MAKERERE





COLLEGE OF BUSINESS AND MANAGEMENT STUDIES

SCHOOL OF BUSINESS

MASTERS IN PUBLIC INFRASTRUCTURE MANAGEMENT (MPIM

DISSEMINATION SEMINAR

Presented by:

- □ Ssemombwe Joseph Nandigobe
- Nakyanzi Sylvia
- Mugala Patricia
- □ Kyagambiddwa James
- □ Kirumira Emmanuel Mukasa

Facilitators

- Prof. Umar Kakumba
- Dr. Godfrey Akileng
- Dr. Peter Turyakira

OCTOBER 14, 2016

- Overview of the Energy Sector in South Africa
- 2. Energy Policy and Regulatory Framework
- 3. ESKOM (SA)- A Historical Perspective
- 4. ESKOM (SA) Successes/ Best Practices

Lessons Learnt

- 5. Challenges & Strategies
- 6. Future Prospects for Uganda

1. Overview of the Energy Sector in South Africa

Electricity production



- Electricity market grew by \$1.4bn in 2009 to reach \$5.6bn
- Electricity generation dominated by state-owned power company Eskom, which currently produces over 96.7% of the power used in the country
- Eskom has a current nominal installed capacity of 44,175MW
- Government addressing electricity supply issues with Eskom and Independent Power Producers ("IPPs")
- South Africa needs over 40,000 MW new generation capacity by 2025
- Eskom is part of Southern African Power Pool, a group of utilities in the region aiming to create a common market for electricity in the region



- Currently, the transmission of electricity in South Africa is undertaken by Eskom
 - The company has over 28,000km of transmission lines spanning the entire country
- Electricity distribution is the final stage in the delivery of electricity to end users, currently undertaken by Eskom, together with 187 municipalities

Source: Presentation by Daniel Modise & Vania Mahotas (2015)

Energy Demand per Sector In SA



- The bulk of energy produced is consumed in the Industry and Transport sectors
- The relatively more industrialized South African Economy leans heavily on availability of cheap and reliable electricity.

Lesson to learn

Uganda needs to produce readily available and affordable energy in order to boost industrialization and economic growth. This is because Energy is at the heart of industrial growth.

Overview of the Energy Sector in Uganda



Total Consumption = 14.94 Million Tons of oil Biomass contributes to 90% (firewood=78.6%), charcoal (5.6%), crop residues 4.7%) Electricity contributes to 1.4% Oil products (vehicles and thermal power plants) 9.6%

- Uganda currently has 850 Megawatts (MW) of installed capacity (with effective generation of approximately 710 MW), of which approximately 645 MW is hydro and 101.5 MW is thermal generating capacity.
- The Government is building more large hydropower facilities, e.g 600 MW Karuma hydro & 183 MW Isimba Falls hydro project.
- □ Uganda has ≈1500 KM of transmission lines (over 33kV),
- Govt aims to double with plans to upgrade existing transmission lines & develop a 220kV "ring" around Lake Victoria in conjunction with Kenya & TZ.

Energy Resource Base in Uganda

• Biomass: (90% Energy source e.g wood, plant remains etc)

Co-generation sites have potential of 190MW. E.g. Kakira Sugar, Kinyara Sugar and Sugar Cooperation are currently producing 30MW for own consumption and 5MW added to grid Peat (decayed organic matter): 800MW for next 50 years

• Hydropower: (1.4% energy source)

Installed Capacity is 683MW

Effectively 300-350MW from the following plants)

Nalubal	e - 180MW	Bujagali	-200MW
Kiira	- 200MW	Mini Hydro Plants	- 53MW

Planned Hydro-Power Capacity over 3,000MW

Isimba - 180MWKalagala - 450MWKaruma - 600MWAyago-600MWKiba- 300MWMurchison Falls- 600MWOriang-400MW

Energy Resource Base Uganda Cont'd

- Renewable Alternative Sources
 - Solar Energy potentially at 200MW, with 5.1kwh/m2 per day
 - 2. <u>Geothermal Energy</u> potentially at 450MW in western Uganda in Katwe-Kikorongo, Buranda, Kibiro Areas
 - 3. <u>Small Hydro plants potentially have 164MW identified on</u> small rivers across Uganda
 - <u>Wind Power present on mountain tops especially</u>
 Karamoja area. Could be used for water pumping and electricity generation

South Africa Energy Supply (145.8 Mtons of oil equivalent)



Uganda's Energy Supply (15 Mtons of oil equivalent)

Wood fuel is dominant source of fuel in Uganda, both currently and in the foreseeable future



Energy Consumption - A Comparison of SA & Uganda



- South Africa consumes about 145.8 Mton oil equivalent of energy,
- Uganda consumes 15 Mtons oil equivalent of energy
- South Africa consumes 10 times as much energy as Uganda annually
- South Africa's Population is at 54 million (2014)
- Uganda's Population is at 34.6 million (2014)
- South Africa's per capita consumption: 2.7 ton oil equivalent
- Uganda's per capita consumption : 0.433 ton oil equivalent
- South Africa's per capita consumption is 6.2 times that of Uganda

Electricity Generation Statistics

	Uganda	South Africa
Installed Capacity	820.5MW	52,811MW
Available Generation Capacity	558.5MW	52,811MW
Peak Demand	487MW	
Annual Av Load Growth	8%	2.3%
Population (2014)	34.6 Million	52 Million
Current Generation Mix	Large Hydro -82% Thermal -10% Mini Hydro -5% Co-generation -3%	Coal-92%Nuclear-5.7%Pumped-1.2%Hydro Power-0.5%Gas-0.1%Gas Turbine-0.1%

Electricity Transmission and Distribution

In South Africa

- Currently, the transmission of electricity in South Africa is undertaken by Eskom, a state owned company
- The company has over 28,000km of transmission lines spanning the entire country
- Electricity distribution is the final stage in the delivery of electricity to end users, currently undertaken by Eskom, together with 187 municipalities
- Eskom is the 7th largest electricity generator in the world, and is the dominant player in Africa supplying 45% of electricity in Africa in countries like Namibia, Lesotho, Mozambique, Zambia, Uganda, etc

Electricity Transmission and Distribution Cont'd

In Uganda

- Current Distribution is to 15% of the total population, only 7% of rural population have access to electricity
- Uganda is one of the countries with the lowest electricity development and lowest per capita consumption of 72kWh in the world.
- Much of the infrastructure is poorly maintained and poor cuts are frequent
- There has been public out-cry about the unreliable electricity supply by UMEME which led to parliament's intervention seeking to take action against UMEME in 2013

SA Energy Policies & Regulatory Framework

Regulatory Framework

The 2 Acts that direct Energy Planning & Policy

formulation in SA

- The National Energy Act (2008) & Regulations
- The Electricity Regulation Act (ERA) 2006

<u>Others</u>

- Income Tax Act of 1962
- National Environmental Management Act (1998)
- National Building Regulations

Energy Policies

- White Paper on the Energy Policy (1998)
- White Paper on Renewable Energy (2003)
- Energy Efficiency Strategy (2005)
- Bio-fuels Industrial Strategy (2007)
- Renewable Energy Policy Roadmaps
- National Cleaner Production Strategy (2004)
- South African Renewables Initiative (SARi)
- Integrated Energy Plan (IEP)-2003
- Integrated Resource Plan (IRP)-2011

Regulators

- 1. Department of Energy (Government Dept.)
- 2. Department of Environmental Affairs (DEA)
- 3. National Energy Regulator of South Africa (NERSA)
- 4. The Central Energy Fund Group (CEF (Pty) Ltd.)
- 5. National Energy Efficiency Agency (NEEA)
- 6. The Energy Development Corporation (EDC)
- 7. South African National Energy Development Institute (SANEDI)

2. Uganda's Energy Policies & Regulatory Framework

Regulatory Framework

The Acts that direct Energy Planning & Policy

formulation in Uganda

The Electricity Act 1999

Energy Policies

- The National Energy Policy 2002
- Renewable Energy Policy 2007

Regulators

- 1. Ministry of of Energy & Mineral Development
- 2. Electricity Regulatory Authority (ERA)
- 3. Rural Electrification Agency (REA)

CASE STUDY KUSILE COAL PLANT PROJECT IN SOUTH AFRICA COMPARED WITH KARUMA HYDRO-POWER PLANT PROJECT IN UGANDA



KUSILE POWER PLANT

KARUMA HYDRO POWER DAM

CASE STUDY: Kusile Plant and Karuma Power Project Overview

	Uganda: Karuma Dam Project	South Africa: Kusile Plant
Type of Plant	Hydro Power Plant	Coal Plant
Project Location	Along Victoria Nile, Karuma Uganda	Whitbank, South Africa
Project Features	Dam and Spillways, Height of dam 20m, 312m long 8 Spillways, 6X100MW turbines Electricity generated to be transmitted to Kawanda UETCL sub-station, 264km away	6X800 coal fired power generating units, a cooling system, a substation nearby
Plant Capacity	600MW	4,800MW
Project Cost	\$2.2 Billion (\$3.66Mn per MW)	\$8.67Billion (\$1.8Mn per MW)
Contractor	Sino Hydro (Lead Contractor)	Mitsubishi-Hitachi Powers systems, Alstrom S&S
Project Duration	2013-2018	2009-2021 (Initially 2015)
Financing Arrangement	Loan from Chinese Ex-Im Bank for 85% cost, Ugandan Government to fund 15% cost	Several Banks loans including US Ex-Im Bank, ADB, HSBC Group, etc

CASE STUDY: Kusile Plant and Karuma Power Project Overview Contd

	Uganda: Karuma dam project	South Africa: Kusile Plant
Project Owner	UEGCL, MEMD	ESKOM
Project Management Issues	 1.Tensions within the Project Management leading to a reshuffle/ reappointment of the Project Steering Team 2.Bribery allegations in procurement 	Alleged Corruption charges on the lead consultant Hitachi Power Africa
Environmental and Social Concerns	1.Fears that the dam will affect the natural habitat for many plant and animal species2.Displacement of local communities and plantations (PAPs)	The plant is estimated to release 36.8 tons CO2, costing South Africa about \$4.4Bn a year. Resistance of the plant by community, interest groups
CSR Efforts	 Employ as many local personnel to build capacity Construction of Schools in the community 	 Develop technologies for Carbon trapping Employ a high number of black South Africans especially in managerial positions (BEM) Build schools, support for local businesses through training and financing

Lessons Learnt from the Case Study

- Project Management hiccups are cross cutting, hence good PM is essential for project success
- Infrastructure projects must also address environmental and social concerns for them to ensure equitable returns and be accepted by the end users .
- Negative project externalities may cost more than other technical options, for example, 30% of Kusile's externality cost would be sufficient to develop 5 times the plant's power using renewable energy
- CSR is a strategic endeavor to ensure project buy-in by communities, stakeholders and interest groups
- Project financing should not only be through government loans. Private finances are a viable solution to speed up infrastructure development
- The future trend for sustainable energy is renewable and greener energy.

Challenges in the SA Energy Sector

- 65% of energy is produced burning coal which releases large amounts of CO2 and other toxic gases in the atmosphere.
 South Africa is one of high- CO2 emissions countries in the World, with the mandate to reduce emissions.
- Financial instability especially to the largest energy supplier ESKOM.
- Instable electricity and load shading

Challenges in the UG Energy Sector

Looking Forward: South Africa

- Enhance green energy sources and reduce heavy dependence on fossil fuels. Renewable energy such as wind and solar energy being given priority
- Improve energy efficiency in various systems ranging in industry, transport, residential etc
- Policy and regulation for energy conservation

Looking Forward: Uganda

- The development of crude oil mining and refining infrastructure in order to increase energy supply
- Increasing rural electrification coverage which creates nuclei for rural social and economic development
- Developing a number of hydropower projects, namely; Karuma of 600MW, Isimba of 180MW and Ayago of 600MW
- Implementing a vigorous program of increased access to modern energy services through rural electrification
- Having renewable energy through co-generation capacity expansion of joint partnership with sugar factories
- Energy efficiency through disseminating solar photovoltaic systems in rural areas not connected to the main grid and supply of energy saving equipment e.g. efficient lighting equipment, efficient motors, efficient cook stoves, ovens etc.

Looking Forward: Uganda Cont'd

- Promotion of Nuclear Energy power programmes and peaceful applications of atomic energy. (Atomic Energy Act, 2008: Ministry of Energy and Mineral Development)
- Recruiting more graduates in the nuclear energy unit and train them in a number of fields related to power production from nuclear energy

Discussion

