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"Enlightening a Continent in the Dark"– Prospects for Hydropower Development in Africa.

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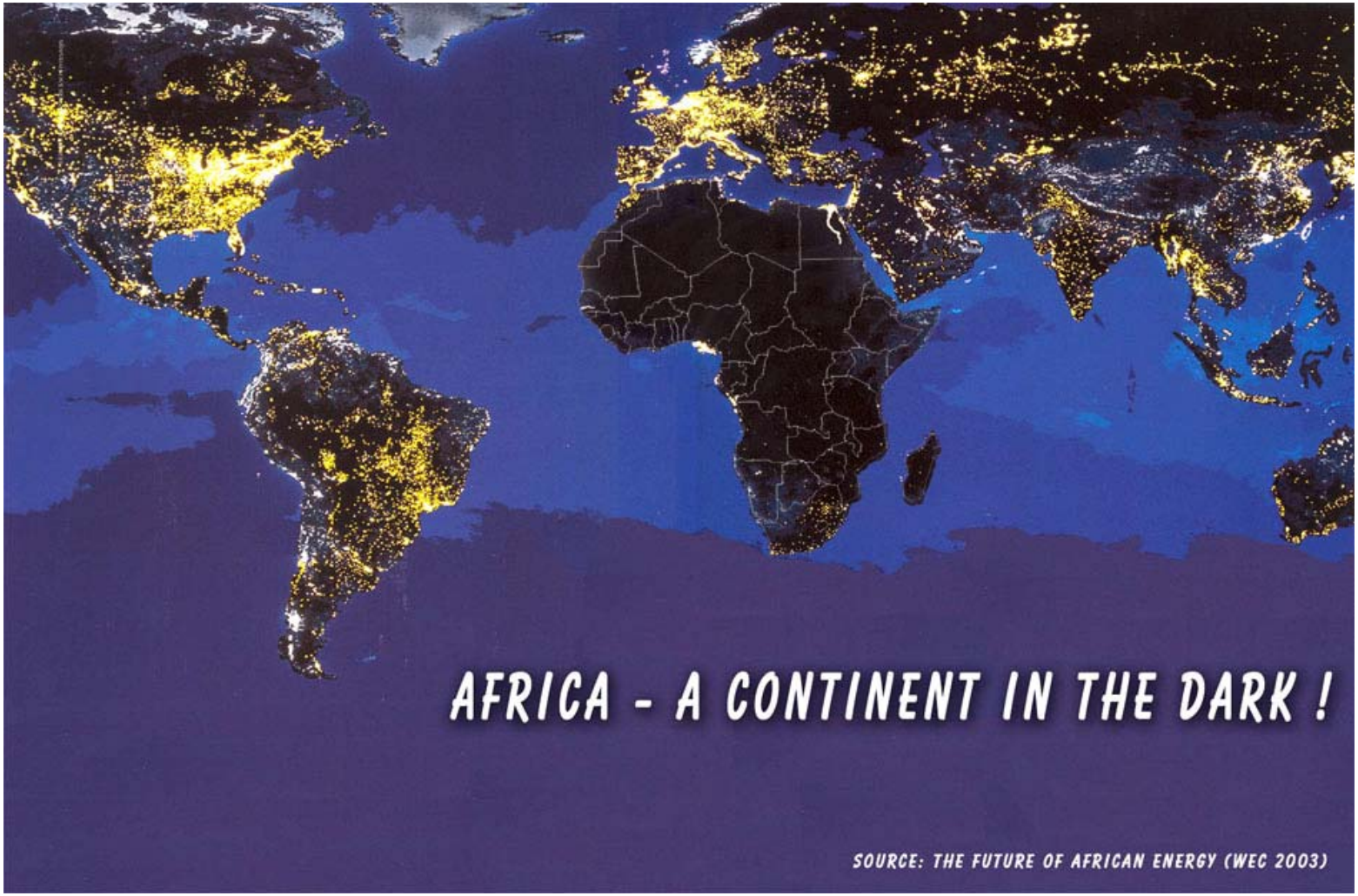
The curent reality



Some features of the African energy picture

- It is well recognised that – access to clean, reliable energy is vital to socio-economic development.

- It has been said that – “The right for development is a basic human right”. (IHA, 2000).

- Most Africans are energy poor in the midst of a relatively energy wealth!

Some features of the African energy picture

Some energy consumption issues

- 13% of the world's population (IEA, 2003);

- 5.5% of the world's total final energy consumption, biomass included (IEA, 2003);

- 3% of the world's modern energy consumption (EIA, 2003);

- 60-80% total energy consumed is traditional biomass;

- Low per capita total primary energy supply, biomass included (TPES) (IEA, 2003)

World	1640 koe/cap
Africa	630
Latin America	1070
China	900
Asia (China excl.)	600

Some features of the African energy picture

- Low per capita electricity consumption (IEA, 2003)

World	2326 kWh/cap
Africa	515
Latin America	1511
China	1093
Asia (China excl.)	549
OECD	
Non OECD	

- This is somehow a paradox because Africa is endowed with some significant energy resources. (WEC/SER, 2004).

Some features of the African energy picture

Resource potential

Type of energy	% World	R/P (Africa)	R/P (World)
Oil reserves	8.9%	33	41
Gas reserves	7.8%	98	67
Bituminous coal	10.5%	233	227
Uranium	20.2%	103	88
Hydroelectricity (*)	13%	-	-

R/P ratio = reserves/production, in years
(*) Hydroelectric technically exploitable potential

- The hydroelectric capability of Africa is mainly located in Central Africa (Cameroon, Democratic Republic of Congo) and Eastern Africa (Ethiopia, Madagascar).

- The Inga site located in DRC represents the highest hydroelectric potential in Africa and one the highest in the world.

Some features of the African energy picture

- Africa has a good energy self sufficiency ratio (Energy production/TPES) (IEA, 2003).

➔ Energy consumed in the continent is largely supplied by indigenous production.

Africa	1.75
Latin America	1.37
Asia (China excl.)	0.88
China	0.99
Middle East	3.32

OECD Total	0.73
Non OECD Total	1.35
OECD North America	0.87
OECD Pacific	0.48
OECD Europe	0.64

- Most of the modern commercial energy produced in Africa is exported to other continents (Ogunlade/Youba, Nairobi 2001).

Prospects for hydropower in Africa's future energy mix

> The increasing need for modern commercial energy …

- It has been established in 1993 (WEC ETW Report) that:
  - ✓ 2 billion people in the world live without access to any modern commercial energy. despite the efforts made and the progress achieved, the situation has not improved much!
  - ✓ 1.6 billion people in the developing world do not have access to electricity; most of them live in shanty towns and rural areas. A good share of them (over 600 millions!) live in Africa.

- For the continent to meet the annual 6% targeted economic growth rate (NEPAD), it will need to increase its consumption of modern commercial energy, and consequently its electricity production and consumption.

- Some of the NEPAD energy objectives
  - ✓ Increase access to affordable and reliable modern energy services from 10 to 35% by 2020;
  - ✓ Provide energy at low cost to support economic growth;
  - ✓ Exploit hydropower;
  - ✓ Strengthen regional energy cooperation (regional networks in the electricity and petroleum sectors; common infrastructures)

Prospects for hydropower in Africa's future energy mix

> <u>…In the context of energy related global environmental concerns</u>

- Historically, traditional sources of energy (mainly traditional biomass) have never promoted and sustained economic or social development.
- Global environmental protection challenges related to the production and consumption of fossil sources of energy;
- Environmental hazards related to fossil based electricity generation;
- Despite the recent controversial debate on hydropower negative impacts;
- A growing international consensus in favour of hydropower development (CSD-9/New York, WSSD/2002, Kyoto/2003, Bonn/2004).
- In line with one of the energy policy actions - **"keep all energy options open"** more and more accepted in the global energy debate (WEC/ETWAN, 2000).

Prospects for hydropower in Africa's future energy mix

> **The potential contribution of Africa's largely untapped hydroelectric resources**

- Per capita electricity consumption in Africa is still low (515 kWh/cap.) compared to the world's average (2326 kWh/cap.);

- Household access to electricity remains low (20%) compared to other regions;

- Northern Africa stands significantly apart, with an average of 86% with countries like Algeria, Egypt, Libya, Tunisia reaching 95%. (Ogunlade/Youba, 2002).

- The rest of Africa averages 15%; Central Africa is the sub-region with the lowest rate (9%); Chad being the country with the lowest (3%).

Prospects for hydropower in Africa's future energy mix

- Total electricity generation in Africa – one of the lowest in the world. (BP Stat-Rev/2004).

OECD	59.3%
Asia Pacific	30.3%
China	11.5%
Europe & Eurasia	29.5%
North America	28.8%
South and Central America	5.3%
Middle East	3.3%
Africa	**2.9%**

- Most of the total electricity in Africa (~67%) is generated only in two (2) countries:

Egypt	18.9%
South Africa	47.7%

Prospects for hydropower in Africa's future energy mix

- Worldwide electricity generation uses mostly (64.5%) fossil fuels (IEA, 2003).

Fossil fuels		**Others**	
Coal	38.7%	Nuclear	17.1%
Gas	18.7%	Hydro	16.6%
Oil	7.5%	Other RE	1.8%
Total	**64.5%**	**Total**	**35.5%**

- Similarly in Africa, electricity generation is mostly fossil fuel based (ageing available data; AEP/AFDB, 1996)

Generation fuel	**Installed capacity (%)**	**Electricity generated (%)**
- thermal	77.1%	78.1%
- hydro	20.9%	18.8%
- nuclear	2.0%	3.0%
- geothermal	Less than 0.1%	Less than 0.1%

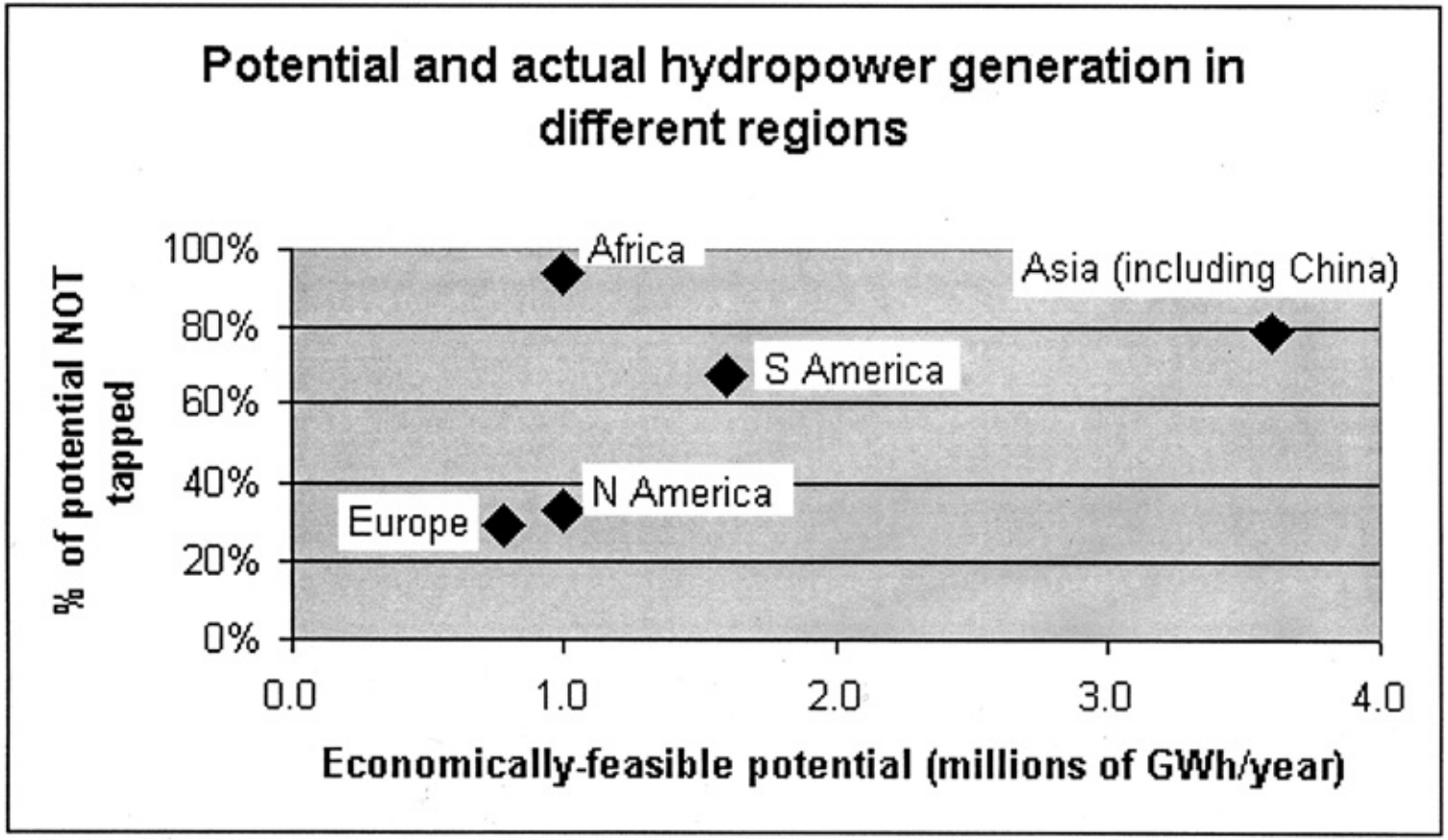
Prospects for hydropower in Africa's future energy mix

- Africa is the world's region which has exploited a very little share of its technical and economical feasible hydropower potential (WEC/SER, 2004).

Europe	75%
North and Central America	69%
South America	33%
Oceania	49%
Asia (China excl.)	22%
China	20%
Africa	**7%**

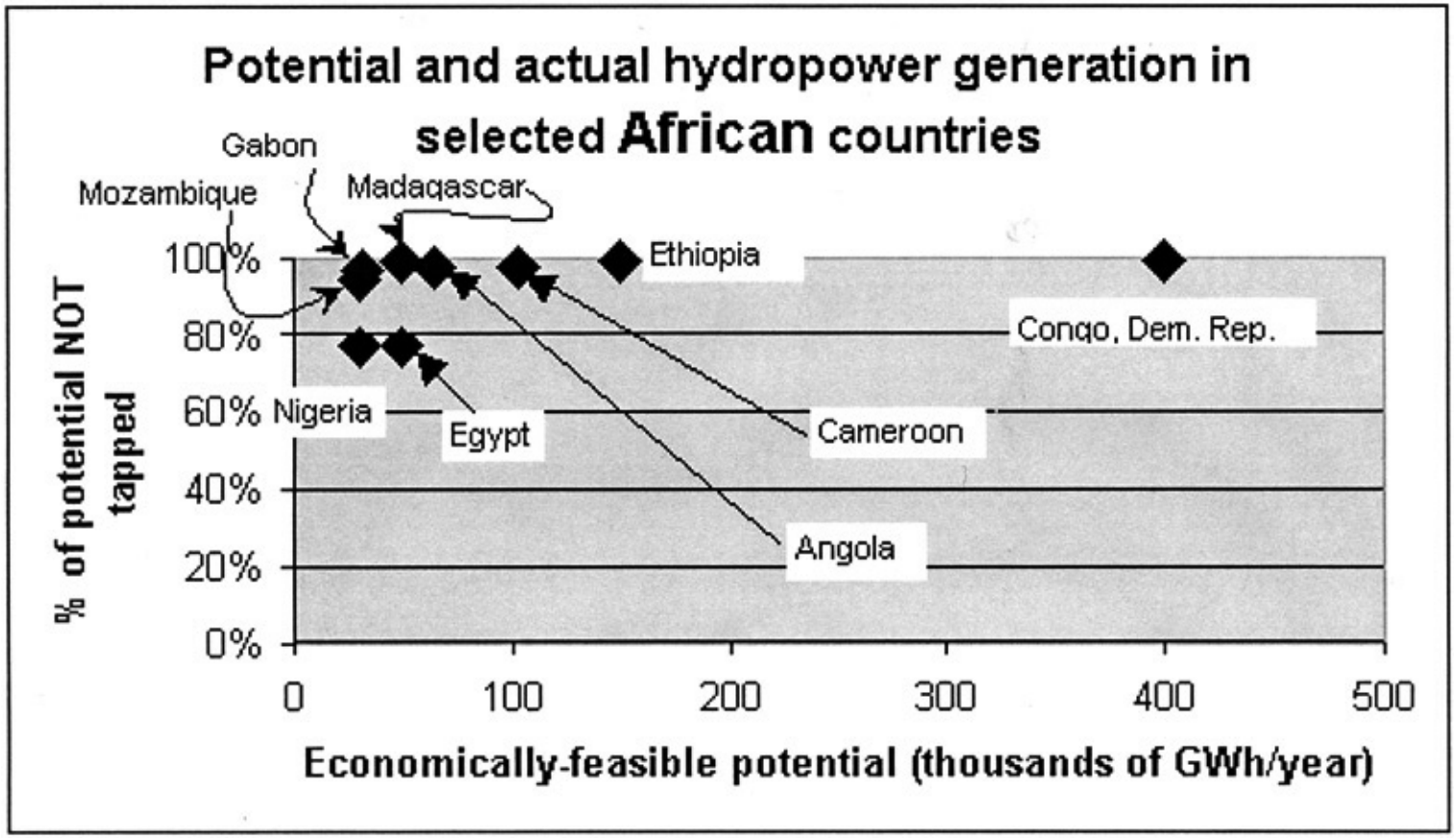
➔ A considerable potential remains in Africa for new development
➔ Hydropower can significantly contribute to reduce energy poverty in Africa

Prospects for hydropower in Africa's future energy mix



Source: DTK - Symposium Dams and Development / 2002.

Prospects for hydropower in Africa's future energy mix



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The challenge of "Enlightening a Continent in the Dark"

> Social & environmental impacts of hydropower

- ✓ Social impacts (negative & positive)
  - variable and project specific,
  - mainly associated with (transformation of land use in the project area, displacement of population living in the reservoir area).

- ✓ Environmental impacts (negative & positive)
  - sedimentation,
  - damaging fishing activities,
  - changes in water quality.

➔ **Impacts of hydro projects are well understood today; appropriate compensation & mitigation measures can be identified and taken to ensure that the project represents a net gain for affected population**.

The challenge of "Enlightening a Continent in the Dark"

> Some of the comparative advantages of hydropower

- the fuel (water) is renewable
- a proven and well advanced technology
- the lowest operating costs and longest plant life
- **Hydro provides some energy independence**

> Other potential benefits

- avoided emissions in terms of avoided fossil fuel generation

- benefits related to dams construction and related reservoir
  - ✓ human well-being
    (secured water supply, irrigation for food production, flood control)
  - ✓ societal benefits
    (recreational opportunities, improved navigation, development of fisheries)
  - ✓ benefits for the electrical system
    (spinning reserve, non-spinning reserve, regulation and frequency response, voltage support, black start capability)

The challenge of "Enlightening a Continent in the Dark"

> The challenge of financing the required investments

- Financing in the energy sector has been significant, although it is difficult to establish the amount of loans and other resource inflows.

- In general, commercial and energy institutions (the foreign private sector) have been investing mainly in the upstream oil and gas sector.

- FDI to Africa has been modest (less than 2%) compared to other developing regions (UNCTAD, 1999).

- Africa has been suffering from a decrease in foreign aid, including energy investments; in real terms, transfer per capita aid has dropped from US$ 32 in 1990 to US$ 19 in 1998 (World Bank, 2000).

The challenge of "Enlightening a Continent in the Dark"

- The main donors are external – World Bank and its member institutions, ESMAP, AFDB, and bilateral ODA sources.

- Financing from local sources has been limited and hence has minimal influence in directing the development of the sector.

- From 1967 to 2000, cumulative lending from AFDB to the power supply sector (which includes projects on production and distribution of electricity, gas, solar, coal, petroleum, and other energy sources), received around 9% of the total amount (Ogunlade/Youba, 2002).

- **External financial assistance is needed for energy development in Africa**
  - ✓ **investment in energy infrastructure is beyond local capacity;**
  - ✓ **the financial needs are beyond the financial capability of the continent.**

- In 2001 ODA was only 0.25%; far from the agreed UN target of 0.7% of the GNP announced during the Earth Summit in 1992 in Rio (Ogunlade/Youba, 2002).

The challenge of "Enlightening a Continent in the Dark"

- Unfortunately, the new world of liberalised markets creates a more difficult context for the financing and development of hydroelectric projects, and specifically the large ones (WEC/ETWAN, 2000).

- One of the major reasons is that large hydro schemes share characteristics of an infrastructure project more than of a commercial venture
  - ✓ long lead time (up to ten and more years from planning to commissioning);
  - ✓ their costs and risks structure;
  - ✓ their geological and overrun costs;
  - ✓ absence of a secure long-term contract for power (WEC/ETWAN, 2000).

➔ **"Unless liberalised markets allow for a fair evaluation of the long term economic risks and rewards of large hydro projects, their role in improving energy poverty and accessibility to electricity might be limited"!** (WEC/ETWAN, 2000).

The challenge of "Enlightening a Continent in the Dark"

> The fostering action of regional energy cooperation

- Promotion of regional or sub-regional energy planning, and establishment of a common energy framework.

- A study carried out by the Southern African Development Corporation (SADC) showed a surplus capacity of over 11, 000 MW within that sub-region, due to the uncoordinated national planning, thus resulting in significant stranded assets.

- The Southern African power Pool (SAPP) hopes to balance the surplus/deficit situation and transform power planning from national to regional self sufficiency (Ogunlade/Youba, 2002).

- Regional integrated electricity planning can help to optimise the utilisation of the existing capacity; therefore, added capacity will provide genuine added value to the energy sector.

The challenge of “Enlightening a Continent in the Dark”

- In the “Study of the African Power Sector” undertaken under the African Energy Programme of the AFDB, three scenarios have been explored :

  - ✓**scenario 1** - a separated development of national generating capacity; this implies a limited integration of sub-regional grids;

  - ✓**scenario 2** - a regional power cooperation with a progressive development of the Inga hydroelectric potential; this implies that the various sub-regional grids will be interconnected through the Central Africa’s grid;

  - ✓**scenario 3** - a regional power cooperation without Inga.

The challenge of "Enlightening a Continent in the Dark"

- Estimated overall investment required (generation and transmission)
  - ✓ **scenario 1** - US$ 155 billion,
  - ✓ **scenario 2** - US$ 132 billion,
  - ✓ **scenario 3** - US$ 128 billion.

- This estimation has shown an undeniable advantage of scenario 2;

- And one of its potential benefits is a more reliable African power system induced by the possibility of mutual assistance among involved countries;

- It has been established that it will also result in a more optimised utilisation of the overall existing capacity;

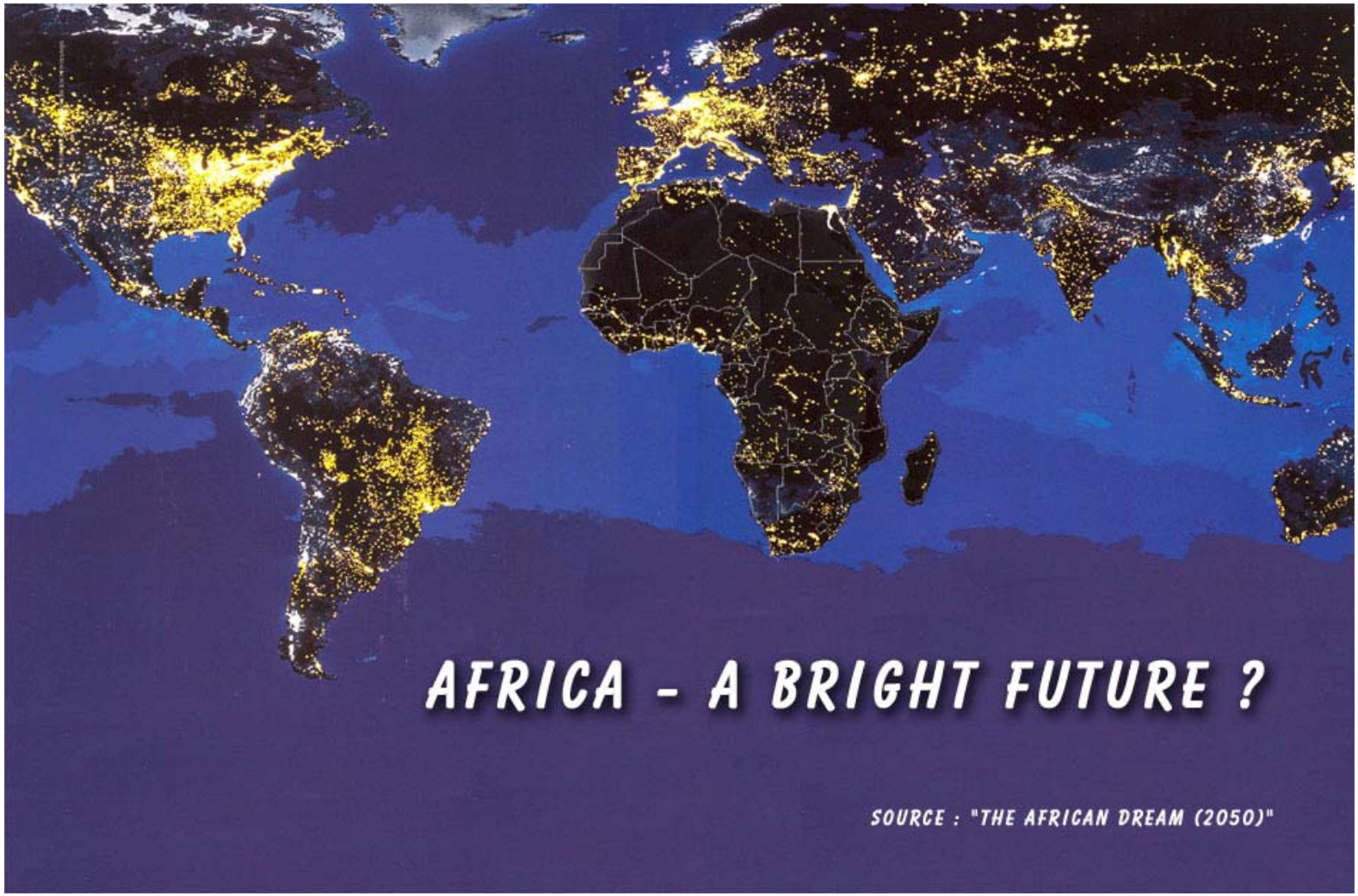
- and in a slowing need of separated national generating infrastructures.

➔ Regional Energy Integration is a driving force to be promoted!

Conclusion

If these prospects are realised,
the challenging dream of **“Enlightening AFRICA”**
could become a “**shining reality**”!

A feasible dream



Conclusion

THANK YOU FOR YOUR KIND ATTENTION!