



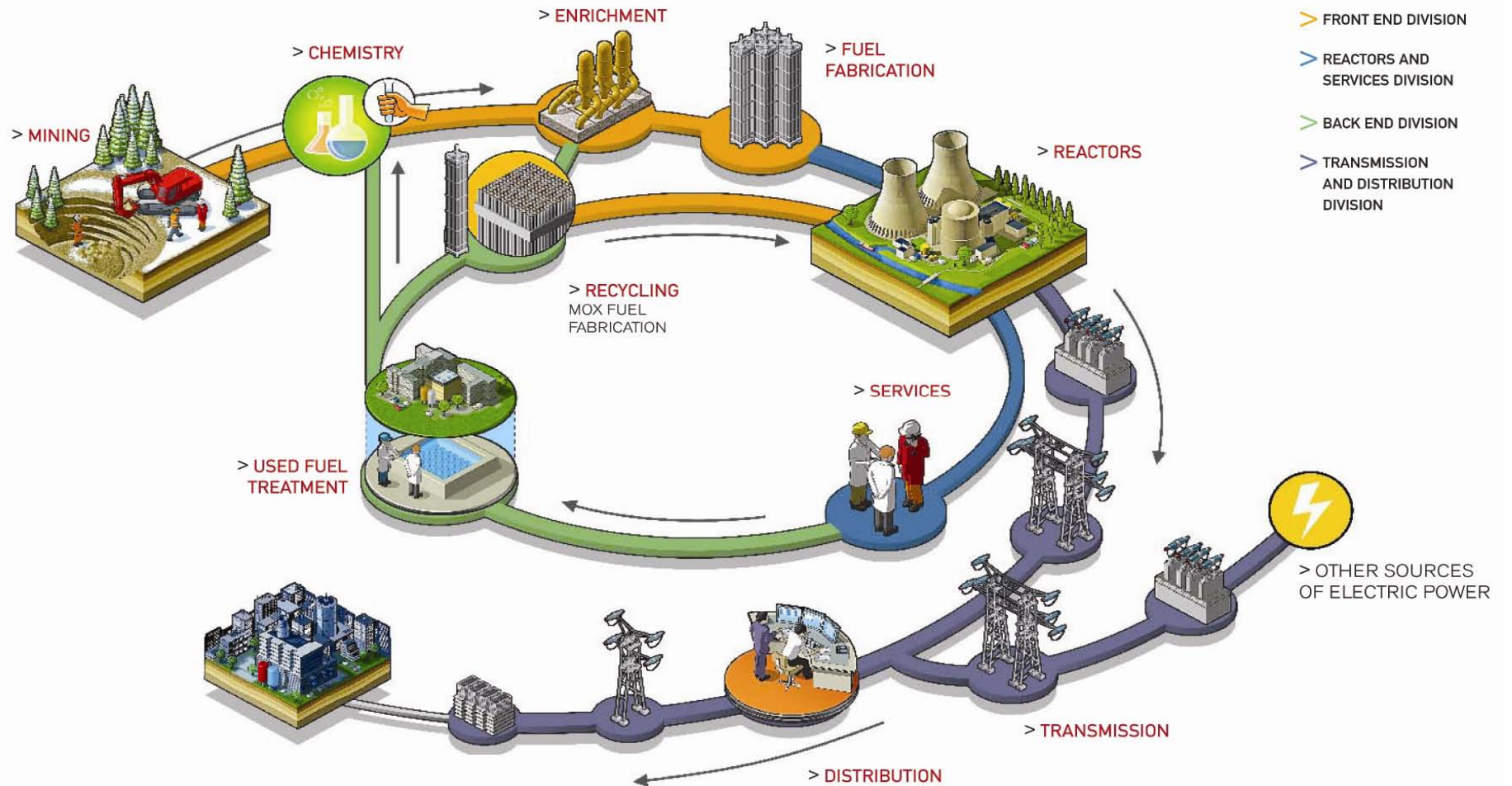
# ***The Perspectives of Nuclear Energy in Europe***

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*Managing Director / Framatome ANP GmbH*

PATRAM 2004, Berlin, September 20, 2004

# Energy, AREVA's core business

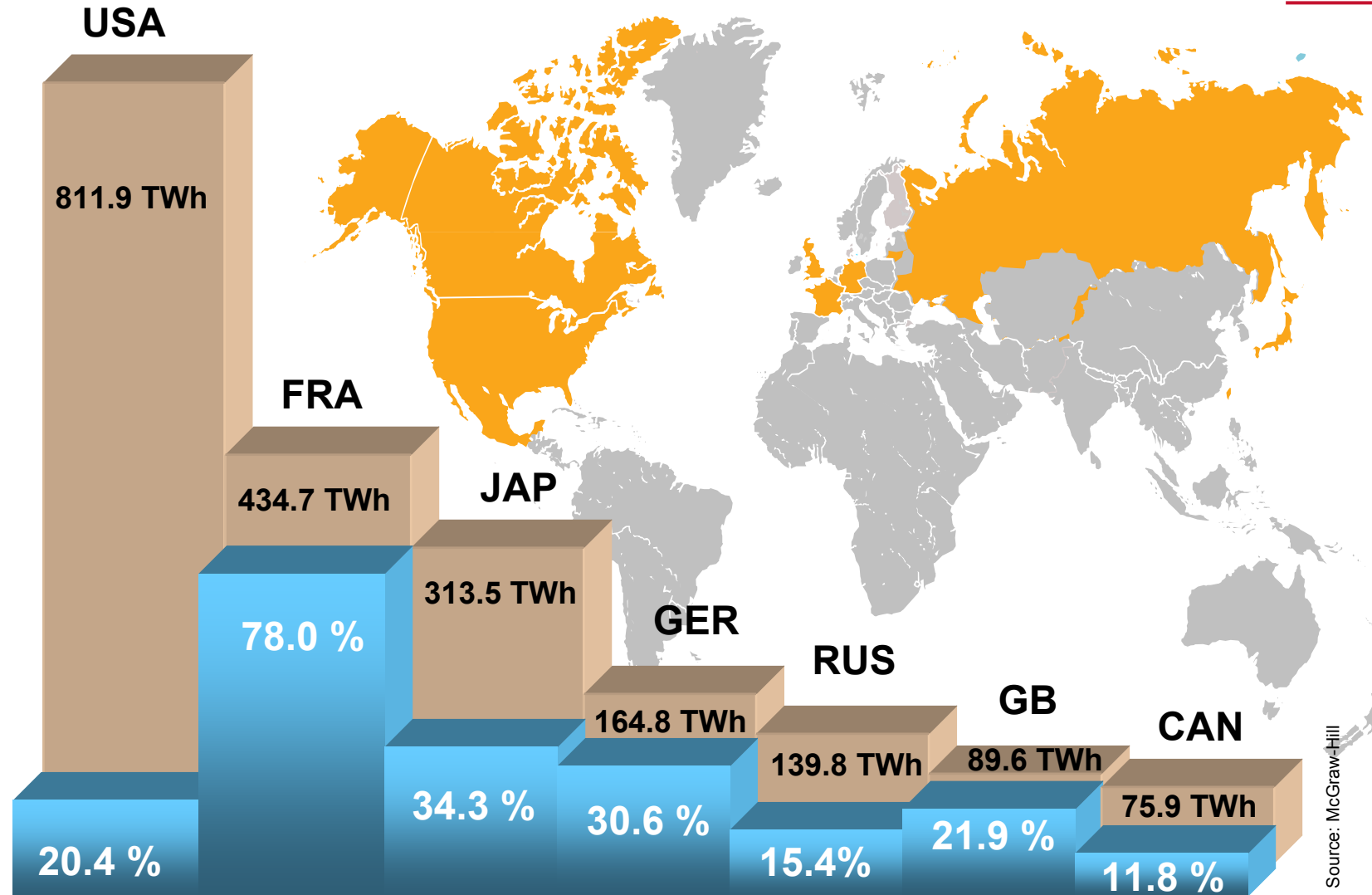


## World Nuclear Power Status, January 2004

	Number of NPPs		Total	
	In operation	Under construction	Plants	MW net
<b>Americas</b>	<b>127</b>	<b>2</b>	<b>129</b>	<b>117 710</b>
- North America	121	-	121	111 673
- Latin America	6	2	8	6 037
<b>Europe</b>	<b>209</b>	<b>10</b>	<b>219</b>	<b>181 312</b>
- West	141	1	142	126 693
- Central & Eastern	68	9	77	54 619
<b>Asia</b>	<b>101</b>	<b>20</b>	<b>121</b>	<b>89 243</b>
<b>Africa</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>1 842</b>
<b>Total</b>	<b>439</b>	<b>32</b>	<b>471</b>	<b>390 107</b>

Source: IAEA, WNA

# Nuclear Power Generation (in TWh and %) in Leading Industrial (G8) Countries, 2002



# Nuclear Power Generation - Recent Market Trends

- **Further expansion** of nuclear programs to meet rising energy needs (Asia, Russia, Finland)
- **Deregulation** of energy markets (EU, partly US)
- **Consolidation** of power generating market: joint ventures and take-overs among utilities and vendors (Asia, EU, US)
- **Initiatives for new NPPs** (Europe, US)
  
- **Power uprating** (EU, US)
- **License extension** (US)
- **Modernization**: Safety upgrade, Instrumentation & control, SG replacement, RPV head replacement (Asia, EU, US)
- **Intensified R&D** (e.g. Generation III reactors, fuel cycle management, improved burn-up rates; Generation IV reactors)
  
- **Availability improvement** (Asia, EU, US)
  - ▶ **Reduction of outage duration**
  - ▶ **Maintenance optimization**: know-how-pooling, alliancing, packaging, advanced inspection technologies

## *Perspectives for New NPPs*

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### ● **Driving Forces**

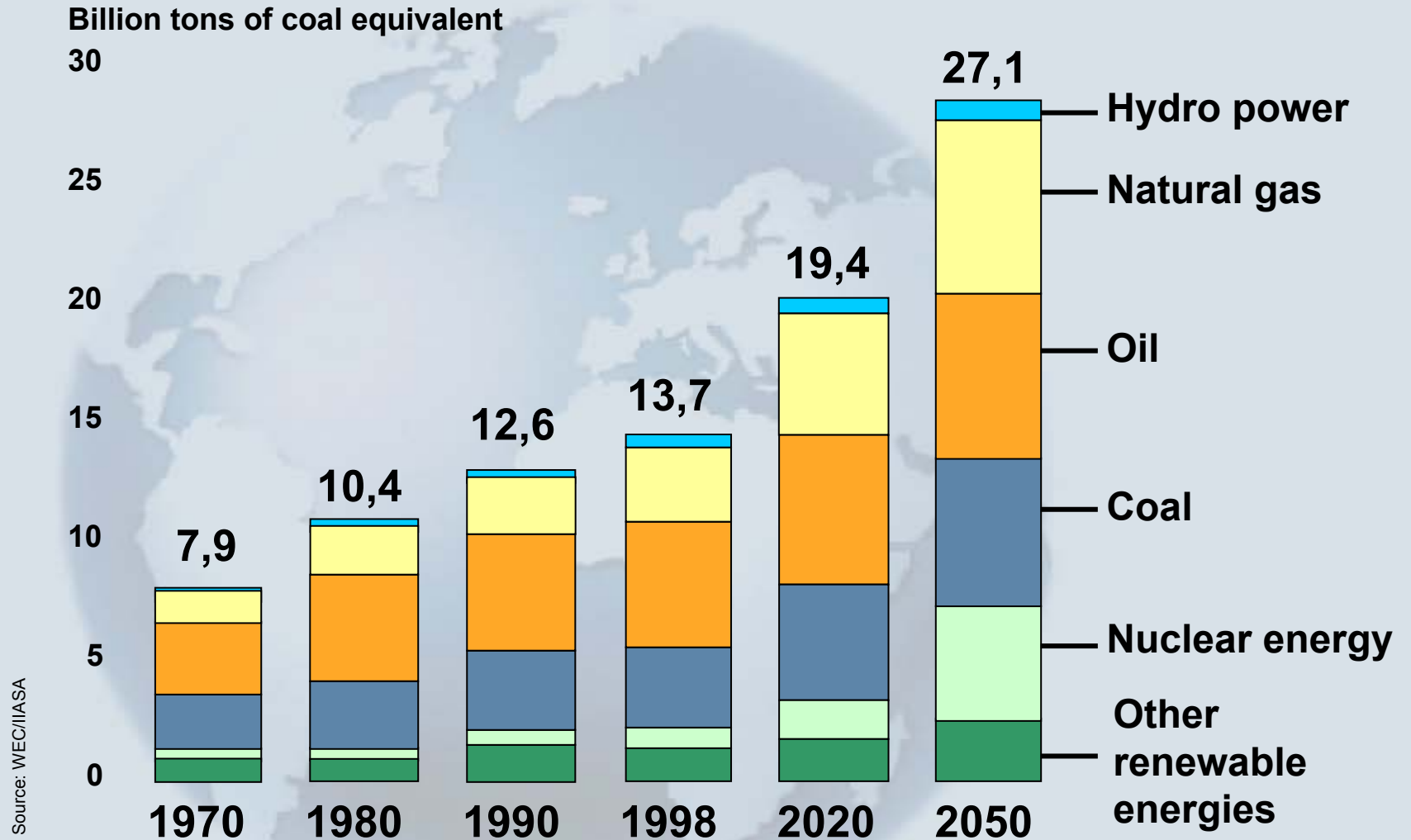
- ▶ **Rising electricity demand** and/or need for replacement of aging nuclear and fossil power plants
- ▶ **Instability** of international markets for **fossil fuels**
- ▶ Ongoing commitment to improving the environment and combating **climate change**
- ▶ **Security of supply** in baseload power generation
- ▶ **Competitive power production costs**

### ● **Prerequisites**

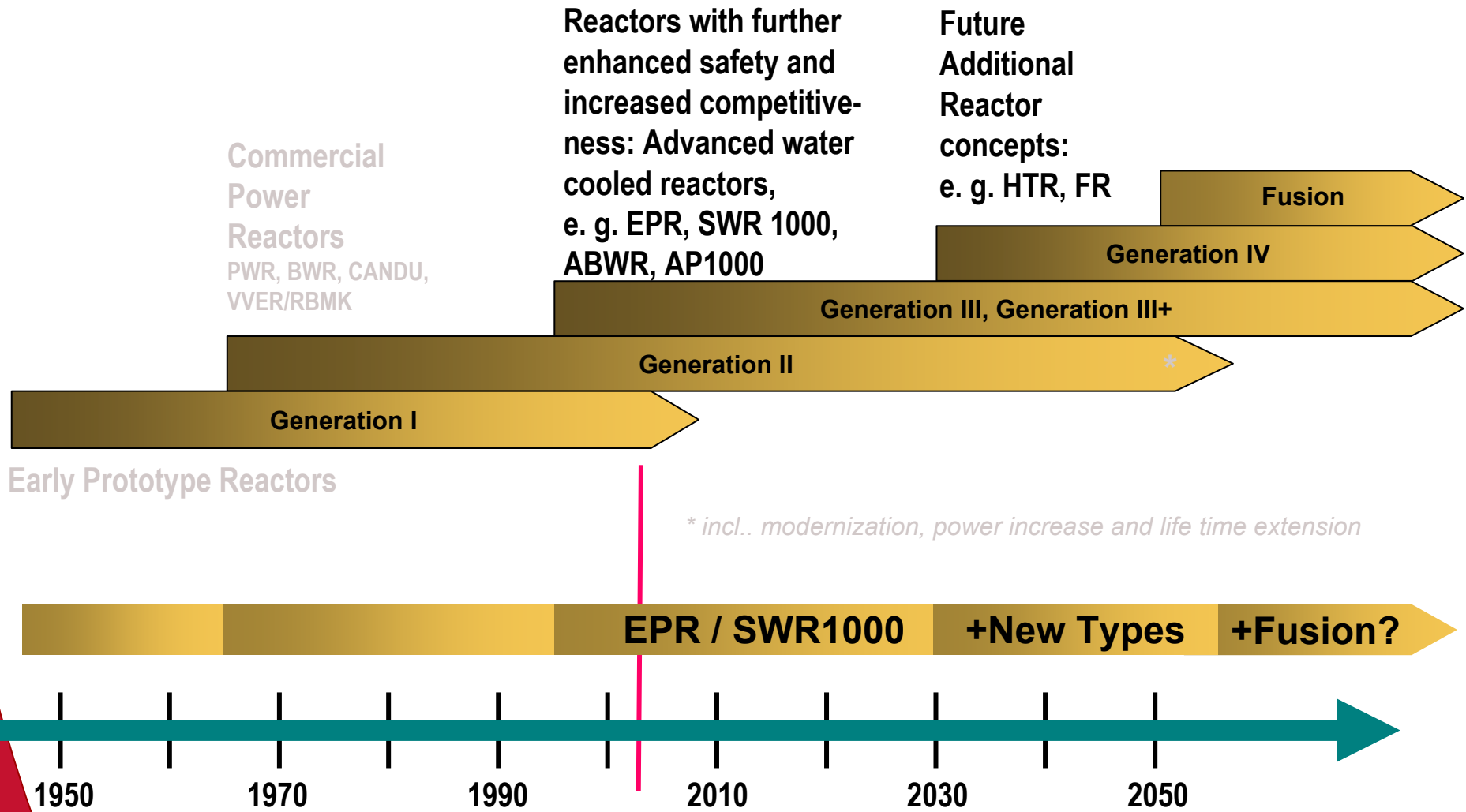
- ▶ Competitive NPPs
- ▶ Safety enhancement (CDF  $\leq 10^{-6}/a$ )
- ▶ Worldwide-acting vendors of NPPs with long-term commitment
- ▶ Viable sub-supplier base
- ▶ Ongoing R&D and education in nuclear technology
- ▶ High-level waste repositories (long-term issue)
- ▶ Public acceptance

# World Primary Energy Demand

(World Energy Council, Reference Scenario)



# Reactor Generations





## *Three Tasks for Nuclear Energy, Today and Tomorrow*

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- > Cover part of power demand growth in industrialized and emerging countries
  - Examples: China, India, Japan, South Korea, Russia, Finland, Brazil, North America
- > Substitution of aging base-load power plants in industrialized countries, starting about 2010
- > Deployment of nuclear energy in new fields other than electricity generation, based on new reactor types („Generation IV“)
  - Examples: Prozess heat, Hydrogen production, sea water desalination

# *New NPP Projects in Europe to Replace aging NPPs*

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## **France**

- Construction of EPR demo plant to be launched in 2004; government has given green light
- Replacement of aging NPPs by EPRs starting 2015 - 2020

## **Switzerland**

- Utilities consider to replace Beznau 1 + 2 and Mühleberg by one large new NPP (e.g. EPR) by 2020

## **Bulgaria**

- To replace old Kozloduy units, government decided to restart Belene project

## **Lithuania**

- To compensate for shut-down of Ignalina (RBMK type, 2 x 1300 MW), a new Western-type NPP project is under consideration

# *Finland: Why additional Nuclear Power?*

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## **New nuclear power plant**

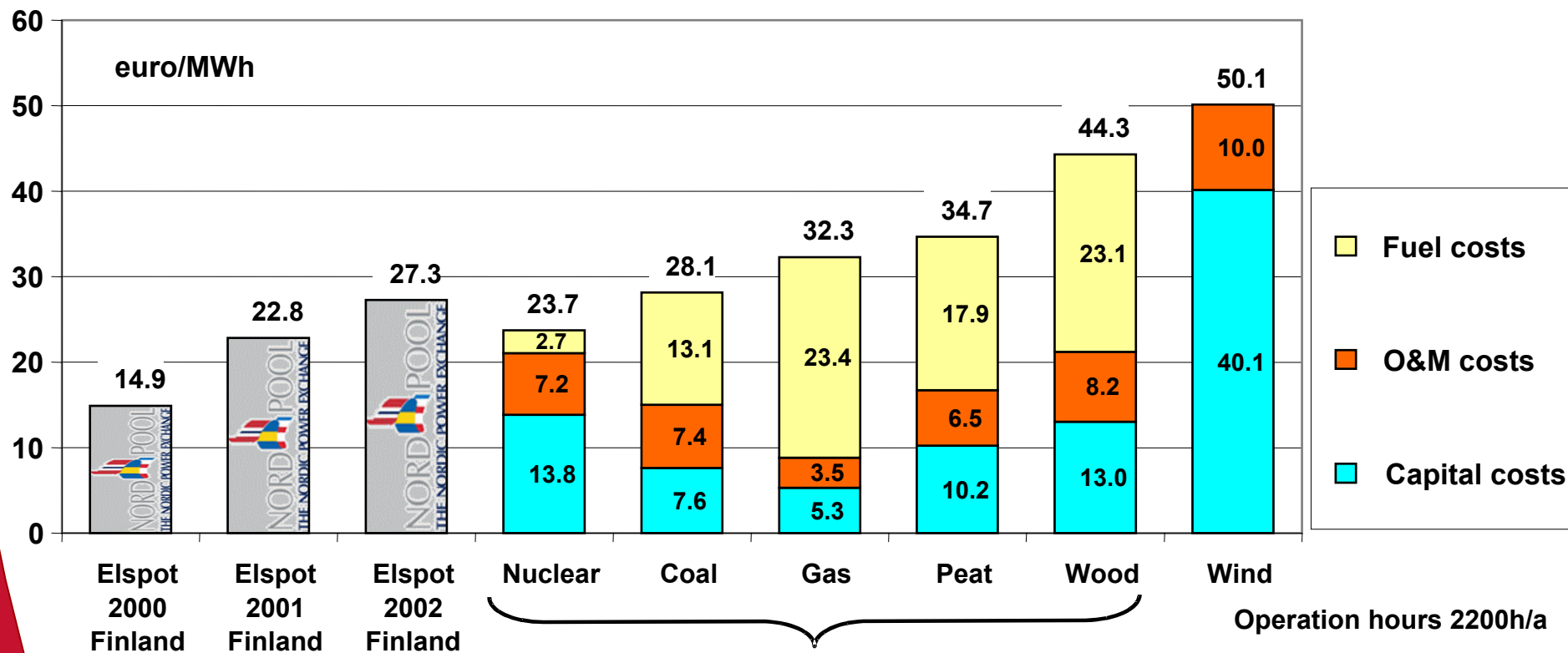
Covers partly the additional electricity demand and replaces old power plants

Enables, together with renewables, the fulfilment of the Kyoto commitments

Secures stable and predictable electrical price

Reduced the dependence on electricity import

# Electricity Generation Costs, Without Emission Trading



Real interest rate 5.0%  
May 2003 prices

Generation costs without investment grant and electricity tax rebate (wood and wind)

Source: R. Tarjanne & K. Luostarinen 15.05.2003  
Lappeenranta University of Technology



***OLKILUOTO, 2009***

- ▶ ***Nuclear power generation will further expand***
- ▶ ***Driving factors: Rise of energy demand and need for sustainable development***
- ▶ ***Industrialized world and major emerging countries count on nuclear power***
- ▶ ***Advanced light water reactors now ready for deployment***
- ▶ ***Promising innovative reactor concepts under development***
- ▶ ***Progress in waste management and transparent performance of nuclear industry are other key issues for public acceptance***
- ▶ ***An efficient, well-managed nuclear infrastructure including packaging and transport remains essential for the success of nuclear energy***