More nuclear power for South Africa: dream or necessity?

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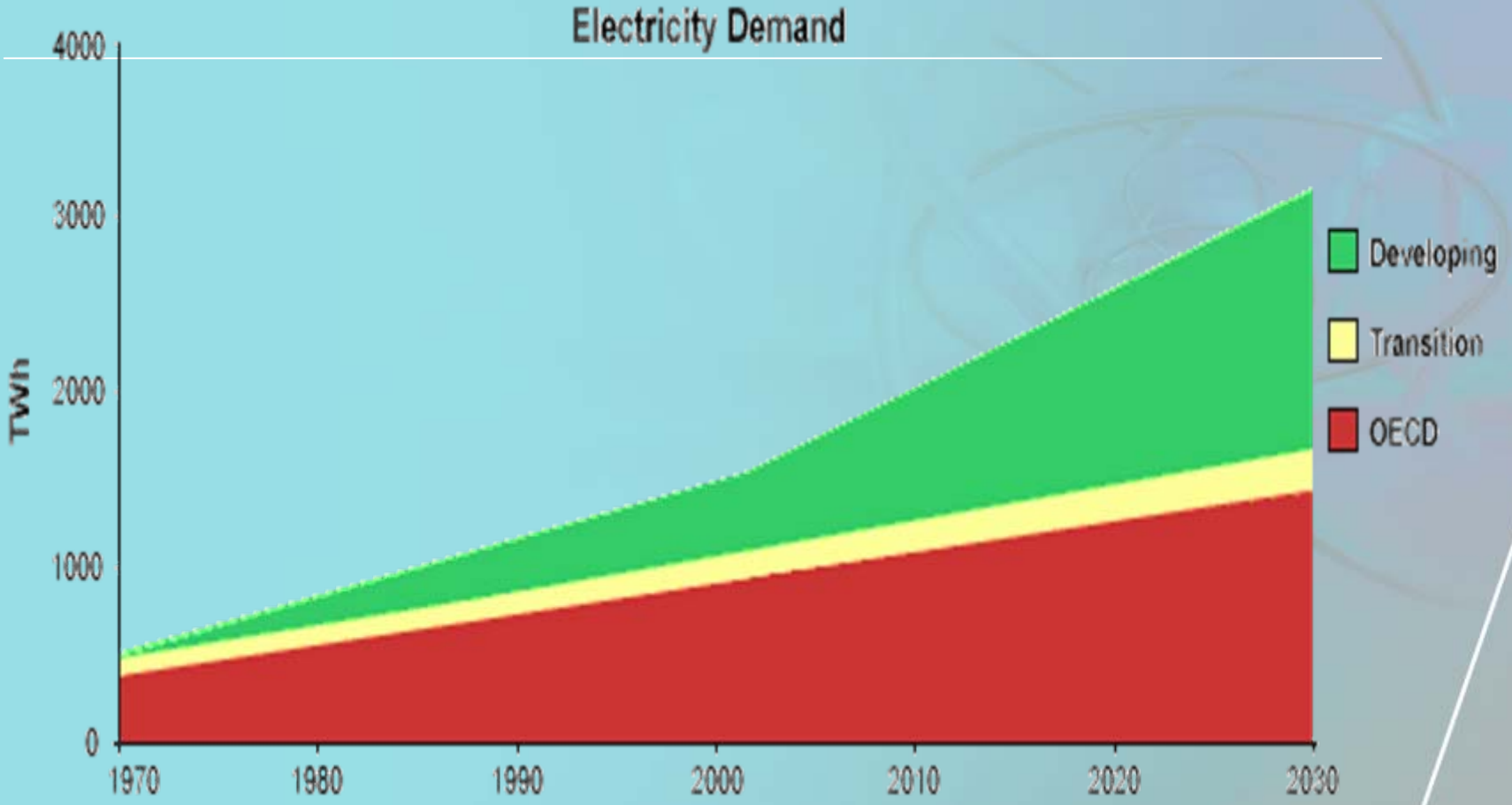
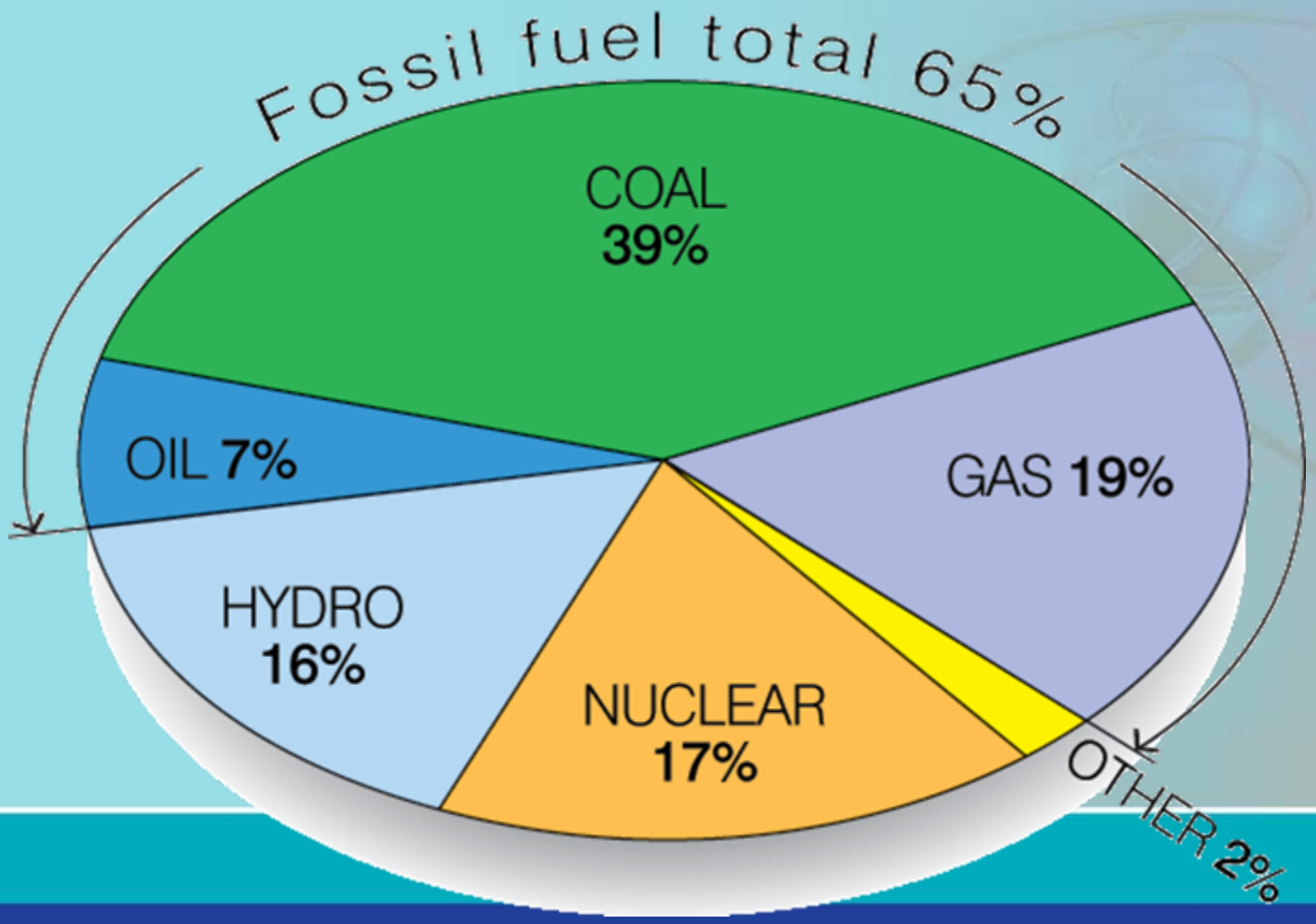
Security of Energy Supply



World electricity production



OECD/IEA

Where does nuclear power fit in?

- 16% of the world's electricity needs supplied by 441 power reactors in operation in 31 countries.
- Plant life extensions, improved capacity factors and new-build (32 reactors under construction) continuously add additional capacity.
- More than 12 000 reactor-years of experience.
- Nuclear power is already cost competitive in most developed economies; will be even more so if current externalised costs for all generating technologies are accounted for.

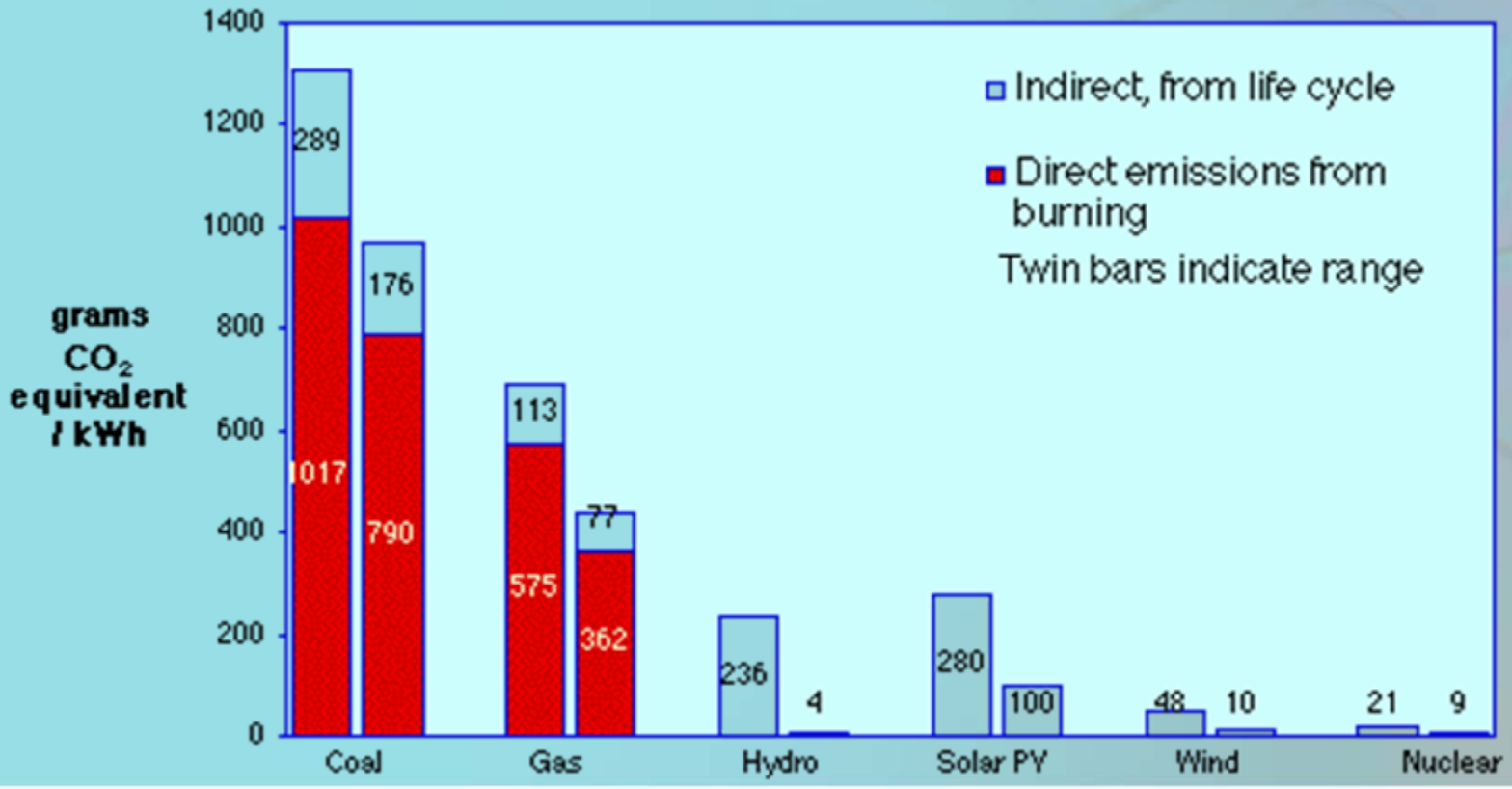
Where does nuclear power fit in? (cont.)

- Abundant uranium resources; closed fuel cycles expected to vastly extend lifetime.
- Concerns about safety, radioactive waste and proliferation largely accounted for and being addressed through a combination of design improvements, continuous R&D, demonstration programmes, tighter licensing and global control regimes, and various other measures.

Where does nuclear power fit in? (cont.)

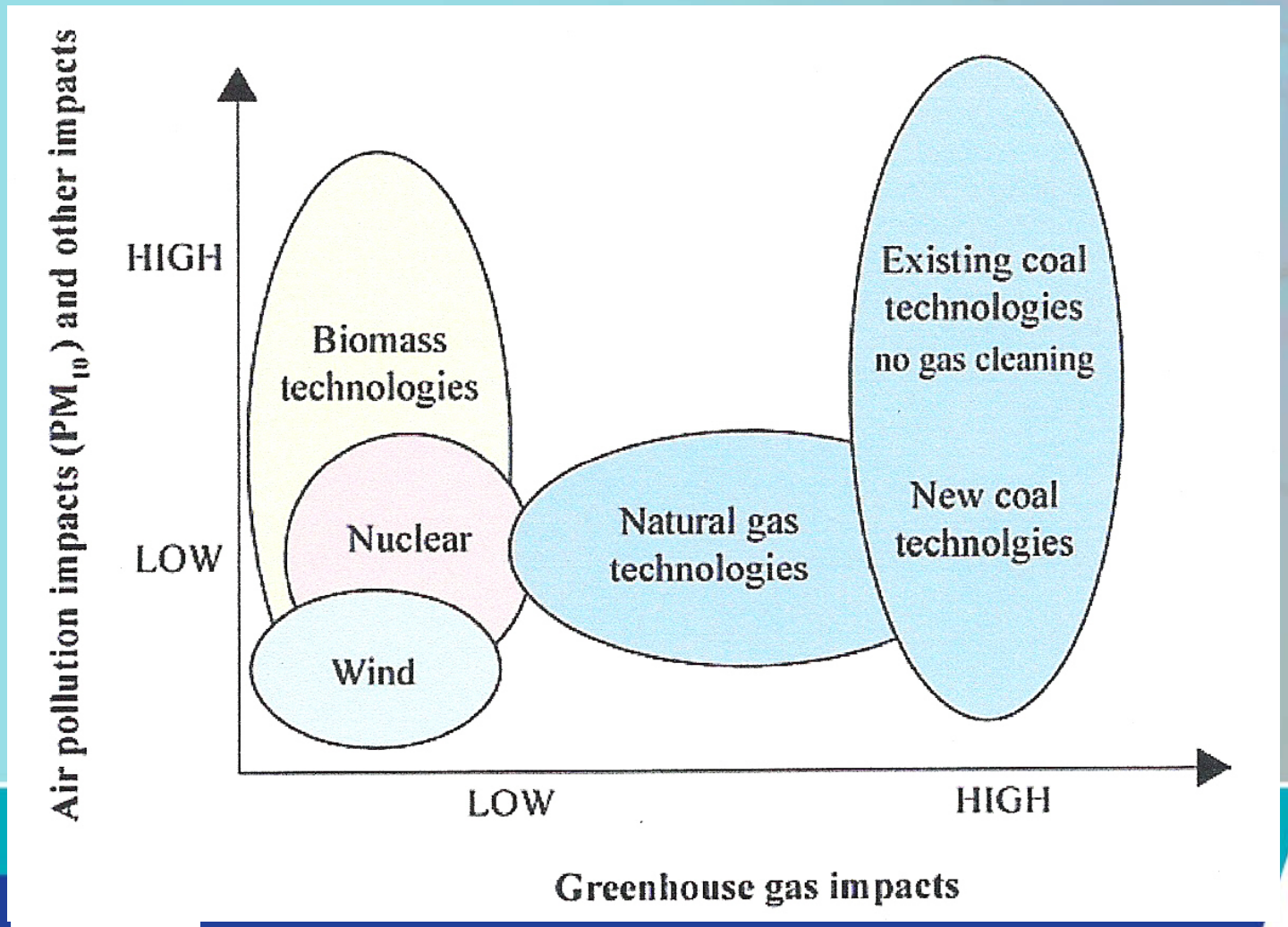
Nuclear energy is the only technologically mature, economically viable, non-greenhouse gas emitting electricity generation technology already deployed for baseload supply on a large scale.

Greenhouse gas emissions from electricity production



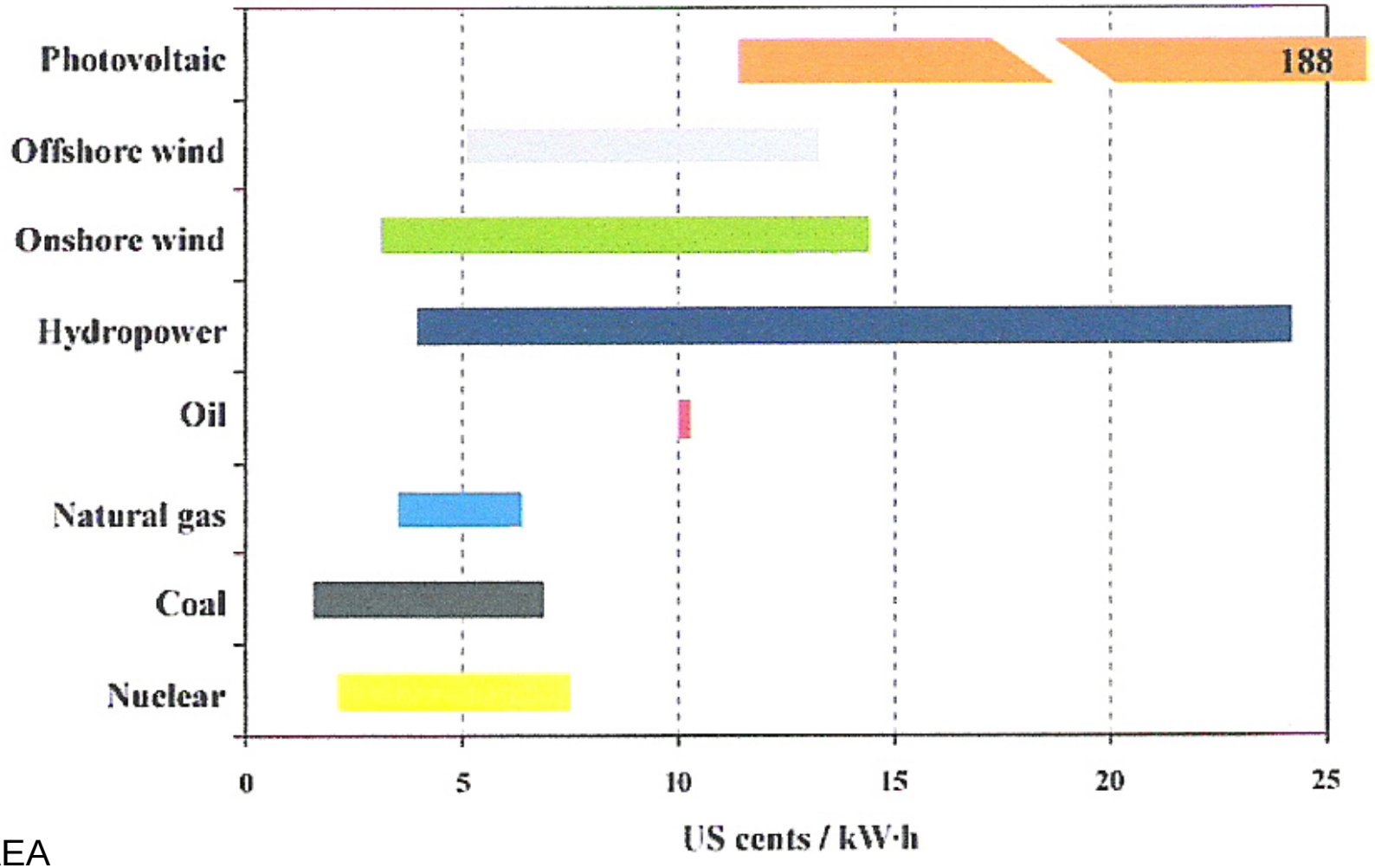
Source: IAEA 2000

Environmental impacts of emissions from electricity generating technologies



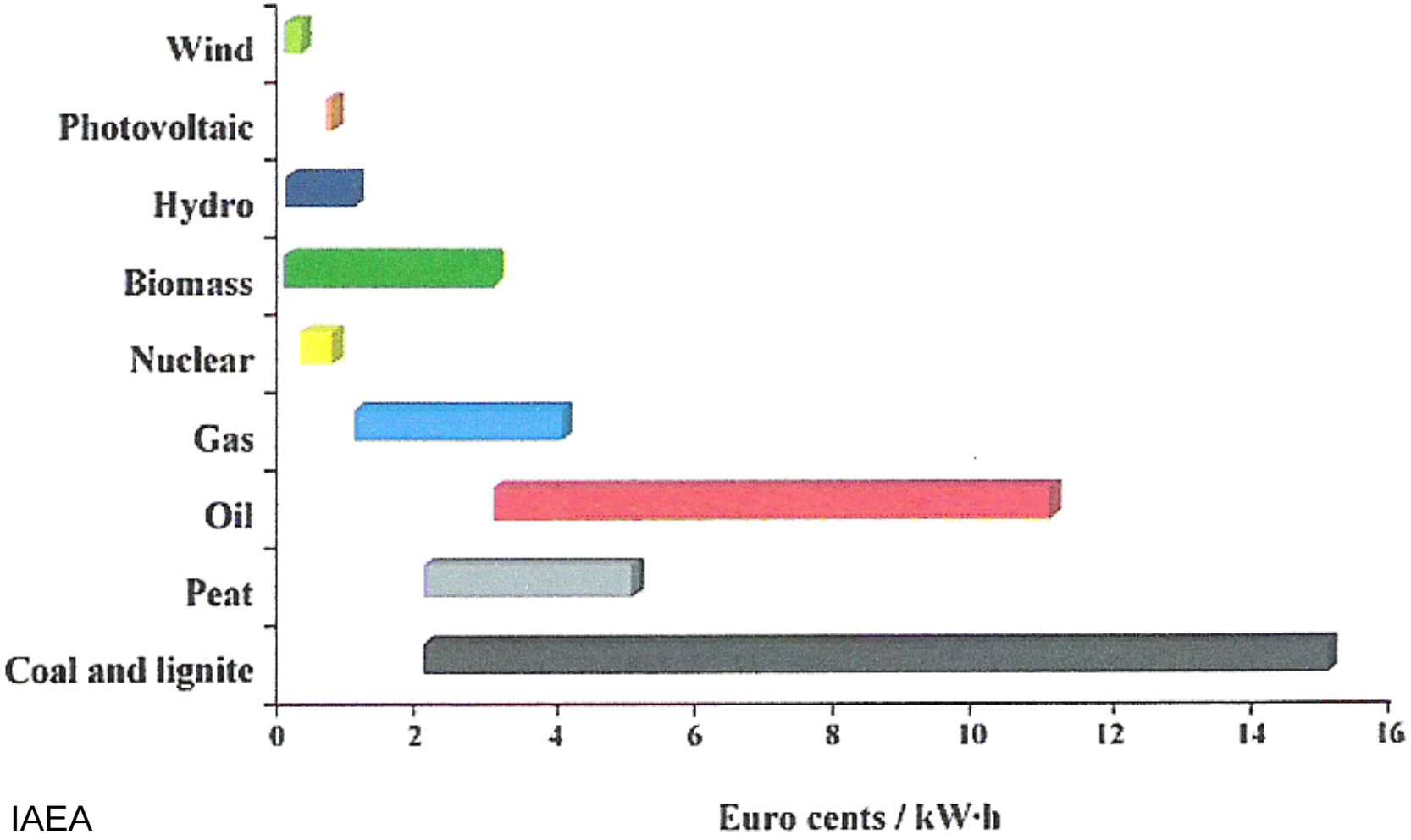
EC 2003

Electricity generation levelised cost (capital and operation)



IAEA

Electricity generation external costs



International nuclear power initiatives

- International Project on Innovative Nuclear Reactors and Fuel Cycles, INPRO (IAEA and 28 member states)
- Generation IV International Forum, GIF (10 member states and Euratom)
- Global Nuclear Energy Partnership, GNEP (16 members)
- Nuclear energy on the agenda of numerous international energy and climate change mitigation initiatives

Eskom capacity expansion progress

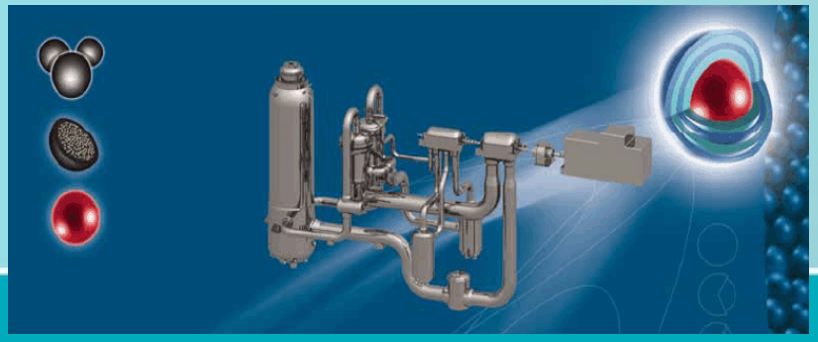
- Two new gas-fired power stations in Western Cape
- Approved construction for 16 000 MW; plans to add 40 000 MW capacity by 2025, half of which will be nuclear
- Approved/planned generation, transmission and distribution projects of >R200 billion
- Construction work on the Medupi Power Station underway
- Supplier of Nuclear One to be announced soon

Nuclear power reactors in South Africa

Koeberg Nuclear Power Station

supplying 5.5% of South Africa's electricity

New-build to follow



PebbleBed Modular Reactor

under development

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“State of the Nation Address”
9 February 2007

- **President Mbeki stated, “with regard to energy, we will also expedite our work to ensure greater reliance on nuclear power generation, natural gas and the various forms of renewable sources of energy”**


Uranium
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PBMR
NNR
Uranium
Vaalputs
Koeberg
Uranium
iThemba
Medical centres
Universities
NAMIBIA
BOTSWANA
ZIMBABWE
MOZAMB
SWAZILAN
LESOTHO
SOUTH AFRICA
INDIAN OCEAN
WINDHOEK
GABORONE
POLOKWANE
MAPUTO
MBABANE
JOHANNESBURG
BLOEMFONTEIN
MASERU
CAPE TOWN
Port Elizabeth
Durban
Port Edward
Beira
Maun
Bulawayo
Musina
Hoedspruit
Kruger NP
Swakopmund
Walvis Ba
Keetmanshoop
Lüderitz
Upington
Oudtshoorn
Beaufort
Cape Agulhas
Etosha NP
Skeleton Coast Park
Central Kalahari Game Reserve
Kgalagadi Transfrontier Park
Namib-Naukluft Park
Ai-Ais/Richtersveld Transfrontier Park
Hluhluwe-Umfolozi GR
Addo Elephant NP
St Lucia
Ulundi

Factors influencing the SA national policy direction

- Security of energy supply
- Global resurgence of nuclear energy
- Government concern about greenhouse gas emissions
- Abundance of uranium in South Africa; government policy on beneficiation of mineral resources
- SA is reinvesting in electricity generation capacity, an opportunity to diversify primary energy sources
- Planned diversification from almost exclusive (ca. 90%) reliance on coal led to decision to limit coal contribution to new build to 50%.
- Geographic factors in Western Cape & Eastern Cape rule out other baseload generation sources. (No local coal or hydro present and gas operation is very expensive.)

Nuclear Energy Policy and Strategy for South Africa

Vision:

Industrial and technological leadership to secure alternative energy resources for the future through the development of a globally competitive infrastructure and skills for the peaceful utilisation of nuclear energy and technology.

Nuclear energy policy objectives

Promotion of NE as important electricity supply option

Creation of framework for safe utilisation of NE

Contribution to South Africa's social and economic growth

Attainment of global leadership and self-sufficiency in the long term

Building the uranium value chain

Promoting energy security

Reduction of greenhouse gas emissions

…….

Nuclear energy policy principles

NE part of diversification and security of energy supply

Economic growth and technol devel through investment

Use of U resources in sustainable manner

Development of industrial support base

Support for research, development and innovation

Development of human resources

&

Regulatory framework, safety, mitigate climate change, low environmental impact, intellectual property, international obligations

Institutional arrangements

Necsa as the anchor for nuclear energy research, development and innovation

Eskom the main operator of nuclear power plants

The National Nuclear Regulator

A National Radioactive Waste Management Agency

A national nuclear architectural capability for design, manufacture and construction of nuclear energy systems

Necsa's role according to the South African Nuclear Energy Policy and Strategy

- Ministerial foreword: "In this extended programme Necsa will play a vital role as the state's body responsible for research and development in the field of nuclear energy."
- 12.2: "Necsa shall serve as the anchor for nuclear energy research, development and innovation in South Africa."
- 13.1 onwards: Government, through Necsa, shall undertake/investigate ……. the uranium value chain, uranium conversion, uranium enrichment, fuel fabrication, reprocessing …..

Necsa - PBMR collaboration

Necsa R&D mandate and infrastructure, licenced facilities, expertise, experience, involvement in PBMR projects.

R&D areas:

- Fuel manufacture and improvement, including irradiation testing
- Waste treatment and minimisation
- Reactor physics
- Materials

Facilities and utilities:

- PBMR Fuel Development Laboratories
- PBMR Fuel Plant
- Helium Test Facility

New initiatives in support of SA Nuclear Inc

- Nano and nuclear
- Nuclear materials development and characterisation
- Nuclear Technology in Medicine and the Biosciences Initiative (NTeMBI)
- Feasibility studies on the re-establishment of the nuclear fuel cycle in SA; establishment of experimental capabilities; skills transfer and development

Front end of the fuel cycle

- Feasibility studies on the fuel cycle: global supply and demand; technology status; techno-economic studies; consultation with local and international role-players; scenario analysis; financing models.
- Consolidation of expertise and experience by involving experts from previous programmes and initiation of a knowledge management programme.
- Planning for experimental programmes and capacity building.
- PBMR Fuel Plant to be constructed on Necsa site.

Back end of the fuel cycle

- Expansion of research and skills base on radioactive waste treatment, minimisation, immobilisation, etc.
- Focus on PBMR type waste, especially containing graphite
- Close collaboration with Eskom, PBMR and the DME on options for the back end of the fuel cycle
- Leveraging high profile of SA waste management experts in IAEA programmes

Irradiation and Post-irradiation Examination

- Expansion of capabilities for irradiation and post-irradiation examination of fuel and reactor materials
- Finalising of requirements and specifications with PBMR and international organisations
- Building on expertise and experience from previous activities and NTP Radioisotopes

Possibilities regarding the fuel cycle in South Africa

- Large reserves of uranium and an active mining industry on which many other countries will rely for their supplies of uranium.
- Long term uranium price buoyancy implies that nuclear fuel cycle investment is attractive and may be needed to underpin security of supply.
- An imminent global shortage of both conversion and enrichment capacity.
- Security of nuclear fuel supply is a matter of concern for any country embarking on a major build programme. SA has the proven ability to respond to this.

State of readiness

- Eskom to announce selected supplier of next nuclear power station
- Legal framework to support policy already exists
- Ongoing Necsa work on fuel cycle; further techno-economic studies to be conducted
- Skills development initiatives underway
- Uranium exploration and mining has increased
- Improved public awareness

Conclusion

Nuclear power, as an important component of global baseload capacity, enjoys growing support in both developed countries and developing economies.

South Africa will significantly increase its nuclear power capacity over the next 20 years.

The local mining, manufacturing and electricity industries are ready to partner with local and foreign players to create a local nuclear industry.


Thank you!
Baie dankie!
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