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Nuclear Technology for Climate

Mitigation, Monitoring, Adaptation

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Drivers for Nuclear Power:

Ghana, a Newcomer's Perspective

Joseph K. Essandoh-Yeddu

Director, Strategic Planning and Policy

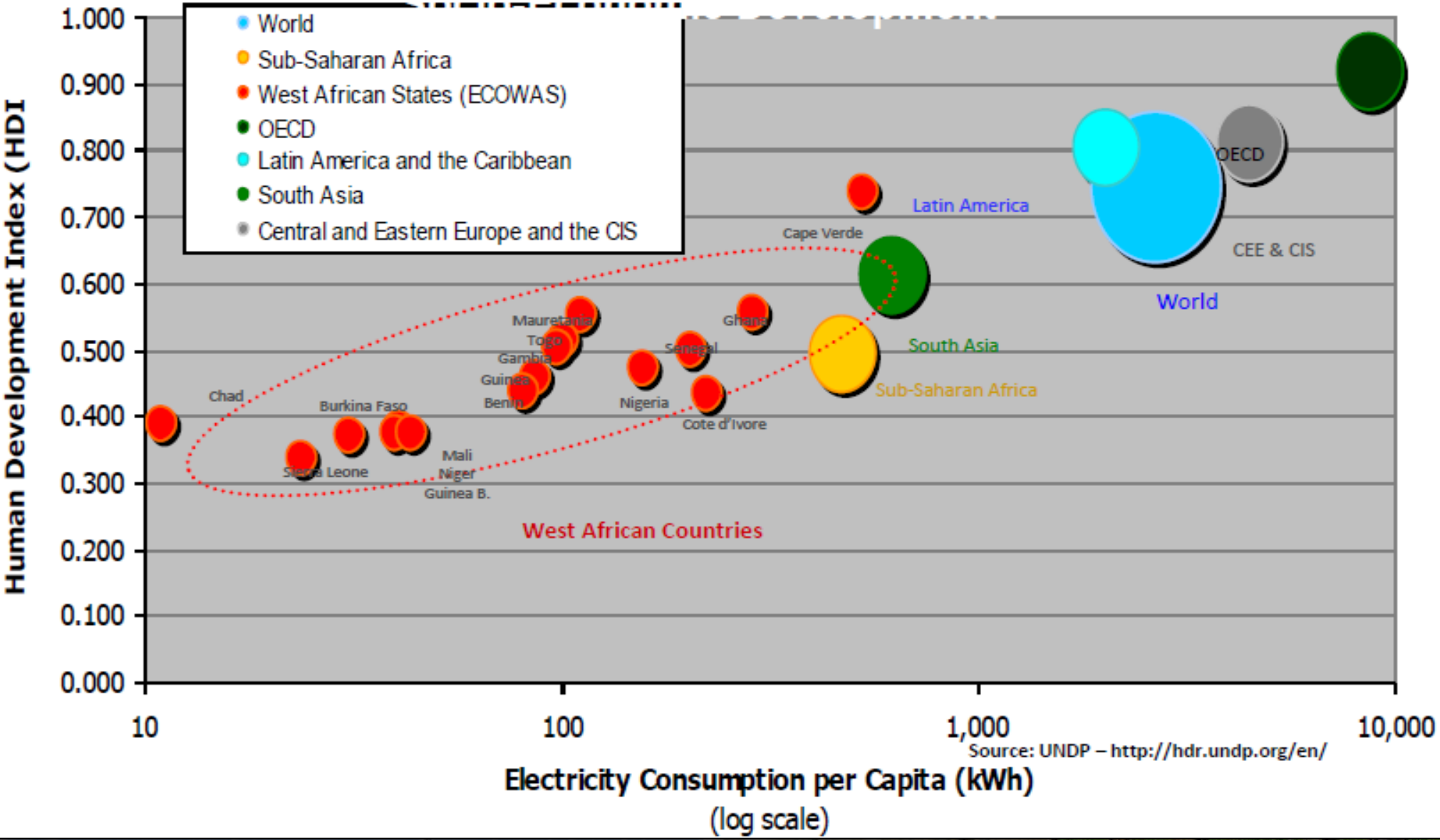
Energy Commission, Ghana

Ghana *{more information available at www.ghanaweb.com}*

- Location: **West Africa**
- Climate: **Tropic-2 seasons**;
  - *Dry and rainy*
- Official language: **English**
- Population:~**30 million** *(24.2 million in 2010 census)*
- Total area: **92,500 square miles/ 237,000 square km**
- 2017 Nominal GDP per capita (US$,PPP): **4,750** (3,*100 in 2010)* *IMF World Economic Outlook (WEO)*
- Major primary economic resources: **Gold, cocoa, bauxite, *petroleum ?***
- Major Sport: **soccer/football**

*Ghana, a **lower middle income** now but can do better*

but less energy – less (non-oil) economic growth!!



Driver_1: Long-Term Vision

100yrs after independence (1957-2057)

Lower-middle** income to **Upper middle / HIGH-INCOME

Current - 2017/2018

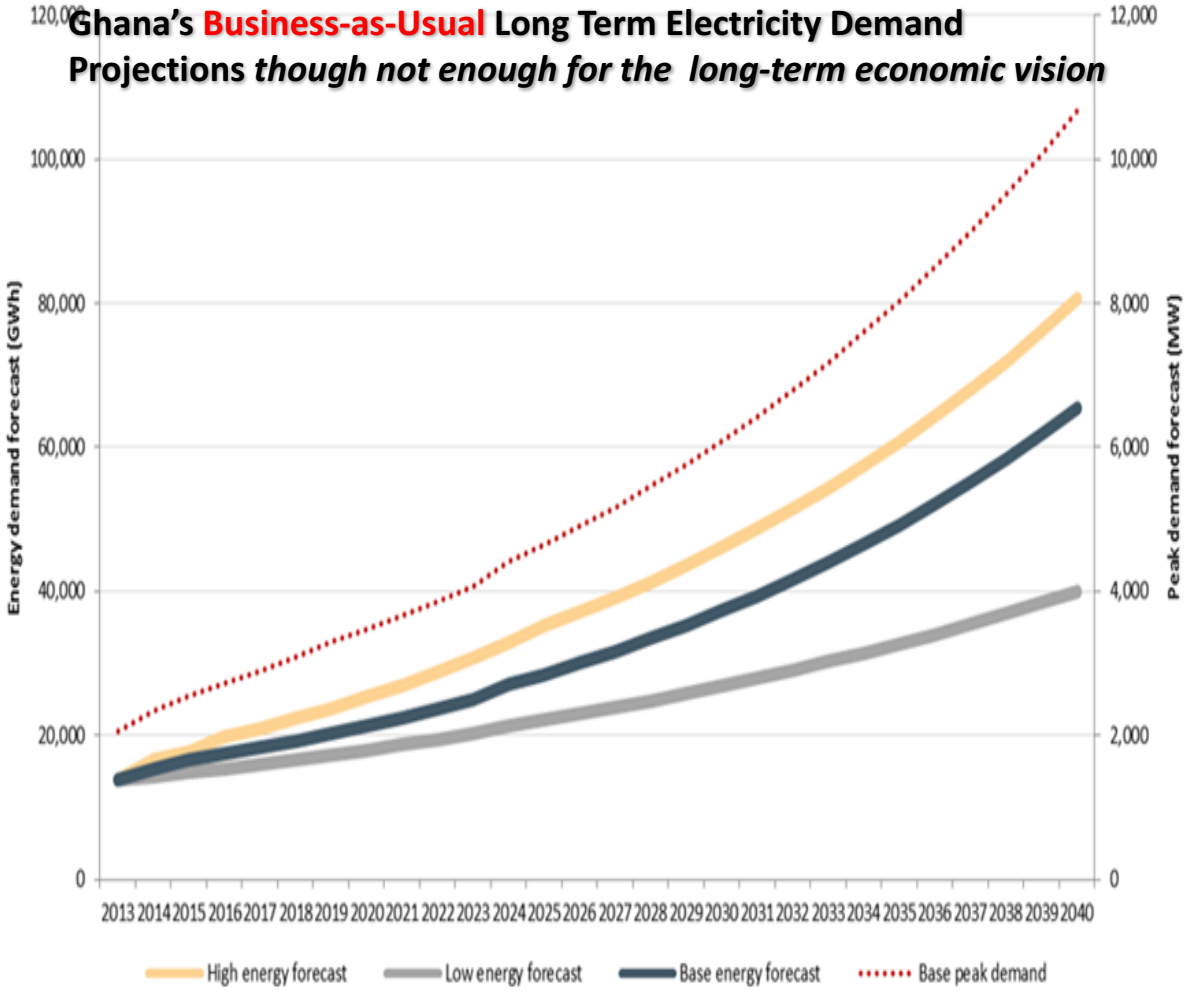
- Population: Lower Middle income: ~ 30 million
- GDP/capita: ~ $1,820
- Electricity consumption per capita: ~ 420 kWh
- Installed grid capacity: ~ 4,800 MW.
- Electricity Access: 84%

Future – 2047/57

- Population: **50/51 million**
- Upper Middle/High income GDP/capita: ~ **$12,736**
- Electricity consumption per capita : ~ **10,000 kWh**
- Installed capacity: ~ **50,000 MW**.
- Electricity Access: **100%**

Comparable to South Korea today

Driver_2: Increased Electricity Demand:

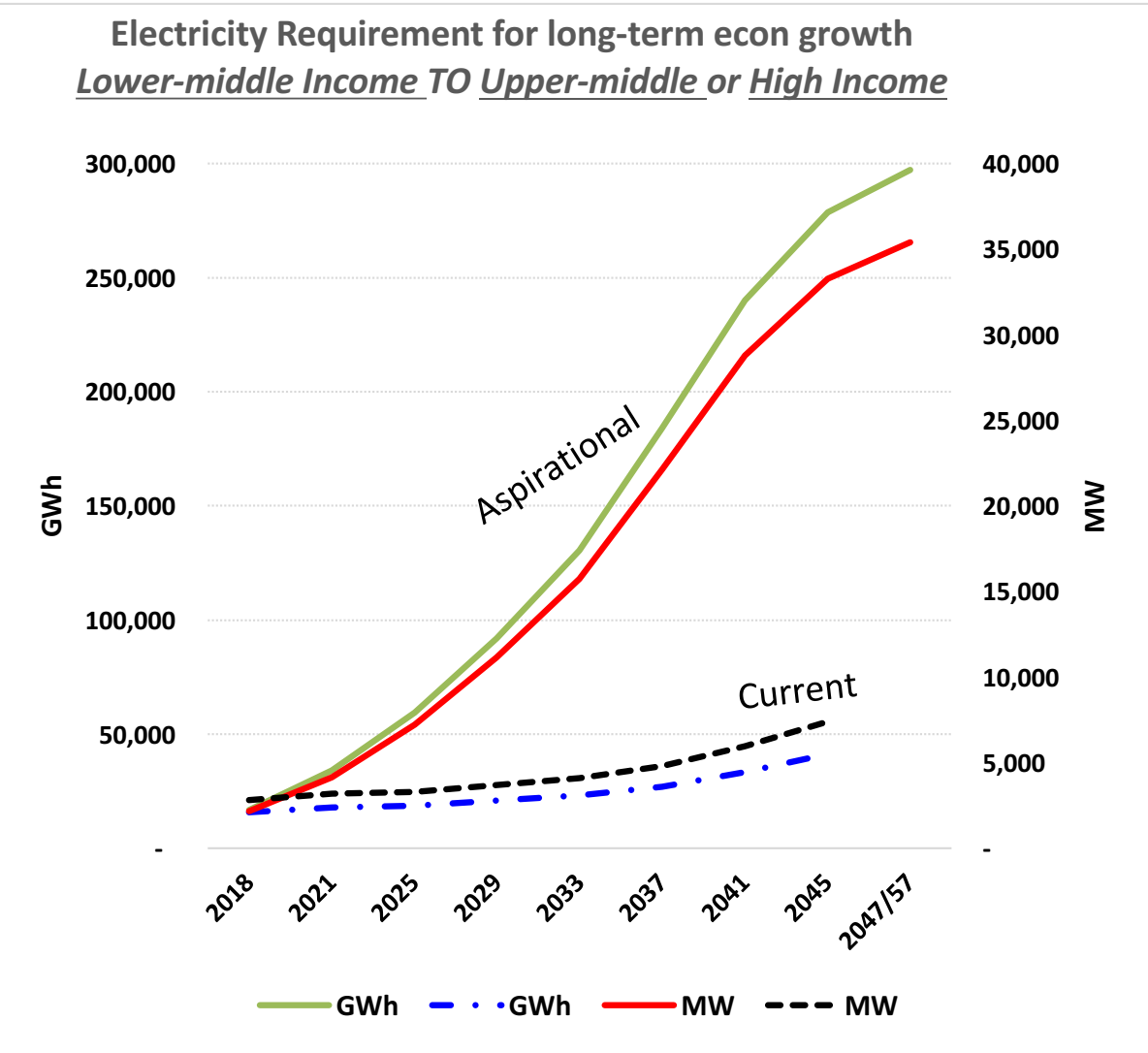


- Energy is the 2nd **largest GHGs emissions *(25% of total)*** in Ghana and it's envisaged to increase with time as a **high income economy agenda is pursued**.
- This pursuit would be largely driven by energy as observed on other developed Countries around the world.
- The **Energy employed thus must be reliable and clean** for Ghana to achieve it's commitment under the **PARIS AGREEMENT** *whilst achieving its economic goals*.

Potential for *higher* ECON growth is great

But Massive electricity requirement

(Top-Down Approach)



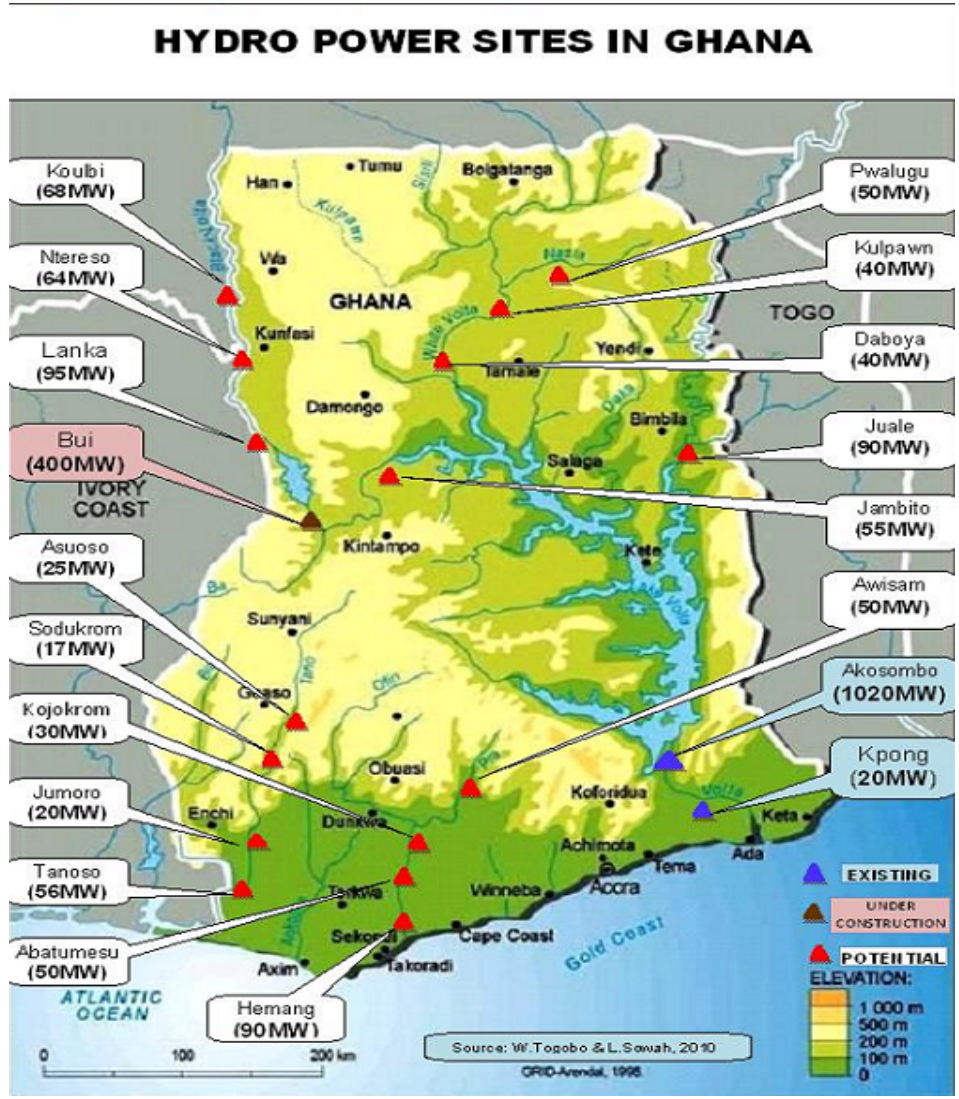
LONG-TERM UPPER MIDDLE INCOME VISION REQUIRES

HIGHER POWER DEMAND (MW)

SECTOR	2017	2047/57
Industrial	**450**	**19,220**
Manufacturing		6,700
Base Metal		2,640
Extractives		1,000
Water & Waste		710
Transport		4,950
Other Industries		3,220
Agriculture	1	670
Service	413	9,470
Households	906	7,123
Export	39	3,000
Network Usage	10	30
Transmission Losses	276	980
Total (MW)	***2,095***	***40,493***

Why Nuclear?: *Driver 3_Limited Hydro Resources*

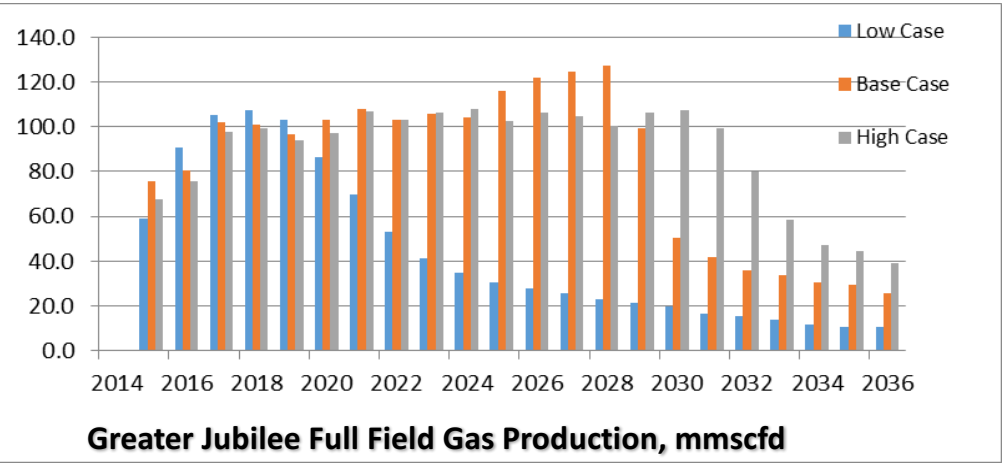
- Ghana's Potential exploitable resource is **only** about **2,420 MW**
- **1,580 MW** already developed at Akosombo, Kpong and Bui.
- Resulting in a total of 65.3% of resource exploited.
- *Remaining **840 MW** can be obtained from 21 sites mainly from medium and small Hydro power plants with capacities below 100 MW.*



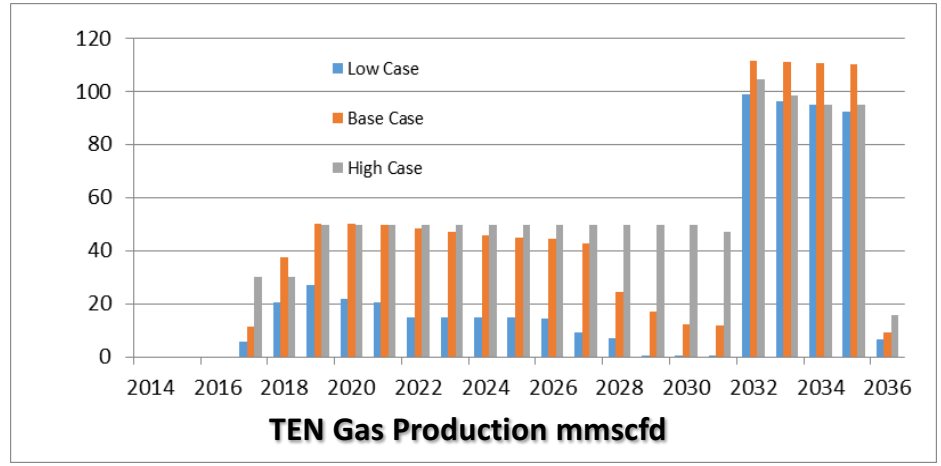
Why Nuclear? : *Driver 4_Limited Gas Resource*

Expecting Depletion by 2040

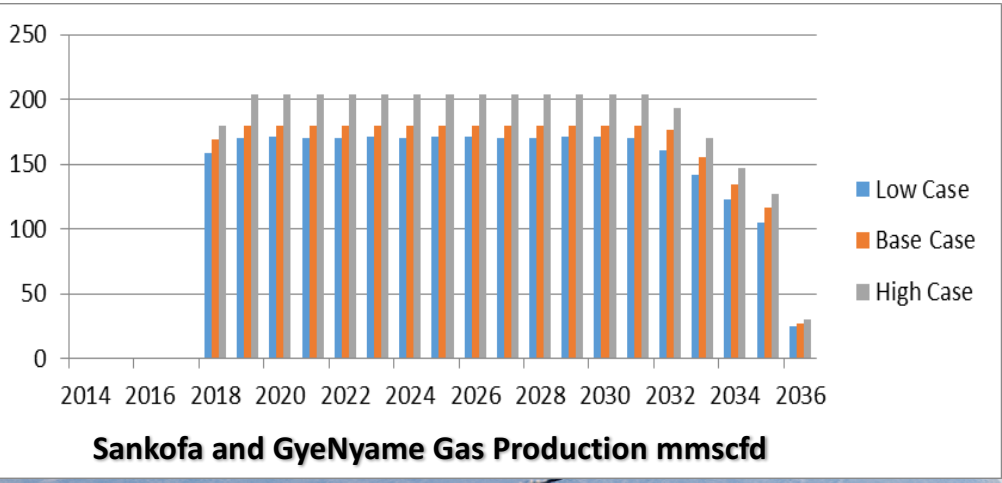
The gas supplies from all the existing fields as projected by Ghana NOC would not be able to sustain the projected electricity and power demand; Gas supplies from most of the gas fields (except TEN) would start dwindling by 2030 *[Source: GNPC –(NOC)]*



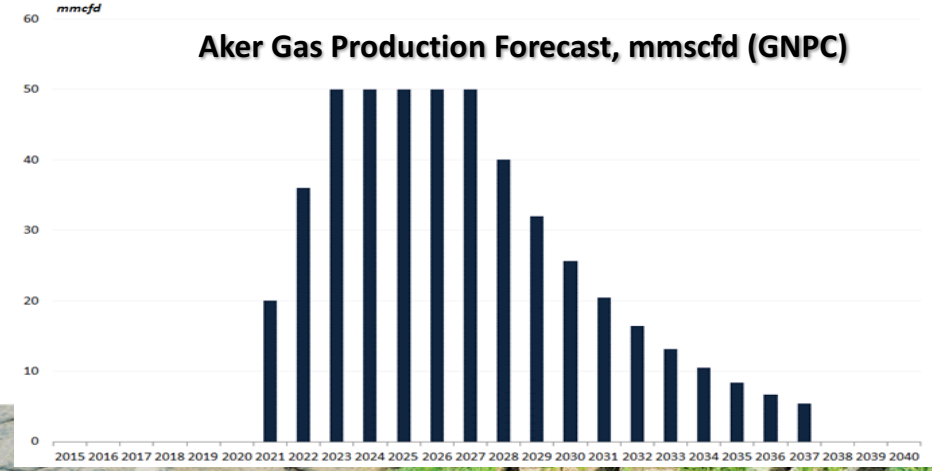
Greater Jubilee Full Field Gas Production, mmscfd



TEN Gas Production mmscfd



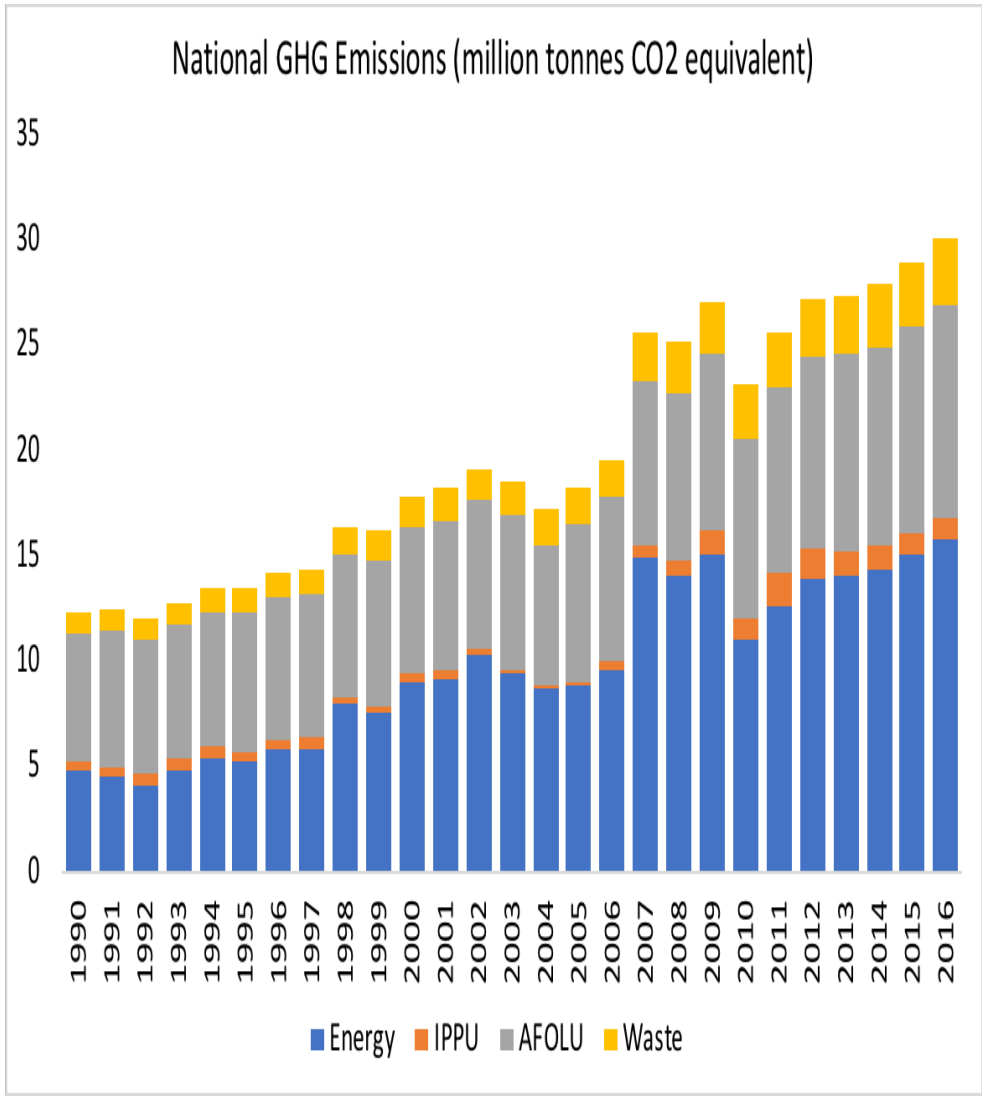
Sankofa and GyeNyame Gas Production mmscfd



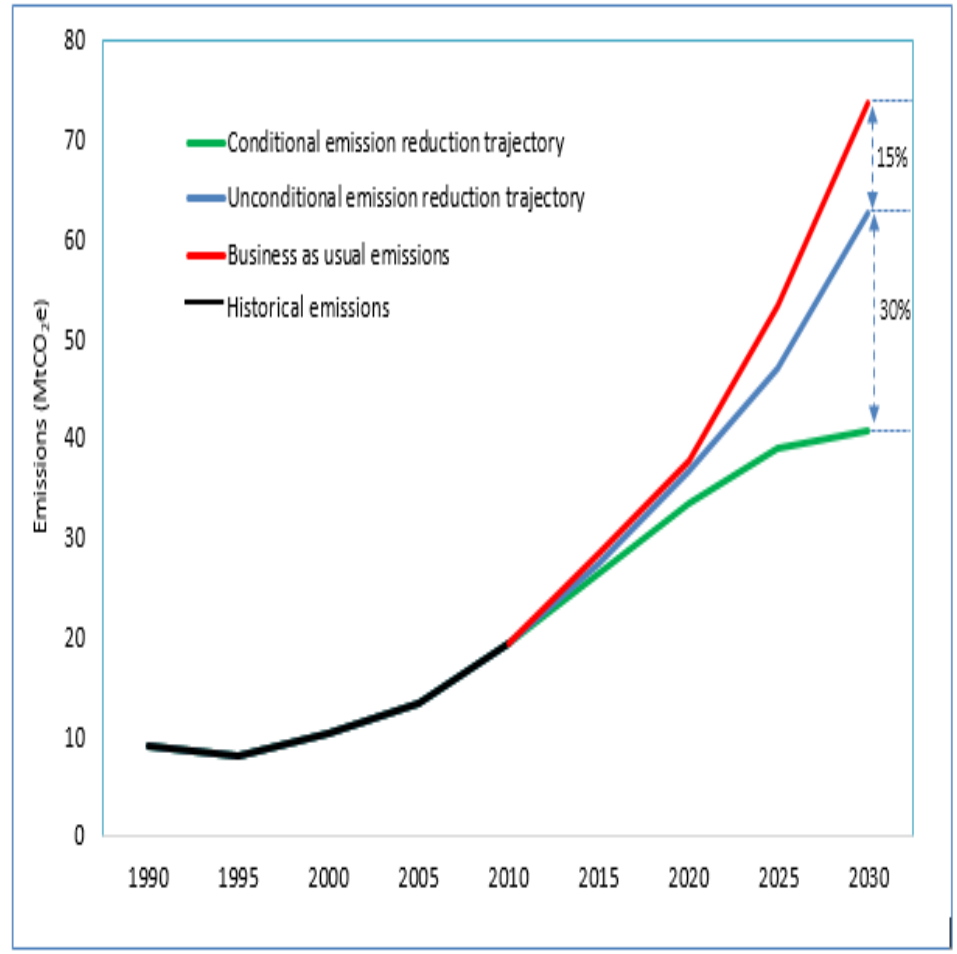
Aker Gas Production Forecast, mmscfd (GNPC)

Why Nuclear? :

Driver 5_*Increasing Greenhouse Gas (GHG) Emissions*

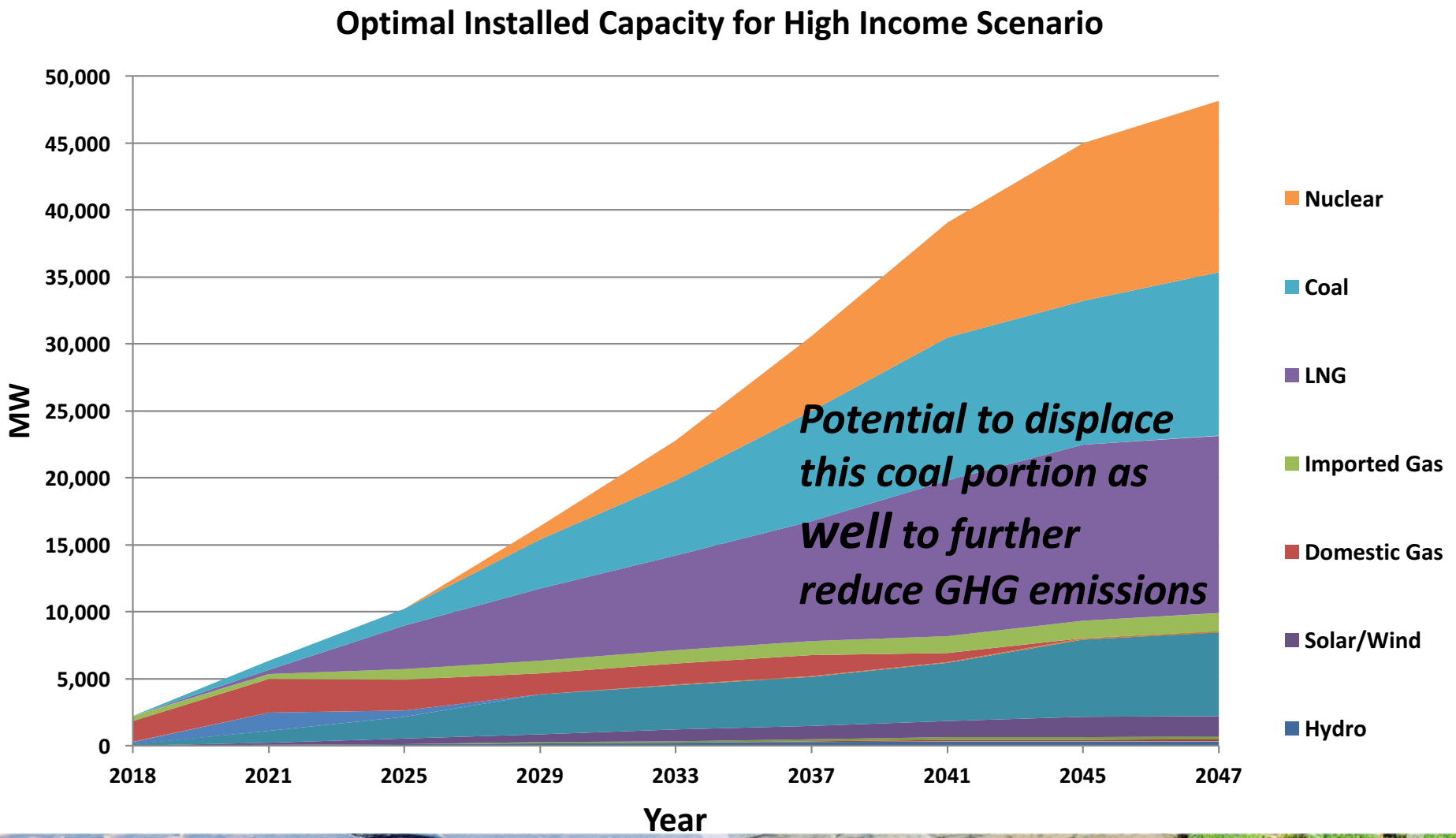


Ghana NDCs

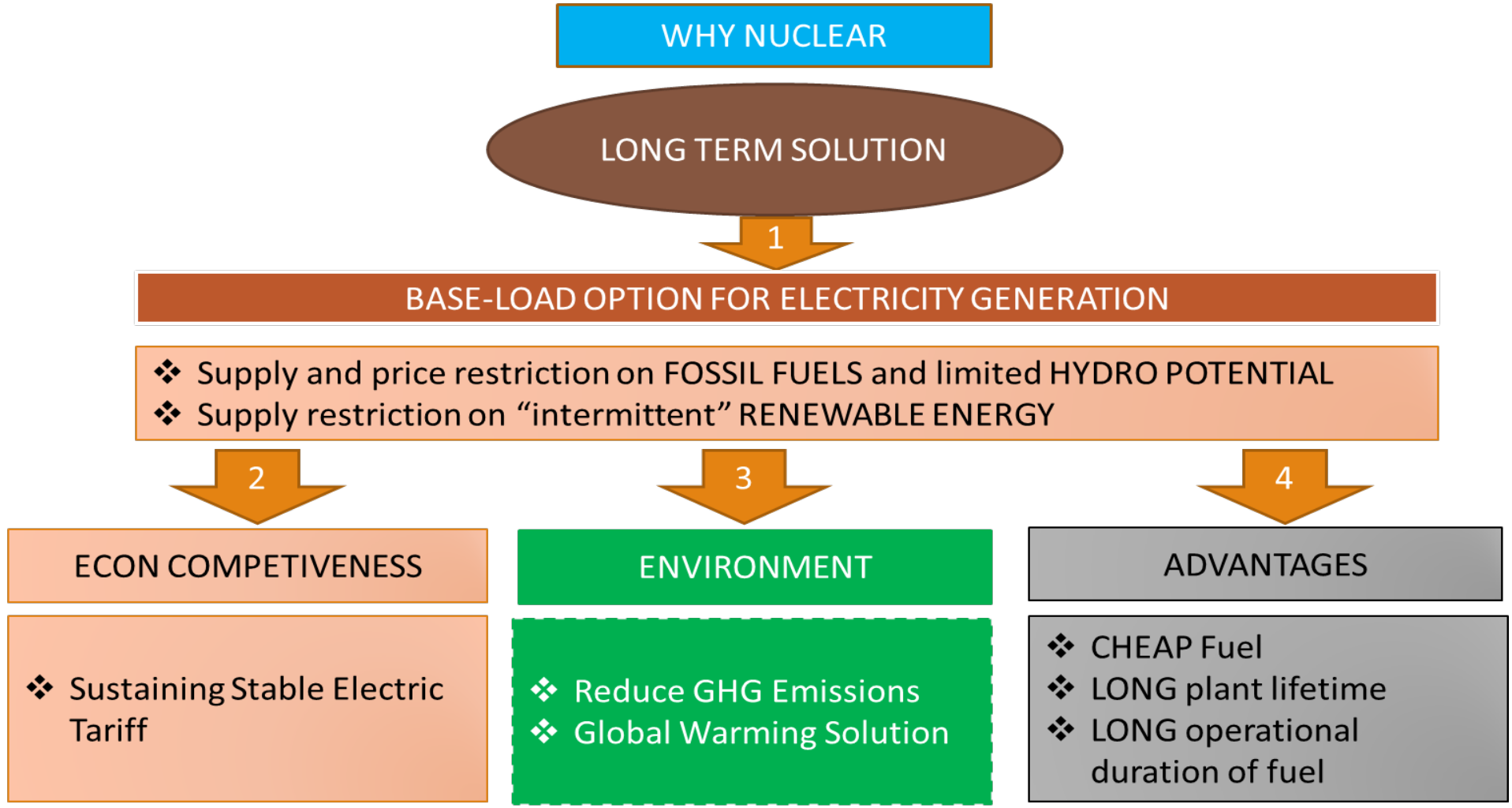


Driver 5: Energy Diversification

Ensuring sustainable fuel mix for power generation



Why Nuclear Energy? – *Summary*



Thank you

Concluding Remarks

- **Question 1:** *Nuclear is an unsafe energy source for a country like Ghana?*
  - ***Answer***: The safety standards in the nuclear industry are unparalleled in the world. Defence in depth principle provides very (extremely) low loss of life risk probabilities. *The number of radiological deaths from even the recent Fukushima earthquake remains minimal to zero.*

- **Question 2:** *We cannot manage our garbage, how can we manage a nuclear power plant?*
  - ***Answer***: Nuclear power is the only **large-scale energy-producing technology** which takes **full responsibility** for all its **wastes** and fully costs this into the project.

- **Question 3:** *If nuclear is for the long-term, why all the noise now?*
  - ***Answer****:* Competency development in nuclear power development is critical and a long road journey. Even starting now does not guarantee a smooth road ahead.

- **Question 4:** *The industry is a hi-tech one, so only foreign personnel will operate?*
  - ***Answer****:* Yes, the industry is highly skilled, **but Ghanaians** can rise to the occasion. *As an example, whereas other countries use consultants for Phase 1, Ghana did most of the work locally, with support from the IAEA.* For a start, we can opt for **Build-Operate-and Transfer (BOT)** or **Build Operate and Own (BOO)** and through **Public-Private Partnership** (**PPP)** arrangement to facilitate **Local Content (Ghanaian participation)**.