Future of Geothermal Development in the East African Countries

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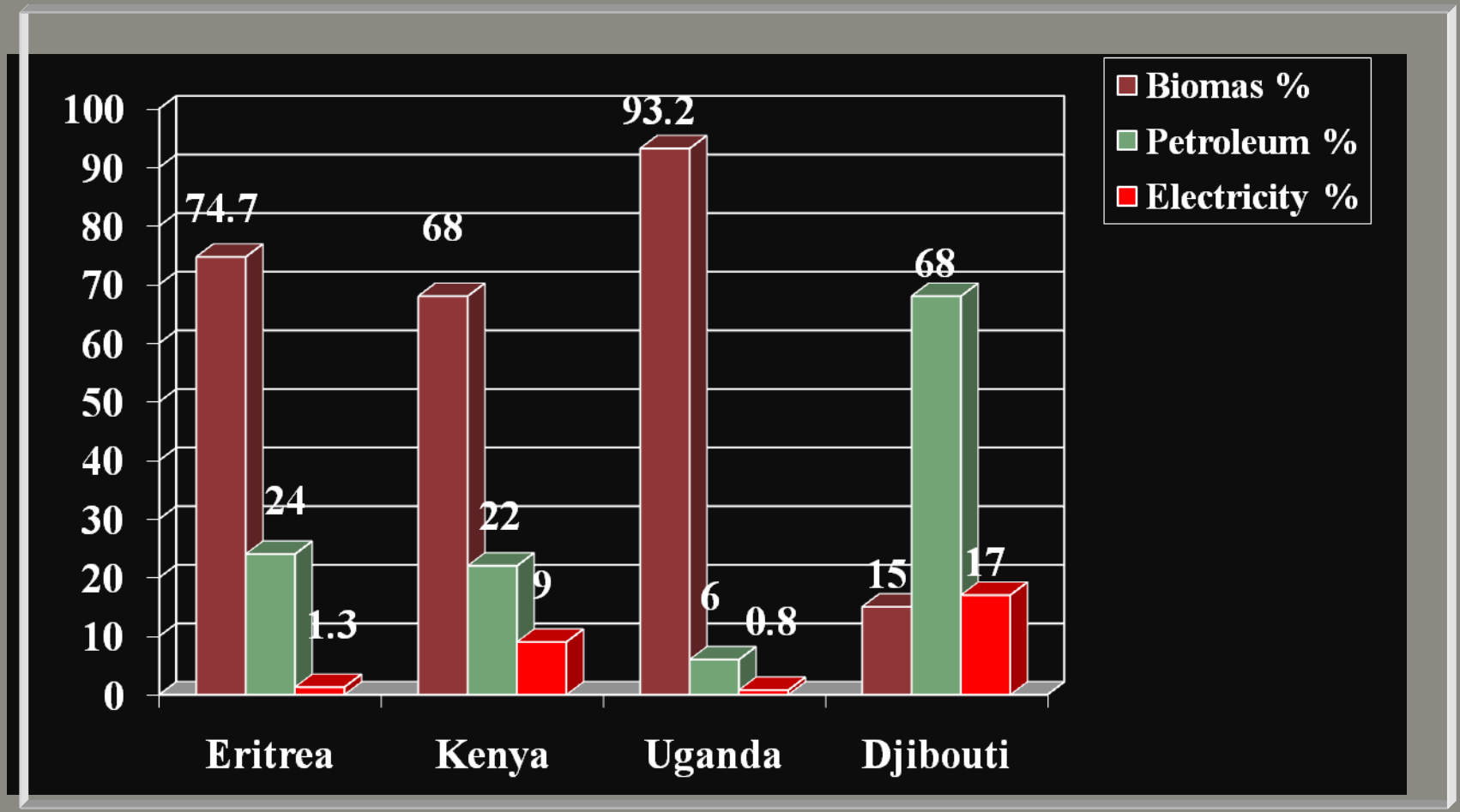
How do things look in the power sector?

Energy Consumption in E. Africa



High utilisation of biomass degrades environment

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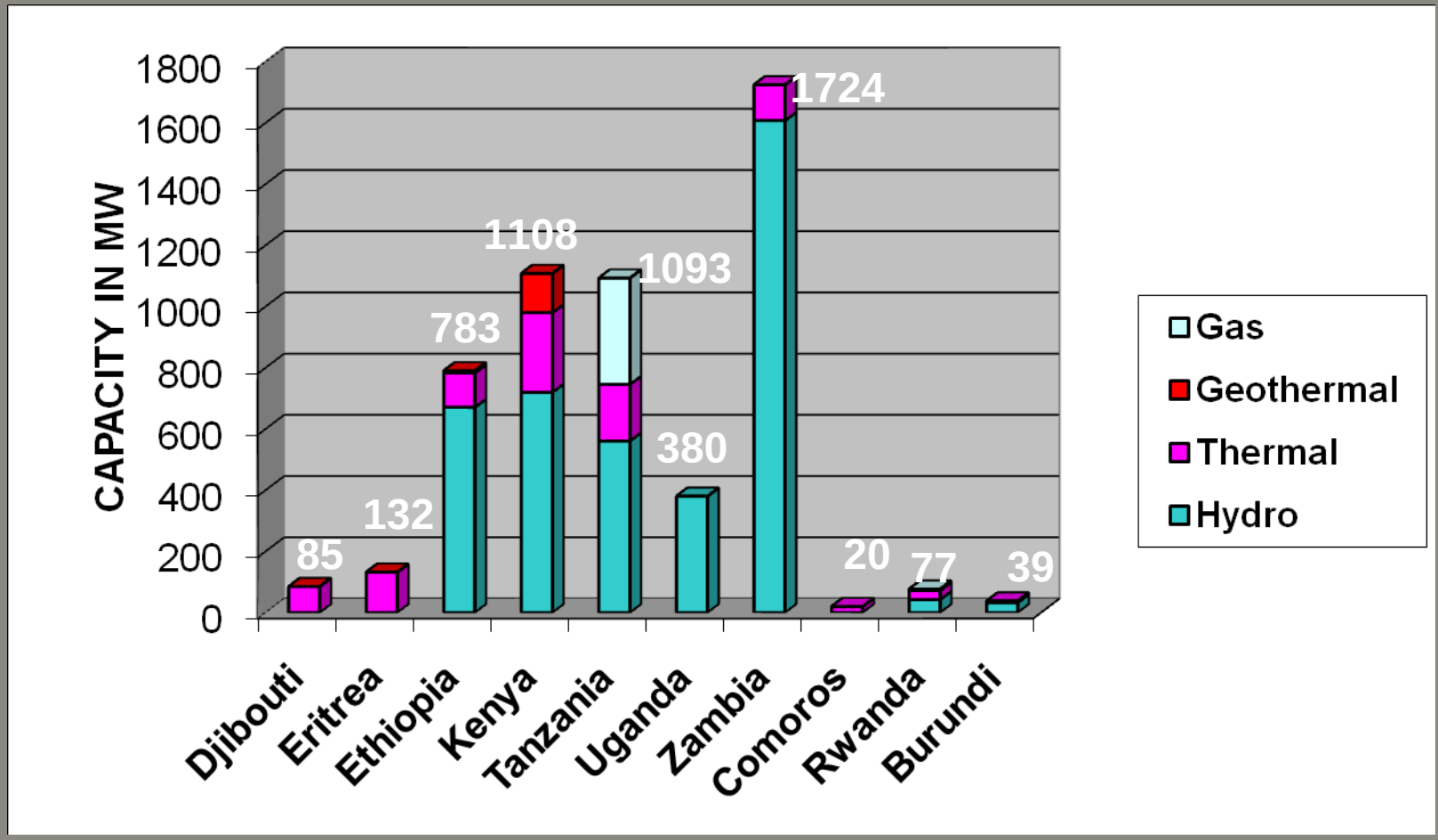
Installed Electricity Total = 5,447.6MW



High dependence on hydropower venerable to drought

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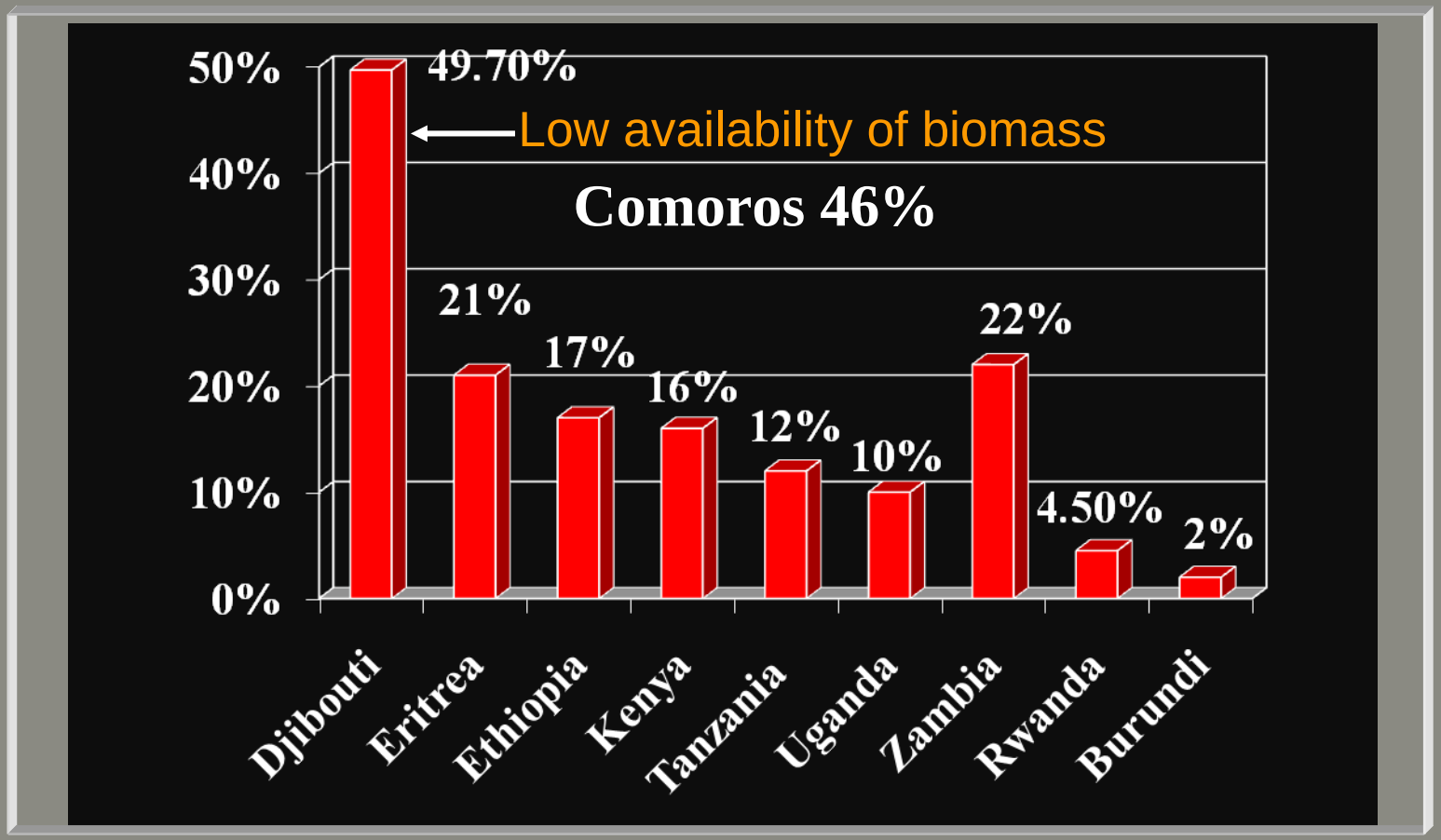
% Population Connected to Electricity



High potential for growth due to current low access

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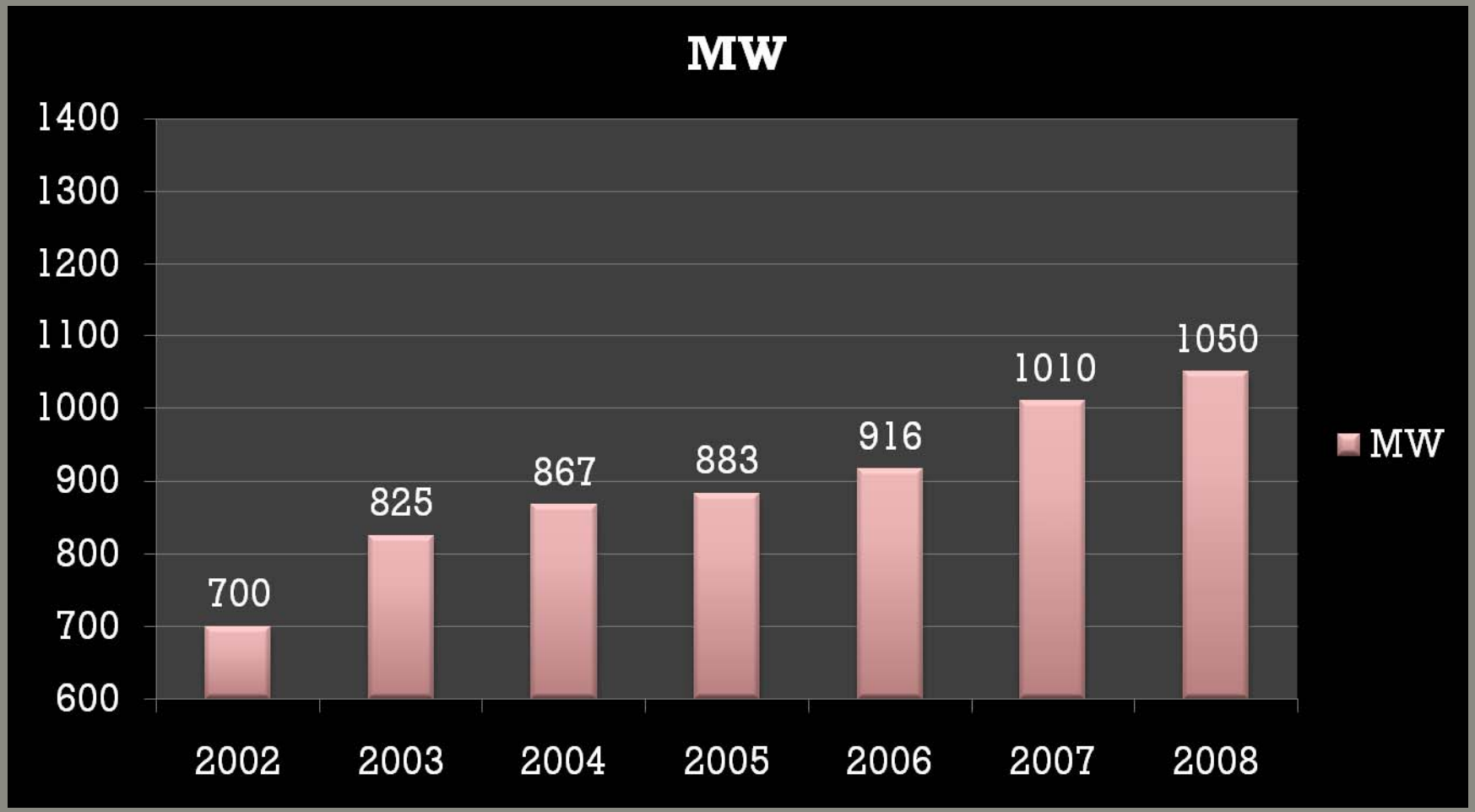
Peak demand Growth in Kenya



Strong growth in demand for power poised to accelerate to over 8% annually

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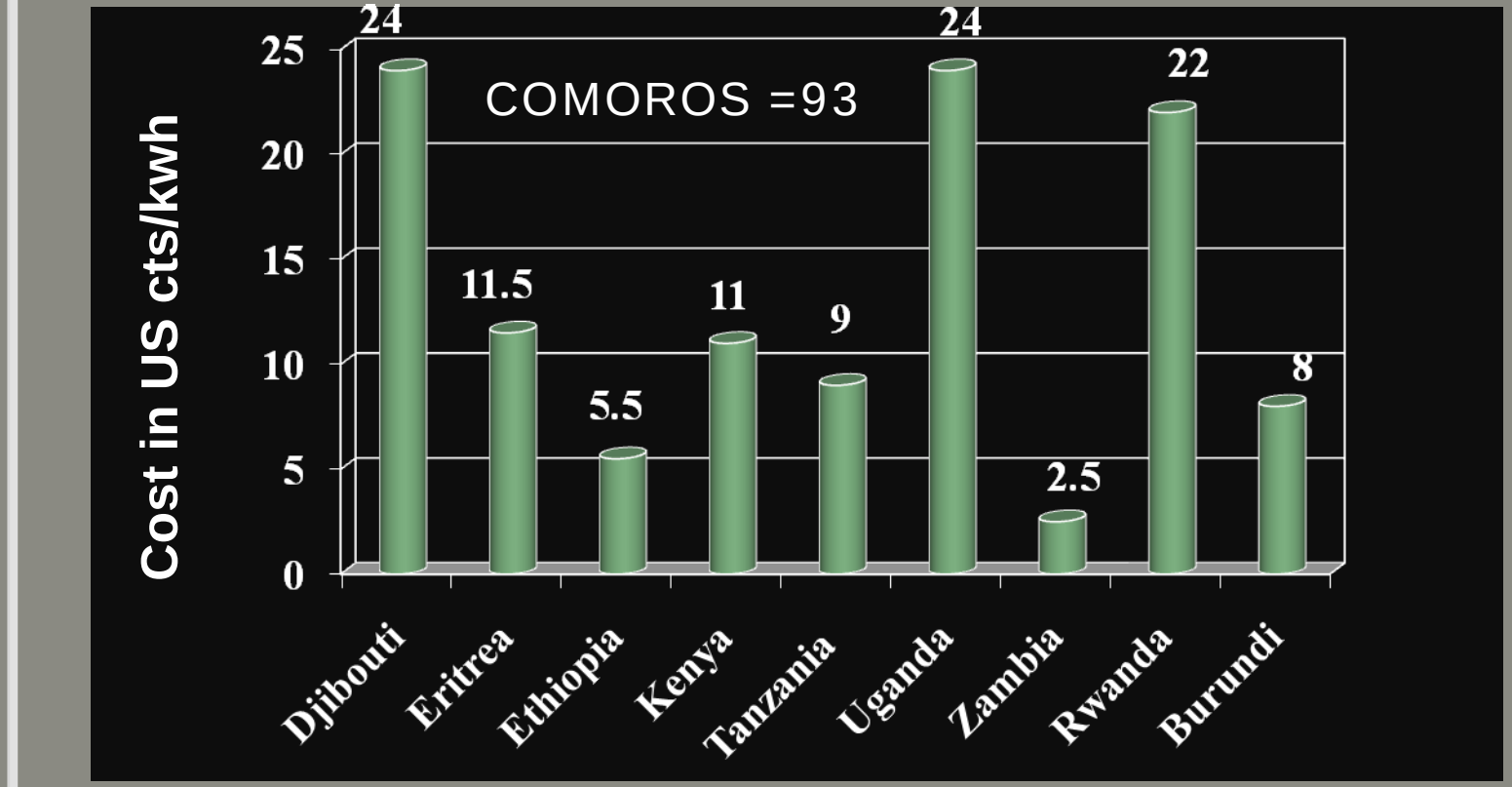
Average Electricity Prices US cts/kWh



High prices due to fossil fuels and drought

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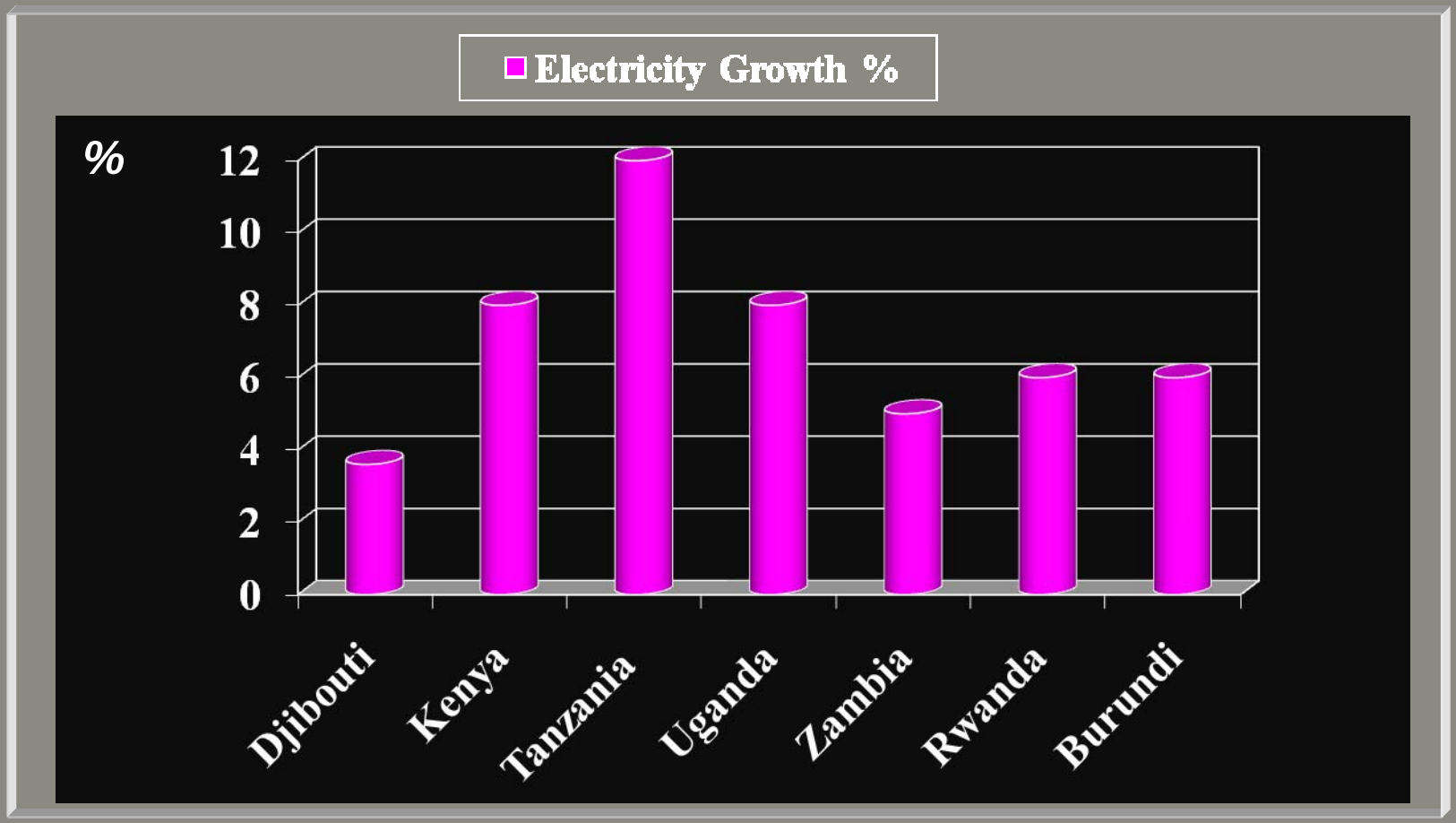
Predicted demand growth



Increase in demand due to economic growth

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Incentives for Geothermal Dev.

- Drought vagaries
- Oil price increases and fluctuations(US$147/barrel)
- Drain on meagre foreign currency earnings
- Environmental benefits

African Rift System

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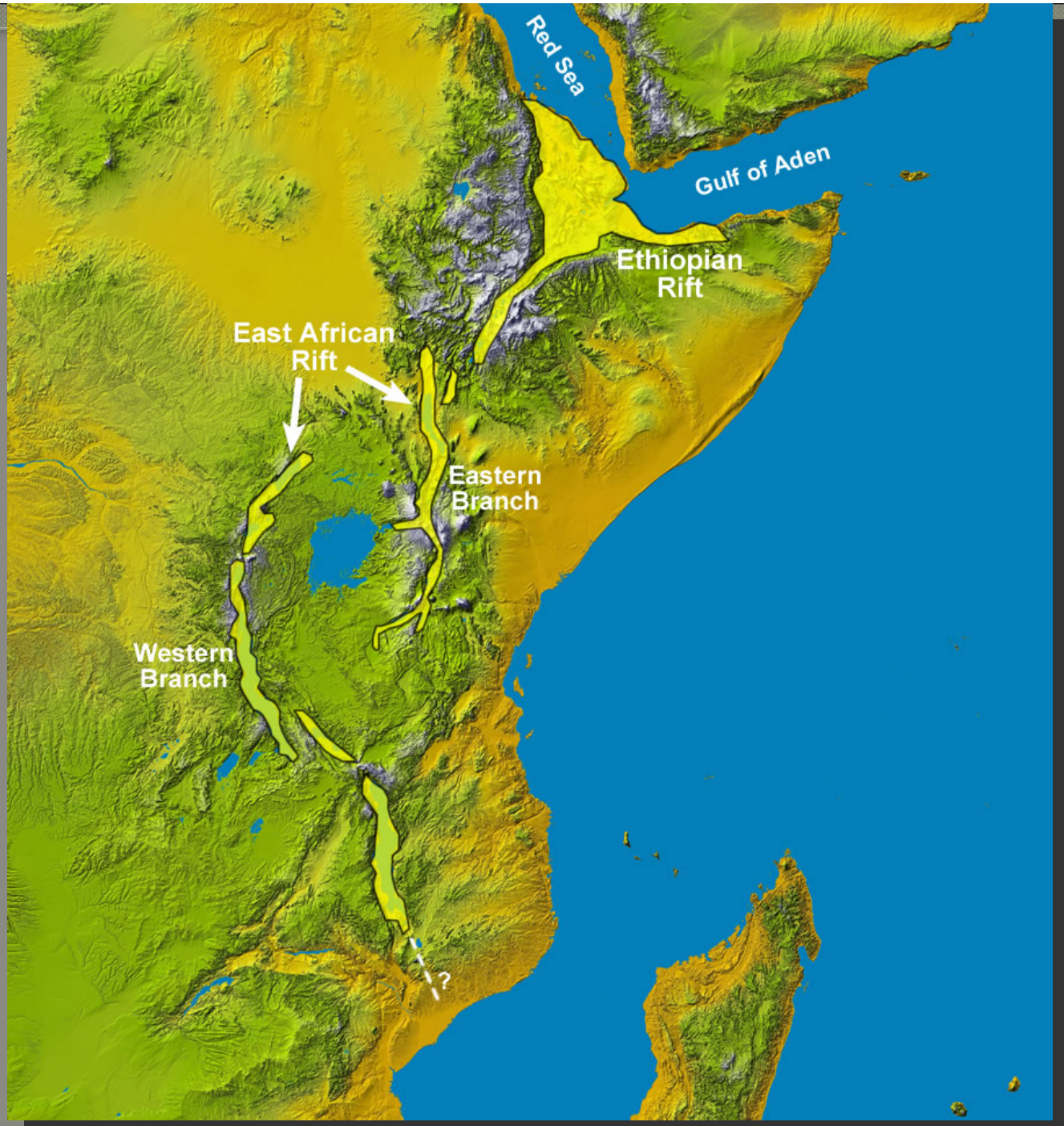

African Rift System

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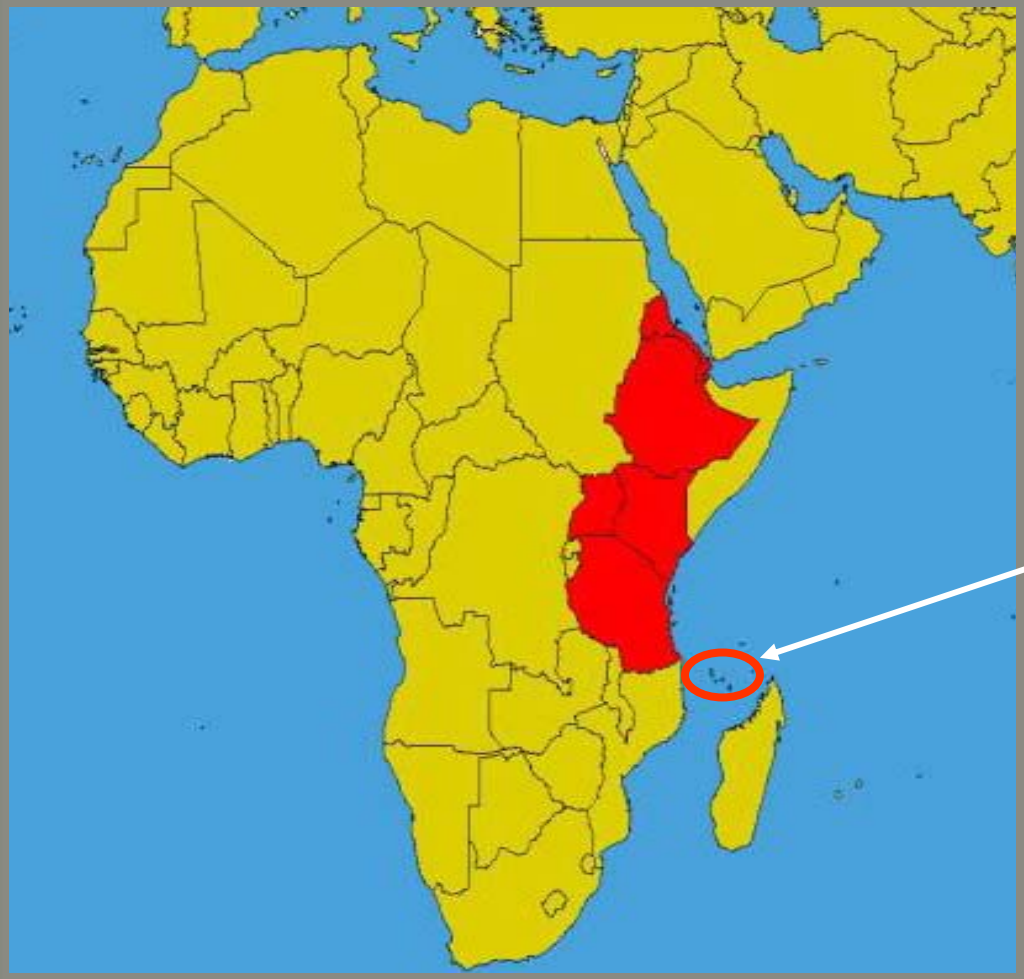
East African Countries with Geo



Djibouti
Eritrea
Ethiopia*
Kenya*
Tanzania
Uganda

ARGeo Countries

Zambia*
Rwanda
Burundi
Comoros

*Power Plant installed

Total Installed
138MW

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What are the problems we identified in Nairobi in 2003?

Factors Affecting Geothermal Dev.

Problem	Solution
◉ Risk of expl. drilling	◉ Create a risk fund
◉ Large upfront cost of development	◉ Promote public-private partnerships ◉ Participation of finance, bilateral donors and development agencies (eg.UNDP, WB)
◉ Country commercial risk	◉ Legal frameworks ◉ Participation of finance bilateral donors and development agencies (eg.UNDP, WB)

Factors Affecting Geothermal Dev.

Problem	Solution
◉ Geothermal not in national development plans	◉ Integrate geothermal in national plans
◉ Lack of knowledge by decision makers	◉ East African conference, rotational every 2 years ◉ Awareness training for decision makers - UNU/GTP-KenGen
◉ Technology transfer south-south and north-south	◉ Establish a regional geothermal school
◉ Lack of incentives	◉ Create incentives in geothermal development policies

What has been achieved so far?

Results

- African Rift Geothermal initiative (ARGeo) formed under UNEP in May 2003 with four components
  - Technical assistance -GEF
  - Geothermal Advice Panel -WB
  - Risk Mitigation Fund -WB
  - Policy, regulatory and transaction advise -WB
- GEF funding US$18.6m
- ARGeo Website developed
- Several pipeline projects evaluated

Results

- ICEIDA US$2.5m- human capacity and equipment survey
- UNUGTP and KenGen started annual short courses in Kenya and continue to provide the 6 months course
- BGR US$2.8m for surveys, conference support and training upto 2009

Results

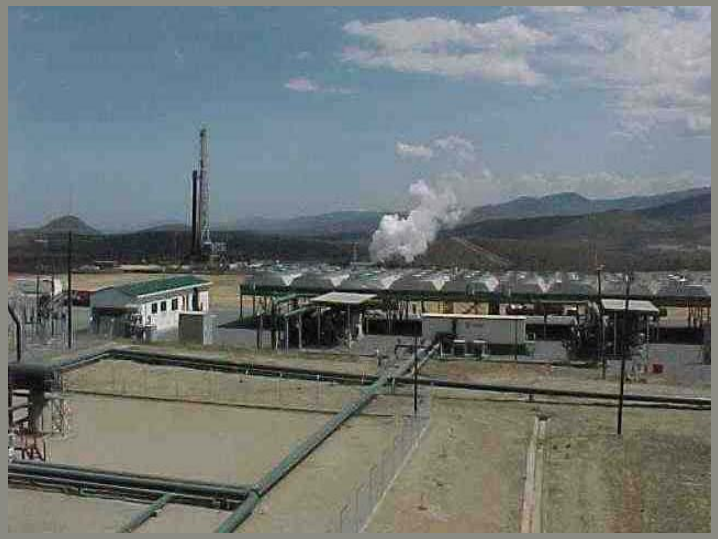
- Uganda :
  - Completed detailed exp. in Katwe, Buranga, Kibiro
  - Shallow drilling in Katwe and Kibiro
  - Hosting of Eastern Africa Geothermal conference in 2008
- Zambia:
  - Reconnaissance at Kapisya and Chinyunyu in collaboration with KenGen
  - Revival of Kapisya plant in progress
- Ethiopia:-
  - Surface exploration and Rehabilitation of Aluto-Langano
  - Hosted the 2006 Eastern Africa Geothermal conference

Results

- Kenya:
  - GoK has developed a lot of interest in geothermal
  - Detailed surveys funded by government in 6 sites
  - Drilling for appraisal wells in Olkaria Domes after 5 years of dormancy
  - Study for establishment of a special purpose company- GDC
  - KenGen developed its own geos. Strategy & plan to develop 1260MW in 10 years
  - 3.8MW added by a Kenyan farmer (Oserian Dev. Company) in 2004 and 2008
  - Olkaria III extra 45MW to be commissioned soon

Results

- Tanzania:
  - carried survey at Songwe-Mbeya with BGR
- Djibouti
  - Signed an agreement with REI for Assal and Surveys done at Assal by REI
- Rwanda
  - Survey done by BGR and KenGen involved
- Strong Interest from Burundi, Comoros and DR Congo
- We should use this wave of increased interest



Olkaria III power Plant 13MW

Total = 58MW

Olkaria III power Plant 45MW

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Oserian I Power Plant 2MW

Total = 3.8MW

Oserian II Power Plant 1.8MW

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Aluto Langano Power Plant 8.5MW

Kapisya power plant 200kw

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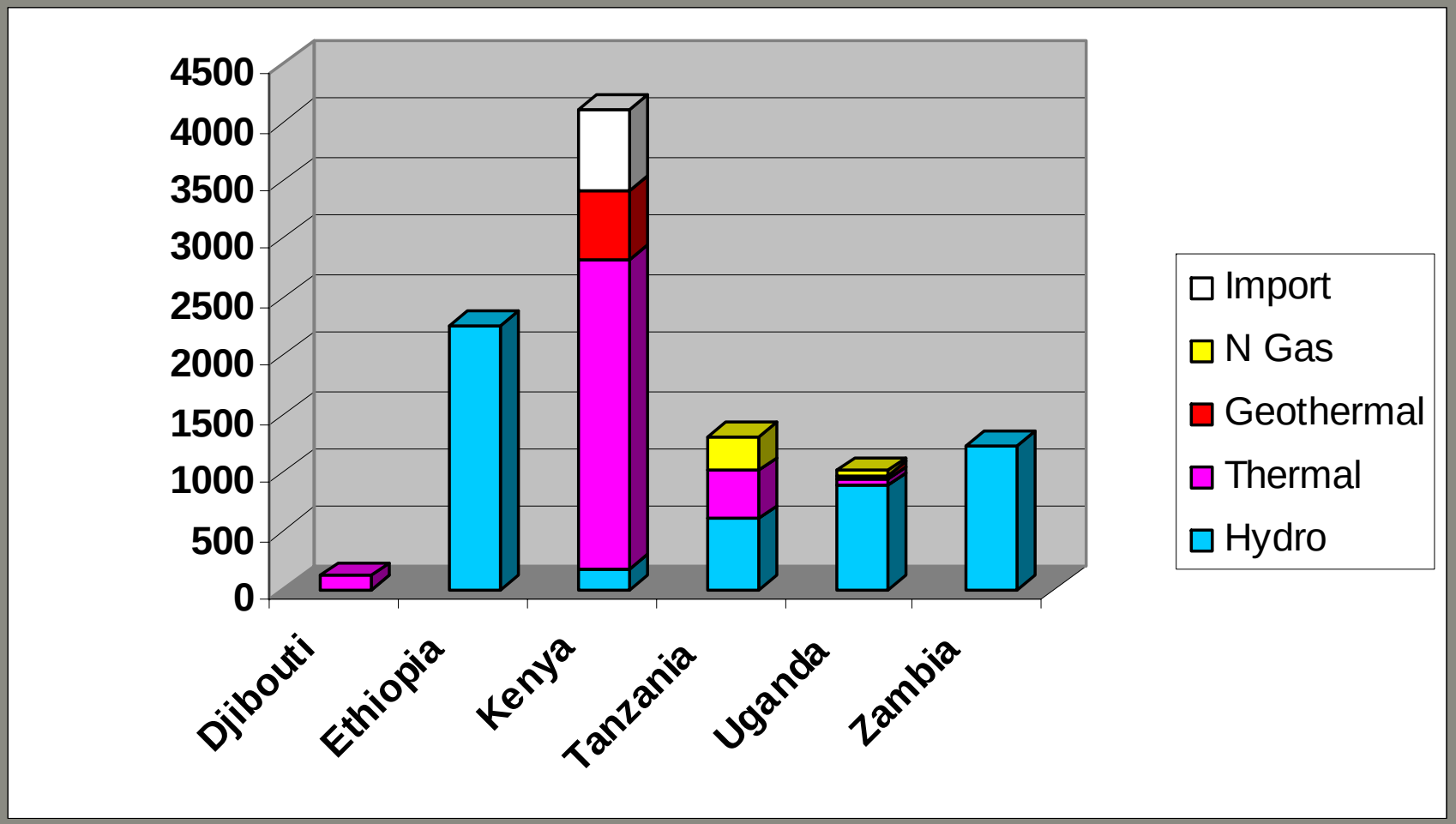
20yr Planned Generation Additions
Total >10,036.5 MW



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What is going to affect geothermal development?

Strengths and Threats of Geo

All Countries

Strengths

- Environmentally benign
- Lower price than thermal
- Save on foreign currency, CDM, tourism
- Indigenous

Threats

- Lack of funds
- High initial drilling risk
- Geothermal out of master plans
- Lack of knowledge
- Reduce the pressure

Strengths and Threats of Geo

Djibouti | Eritrea | Ethiopia | Kenya

Strengths

- No oil, gas or hydro

Threats

- Long transmission line required
- Import from Ethiopia
- High saline resource

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Strengths and Threats of Geo

Djibouti | **Eritrea** | Ethiopia | Kenya

Strengths

- No oil, gas or hydro

Threats

- Long transmission line required
- Import from Ethiopia

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Strengths and Threats of Geo

Strengths

- Huge potential
- Can supply remote villages
- Provide energy mix

Threats

- Huge hydro potential
- High natural gas potential

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Strengths and Threats of Geo

Djibouti → Eritrea → Ethiopia → **Kenya**

Strengths

- Limited future economic hydro
- Proven resource
- Large potential

Threats

- Imports from neighbouring countries
- Nuclear and coal

Strengths and Threats of Geo

Tanzania | Uganda | Burundi | Rwanda

Strengths

- Can supply remote villages
- Make foreign currency by selling gas

Threats

- Large hydro
- Natural gas
- Not proven potential
- Geothermal not given priority

Strengths and Threats of Geo

Strengths

- Environmental issues with hydro
- Connect to villages in the west
- Sell oil and generate with geothermal
- Strong GoU interest

Threats

- Large hydro
- Recently discovered oil
- Not proven potential

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Strengths and Threats of Geo

Tanzania | Uganda | **Burundi** | Rwanda

Strengths	Threats
• No oil or gas • Limited future hydro	• Import from neighbouring countries • Not proven resource

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Strengths and Threats of Geo

Strengths	Threats
• Limited future hydro	• Natural gas • Lack of knowledge and trained staff • Not proven potential • Import from neighbouring

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Strengths and Threats of Geo

Zambia | Comoros | DR Congo

Strengths	Threats
• Have offgrid policy • Supply remote villages	• Large hydro potential • Coal potential

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Strengths and Threats of Geo

Zambia | **Comoros** | DR Congo

Strengths

- No hydro or other indigenous resource
- Support tourism
- Government keen to support dev.

Threats

- Population scattered in many islands
- Still active volcanoes
- No proven potential

Strengths and Threats of Geo

Zambia → Comoros → DR Congo

Strengths	Threats
• Can supply eastern part villages	• Large hydro potential • No proven potential • Active volcano • Lack of knowledge and staff

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Estimated Geothermal Potential

170-	Country	Power (MW)
1	Djibouti	230-860
2	Eritrea	400-500
3	Ethiopia	700-1000
4	Kenya	>4000
5	Tanzania	230-460
6	Uganda	450
7	Zambia	?
8	Rwanda	170-300
9	Burundi	?
10	Comoros	450?
11	Dr Congo	?
	Total	4,680-7,820

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Predicted Geothermal Installations (20 Yrs)

	Country	Power (MW)
1	Djibouti	100
2	Eritrea	20
3	Ethiopia	120
4	Kenya	1200
5	Tanzania	10
6	Uganda	50
7	Zambia	10
8	Rwanda	30
9	Burundi	5
10	Comoros	20
11	Dr Congo	5
	Total	1570

+/- 10%

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Conclusions

- There are future opportunities of increasing geothermal utilisation in Eastern Africa inspired by:
  - Economic growth
  - Rural Electrification focus
  - High price of oil
  - Frequent drought
  - Environmental concerns
  - CDM availability
  - Increased awareness and training
  - Increased government and private investment

Conclusions

- 1600 MW is predicted to be installed in the next 20 years of which Kenya will develop the largest portion
- ARGeo has potential to tap into the synergies of the region and therefore must be upgraded in order to include the countries who have shown interest, eg Comoros, Rwanda, DR Congo and Burundi, Yemen

Conclusions

- Geothermal be placed in master plans in order to receive enough attention.
- There is threat from importations, large hydro, fossil fuels, lack of focus and lack of funds.
- Governments from the Eastern Africa countries must play an increasing role in geothermal development.
- The country institutional setup should provide for department dedicated to Geothermal.

Thank You

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