Nuclear Technology: Global trends and Local Possibilities

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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.
Number of people without access to electricity in Reference Scenario.

An investment increase of only 5% p.a. would secure universal access by 2030.
WEO 450 Scenario
(450 ppm CO$_2$ maximum)

Fossil fuels peak by 2020
World abatement of energy related CO$_2$ emissions in 450 Scenario

An additional US$10.5 trillion needed until 2030
Nuclear capacity under construction

75% in non-OECD countries, 40% in China
A seismic map of South Africa

4.1 MAP 1: SEISMIC HAZARD MAP OF SOUTH AFRICA
(INCLUDING THE KINGDOMS OF LESOTHO AND SWAZILAND)

Peak ground acceleration (g) with a 10% probability of being exceeded in a 50 year period.
Potential Nuclear Sites

POTENTIAL NUCLEAR COASTAL SITES

LEGEND
- TOWNS
- Nuclear Power Station
- Potential Nuclear Sites

CROSS REFERENCE:
NSIP-GEN-014505#P1-1

Map showing potential nuclear sites along the coast, including sites such as KLEINSEE, Koeberg N.P.S., and Port Elizabeth.
He’s grown a foot since I saw him last......
Fukushima – the wave arriving
Fukushima - sea water rushing into the plant
Submerged...
Where & when were these pictures taken?

Answer: Chernobyl, 2006
Mining…. 4\textsuperscript{th} largest uranium reserves in the world are in South Africa.
SAFARI-1 Research Reactor
Historic Strategic Programme

Uranium Enrichment

Weapons programme

Fuel Fabrication
Two PWR Reactors at Koeberg (1800 MW)
Investment (Capex)\(^{(1)}\)
$ MM

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Assuming 1,000 MW plant

Recent Industry Developments
US Electricity Production Costs

**US Electricity Production Costs 1995-2008**

*in 2008 cents per kilowatt-hour*

Production Costs = Operations & Maintenance + Fuel. Production costs do not include indirect costs or capital.

Source: Ventyx Velocity Suite, via NEI
Cost of producing electricity from new power stations

(European Union estimate, 2008)
But the fundamentals remain unchanged…

Diversification from reliance on coal must lead to more nuclear because of absence of other baseload options. If we don’t diversify, our carbon strategy will be to plead for special treatment as a developing world nation to avoid penalties.

Geographic factors in Western Cape & Eastern Cape rule out local coal or hydro, and gas prices are very volatile. Transporting millions of tons of coal to these regions is impractical and prohibitively expensive.
But the fundamentals remain unchanged…

Costing over the 60 year life time of power stations, in a world that is rejecting unsequestrated carbon, introduces large cost uncertainties into fossil fuel generation.

Long term price trajectories means nuclear fuel cycle investment is attractive and may be needed to underpin security of supply.