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GHANA’S EXPERIENCE IN LONG-TERM ENERGY PLANNING AND THE USE OF IAEA’S ENERGY PLANNING TOOLS

by

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Outline of Presentation

- Initial efforts in Long-term Energy Planning
- Institutionalization of Long-term Energy Planning
- Efforts to develop local energy planning capabilities
- IAEA's assistance
 - In developing local energy planning capabilities and in the use of IAEA energy planning tools
- Challenges in the use of IAEA energy planning tools
- Concluding remarks

Initial Efforts in Long-term Energy Planning

- Were accomplished by using foreign consultants
 - In 1975, foreign consultants (*i.e. Acres International and Shawinigan Engineering Company*) completed the first Generation Expansion Study for the Volta River Authority (*i.e. the public generation and transmission utility*).
 - The study recommended the construction of 160 MW Hydropower plant, which was commissioned in 1981
 - In 1985, Acres International completed a comprehensive Generation and Transmission Planning Study (1983 – 2003) for the Volta River Authority
 - To ensure orderly and economic expansion of generation and transmission facilities over the planning period.

Institutionalization of Energy Planning

- In order to wean off dependency on foreign consultants
 - The government in 1997 established the Energy Commission by Parliamentary Act 1997, i.e. Energy Commission Act 541
 - The Energy Commission was mandated among other things
 - *Prepare, review and update periodically indicative national energy plans to ensure that all reasonable demands for energy are met.*
 - *Secure a comprehensive database for national decision-making, evaluation of the extent of development and utilization of energy resources available to the nation;*
 - *Advise the Minister of Energy on national policies for the efficient, economical and safe supply of electricity, natural gas and petroleum products having due regard to the national economy.*

Initial efforts to develop local capabilities

- In order to develop local capabilities
 - The Energy Commission in 2000 initiated a long-term energy planning study with Ramboll, a Danish consultancy firm as consultant to:
 - To develop capabilities in the Energy Commission in the use of LEAP model (*i.e. Long-range Energy Alternatives Package*) for long-term energy planning
 - To assist the Energy Commission staff develop a Strategic National Energy Plan (2000 – 2020)
 - The Volta River Authority also initiated a study, which was completed in 2001 with Acres International as consultant to
 - To develop capabilities in Volta River Authority in the use of GENSIM model and Acres Reservoir Simulation Package;
 - To assist VRA staff develop a Generation and Transmission Master plan (2000 – 2020)

IAEA's assistance

- In developing local energy planning capabilities
 - Personnel from the Energy Commission and other stakeholder energy institutions have participated in a number of IAEA training courses e.g.
 - 2 Ghanaians participated in a Regional Training Course in MAED model in Trieste, Italy from November – December, 2001 as part of TC Regional project RAF/0/016
 - 2 Ghanaians took part in a Regional Training Course in WASP IV model in Abuja, Nigeria from June – July, 2003 also as part of TC Regional project RAF/0/016
 - There were also IAEA Expert Missions to Ghana in 2002 and 2003 to review and assist the National Project Team in undertaking MAED and WASP IV model analysis.

IAEA's assistance

- In developing local energy planning capabilities
 - In 2004, the Ghana Atomic Energy Commission on behalf of the government submitted a proposal to the IAEA for a TC National project for Energy and Nuclear Power Planning Study.
 - However, the Agency wanted Ghana to further strengthen its energy planning capabilities in the use of IAEA energy planning tools therefore approved a TC National Project GHA/0/008: Planning for Sustainable Energy Development - Ghana Country Study for 2005 – 2006 project cycle. This was extended to cover 2007 – 2008 project cycle

IAEA's assistance

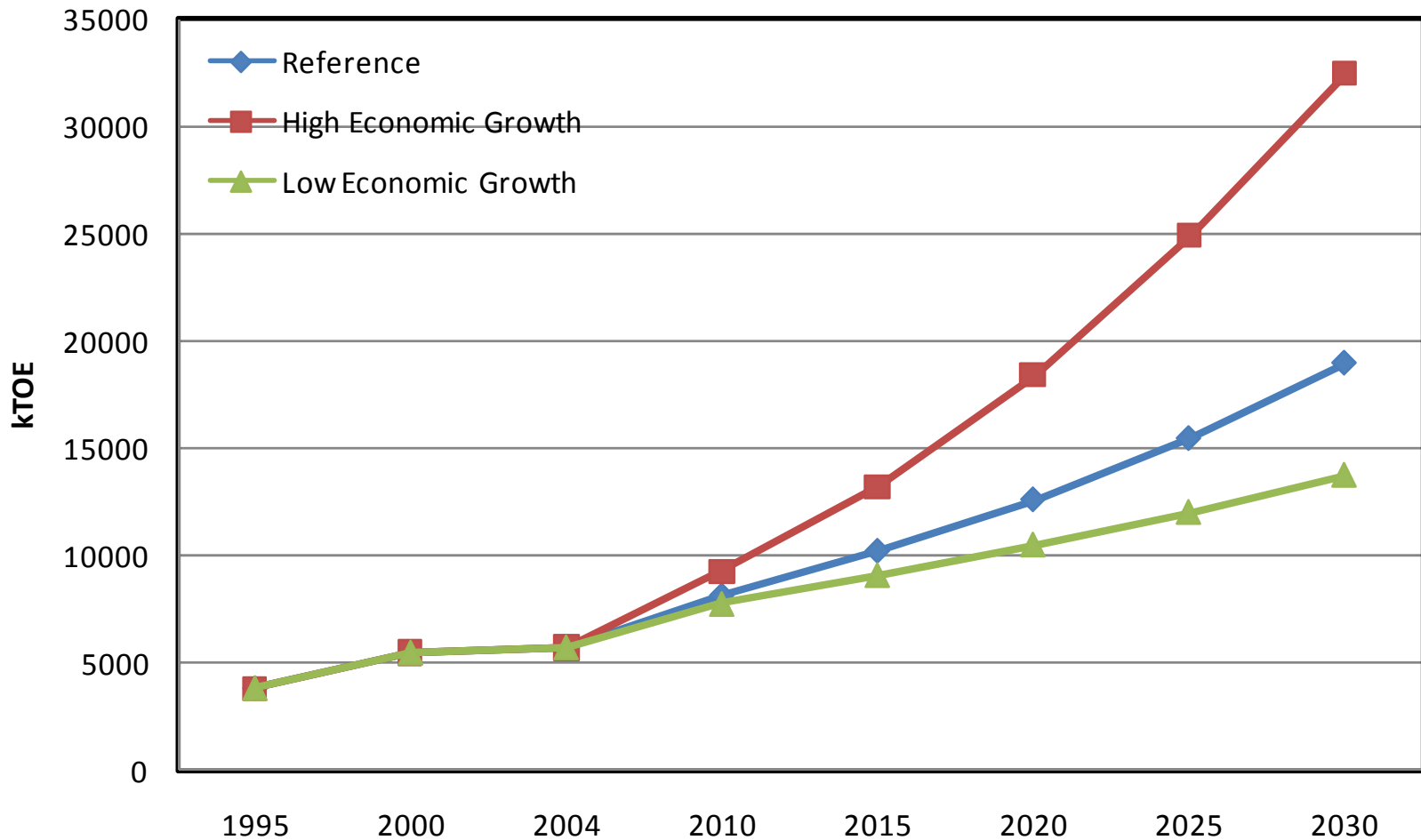
- In developing local energy planning capabilities – training under the TC National Project GHA/0/008
 - The Energy Commission and the IAEA organized the following 3 National Training Workshops in Accra:
 - MAED model training workshop in April 2006;
 - For the National Project Team
 - WASP IV model training workshop in March 2007
 - 24 participants including the National Project Team attended;
 - MESSAGE model training workshop in June/July 2007
 - 24 participants including the National Project Team attended;
 - 2 members of the National Project Team visited the Energy Research Centre, University of Cape Town under IAEA fellowship programme to improve their skills in the use of MESSAGE model

IAEA's assistance

- In developing local energy planning capabilities – using the IAEA tools under the TC National Project GHA/0/008
 - The National Project Team after the training was able to use the:
 - MAED model to perform energy demand projections (2004 – 2030) based on three scenarios formulated;
 - WASP IV model to undertake optimal expansion planning of the electricity generation system taking into account issues like lack of domestic energy resources; dependency on energy imports etc
 - MESSAGE model for the analyses of the optimal energy mix;
 - The results of these analyses were used to prepare “ Planning for Sustainable Energy Development – Ghana Country Study Report”
 - 2 members of the National Project Team were at the Agency in June 2009 for the review of the model results and the Country Study Report

MAED model – MAED-d Results

Trends in Total Final Energy Demand



MAED model – MAED-d Results

Comparison with the result of other studies

	SNEP study			VRA study			MAED study		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
Average Annual GDP Growth Rate (%)	4.18	6.61	9.32	3.00	5.00	6.00	4.77	6.50	9.32
End Year Final Electricity Demand (kTOE)	1550.817	2219.69	2830.181	1453.1	1666.5	2222.79	1908.75	3772.49	8176.11
Final Electricity Demand Growth Rate (%)	5.54	7.32	8.96	5.5	6.3	8.0	5.55	8.38	11.61
Income Elasticity of Electricity Demand	1.33	1.11	0.96	1.83	1.26	1.33	1.16	1.29	1.25

- Note: End Year for SNEP study and VRA study is 2020, but 2030 for the MAED study*

WASP IV model — Results

- Generation Option including 420 MW Coal Power Plant in the Generation Mix

	2005	2010	2015	2020	2025	2030
Total Capacity (MW)	1730	2120	3700	4780	6190	8180
Plants based on	Shares of Electricity Generation Capacity by Fuels (%)					
Hydropower	68	56	43	33	25	19
Renewable	0	0	0	1	6	5
Light Crude Oil	32	35	0	0	0	0
Diesel	0	9	0	0	0	0
Coal	0	0	0	0	7	10
Indigenous Nat Gas	0	0	3	2	2	0
Imported Nat Gas	0	0	54	64	60	65

- Main issue: High dependency on imported Natural Gas

WASP IV model — Results

- Generation Option including 220 MW Nuclear Power Plant in the future Generation Mix

	2005	2010	2015	2020	2025	2030
Total Capacity (MW)	1730	1810	3810	4890	6230	8170
Plants based on	Shares of Electricity Generation Capacity by Fuels (%)					
Hydropower	68	56	43	34	25	19
Renewable	0	0	0	1	6	5
Light Crude Oil	32	40	0	0	0	0
Diesel	0	4	0	0	0	0
Nuclear	0	0	0	0	4	3
Indigenous Nat Gas	0	0	3	2	2	0
Imported Nat Gas	0	0	54	63	64	73

- Main Issue: High dependency on imported natural gas

WASP IV model — Results

- Investment Requirements (USD million) for 2 of the generation options analysed

Electricity Generation Option	Capital Investment	Operation Costs	Total Costs
Coal Option_420 MW	1513.16	5247.85	6764.26
Nuclear Option_220 MW	1534.83	5211.44	6746.27

- *Note: Nuclear option appeared cheaper maybe due to the small size of the nuclear power plant.*

Other uses of IAEA Energy Planning tools

- The Bui Secretariat (*i.e. the government body to oversee the implementation and construction of Bui Hydropower plant*) also used the WASP IV model to undertake the Bui Hydropower project feasibility study update;
- 150 MW, 200 MW and 400 MW capacity options for Bui Hydropower plant were analyzed;
- 400 MW option was selected.

Challenges

- Lack of local capabilities in energy planning before the introduction of the IAEA energy planning models;
- Training periods were not enough to completely understand the working principles of the energy models to undertake independent analysis;
- Limited human capacity in stakeholder institutions to allow for full participation in project meetings to discuss and find solution to problems;
- Non-availability of some information required by the models;
- Available information can be sometimes difficult to locate and obtain;

Concluding Remarks

- IAEA energy planning models have proven to be very useful in our national energy planning process;
- With the use of the models we have realized that to ensure future energy supply security, there is an urgent need to diversify the supply of its primary energy resources;
- The results of the study are still being reviewed by the National Steering Committee and other stakeholders;
- With the help of the IAEA, we have moved from depending absolutely on foreign consultants to using local expertise with minimum assistance;
- We have not fully mastered the IAEA energy planning tools yet, we are still in the learning process.



Thanks a lot for your attention

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