

Nuclear Power in Africa

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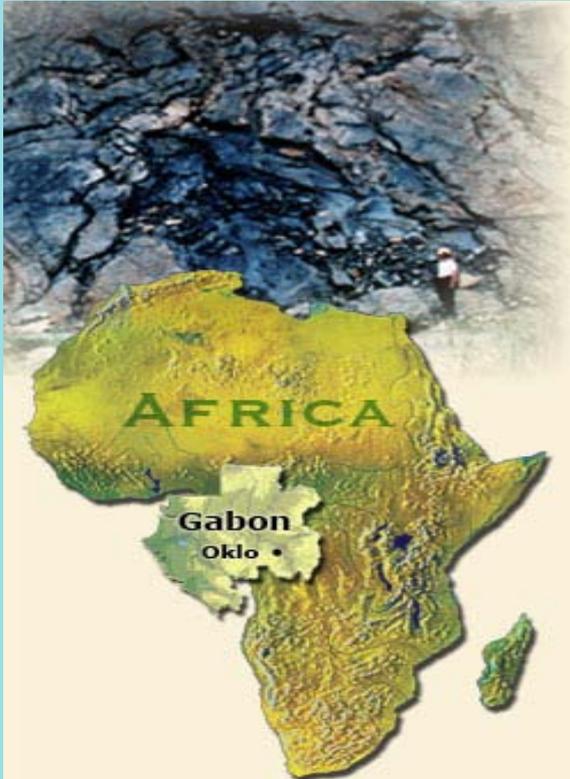
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- Energy and nuclear technology in Africa.
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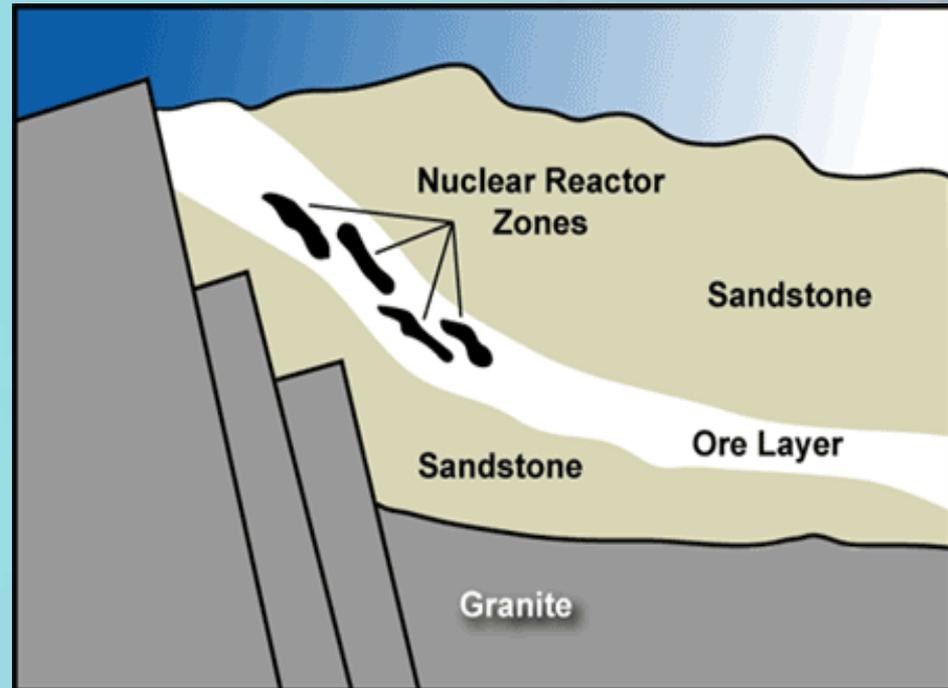
Where does nuclear power fit in the global electricity generating industry?

Nuclear and hydro power are the only technologically mature, limited greenhouse-gas emitting electricity generation technology already deployed for base-load supply on a large scale.

The first nuclear reactor in the world?



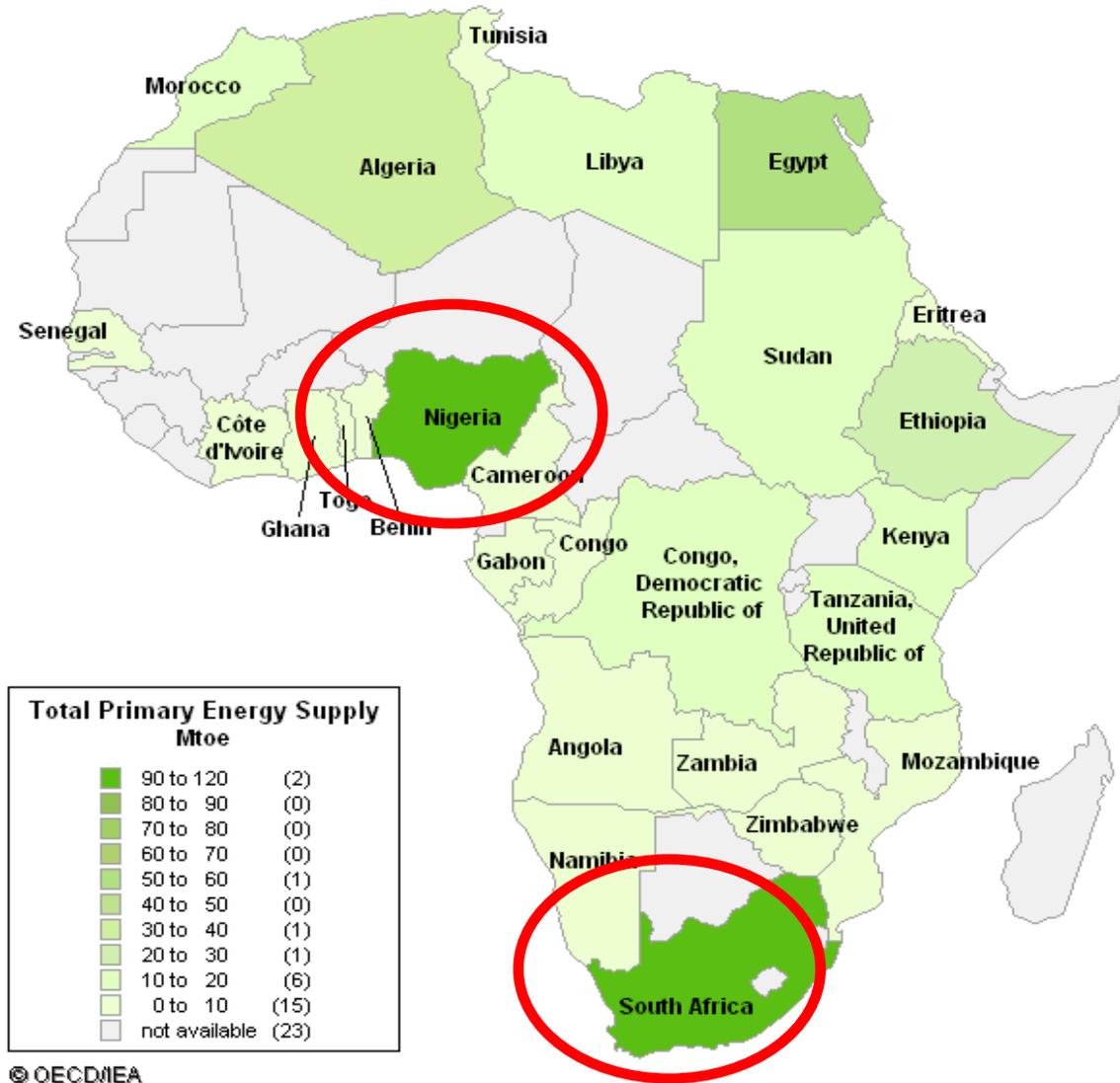
The uranium isotopes found at Oklo strongly resemble those in the spent nuclear fuel generated by today's nuclear power plants.



The energy and nuclear technology state of the African continent

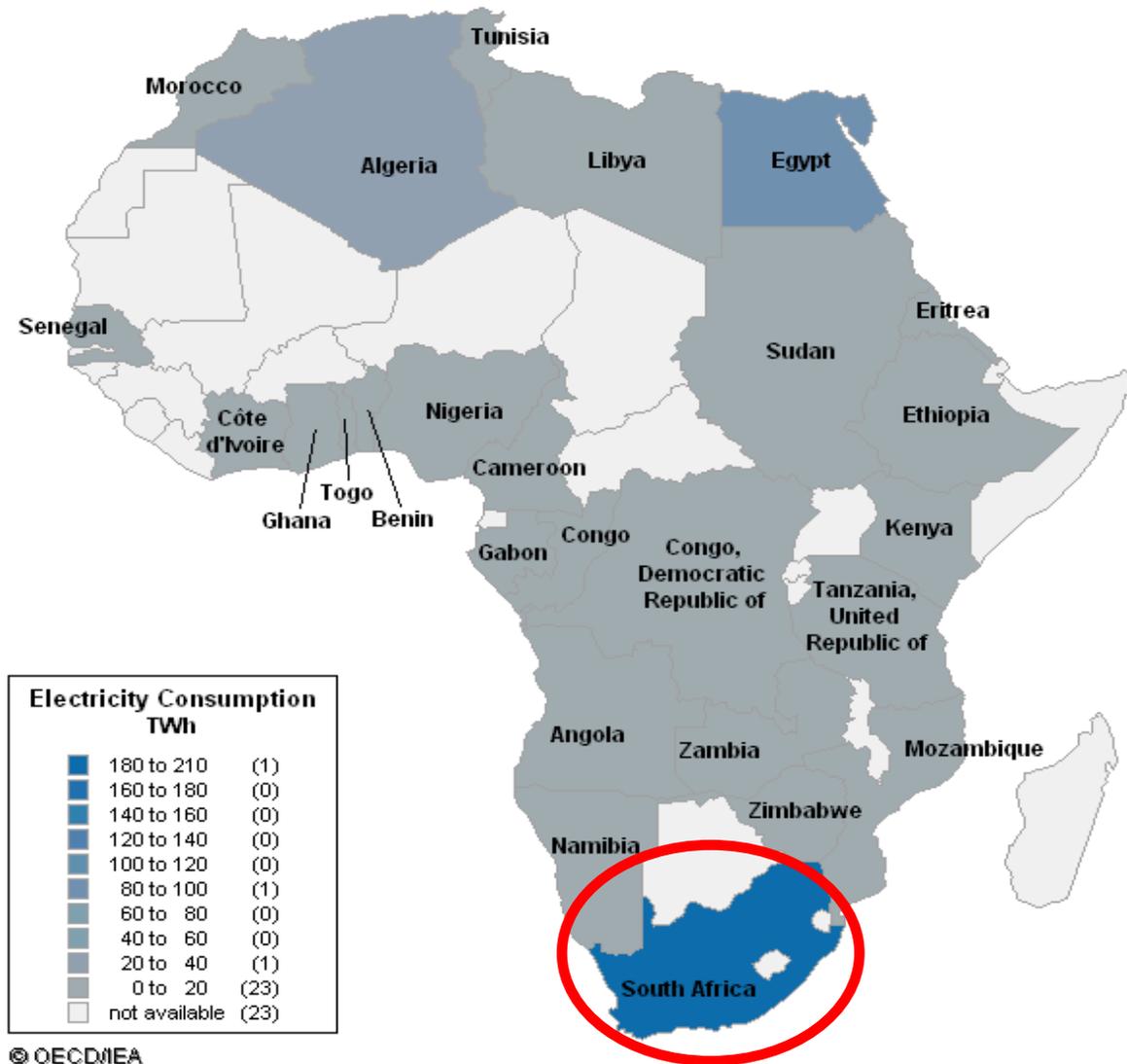
Africa

Nigeria and South Africa consume the most energy.



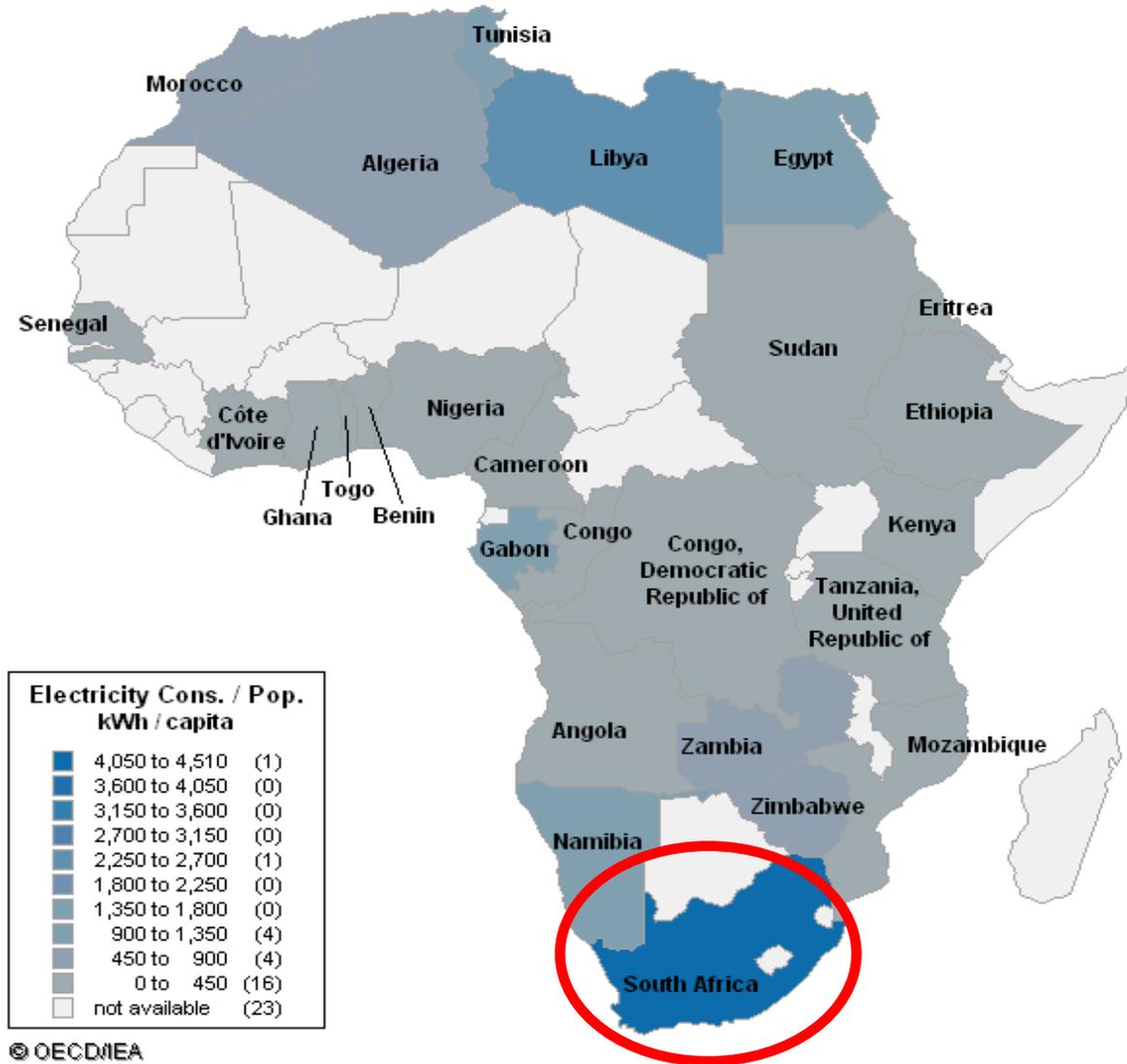
Africa

African electricity consumption is only 4% of total energy consumption, with South Africa leading.



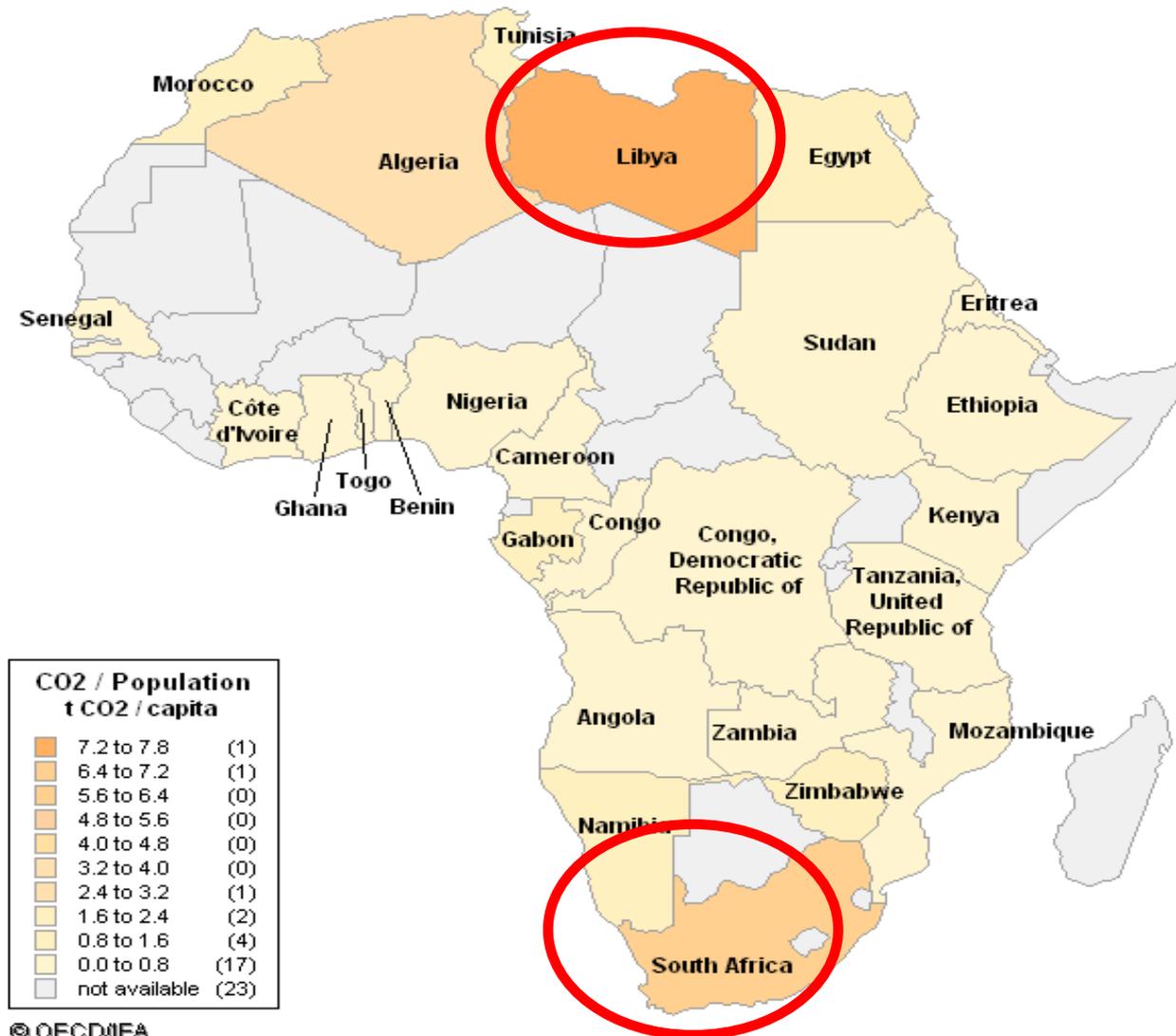
South Africa

Only South Africa matches the lower end of the OECD spectrum in terms of electricity consumption per capita.



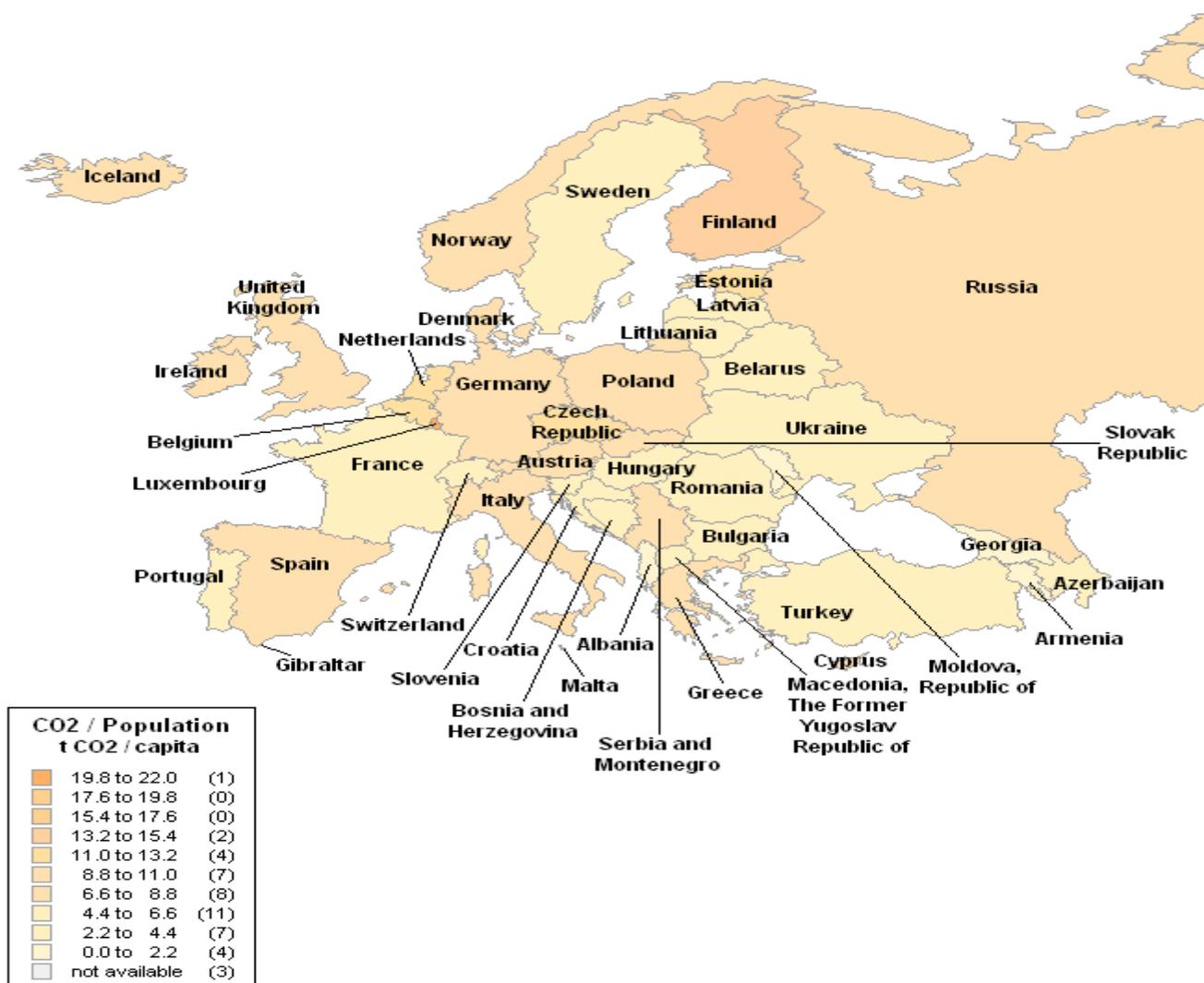
Africa

Only Libya and South Africa are “offenders” in terms of carbon dioxide emissions per capita.



Europe

18 European countries have higher carbon dioxide emissions per capita than Libya and South Africa and 29 have lower emissions.



Key issues affecting choices in the energy sector in Africa

- Small base-load capacity constrains economic growth.
- Electricity grids are generally small, but various expansions and regional grid connections are underway.
- There is a need to secure energy supplies and diversify across base-load.
- In the medium term, for all African countries except South Africa, greenhouse gas emission levels are unlikely to play a critical role in electricity generation decisions.
- The main factor determining choice of generation source will be security of supply, based on local conditions.

Key issues affecting choices in the energy sector in Africa (cont.)

- Various countries have announced intentions to build nuclear power stations.
- Very large units (>1000 MW) are probably unsuitable due to the risk of grid instability and outages when such a unit goes down.
- The size and intrinsic safety of various small and medium-size reactors being developed make them an attractive option for Africa, but these technologies do not have an licensing and industrial operational track record.

Nuclear technology in Africa

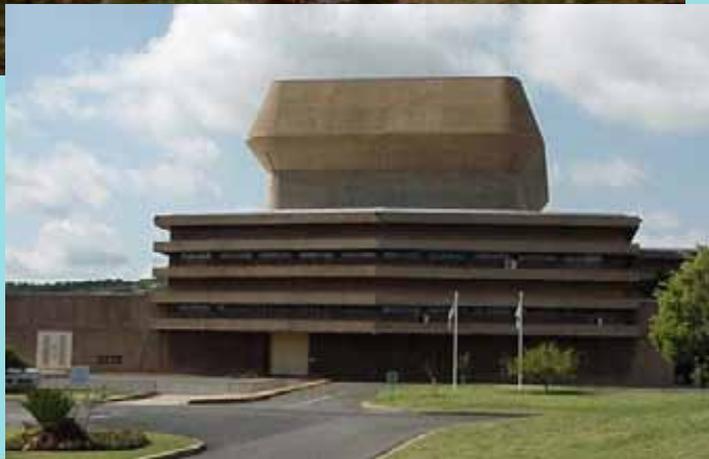
- None of the nuclear power plants currently under construction around the world is in Africa.
- There are ten research reactors in Africa.
- Nuclear regulatory authorities exist in various African countries.
- Skills are generally thinly dispersed and often sub-critical. Fewer than 10 000 people work in the nuclear sector in Africa.
- Africa is a major uranium producer.

Nuclear reactors in South Africa



Koeberg Nuclear Power Station

2 x 900 MW PWRs in operation since 1984/5; supplying 5.5% of South Africa's electricity.



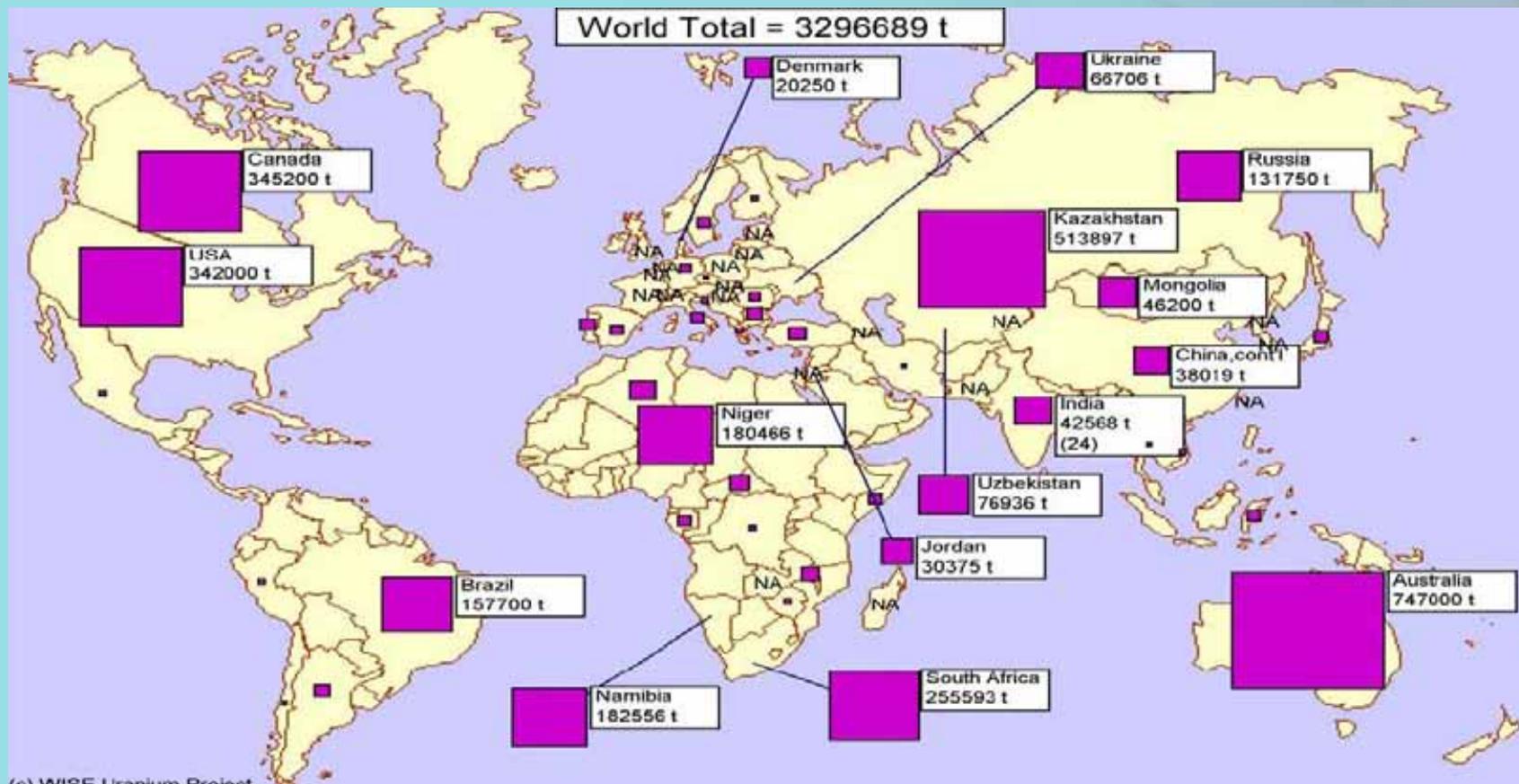
SAFARI-1 Research Reactor

20 MW; in operation since 1965.

Research Reactors in Africa

Country	Reactor	Location	Power	First criticality
Algeria	NUR	Draria, Algiers	1 MW	1989
	ES-SALAM	Aïn Oussera	15 MW	1992
DR Congo	TRICO-II	Kinshasa	1 MW	1972
Egypt	ET-RR-1	Inshas, Cairo	2 MW	1961
	ET-RR-2	Inshas, Cairo	22 MW	1997
Ghana	GHARR-1	Legon, Accra	30 kW	1994
Libya	IRT-1	Tripoli	10 MW	1981
Morocco	MA-R1	Maâmora, Rabat	2 MW	2007
Nigeria	NIRR-1	Zaria	30 kW	2004
South Africa	SAFARI-1	Pelindaba	20 MW	1965

Reasonably assured uranium resources (tons @\$130/ton)



AFRA

GUIDELINES AND INDICATORS FOR THE
ACHIEVEMENT OF SUSTAINABLE NATIONAL
NUCLEAR INSTITUTIONS IN AFRA MEMBER STATES



AFRICAN REGIONAL COOPERATIVE AGREEMENT FOR
RESEARCH, DEVELOPMENT AND TRAINING RELATED TO
NUCLEAR SCIENCE AND TECHNOLOGY

AFRA 0001
July 2003

1. Radiation safety
2. Human health
3. Increasing agricultural productivity
4. Industrial applications of radiation technology
5. Promotion of self-reliance and efficient management practices

Sometimes reportage borders on racism ...

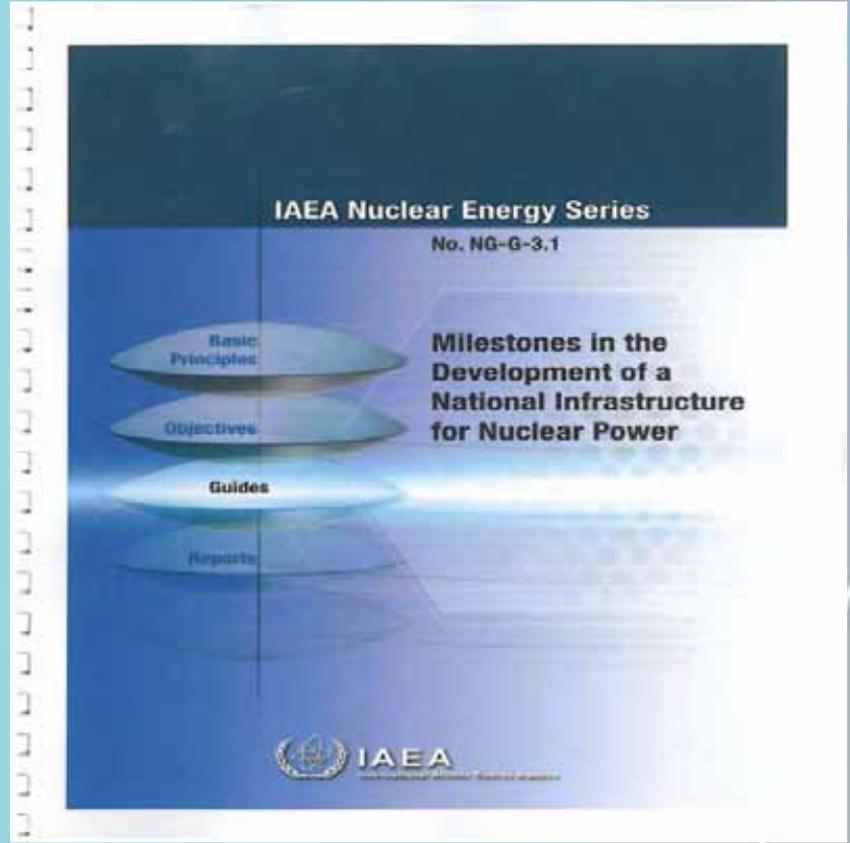
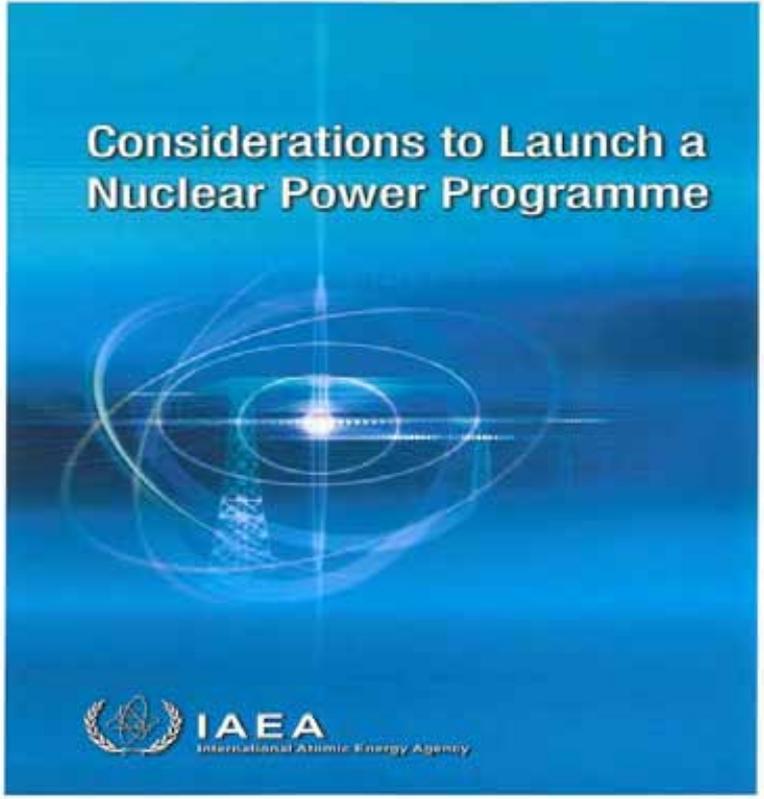
Safety concerns dog Nigeria's Nuclear dream:

“Should a country whose oil pipelines and flow stations are routinely sabotaged by armed militiamen own a Nuclear Plant? No, says Nigeria's tribe of environmental activists, who appear set to oppose the country's leader's plan to build a Nuclear Plant.”

Business in Africa Online, 02 November 2006

Considerations regarding the introduction and sustainable use of nuclear power

IAEA studies on launching nuclear programmes



Beginning a nuclear programme

- Ensure the safety, security and non-proliferation of nuclear material;
- Join appropriate international legal treaties and conventions;
- Comprehensive legal framework, incl. safety, security and nuclear liability and other legislative, regulatory and commercial aspects;
- Effective, independent, competent regulatory body;
- Role of nuclear power in nation's sustainable development strategy;

Beginning a nuclear programme

- Project management capabilities;
- Human resource capability within both the government and industrial sectors;
- Financial resources for construction, operation and decommissioning;
- Policies, programmes and resources for decommissioning and safe management of spent fuel and radioactive waste;
- Industrial capability for support for the nuclear programme,
- Gaining and keeping confidence of the nation and international community.

Nuclear power infrastructure elements

National Position

Legislative Framework

Regulatory Framework

Funding and Financing

Human Resources

Radiation Protection

Nuclear Safety

Security and Physical Protection

Emergency Planning

Management

Nuclear Fuel Cycle

Radioactive Waste

Safeguards

Environmental Protection

Site and Support Facilities

Electrical Grid

Procurement

Stakeholder Involvement

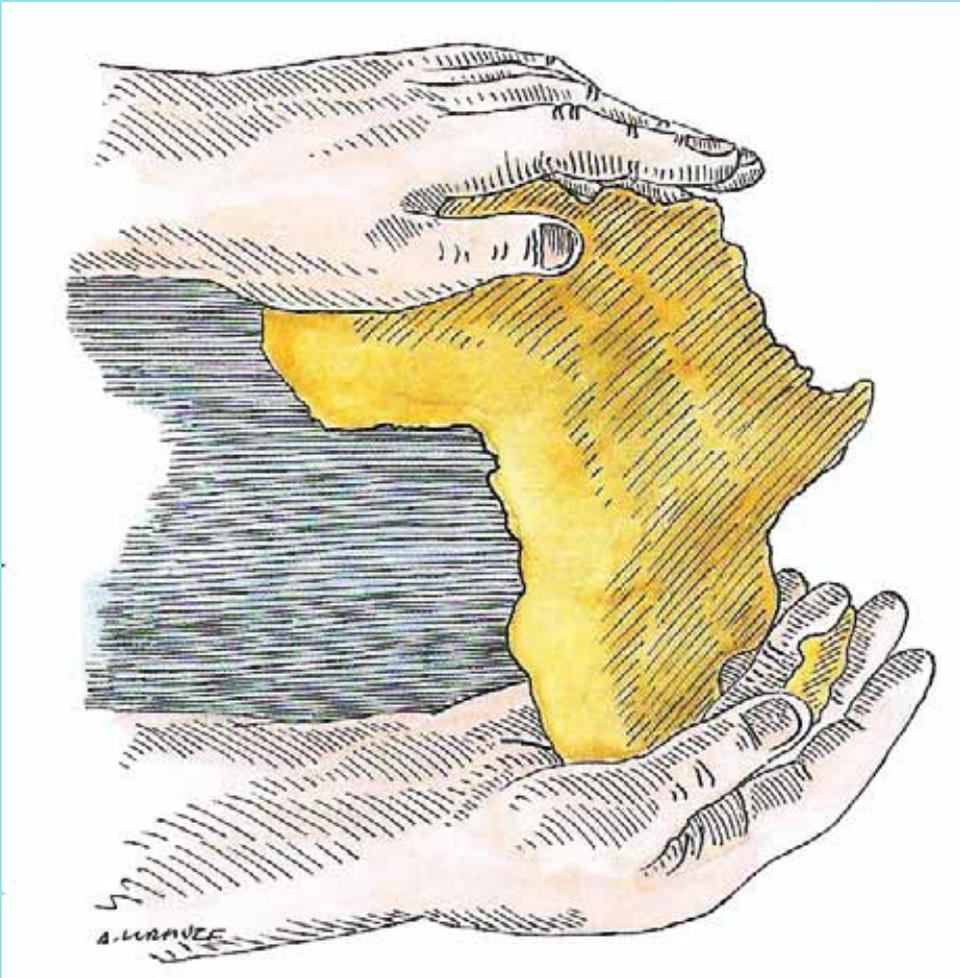
Industrial Involvement

Conclusions

- Peaceful applications of nuclear technology are well established in Africa, but nuclear power lags behind.
- A broad range of interrelated factors need to be taken into account when considering the introduction of nuclear power.
- The IAEA offers excellent guidelines and assistance in this regard.
- Regional partnerships are highly desirable, even a critical success factor.
- Consider the recent example of United Arab Emirates.

Conclusions

- Need to look at specific regional geopolitical and resource issues.
- Where would it make sense to establish small nuclear power reactors?
 - Namibia
 - Algeria (inland).
 - Egypt
 - Nigeria



Thank you!
Merci beaucoup!
Asante sana!