

Nuclear Power as Bridging Technology

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Slogan “**Nuclear power as bridging technology**” means:

- Bridge to energy future founded on renewables
- Implies **common view: renewables will be the future.**

Until recently, this view was not common at all.

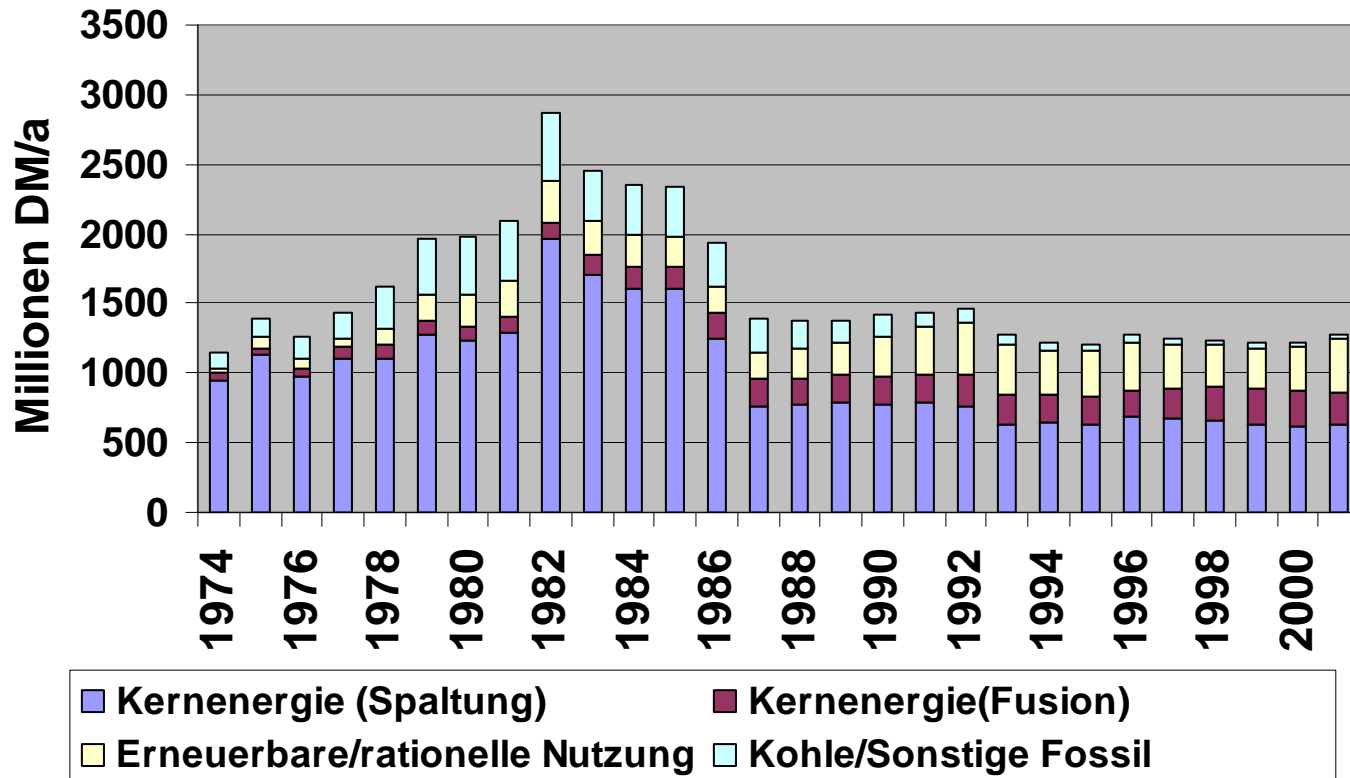
- Until first oil crisis 1973, energy community + governments,
- convinced of an immense nuclear potential,
- did not at all consider renewables a serious option.

This paradigm worked in 60ies/70ies as self fulfilling prophecy:

- enormous resources spent on development of nuclear,
- absolutely no R&D on renewables until 1973,
- thereafter only modest R&D budgets.

Ausgaben des Bundes für Energieforschung und Energietechnologien

Quelle: Bundesforschungsberichte, diverse Jahrgänge



Status of Nuclear Energy world

Source: IAEA- PRIS 8 -2010

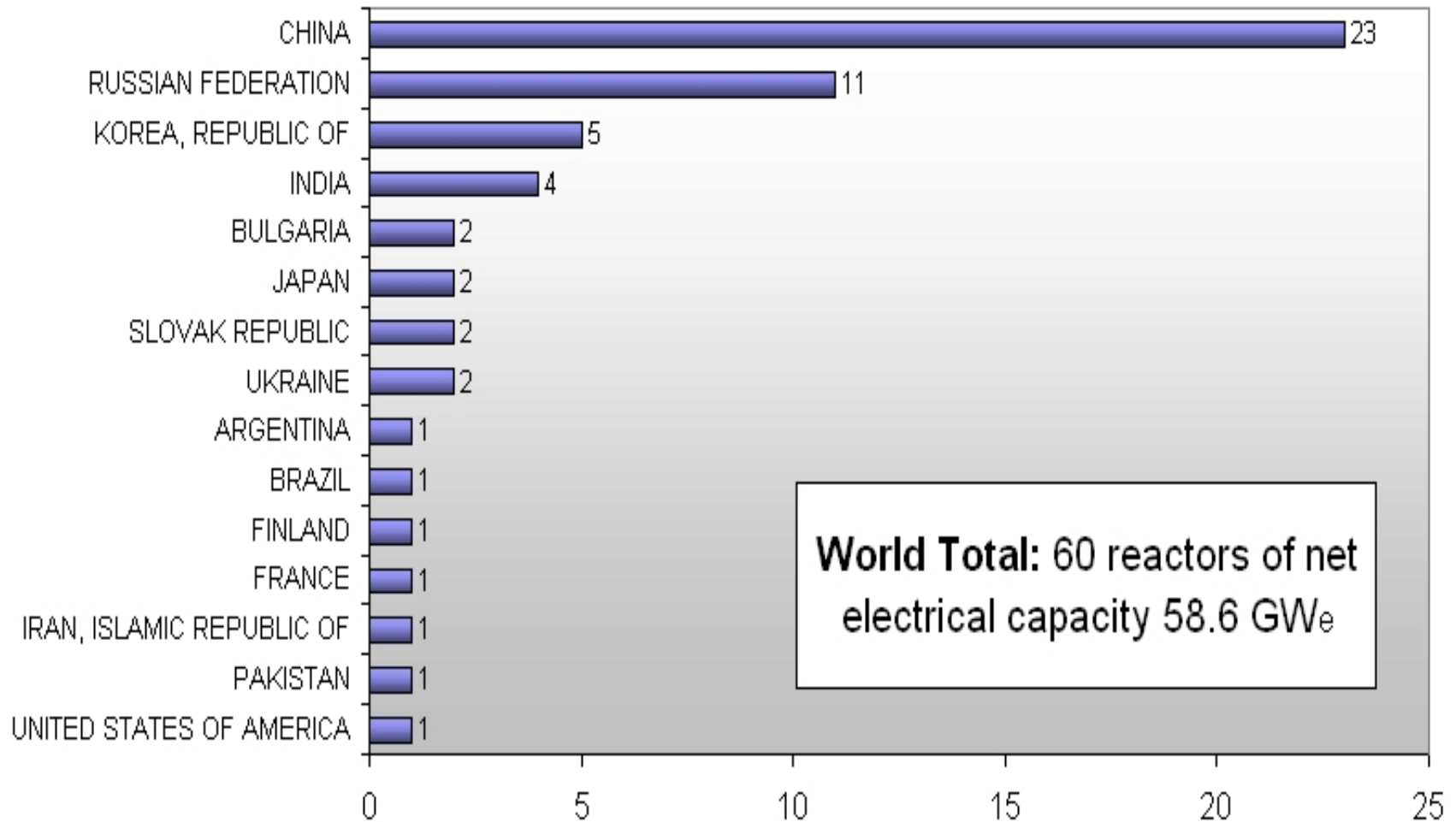
In operation:

- 441 nuclear plants in 31 of 236 countries
- total net el. Power 375 GW, of which
- more than 2/3 installed in 5 countries
(USA, France, Japan, Russia, Germany)
representing 11% of world population.

Under construction:

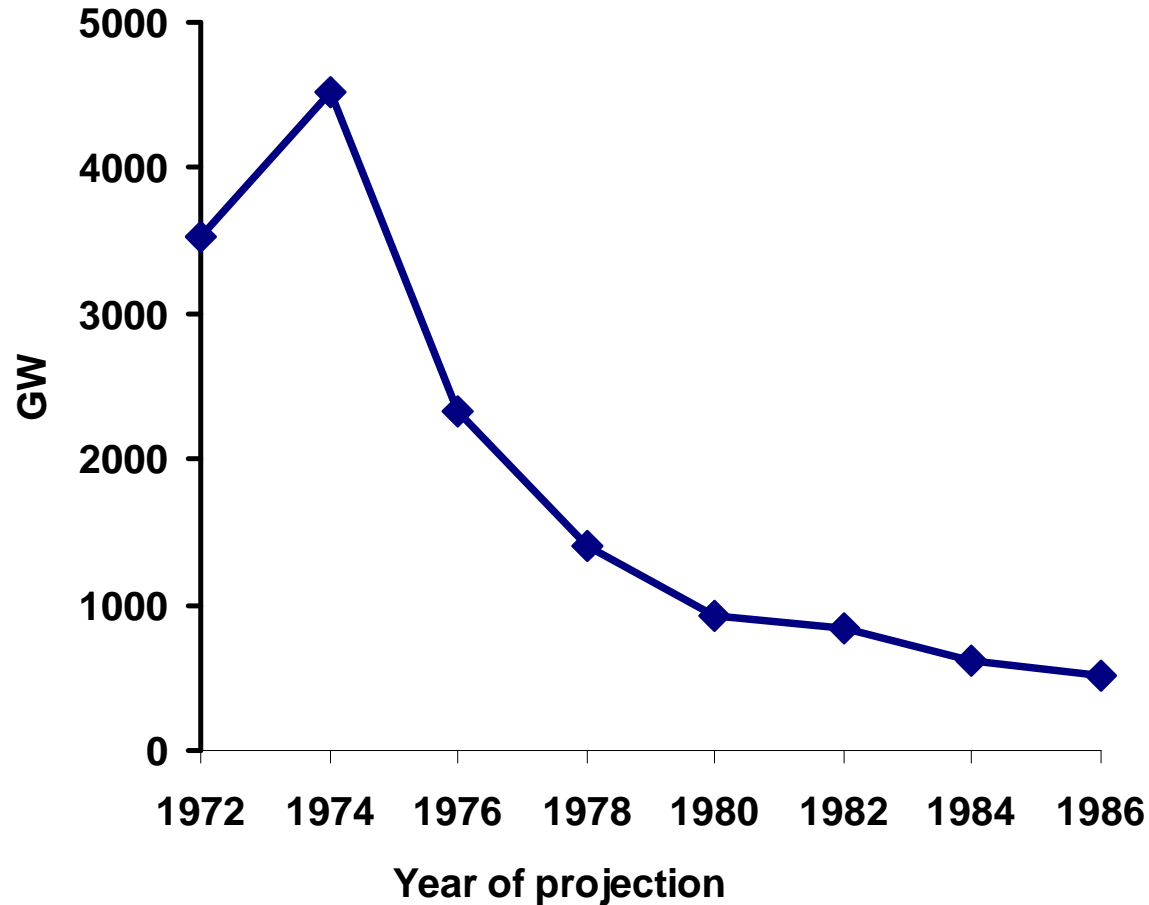
- 60 reactors, net el. Capacity 59 GW, of which
- 23 China, 11 Russia, 26 in 13 other countries
- 15 construction start over 25 years ago

Number of Reactors under Construction Worldwide

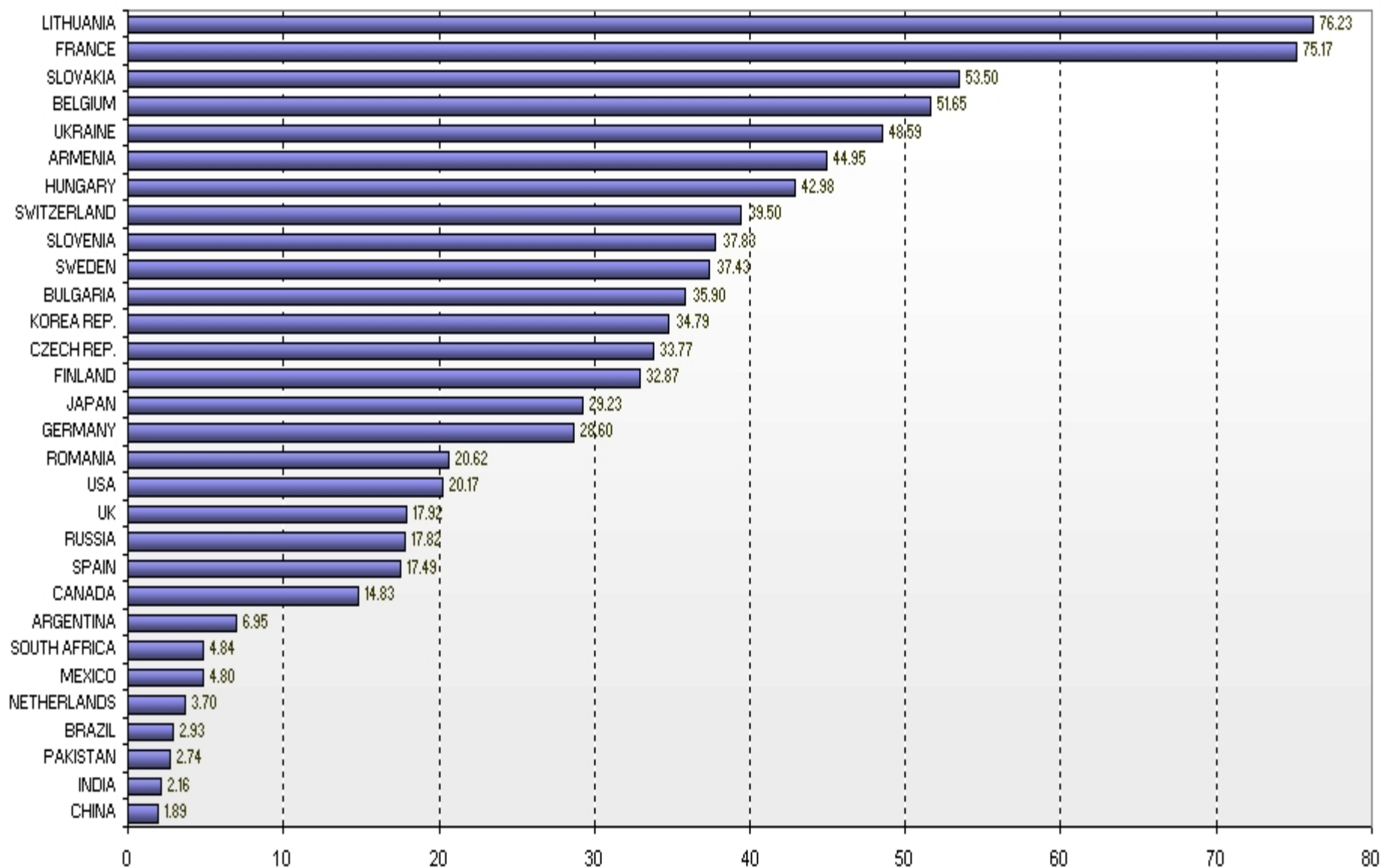


Note: The World Total includes also 2 reactors under construction in Taiwan, China.

IAEA Projections of World Nuclear Capacity in the year 2000



Nuclear Share in Electricity Generation in 2009

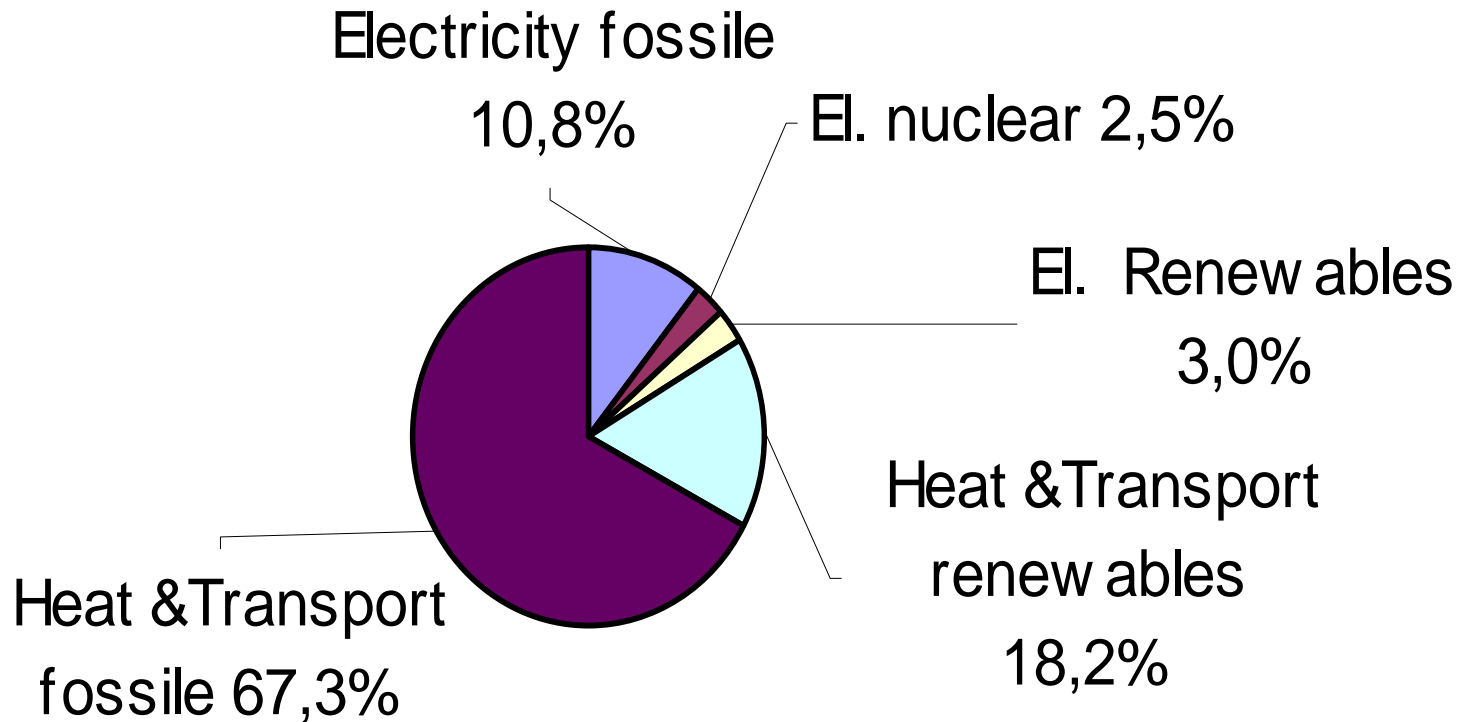


Note: The nuclear share in Taiwan, China was 20.7%

[%]

World Final Energy Consumption 2005

Source: IEA Key World Energy Statistics 2008



Nuclear contribution to energy supply

World Final Energy Consumption 2008

Source: IEA key world energy statistics 2010

- share of electricity 17,2 %
- of which nuclear generation 13,5%
- result: share of nuclear electricity 2,3%

Nuclear Contribution to world energy supply, thus to climate protection: **rather modest**

If nuclear energy shall in future contribute substantially, worldwide **nuclear capacity needs large increase**

IEA 2008: Perspectives Energy Technology (1)

Worldwide CO₂- emissions

in 2005 27 GT

in 2050

- Basic Scenario 62 GT
- Scenario Energy Revolution 14 GT
- Effect E- Revolution - **48 GT**

IEA 2008: Perspectives Energy Technology (2)

Scenario energy revolution2050, Effects:

- Final energy consumption - 48%, due to
- Renewable energy - 21%
- CO₂- separation/disposal - 19%
- Nuclear energy - 6%

Required nuclear capacity

- 2005 – 2050, 32 new plants 1000MWe each,
- Result 2050: 1440 new plants, 1440 GW,
4 times the present world nuclear capacity

Nuclear capacity increase according to IEA Scenario “Energy Revolution”: Resulting problems

- Far more than (at present) 31 States will have to engage in nuclear energy. 205 out of 236 countries did not engage up till now, why should they in future?
- Only 5 countries produce over 50% of electricity by nuclear. Many, many more will have to in future.
- Non- Proliferation- Policy: Would USA, Russia, China tolerate erection of nuclear infrastructure in almost all regions of the world?
- Financing Investment costs, which (per kW capacity) are far higher for nuclear plants than for conventional plants.
- System conflict between nuclear operation and high level of fluctuating power generation by wind + solar capacity.
- Finally: dangers of nuclear catastrophe (civil and military) multiplied, as well as amount of nuclear waste.

Another Problem: Uranium

Secured + estimated uranium reserves (IEA:4600 kT)

- are sufficient for 70 years of nuclear generation at the now existing level,
- but would be exhausted already before 2050 at an increasing level as in scenario energy revolution.

However, uranium scarcity will result in discovery of new - and exploration of unconventional – resources.

This implies mining of poor resources (less than 1% Uranium), causing enormous environmental problems.

Schnelle Brüter ?

- **Theoretisch könnten Brüter bis zu 60 mal mehr Energie aus dem Natururan erzeugen als die derzeitigen (Leichtwasser-) AKW**
- **Bis Mitte 70er Jahre schien der kommerzielle Einsatz von Brütern bald erreichbar**
- **Voraussagen nationaler Atomenergiebehörden für die im Jahr 2000 installierte Brüterkapazität**
 - **1974 USAEC für USA: 450 GW**
 - **1975 UKAEA für GB: 33 GW**
 - **1978 CEA für Frankreich: 16 – 23 GW**
- **Nunmehr ist weltweit noch ein einziges Brüterkraftwerk in Betrieb (0,6 GW in Russland)**

Number of Operating Reactors by Age (as of March 2009)

