COUNTRY PRESENTATION ON GHANA

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on
Steps for Conducting Nuclear Power Plant Technology Assessment
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Introduction

- Ghana is a West African State located between latitudes 4^{o} 44’ and 11^{o} 11’ North and longitudes 3^{o} 15’ West and 1^{o} 12’ East.
- The total land area of the country is about 238,460 sq km.
- It is bounded in the North by Burkina Faso
- In the West by La Cote d’ Ivoire and in the East by Togo.
- The Gulf of Guinea in the Atlantic Ocean borders the South with 539 km of coastline.

Introduction

Ghana's Economy and Demography

Ghana 's current population is estimated to be 21.4 million

The economy of Ghana is agriculture based with a GDP per capita of about $700 and purchasing power parity (ppp) $3000

Agriculture constitute about 36% of GDP

To arrest the current situation, the Ghana government has launched a program to propel Ghana's economy to a middle income status by 2015

Installed Electricity Capacity

- Ghana's total installed electricity generation capacity currently stands at 1810MW

- This is made up of:

- Hydro Power - 1180MW
- Thermal Power – 630MW

Electricity Situation

- Ghana's Electricity generation is growing at 7% per annum
- This growth rate is expected to increase if the government's plan to achieve a middle income status by 2015 is kept on track
- The high dependency on rain-fed hydro power, which accounts for 65% of installed capacity has led short falls in electricity supply incase of drought.
- In 2006 and 2007 the nation experienced its third and worst major energy crisis as result of this

Electricity Situation

The thermal plants are currently run on light crude oil imported from Nigeria

Efforts are under to run the plants on gas imported from Nigeria through the West Africa Pipeline

Currently there are delays in the supply of gas from Nigeria

In 2007 Ghana discovered oil in commercial quantities off its coast. There is a general consensus that the oil should be used in the transport sector

Energy Security

The energy security of Ghana is under threat due to uncertainties with future gas supply from Nigeria;

- Frequent crisis in the Niger Delta
- Nigeria's own growing demand with increasing number of thermal power plants to be constructed.
- Proposed Nigeria-Algeria Gas Pipeline through Sahara Desert to export gas to Western Europe

Committed Additional Power Plants

- The Bui hydro power project – capacity 400MW, expected to be completed in 2012
- Three thermal plants - total capacity 655MW, expected to be completed in 2010
- The Bui hydro plant is a peaking plant with 27% availability
- The new thermal plants are to run on gas imported from Nigeria through the West Africa pipeline
- Any further delay in the supply of gas will prevent them from coming on line

Other Energy Options

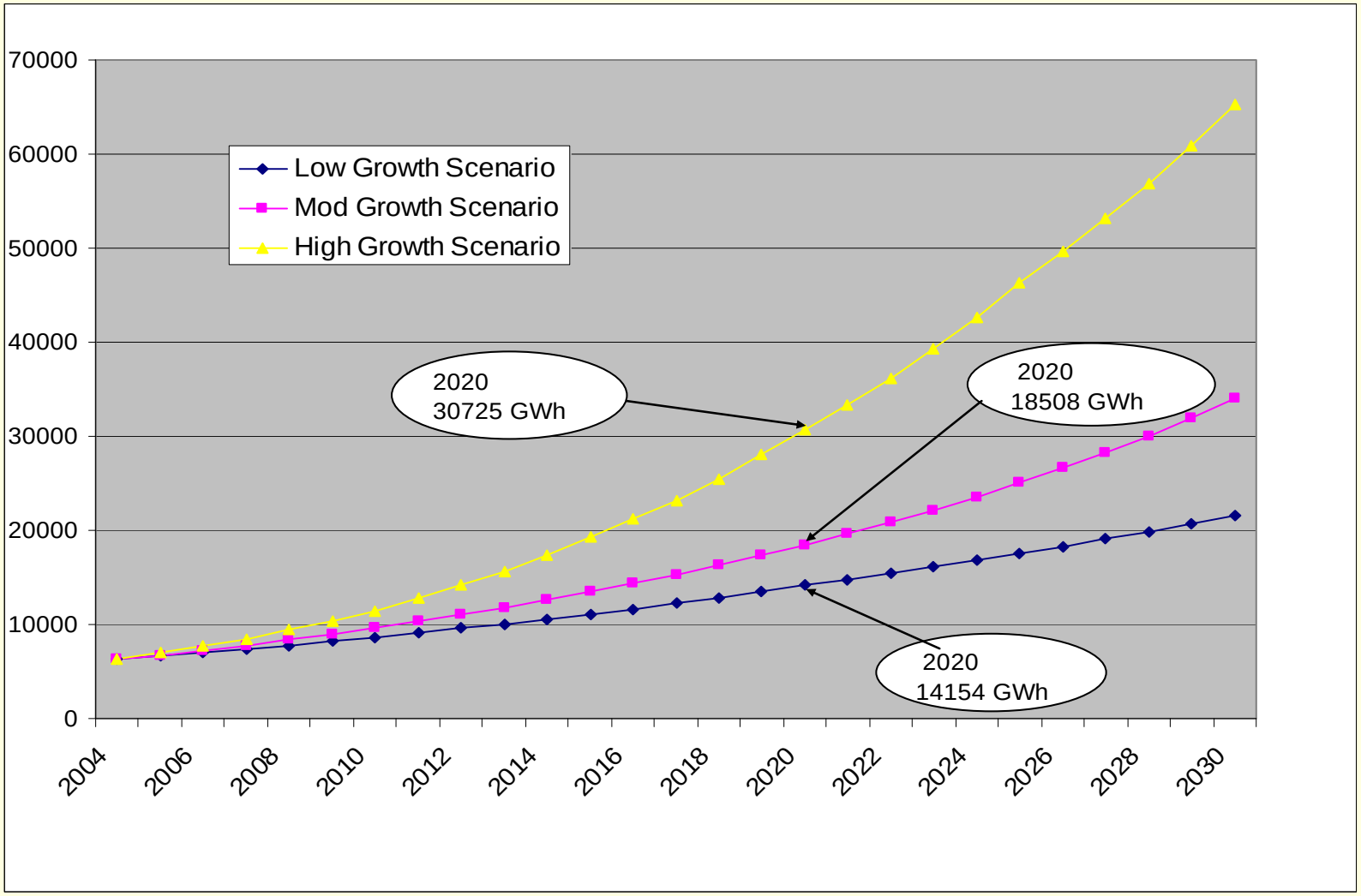
- Other energy options under consideration include:
- Medium hydropower projects at Pwalugu on White Volta, Juale on Oti River, Hemang on Pra River and those on Ankobra and Tano which can provide a total of 425 MW
- Contributions from renewable energy sources such as solar, wind, biomass are expected to produce 380-500 MW of peak electric power.
- This amount cannot exceed 10% of the required total demand

West Africa Power Pool

In order to foster political and economic co-operation in the West Africa sub-region the West Africa power pool was launched in October 2000.

This involves the interconnection of the national grids of 15 West African States across a distance of 5600km.

Projected Electricity Demand using MAED Model



Nuclear Power

- In 2007 when the third major energy crisis occurred, difficulties to raise funds to procure light crude oil for thermal power generation to meet the shortfall in the face of high crude oil prices and delays in the West African Gas pipeline project brought the consideration of nuclear energy for electricity generation to the fore.

- The President of Ghana set up a committee to assess the viability of the nuclear option in Ghana. The government later on took a cabinet decision to build a 400 MW nuclear power plant by 2018 following the submission of the committee's report to the President.

Nuclear Power

- The consideration of nuclear power in Ghana is not new
- In 1961, Government decided to undertake the Ghana Nuclear Reactor Project
- 2MW Soviet Reactor to be used for Research, Training and Production of Isotopes
- President Nkrumah in his Statement intended that Universities with GAEC will develop Human Resource for generating nuclear electricity to supplement the hydro-electricity.
- Unfortunately, the nuclear programme has not developed as expected due to various socio-economic and political factors.

Nuclear Power –International Partnership

- By signing the IAEA's Non-Proliferation Treaty, Ghana has the basic and inalienable right to develop research, production and use of atomic energy for electricity production.
- IAEA can assist Ghana to develop human resource, skills and competencies for her nuclear power projects.
- Ghana is to benefiting from the IAEA/AFRA Network for Education in Nuclear Science and Technology (AFRA-NEST).

Nuclear Power –International Partnership

- IAEA has approved a national project for Ghana for 2009-2011 programming cycle for planning the nuclear power programme.
- During and after the construction of the NPP, Agency will conduct regular expert missions to assess the safety and security of the plants.
- Operators and Managers will participate in IAEA organised seminars, workshops, etc. for exchange of information and learn of best practices.

Nuclear Power –International Partnership

- Global Nuclear Energy Partnership (GNEP) which Ghana signed can provide advice, and support in diverse ways.
- GNEP can possibly arrange for reliable fuel supply using Bilateral and Multilateral agreements.
- Ghana can establish links with other global and regional safety networks i.e. Asian Nuclear Safety Network and Ibero-American Nuclear and Radiation Safety Network.

Nuclear Power –International Partnership

- For human capacity building, negotiations are on-going for Ghana's School of Nuclear and Allied Sciences (SNAS) to establish agreements with.

  - World Nuclear University (WNU), London, UK.
  - European School of Advanced Studies on Nuclear and Ionizing Radiation Technologies, University of Pavia, Italy.

-Centre for Applied Radiation Science and Technology, North-West University, South Africa.

Nuclear Regulatory Authority

- Currently the Radiation Protection Board in Ghana regulates the installation and operation of all ionizing radiation emitting devices in Ghana.

- Efforts are underway to strengthen this organization to regulate the nation's nuclear power program.

Nuclear Power Technology Assessment Criteria

- Economics
- Safety
- Adaptability to the Ghanaian and West African Grid network
- Simplicity of design
- Plant availability

Economics

- Since nuclear power systems are capital intensive, a suitable plant should be the type with a low capital cost
- The power plant should be built in a short time as much as possible.
- Though economy of scale favors plants with large capacities a small and medium reactor (SMR) with the least relative cost is favored due to capital constraints and other factors.

Safety

- With regard to safety, the major area of consideration are:
- Inherent safety i.e. the safety system of the plant being less dependent on human intervention
- In this regard reactors with passive cooling systems are favorable
- The reactor should be sensitive to adverse operational conditions and shut down under such conditions

Simplicity of Design

- The design of the reactor should be as simple as possible to facilitate local construction, operation and maintenance.
- Simple design also eases the work of regulatory body

Plant Availability

- The plant should not be prone to frequent break downs.
- Due to the weak industrial base of our country the plant should be of standardized design fitted with components which are standardize specifications
- This will make it easy to procure broken down parts.
- In this regard a reactor of a specific make or brand is preferred to a custom made one

Grid Compatibility

- IAEA technical reports stipulate that the size of a power plant should not exceed 10% of overall grid capacity
- The small size of our grid therefore makes an SMR suitable
- In addition a power plant capable of operating in grid following mode is suitable.
- The power plant should be able to withstand grid fluctuations
- It should be able brought to a full power within a short time after shut down

Concluding Remarks

- Available information indicates that it is difficult to get a reactor which can meet all the above criteria
- Though some candidate plants have been identified, thorough assessment of these plants has become difficult.
- This is due to unavailability of adequate data on these plants as well as the methodology for assessment.
- It is expected that this workshop will equip us with the requisite methodologies and data for assessing the various nuclear technologies for power generation
- This will enable us to identify the most suitable nuclear power technology for electricity generation in Ghana

THANK YOU!!