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Carbon Capture and Storage – A Way Forward for Cleaner Fossil Fuels

Funding Needs and Opportunity

**Elena Virkkala Nekhaev, Director of Programmes,
World Energy Council**

Erice, 24 August 2005



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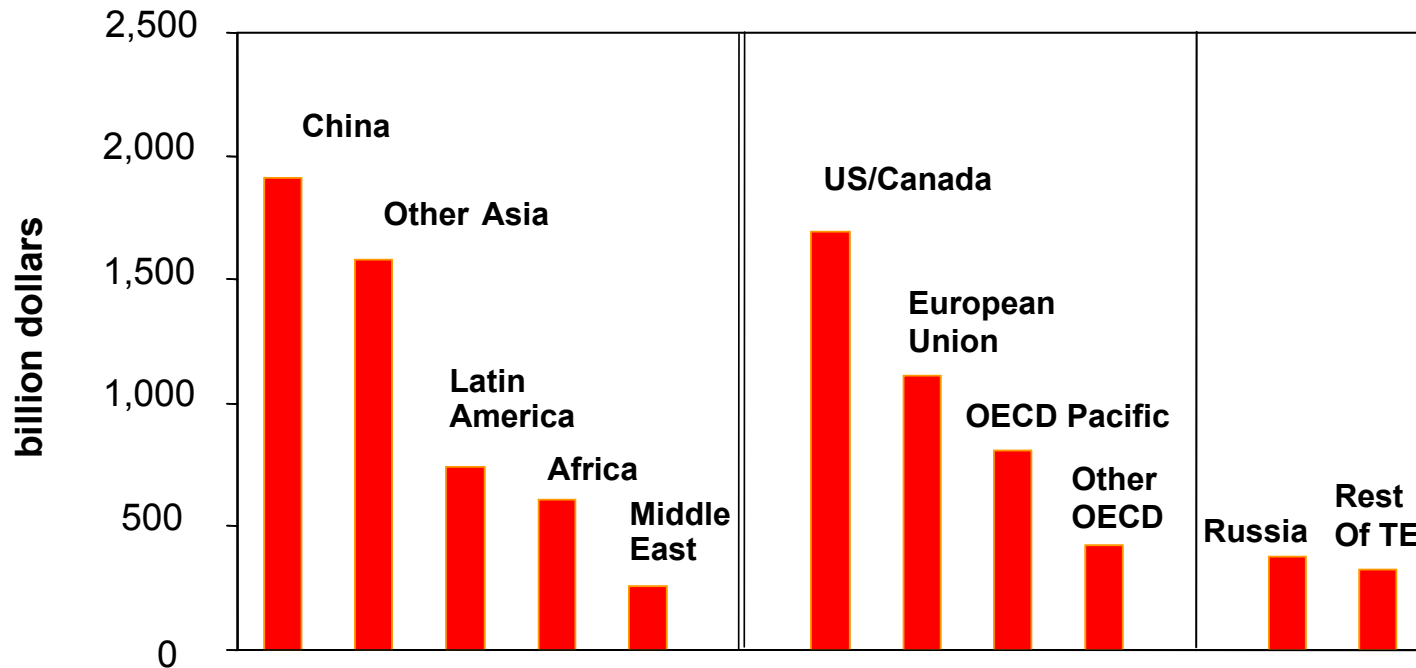
Great Expectations

- **55% increase in global energy demand between 2000 and 2020**
- **US\$16 trillion (3-4% of world GDP) required for energy investment**

	1998	2020	2100
Developing Countries	35%	50%	70%



Electricity Sector Investment by Region 2001 - 2030



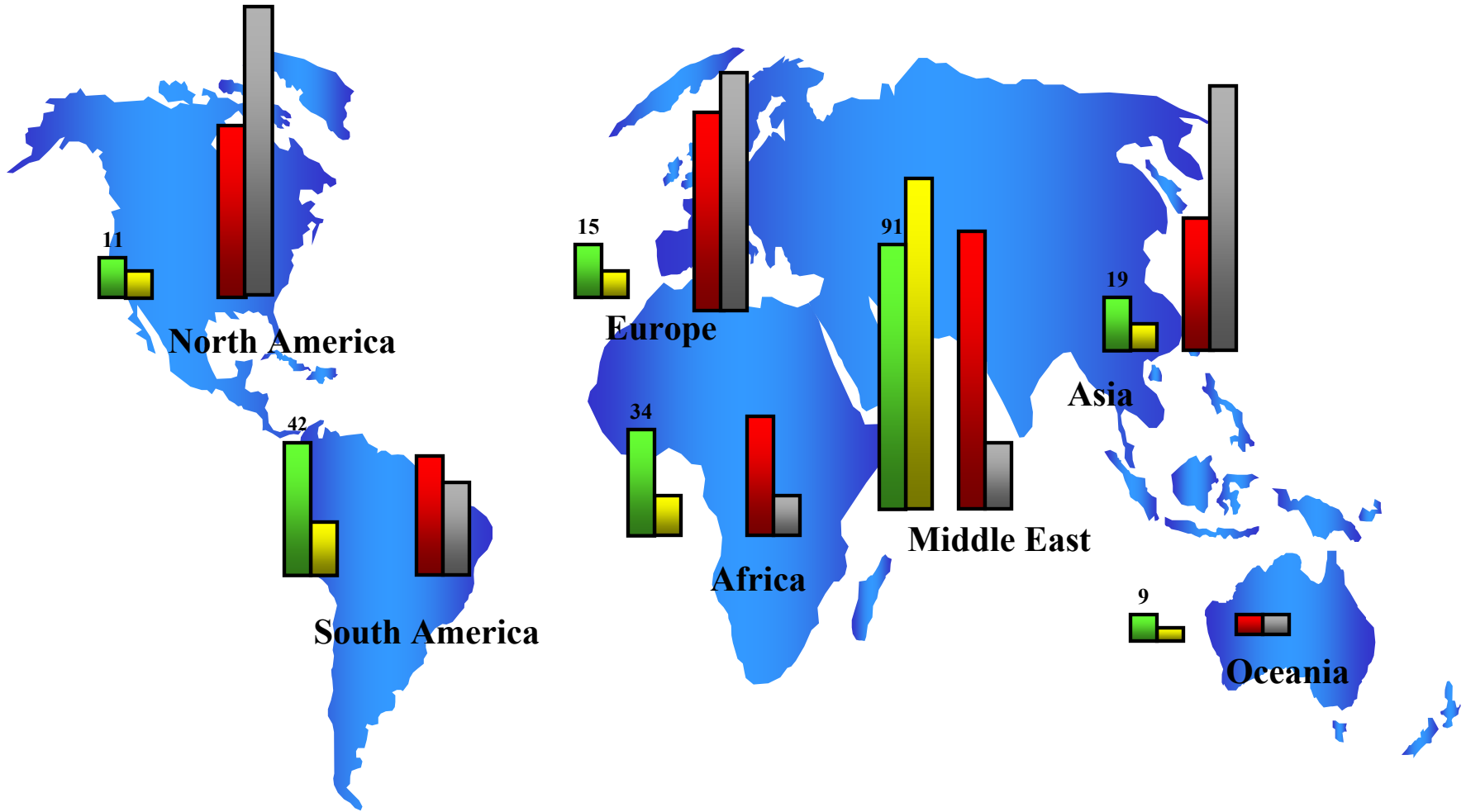
Source: World Energy Investment Outlook, IEA - modified



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Survey of Energy Resources 2004

Oil



R/P RATIO
41.2 years

RESERVES
148 Gt

PRODUCTION
3.5 Gt/year

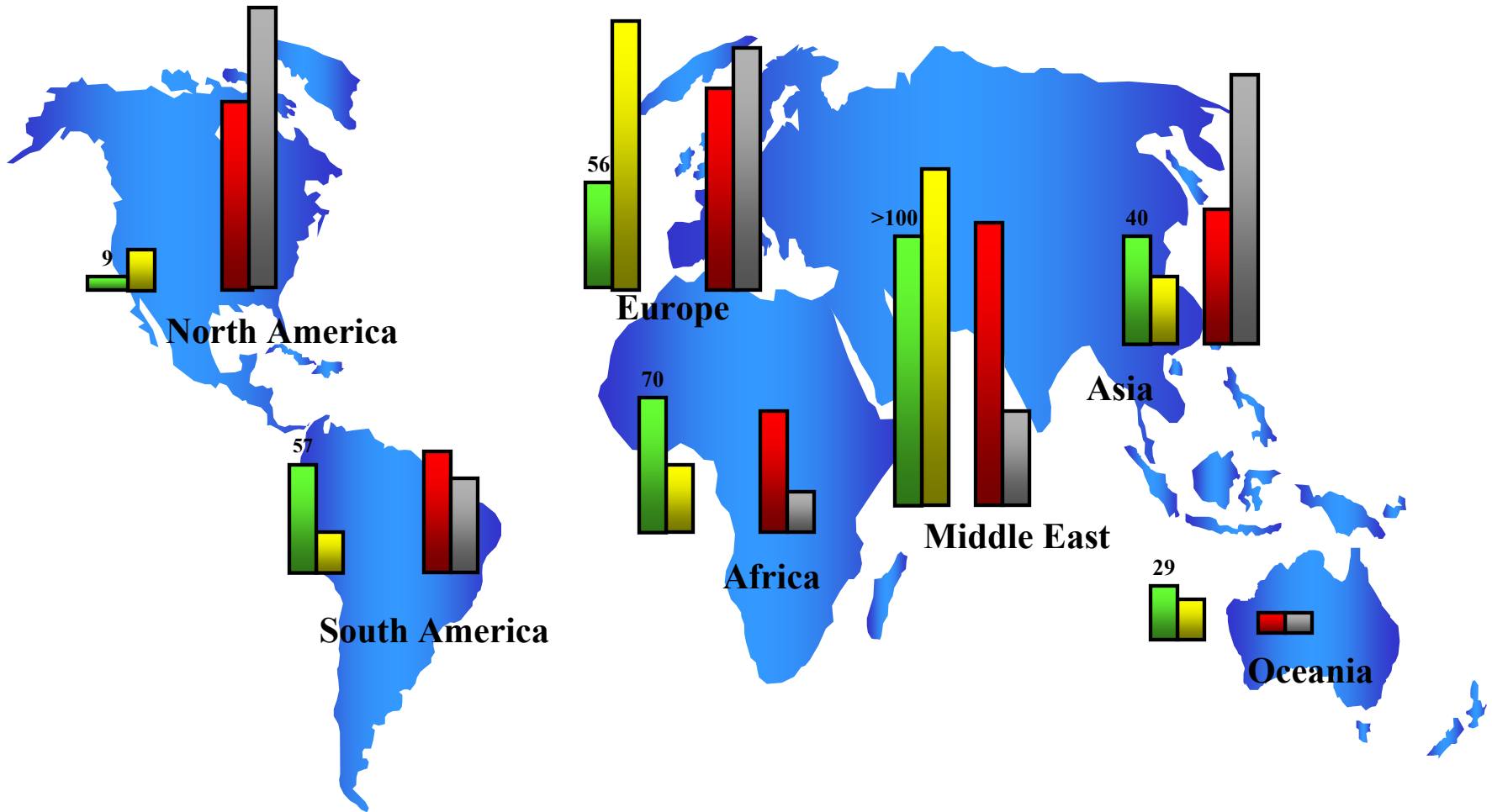
CONSUMPTION
3.5 Gt/year



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Survey of Energy Resources 2004

Natural Gas



R/P RATIO
59.8 years

RESERVES
171 tcm

PRODUCTION
2.6 tcm/year

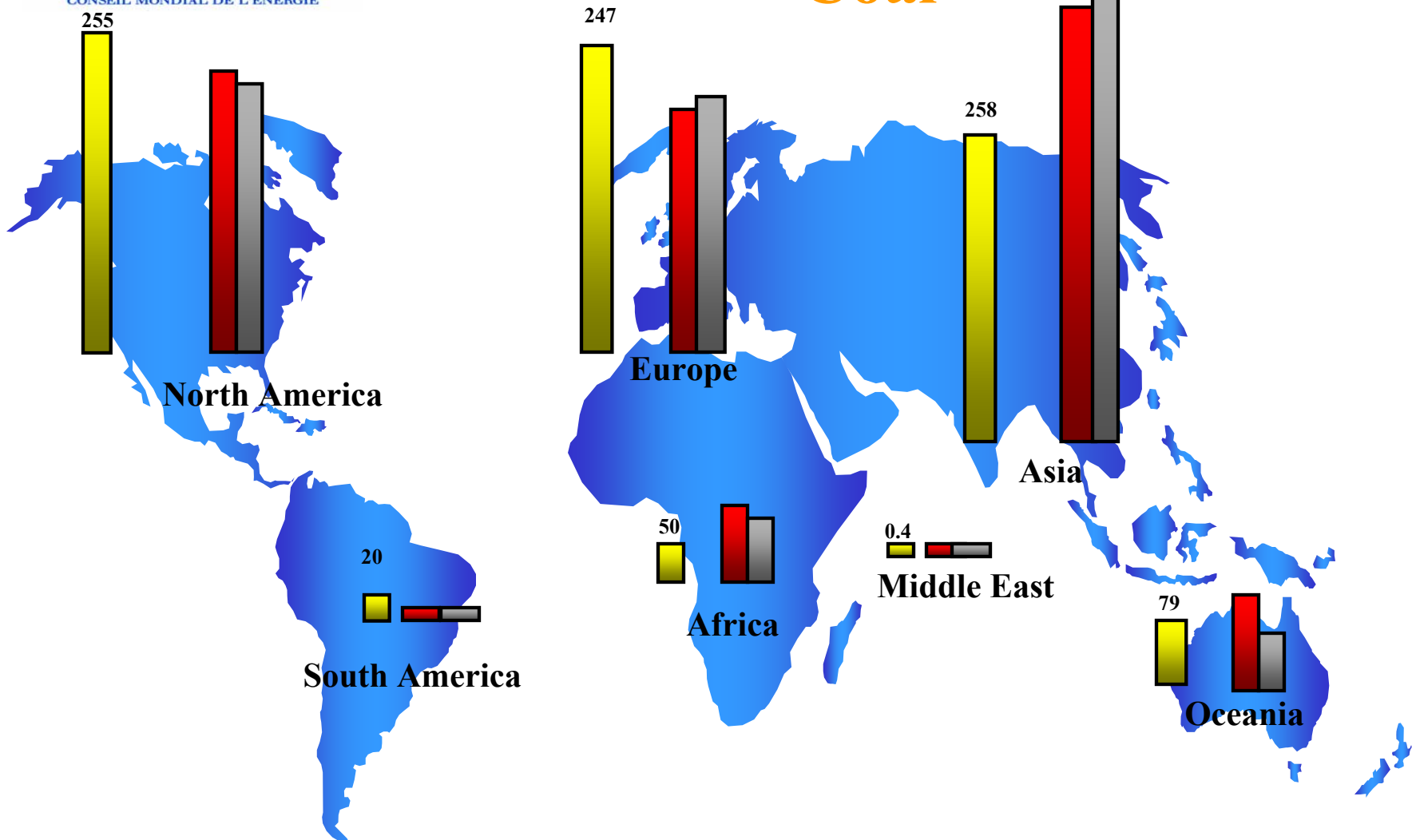
CONSUMPTION
2.6 tcm/year



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Survey of Energy Resources 2004

Coal



RESERVES
909 Gt

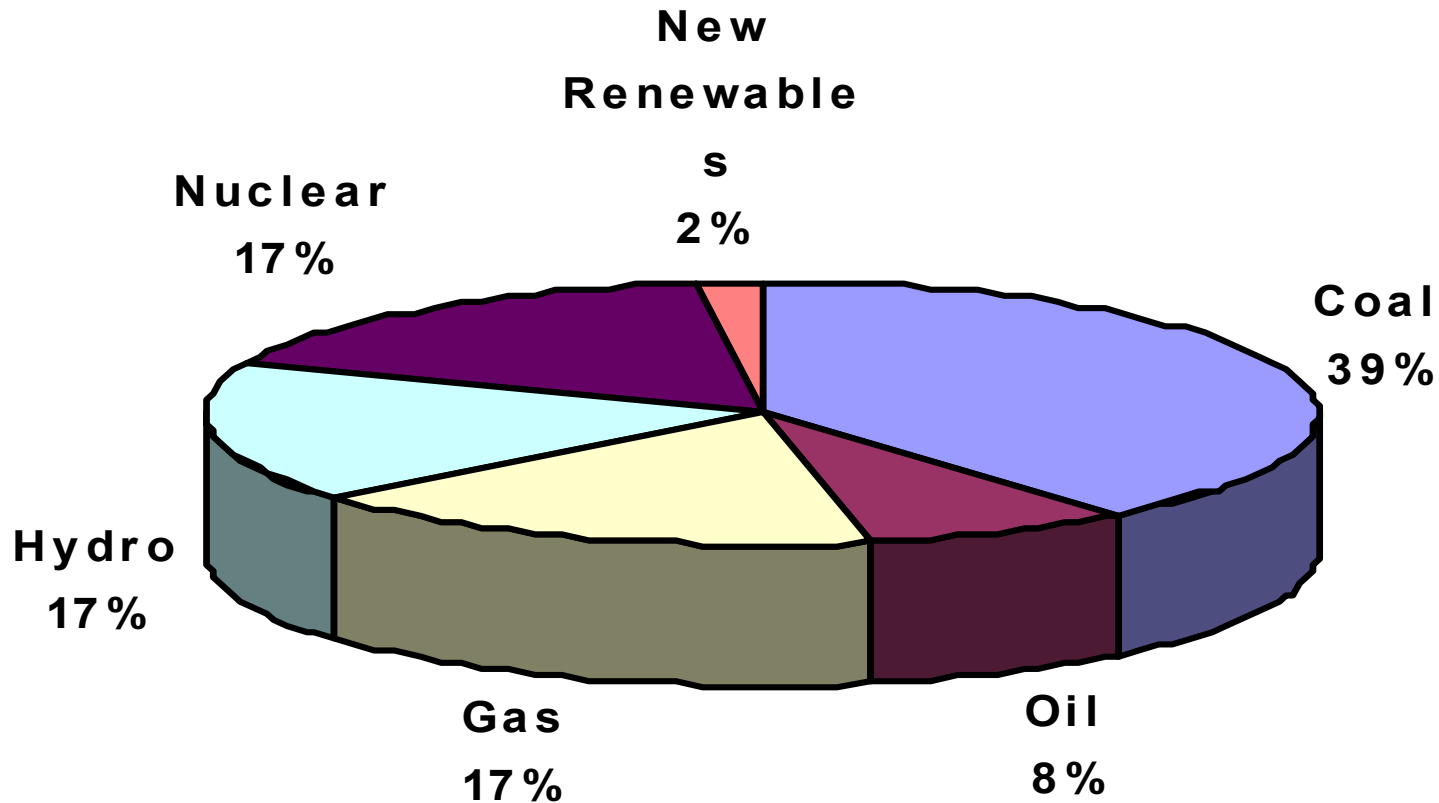
PRODUCTION
4.8 Gt/year

CONSUMPTION
4.8 Gt/year



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World Electricity Production



DATA ON INVESTMENT, PRODUCTION AND EXTERNAL COSTS OF ELECTRIC POWER PLANTS

Type of plant	Average Investment cost * (€ / kW)	Production cost * (including exploitation, investment amortization, fuel and R&D) (€ / MWh)	External costs ** (€ ₉₅ / MWh)	Rate external cost / production cost (%)
Nuclear	1730	29	0.05 – 4.8 (0% actualization)	0.2 – 17 %
Coal (CFB)	1273	33	19 – 99	58 – 300 %
Gas (CCGT)	488	35	7 - 31	20- 89%
Hydro		40	0.04 – 6.03	0.1 – 15 %
Micro Hydro	1250			
Wind (terrestrial)	1000	45	0.5 – 2.6	1.1 – 5.8 %
Solar PV (grid -connected)	8000	650	1.4 – 3.3 (only one study)	0.2 – 0.5 %
Biomass	1200	128	2.0 - 50	1.6 - 39 %
Geothermal	1830	55***	0.2 – 0.5***	4 – 14%

* Source Eurostaf Les Echos march 2003

** Source European Commission Externe 1999

*** Source IGA 2004



Life Cycle Emissions

Life Cycle Emissions g/kWh	CO ₂ G/kWh	SO ₂ g/kWh	NO _x g/kWh
Coal Best Practice (UK)	955.00	11.80	4.30
Coal FGD and low NO _x (UK)	987.00	1.50	2.90
Gas CCGT (UK)	430.00	-	0.50
Hydro small scale	9.00	0.03	0.07
Hydro large scale	3.60-11.60	0.009-0.024	0.003-0.006
Wind	7.00-9.00	0.02-0.09	0.02-0.06
Solar PV	98.00-167.00	0.20-0.34	0.18-0.30
Energy crops current practice	17.00-27.00	0.07-0.16	1.10-2.50
Energy Crops future practice	15.00-18.00	0.06-0.08	0.35-0.51
Geothermal	79.00	0.02	0.28



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Clean Coal Technologies

- **Cleaner coal technologies for reduction of energy-related GHG emissions and for access to energy.**
- **Related costs are high and will have to be brought down.**
- **The costs of doing nothing might be even higher.**



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Electricity Sector Investment 2001-2030

China and India

- ✚ China will need more electricity investment than any other country or region ~ **US\$2000 billion**.
- ✚ From 2005, China will have the **world largest electricity system** with **380000 MW** installed capacity.
- ✚ Most of the new China capacity will be based on **coal and hydropower**. Also over **100 GW** of **natural gas-fired capacity** is expected to be added by 2030.
- ✚ India is expected to invest ~ **US\$665 billion** in the power sector by 2030. Most of new Indian capacity is expected to be **mainly coal-fired**, with natural gas becoming the second-largest source of electricity generation.



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World Energy Council (WEC)

To promote the sustainable supply and use of energy for the greatest benefit of all

- **Established in 1923 as the World Power Conference**
- **Member Committees in 97 countries**
- **Multi-energy, non-governmental, non-commercial**
- **Triennial World Energy Congress**
- **Work Programme: Studies, Technical Committees, Regional Programmes, Global Energy Information System (GEIS)**



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Global Energy Information System (GEIS)

www.worldenergy.org



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for the greatest benefit of all

Highlights

Energy and Sustainable Development

A special edition of Global Energy Report released to coincide with the Johannesburg summit. Features articles from WEC, WTO, World Bank, Global Environment Facility, UNDP and a range of commercial energy businesses.

Sustainable Development

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