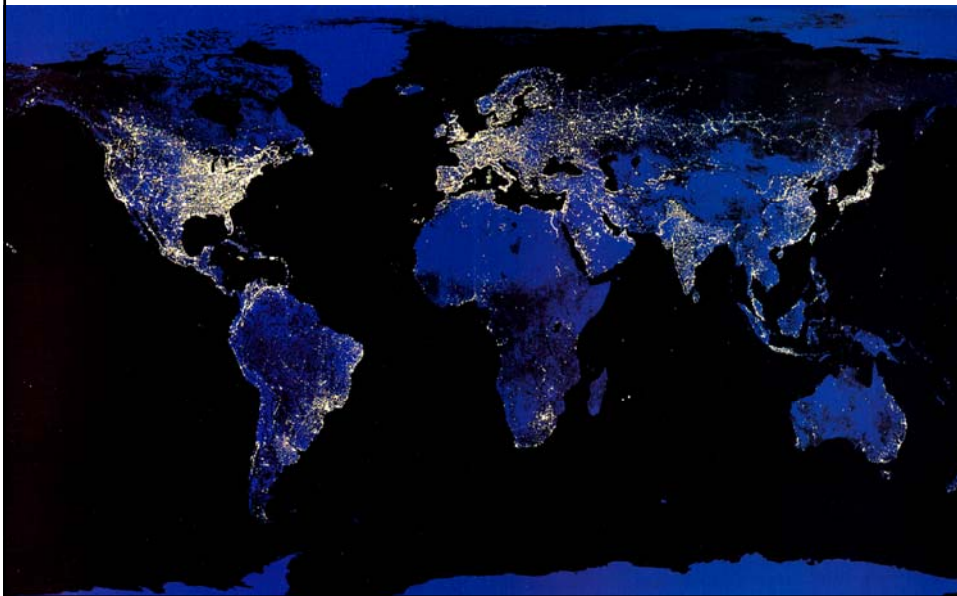


# The Future of Nuclear Power after Fukushima

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## Trends – Energy consumption map



## Before Fukushima: Nuclear Renaissance

Reasons:

- The increasingly evident causal link between fossil fuel and climate change
- The emergent global need for energy: Industrialization moves to east
- Too risky to be too dependent on oil, coal and gas
- The nuclear technology works and it is moveable
- There are uranium in great quantities

## Energy consumption of the world

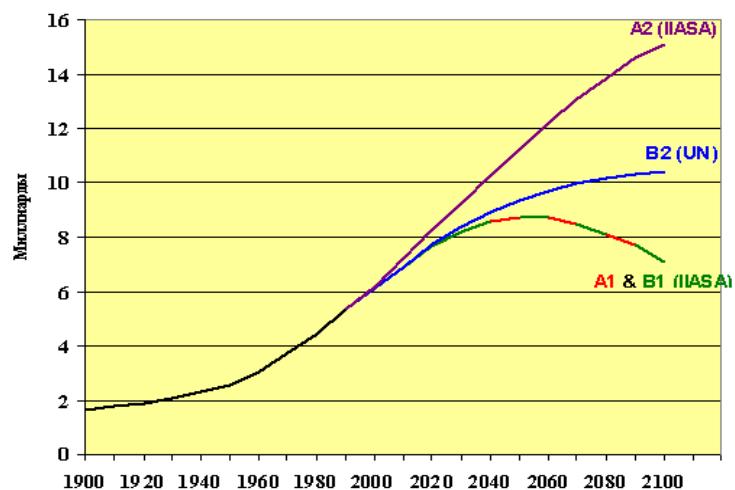
- $\frac{3}{4}$  of the world's population consumes about  $\frac{1}{4}$  of total energy.
- The average level of power consumption in developing countries is  $\frac{1}{10}$  of the consumption in the developed countries.
- Almost two billion people in developing countries have no access to electricity.

## The problem

- Growing demand for energy
- Population growth
- Climate change – global warming

Conclusion: we need to consume less or produce more renewable energy sources

## Population prospect



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## Prospect for the power industry up to 2050

In developing countries the energy demand will increase as follows:

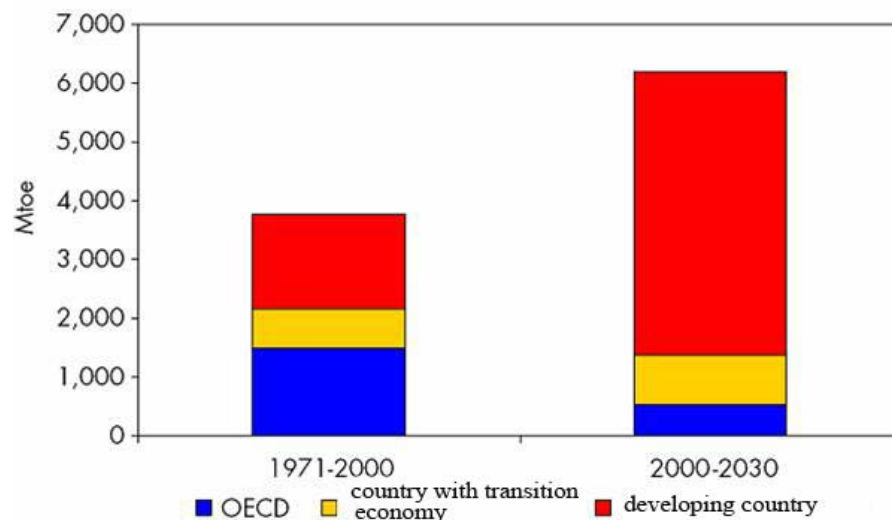
- 3 to 5 times – for primary energy
- 5 to 7 times – for electricity.

In developing countries the increase in demand for primary energy will be over 70% of the total growth in the world.

Source: IIASA/WEC

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Consumption energy in the world



Reference: IEA

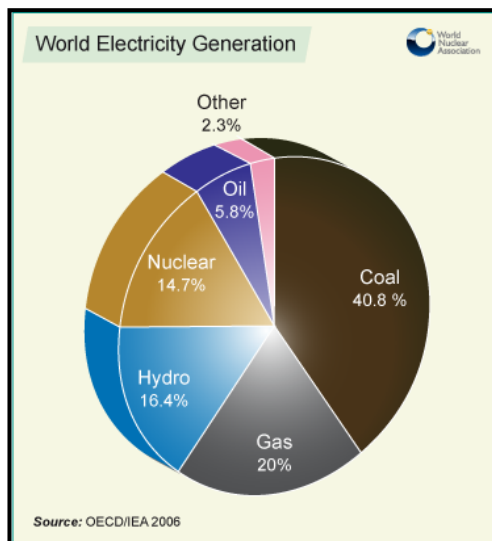
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### Nuclear Power Today: At a glance

- 438 commercial nuclear power reactors
- 375 GWe installed (approx 11% of global generating capacity)
- 16-17 % of global electricity supply
- More than 14,000 reactor-years of operating experience

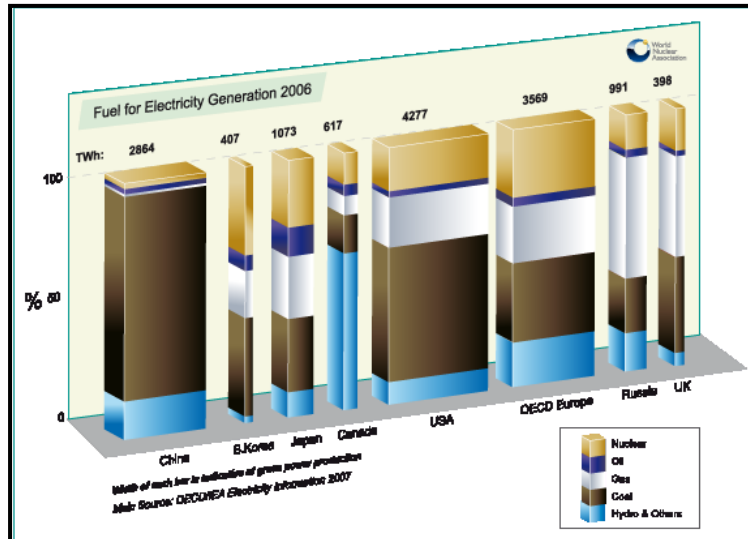
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## Nuclear Power in the World Today



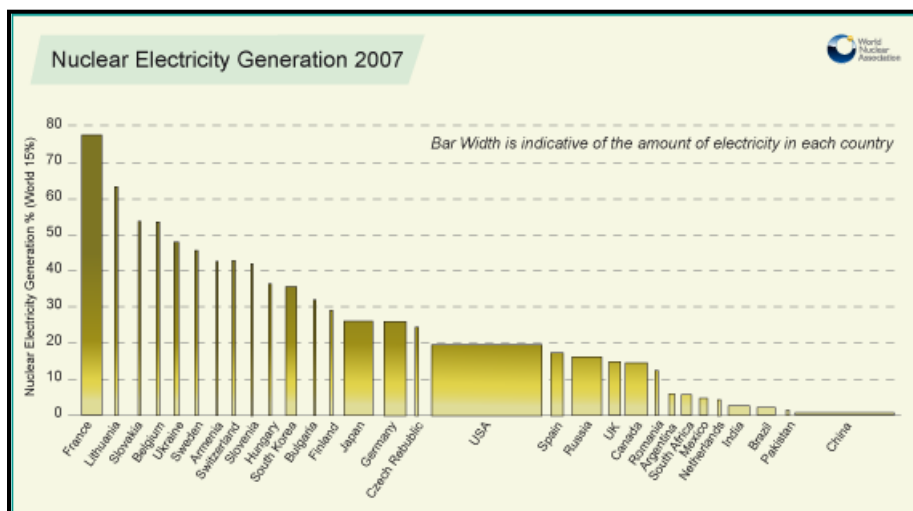
- 438 commercial nuclear power reactor
- 30 states in the world
- 372 GWt of total capacity
- 15% of the world's electricity
- 280 nuclear research reactors
- 220 reactors power ships and submarines

## Nuclear Power in the World Today



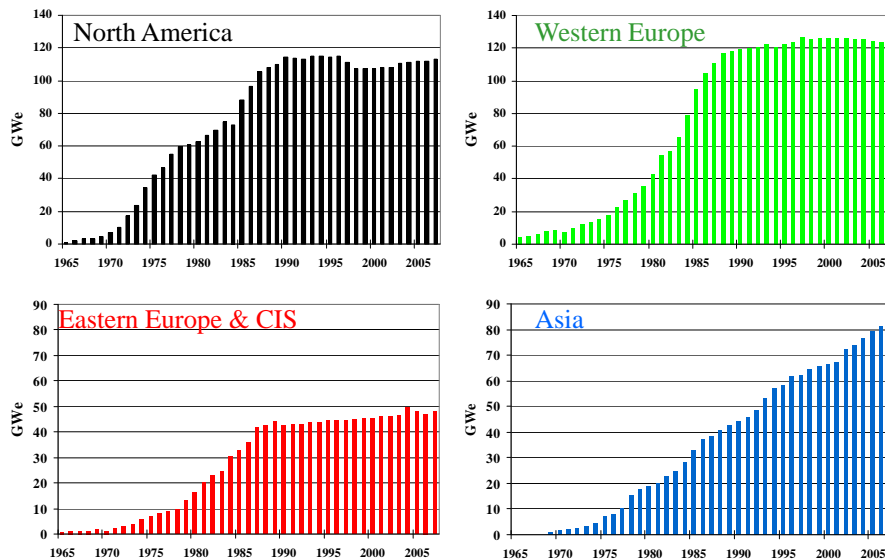
Source: World Nuclear Association (update March 2009)

## Nuclear Power in the World Today



Source: World Nuclear Association (update March 2009)

## Development of regional nuclear generating capacities



### New countries which are planning to use nuclear energy during 2015-2030

- Latin America: 3 + 2 expected new (Chile, Peru)
- Western Europe: 9 + 3 expected new (Portugal, Turkey)
- Eastern Europe: 10 + 3 expected new (Belarus, Kazakhstan, Poland)
- Africa: 1 + 5 expected new (Algeria, Egypt, Libya, Morocco, Tunis)
- Middle East&South Asia: 3 + 1 expected new (Bangladesh)
- South East Asia&the Pacific: 0 + 4 expected new (Australia, Indonesia, Malaysia, Thailand)
- Far East: 3 + 3 expected new (North Korea, Philippines, Vietnam)
- In total about 20 new countries are considering to start using nuclear energy during 2015-2030

<b>Per-capita electricity consumption and projected nuclear power growth in selected countries and in Africa</b>				
Country	Years	Annual electricity consumption, kWh/capita	Installed or projected nuclear power capacity, GW(e)	Projected growth in nuclear power capacity
China	2002	1208	5.3	6-7 times
	2020		32-40	
India	2002	421	2.6	11 times
	2022		29	
Pakistan	2002	384	0.42	10 times
	2030		4.2	
Russia	2002	5320	21	2 times (100%)
	2020		40--45	
ROK	2005		16.8	57%
	2015		26.4	
USA	2002	13228	99	11%
	2020		~110	
Africa	2002	514	1.8	0-128%
	2020		1.8-4.1	

## Europe divided

- Against: Austria, Denmark, Germany, Italy, Switzerland
- In favour: Czech Republic, Finland, France, Poland, Slovakia, Sweden, UK



## Asia

- In favour: China, India, Vietnam, Malaysia, North Korea, South Korea

## North America

- The United States: 103 commercial nuclear power plants in operation. Planning to build a new reactor.
- Wait-and-see
- Canada: 17 reactors. Canada plans to expand the nuclear capacity over the next decade

## Germany

- Nuclear power will be shut down in 2022
- Gas dependency on Russian gas
- Use of coal
- Renewable energy

## Japan

- Japan needs to import about 84 % of its energy
- Phase out nuclear power in 2050
- Nuclear power: 30 % of the electricity and before Fukushima the plans was to increase this capacity to 40 % by 2017
- Future: is there really an alternative without nuclear energy?

## Sweden

- 10 reactors in operation, covers about 45-50 % of the electricity consumption
- 1980 a national referendum: nuclear power should be phased out in 30 years
- Today: the operating 10 reactors can be replaced

## Conclusions

- A nuclear renaissance in some countries and in some regions
- Phasing out in some countries
- Decisive factors:
  - financial costs
  - the development of renewable energy sources:  
**Test-case Germany**
  - Improvements of safety and security systems
  - solving of the nuclear waste problem