possibility of major suppliers becoming insolvent.

It is estimated that the earliest time that all SA refineries can be converted, allowing reasonable time for phasing in the changes, is by the end of 2016.

2.11 Fuel specifications given the unique mix of crude based and synthetic fuels in SA by John Fitton from SAPIA.

South Africa is currently operating 6 refineries producing up to 708,000 bpsd of oil products. The Synfuels industry supplies ~30% of SA transport fuel consumption. The Sasol Synfuels plant is Coal-fed, supplemented with natural gas with a capacity of 160,000 bpd crude oil equivalent and the PetroSA natural gas-fed plant has a capacity of 45,000 bpd. The Total capacity of synfuels processing plants is about 205,000 bpd crude oil equivalent located at two of the main refineries. The main products are diesel and petrol whose greatest percentage (60%) is used in inland SA.

The consideration of any fuel specifications takes into account;

- the diverse vehicle parc (age & technology),
- altitude (60% of parc operates at >1500 m),
- climatic conditions,
- production technologies and feedstocks,
- No negative impact on the poor and
- The need to ensure cost competitiveness.

The Crude based products are mainly petrol and diesel with high densities, sulphur content and high aromatics. The synthetic (coal/gas) based product is mainly petrol with low sulphur, olefins, low density diesel, lower viscosity and high cetane number.

The main challenges facing the synfuel processing industry in the bid to meet cleaner fuel specifications are a more complex plant from syncrude to final products and requires very costly product upgrade and blending with other products. For the crude processing industry, the main challenge is the desulphurising resulting in costly upgrade.

Conclusions

The fuel specifications need to be set in the best interest of the country, taking the following into account; fit for purpose, cost effective, minimise impact on balance of payments (local upgrading) and positive impact on urban air quality. A systems approach should be used to define any fuel specifications. This includes inter relating vehicle technology, fuel quality, clean air and Inspection and Monitoring programs. Tailor made specifications are required, learning from the lessons learnt from the past and journeys in other countries.

2.12 Assessment of the current and future vehicle fleet in South Africa was jointly presented by Mike Stead and John Fitton from SAPIA.

Vehicles in SA are both locally manufactured and imported. However, the local industry is somewhat protected because it is very beneficial to the country's greater economy. The brands manufactured locally include Nissan, BMW, Renault, Ford, Volvo, among others.

The vehicle parc study sought to understand the vehicle parc in terms of its: size, engine emissions technology, annual usage, fuel consumption and key fuel qualities. The data for the vehicle parc study was drawn from vehicle registration systems, oil companies, reference libraries, relevant government institutions and some Original Equipment Manufacturers (OEMs) operating in South Africa. Other data was researched on the internet. It was assumed that there would be a short term increase in vehicle numbers between 2008 and 2014 during the World Cup season. New vehicle replacement and growth was initially set at 9.5% per annum (based on history), subsequently reduced. Vehicle scrapping rate was found to be relatively constant but varies according to vehicle types.

Study results

The study revealed that the new vehicles will be more efficient requiring upgraded fuel types. However, there will be a reduction in distance travelled and an increase in public transport usage due to higher fuel costs. The current calculated average age of the RSA passenger and LDV vehicle parc is 10 years. This is compared to the passenger car parc estimation of 10.3 years in 2003 (National Octane Study). Predominance of Euro 2 and older technology vehicles is likely to stay for many years to come. The actual emission performance of the vehicle is dependant on the actual level of maintenance. Hence one cannot assume that the actual car parc emissions are in line with the manufactured emissions performance. The demand for enabling fuel demonstrates a wedge effect as new technology vehicles grow over time.

2.13 When Opposing Views Emerge On Specification Limits: Guidelines for Managing Toward Consensus by John Walsh from Afton Chemicals

All over the world, some specs/ regulations have worked well and other have not. Those that have worked well showed broad acceptance and success in achieving goals pertaining to emission reduction, performance, etc. However those that have not worked well were poorly

accepted, did not achieve goals for emission reduction, performance, etc, required alteration and there were legal and/ or political battles. Given a scenario where specs/ regulations are faced with opposing views, what can be done to achieve a harmonised position? Some guidelines are provided to ensure development of fuel specs/regulations that are widely acceptable. These include;

- Specs need to be based on good science. Good science has credibility, is transparent, independently peer reviewed for validation and has a strong consensus within expert scientific community
- Specs should actually produce the intended results. They should be able to reduced emissions, have health benefits, enable vehicle performance

Despite the fact that some guidelines have been availed to enable an almost smooth process in defining fuel specs/regulation, there are still challenges faced. These include;

- Scientific data not always available,
- there can be opposing scientific views,
- challenges on how to define appropriate level of 'precautionary principle' when uncertainties exist,
- Competing commercial motivation between different groups such as crude producers, refiners, marketers, shippers, etc.
- Debate as to who bears costs for emissions improvement (e.g. cleaner fuels vs. cleaner auto emission equipment)
- Socio-economic / Political / Public Relations Issues e.g the food Vs biofuels paradox

These solutions to each of these challenges respectively are;

- Encourage spec-setting processes that encourage stakeholders to fund the science to get the data. Stakeholders should cooperate in defining how studies will be done and commit to accepting the results.
- Parties with opposing views must share and assess each other's data. (i.e. opportunity for rebuttal. Transparency is critical because if a scientific claim is not transparently vetted: Credibility and buy-in (commitment) to the specs is undermined, commercial motivations are encouraged and Science-based processes are discouraged
- Sometimes a decision must be made before scientific consensus has been reached. At such times, the 'precautionary principle' is often cited. Proper application of the Precautionary Principle (as agreed in the Rio Earth Summit declaration) therefore requires assessment of: the 'severity' of the risk, the risks & unknowns of eliminating or restricting the component, risks and unknowns of alternative components, costs and all these factors should be data-driven & depend on good science
- The challenge of competing commercial motivation can be addressed by ensuring that all stakeholders uphold the proper process. This is not easy given the large imbalances in stakeholder political/public relations strengths and financial resources.

- Emissions can be improved by making cleaner fuels or making cleaner cars. Therefore, refiners and automakers should share cost of improving emissions. They should be able to pass these costs along to consumers. Timing of fuel and vehicle improvements should be synchronized to work together
- Countries need to set clear policy priorities that respect previous guidelines for Political or populist specs that are not long term sustainable.

The discussion of fuel specs should provoke several questions; Are these guidelines helpful for Africa's needs and goals? What modifications / additions are needed? How to adopt and institutionalize helpful guidelines?

How should ARA & African countries ensure their unique needs are best served? How avoid repeating mistakes from other world regions? What external (EU, US, etc) solutions fit Africa? What external solutions are not a helpful fit? Which international specification forums should African countries (or African Union) and/or ARA engage with to ensure their needs are respected:

2.14 Production of Low to Ultra Low Sulfur Diesels (ULSD) and Ultra Low Sulphur Kerosene (ULSK) by Stéphane Wambergue – Axens.

There is a growing demand for diesel for mainly on-road usage. There quality requirements for Ultra Low sulphur diesel for on-road usage have become stringent. And there is a current move towards more stringent sulfur specifications for off-road diesel. Catalysts are used in the purification process to ensure low sulfur diesels. Currently, Axens is using two main catalysts that include NiMo and CoMo to achieve ULSD and ULSK. For ULSD, NiMo is used at high pressures for best results and CoMo at lower pressures. Axens has developed a new NiMo High-Temperature Reduced (HR) catalyst named HR 626 in the new HR 600 series to be used in the processing of ULSD. Commercialisation of the catalyst was done in July 2007 and the first firm order made in August of the same year. HR 626 has replaced 23 times non Axens catalysts over the past 25 months

The main characteristics for this catalyst and all HR series catalysts include; Very High Activity, Outstanding Stability and Regenerability of up to 95% of the initial activity. HR catalysts re-use cost is estimated to be at least 3 times less expensive than boosted catalysts. Over the catalyst life, HR catalysts are 30 to 40% less expensive than boosted catalysts.

Axens has received 205 awards for the HR 500 Series covering all HDT Services. For HR 626 the latest generation CoMo for ULSD, the company has received 46 awards after only 24 months.

2.15 The Partnership for Clean Fuel Vehicle by Jane Akumu - UNEP

The global vehicle fleet is expected to triple, increasing air pollution and greenhouse gas emissions from the automobile industry. Currently the world vehicles number is estimated at 700 million. The growth in vehicles has been estimated at 11.5% between 1995 to 2000. Most of the growth is

taking place in the developing and transition countries and yet there exists none or limited fuel efficiency strategies. Fuel consumption in the transport sector has also grown as a result of the increase in vehicle number. The growth in number of vehicles in Uganda has been tremendous with an increment from only 26,000 vehicles in 1980 to 629,175 vehicles in 2006.

The transport sector is emitting one-quarter of global greenhouse gas emissions. Apart from the concern about emissions, countries are faced with raising fuel costs resulting in high import bill and threats to their Energy security.

A number of strategies were proposed to reduce vehicular emission in Urban areas and they include;

- Good city planning
- Promoting non-motorized transport
- Promoting public transport
- Cleaner fuels and vehicles

A Partnership for Clean Fuels and Vehicles (PCFV) was formulated to empower developing nations to achieve reduction in the growing emission levels. This was set up at the World Summit on Sustainable Development, September 2002. The main objective is to address urban air quality in developing countries by promoting clean fuels and vehicles. It comprises over 100 partners from governments, industry, international organizations and civil society

The main goals of PCFV is to;

- To reduce sulphur in vehicle fuels to 50 ppm or below worldwide, concurrent with clean vehicles and clean vehicles technologies, with roadmaps and timelines developed regionally and nationally
- To phase out leaded gasoline by end of 2008 worldwide to be followed by the global introduction of vehicles with catalytic converters

The key campaigns carried out under PCFV so far include;

- Elimination of lead in gasoline
- Phase down of sulfur in diesel & gasoline fuels, concurrent with
- Adoption of cleaner vehicle technologies
- Development of Automotive Fuel Efficiency policies & strategies

Achievements

The PCFV was launched in September 2001 in Africa and by January 2006, all of Sub-Saharan Africa had phased out leaded gasoline. The "Global Fuel Economy Initiative" launched March 4 2009 with an aim to achieve 50% improvement in fuel economy across the global vehicle fleet by 2050. Currently the global average 8L/100km and the goal is to achieve a global fleet average of 4L/100km (25km/L). In turn this improved fuel economy will result in a drop in CO₂ emissions from 180gm/Km CO₂ to 90gm/Km.

Therefore PCFV can help:

- Build consensus amongst stakeholders
- Help prepare time frames and roadmaps
- Present policy options for consideration
- Be a catalyst for action
- Provide various types of support

Developing countries can achieve a sustainable transport sector characterised by reduced emissions levels by implementing the following recommendations;

- To lower sulphur levels in diesel fuels to at least 500ppm in the short term
- Target 50ppm as a long term goal and combine with Clean fuel efficient vehicles for max benefits
- Import vehicles that are fitted with catalytic converters
- Review vehicle importation age and emissions
- Regulations key in determining current and future standards

2.16 Fuel & Vehicle Challenges Arising from Improving Specifications by Allen Aradi – Afton Chemicals

The main drivers for the evolution of fuel specifications are; Environmental Stewardship, consumer purchasing power and fuels Supplies with a focus on the cost of crude oil, refining and transportation and storage infrastructure.

- **Environmental Stewardship**

With the on-going environmental concerns, fuel specifications are becoming more stringent. Forecasts reveal that the current fossil fuel based economies will undergo a transition to biomass driven economies in the future.

- **Consumer purchasing power**

The consumer purchasing power in Africa is very low compared to the EU, Asia and the USA. This is because of the low income levels. The National Average Per Capita Income using Atlas method shows that the EU and USA has got higher Income that is 32X that of Africa.

- **Fuel supplies**

Fuel supplies in Africa are affected by the price of Crude and the refining costs. Most of the crude in Africa is exported. Ironically, countries with lots of crude oil are still unable to meet their local demand for products. Most of the refineries operating in Africa are old and have lower efficiencies. Government energy policies favour the importation of refined products. There are several challenges faced in the development of storage and transportation infrastructure.

He further discussed the key drivers for diesel specifications in Africa. These included;

- Compromise on the emission controls by the OEMs. This results in emission of exhaust smoke and particulate, engine failure due to lubricant soot loading, engine life significantly shortened, engines prone to knock due to poor cetane fuels, etc
- Low consumer purchasing power that is 32 times lower than the US and EU
- Diesel fuel supply issues such as high sulfur levels, adulteration, cetane quality and lubricity.

Recommendations focus points for diesel specification included;

- Increase in fuel cetane (measure of the fuel's compression ignition delay); leading to better starting of engine and drivability, lower emissions and better and consistent fuel economy.
- Fuel detergency; Clean fuel delivery systems maintain good drivability and lower emissions
- Combustion improver; Decreases black smoke and particulate and improves combustion across the whole cycle.
- Lower fuel sculptures; decreases black smoke and particulate, decreases environmental corrosiveness of emissions control system.

3.0 CONCLUSIONS

- i. The rate of tightening of fuel specifications should proceed in light of the fact that African countries also have as their primary objective to develop their economies. ___A careful balance between consumer purchasing power, environmental stewardship, OEM technologies, and fuel specifications must be struck
- ii. Targeted harmonization of specifications regionally in the near term, and over the whole of Africa in the long term, synchronized with emission hardware improvements in the vehicle fleet, to improve emissions via improving fuel and vehicle quality must be done.
- iii. Simultaneous with specifications implementations, OEMs need to create technology to function adequately with the fuels thus specified.

4.0 RECOMMENDATIONS

The members with the guidance of the ARA working group on Specifications made a number of key recommendations that will enable Africa achieve fuel specifications levels that meet international standards. The recommendations are;

- i. Governments should ensure that official fuel specifications reflect AFRI-2 or better by end 2010
- ii. Governments should ensure that official fuel specifications reflect AFRI-4 or better by 2020
- iii. the definition of an AFRI-5 specification should be determined for more heavily polluted urban areas to reflect differences in urban and rural air quality
- iv. Members should develop investment plans with their shareholders to meet the AFRI-4 specifications by the 2020 deadline.
- v. Members should actively engage with all stakeholders in the above process
- vi. Members should establish constructive dialogue with respective Regional Communities of States (eg. EAC) , Government, Ministries and other stakeholders to establish specification changes within a firm timetable and a durable regulatory environment
- vii. Members should communicate to their Governments about key recommendations and regulatory measures suggested at different forums in order to improve the vehicle fleet. Apart from communicating, governments should be tasked to adopt and enforce them.

ANNEXES

ANNEX 1: PROGRAMME

24th of September 2009

- 09.00 Arrival and welcoming of participants
09.15 Speech by the State Minister of Energy
– *Hon. Simon D'ujanga*
- 09.25 General ARA presentation –
Joël Dervain - ARA
- 09.35 Introduction and objectives of the meeting
- 09.45 Coffee Break**
- 10.15 Presentation of Afri Specifications by *Emmanuel Quartey - ARA*
- 10.40 World Bank / ARA Sub Saharan Africa Health and Refinery Study by *John Mruttu - KPRL*
- 11.25 Questions & Answers**
- 11.40 Evolution of Euro standards in a European environment and their relevance to Africa by *Michel Rouyer - TOTAL*
- 12.20 LUNCH**
- 14.30 East African Refinery Development Programme, by *Gerald Banaga-Baingi - MEMD*
- 14.50 Focus on West Africa by *Michel Koblavi - SIR*
- 15.20 Break**
- 15.40 Focus on South Africa by *Anton Moldan- SAPIA*
- 16.10 Conclusion of the first day

25th of September 2009

- 09.15 Analysis of the costs of upgrading refineries to meet higher fuel specifications by *Mike Stead - SAPIA*
- 09.45 Fuel specifications given the unique mix of crude based and synthetic fuels in SA by *John Fitton – SAPIA*
- 10.10 Assessment of the current and future vehicle fleet in SA by *Mike Stead/John Fitton – SAPIA*
- 10.40 Coffee break**
- 10.50 When Opposing Views Emerge On Specification Limits: Guidelines for Managing Toward Consensus by *John Walsh – Afton Chemicals*
- 11.20 Refining technologies for clean fuels production by *Stéphane Wambergue - Axens*
- 12.00 Questions & Answers**
- 12.30 LUNCH**
- 14.00 The Partnership for Clean Fuel Vehicle by *Jane Akumu - UNEP*
- 14.35 Fuel & Vehicle Challenges Arising from Improving Specifications by *Allen Aradi – Afton Chemicals*
- 15.00 Questions & Answers**
- 15.20 Break**
- 16.00 Conclusion and closing remarks

ANNEX 2: LIST OF PARTICIPANTS FOR THE ARA/UNEP/MEMD SPECIFICATIONS MEETING

	COUNTRY	NAME	ORGANISATION	DESIGNATION
1.	Uganda	Hon. Simon DØUjanga	Ministry of Energy and Mineral Development	Minister of State for Energy
2.	Côte d'Ivoire	Joël Dervain	SIR	Managing Director
3.	Côte d'Ivoire	Michel Koblavi Dibi	SIR	Head of Strategy and Development
4.	Kenya	Raj Varma	KPRL	CEO
5.	Kenya	John Mkwawi Mruttu	KPRL	Chief Financial Officer
6.	Cameroon	Antoine Désiré BEYENE ZIBI	Sonara	Head of Quality Control Service
7.	Cameroon	MBOUA NKOT Pierre Achille	Sonara	
8.	Nigeria	Bashir Suleiman ABDULLAHI	NNPC/ Port Harcourt Refining Company	Managing Director
9.	Nigeria	Sheikh Tanimu MOHAMMED	NNPC	Technical Assistant to Group Executive Director (Refining & Petrochemical Directorate)
10.	Kenya	Sam Wamathu	ENGEN	
11.	Kenya	Powell Maimba	ENGEN	
12.	Uganda	Fred Gibson	ENGEN	
13.	Angola	Gilberto De Sousa	SONANGOL	
14.	Angola	Pedro Antonio Onde Quianica	SONANGOL	
15.	Angola	Nanga Joao	SONANGOL	
16.	SUDAN	Elimam Elamin Talha Nourelaim	KRC	
17.	Kenya	Jane Akumu	UNEP	Programme Assistant óTransport Unit

18.	SUDAN	Mohammed Abdelmageed Alaagib Abdelmageed	KRC	
19.	Côte d'Ivoire	Brice Georges Kadja	PETROCI	Shipping & Operations Desk
20.	Côte d'Ivoire	Akpass Valentin Akmel	PETROCI	
21.	France	Stéphane Wambergue	Axens	
22.	France	Michel - Jean ROUYER	TOTAL	
23.	Ghana	Emmanuel Quartey	Consultant	Consultant
24.	South Africa	Anton Guy Sturt Moldan	SAPIA	Environment Adviser
25.	South Africa	Michael Charles Stead	SAPIA	
26.	South Africa	John Craig Fitton	SAPIA	
27.	South Africa	Christian Fassinou	SHELL	
28.	UK	David Roger Bleasdale	CITAC	Manager
29.	Uganda	Laura Hughes	Tullow Uganda Operations Pty Ltd	Senior Commercial Advisor
30.	Kenya	Wanjiku manyara	Petroleum Institute of East Africa	Executive Director
31.	USA	Allen Aradi	Afton Chemical	Senior Advisor, Fuels R&D
32.	Greece	Photis Stephanides	Consultant	
33.	Gabon	Apollinaire Adonis MOUDOUMA	Ministère du Pétrole	Chargé d'Etudes
34.	Gabon	Patrick OGOULA WORA		Chef de service du Raffinage à la Direction Générale des Hydrocarbures au Gabon

35.	Canada	John H. Walsh	Afton Chemical	Worldwide Marketing Director
36.	Uganda	Daniel Segal	KOBIL	
37.	Côte d'Ivoire	Bato Diomandé	SGS	
38.	INDIA	Gopal Dekate	ESSAR Oil Ltd	VP ó Technical, Business Development
39.	DRC	Mr. Francois Baya Kele	Permanent Secretary of Hydrocarbons	Ministry of Hydrocarbons
40.	Kenya	Mr. Patrick Nyoike	The Permanent Secretary	Ministry of Energy
41.	Kenya	Ms. Eunice Muthamia	Public Relationship Officer	Ministry of Energy
42.	Kenya	Mr. Joseph Wafula		Ministry of Energy
43.	Ethiopia	Mr. Mekonnen Yigzaw	Director General	Ethiopian Petroleum
44.	Tanzania	Mr. Erasto Mulokozi Simon	Petroleum Geologist	Ministry of Energy and Minerals
45.		Mr. Hamisi Ahmad Danda	Principal Marketing Officer	Tanzanian Petroleum Development Corporation
46.	EAC	Mr. Willy Musinguzi	Principal Standards Officer, EAC	The East African Community
47.	Tanzania	Ms. Kezia Mbwambo	Air Quality Monitoring	Tanzania Bureau of Standards
48.	Côte d'Ivoire	Fatma Haidara	ARA	Office Manager
49.	Uganda	Hon. Simon DøUjanga	Minister of State for Energy	Minsitry of Energy and Mineral Development
50.	Uganda	Rev. Frank Tukwasiibwe	Ag. Commisioner	Petroleum Supplies Department (MEMD)

51.	Uganda	Mr. Herbert Mugizi Magyezi	Geologist	Petroleum Exploration and Production Department (MEMD)
52.	Uganda	Mr. G. Banaga-Baingi	Head of MidStream Petroleum Unit	Mid Stream Petroleum Unit MEMD
53.	Uganda	Mr. Ahimbisibwe Michael	Senior Energy Officer	Energy Resources Department (MEMD)
54.	Uganda	Mr. Kimuli Godfrey	Senior Energy Officer	Energy Resources Department (MEMD)
55.	Uganda	Ms. Caroline Aguti	Senior Petroleum Officer	Petroleum Supplies Department (MEMD)
56.	Uganda	Mr. Wamala Julius Namusanga	Senior Petroleum Officer	Petroleum Supplies Department (MEMD)
57.	Uganda	Mr. Clovis Irumba	Organic Geochemist	Petroleum Exploration and Production Department (MEMD)
58.	Uganda	Mr. Dick Lufafa	Environmental Monitoring Officer	National Environmental Management Authority
59.	Uganda	Ms Jane Mbabazi	Petroleum Officer	Petroleum Supplies Department (MEMD)
	Uganda	Mr. Andrew Oboke	Petroleum Officer	Petroleum Supplies Department (MEMD)
60.	Uganda	Mr. Wilbrod Byamukama	Petroleum Officer	Petroleum Supplies Department
61.	Uganda	Mr. Peter Kitimbo	Principal Analyst Head of Petroleum Inspection and Laboratory	Uganda National Bureau of Standards

62.	Uganda	Ms. Irene Batebe	Chemical and Process Engineer	Mid Stream Petroleum Unit MEMD
63.	Uganda	Ms. Racheal Mugabi	Chemist	Mid Stream Petroleum Unit (MEMD)
64.	Uganda	Ms. Pamela Kusimba	Communications Officer	MEMD
65.	Uganda	Ms. Susan Nalwoga	Communications Officer	MEMD
66.	Uganda	Ms. Sylvia Kajumba	Communications Officer	MEMD