

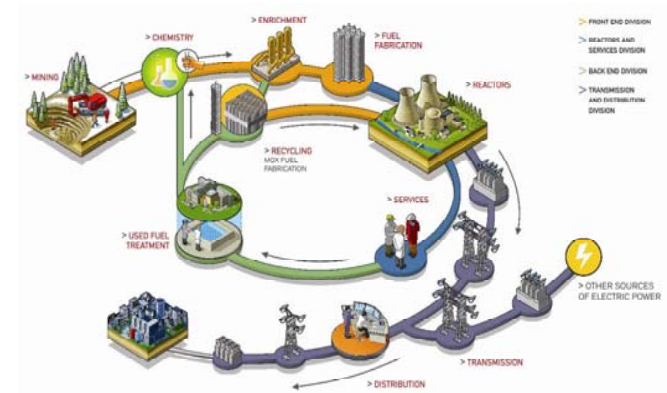
LAS ANS SYMPOSIUM 2005  
 Maintaining the Nuclear Option in Latin America



Rebirth of Nuclear Energy in Europe

Frank Apel  
 Framatome ANP  
 Vice President Sales Development and Marketing  
 West Europe, South America, Africa

Energy, AREVA's core business



AREVA Group

On March, 2005

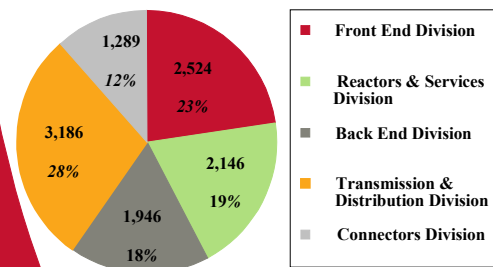


Energy				
Front End Division	Reactors & Services Division	Back End Division	Transmission & Distribution Division	Connectors Division
<ul style="list-style-type: none"> <li>▶ Mining</li> <li>▶ Chemistry</li> <li>▶ Enrichment</li> <li>▶ Fuel</li> </ul>	<ul style="list-style-type: none"> <li>▶ Reactors</li> <li>▶ Equipment</li> <li>▶ Nuclear Services</li> <li>▶ Nuclear Measurement</li> <li>▶ Consulting and Information Systems</li> <li>▶ Technitome</li> </ul>	<ul style="list-style-type: none"> <li>▶ Treatment</li> <li>▶ Recycling</li> <li>▶ Logistics</li> <li>▶ Engineering</li> <li>▶ Cleanup</li> </ul>	<ul style="list-style-type: none"> <li>▶ Products</li> <li>▶ Systems</li> <li>▶ Automation &amp; Information Systems</li> <li>▶ Services</li> </ul>	<ul style="list-style-type: none"> <li>▶ Communications Data Consumer</li> <li>▶ Automotive</li> <li>▶ Electrical Power Interconnect</li> <li>▶ Microconnections</li> </ul>

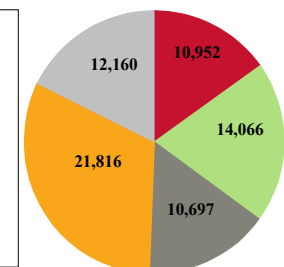
2004 Financial Highlights

**M€ 11,109 Sales**  
**M€ 613 Operating income**  
**M€ 428 Net income**  
**70,069 Employees**

Sales by business  
 (in millions of euros and %)



Workforce by Business



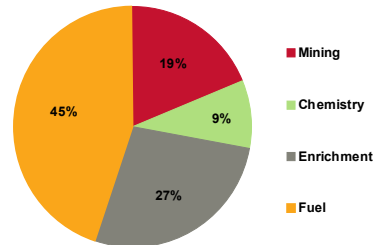
## Front End Division

- ▶ This division includes the group's business lines involved in producing nuclear fuel for electric power generation: uranium mining, concentration, conversion and enrichment, and nuclear fuel fabrication. Customers buy uranium concentrates from AREVA and contract for commercial processing and fuel fabrication services, retaining ownership of their materials throughout these operations.



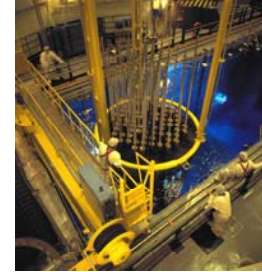
Fabricating fuel for pressurized water reactors (PWR) at the FBFC plant in Romans (France).

- ▶ **2,524** million euros in sales
- ▶ **10,952** employees
- ◆ Sales by Business Unit:



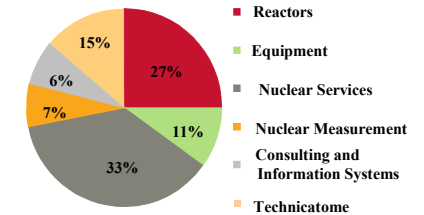
## Reactors & Services Division

- ▶ The Reactors and Services Division designs and builds pressurized water reactors (PWR), boiling water reactors (BWR) and research reactors. AREVA also offers products and services to operate and maintain every type of reactor on the market.



Reactor vessel inspections at the Civaux power plant (France).

- ▶ **2,146** million euros in sales
- ▶ **14,066** employees
- ◆ Sales by Business Unit:



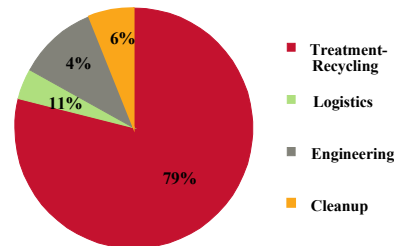
## Back End Division

- ▶ This division encompasses the treatment and recycling of fuel after use in nuclear power plants. The group also provides interim storage solutions for used nuclear fuel to customers opting for this approach.



Maintaining and servicing shipping casks. COGEMA-La Hague plant (France).

- ▶ **1,946** million euros in sales
- ▶ **10,697** employees
- ◆ Sales by Business Unit:



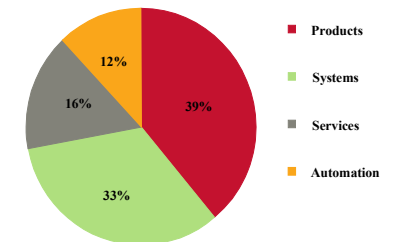
## Transmission & Distribution Division

- ▶ This division provides products, systems and services for the medium- and high-voltage energy markets. Its products are used to transmit and distribute electricity from the generator to the large end-user to ensure the reliability, quality and safety of energy flows and to operate efficient networks through information management. The division's customers are electric utilities as well as the oil, mining and metals, wind energy, paper and glass, transport, and power engineering industries.



Installing equipment at the Norwich substation (United Kingdom).

- ▶ **3,186** million euros in sales
- ▶ **21,816** employees
- ◆ Sales by Business Unit:



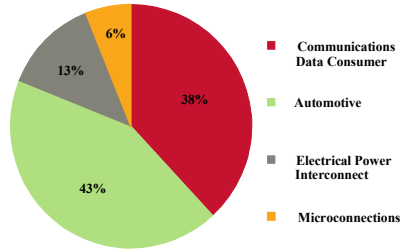
## Connectors Division

► The Connectors business is a precision manufacturing industry involving the design and fabrication of electrical, electronic and optical connectors, flexible microcircuitry and interconnect systems. Connectors link cables and equipment to electrical and electronic components.



Manufacturing connectors for smart cards.  
FCI plant at Mantes-la-Jolie (France).

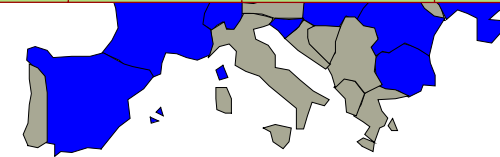
- 1,289 million euros in sales
- 12,160 employees
- ◆ Sales by Business Unit:



## Nuclear Energy in Europe



	"Nuclear" countries	Number of NPPs	Nuclear electricity
EU-15	8	136	33.4%
EU-25	13	155	32.0%



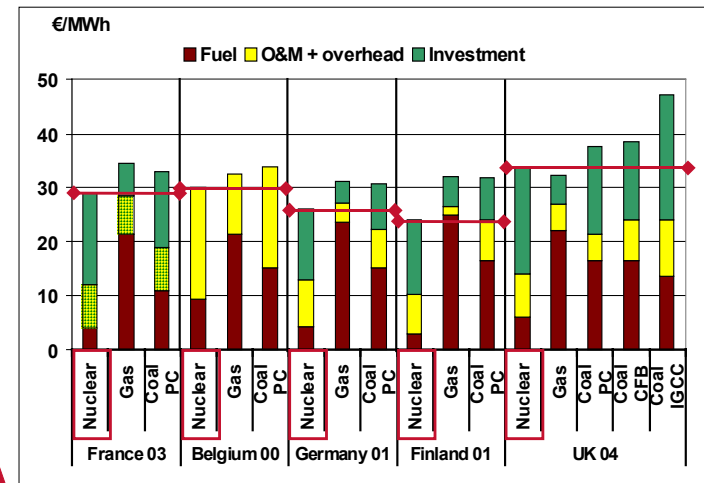
## Time for Nuclear Renaissance?



## Time for a Nuclear Renaissance

### ◆ What Has Changed?

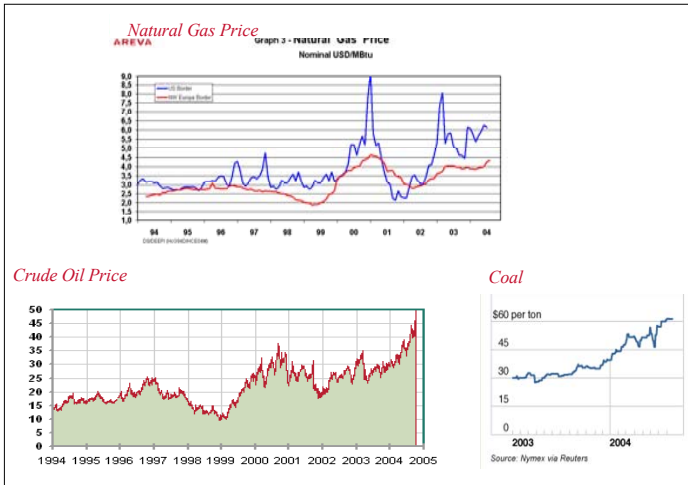
#### 1. Revised assessments of elect. PRODUCTION COSTS (w/o CO<sub>2</sub> Tax)



## Time for a Nuclear Renaissance

### What Has Changed?

#### 2. Higher unpredictability of FOSSIL FUELS MARKET PRICES



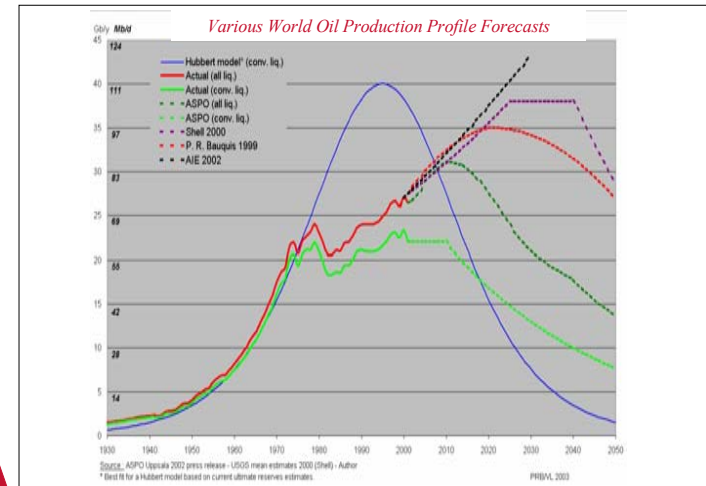
Rebirth of Nuclear Energy in Europe, Frank Apel, Framatome ANP

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## Time for a Nuclear Renaissance

### What Has Changed?

#### 3. Increased awareness about LIMITED FOSSIL FUELS SUPPLY



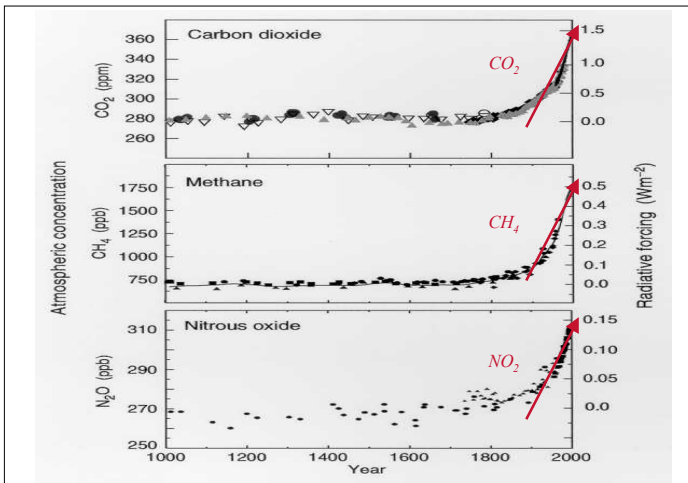
Rebirth of Nuclear Energy in Europe, Frank Apel, Framatome ANP

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## Time for a Nuclear Renaissance

### What Has Changed?

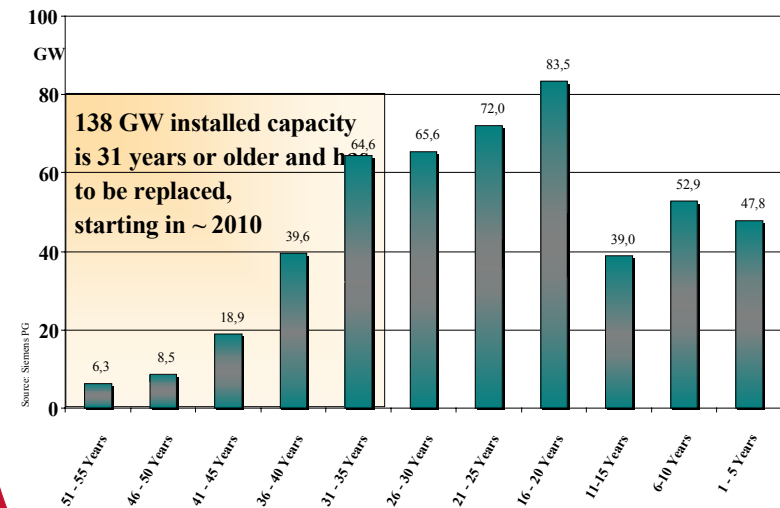
#### 4. Growing Concerns for Greenhouse Gas Emissions ...



Rebirth of Nuclear Energy in Europe, Frank Apel, Framatome ANP

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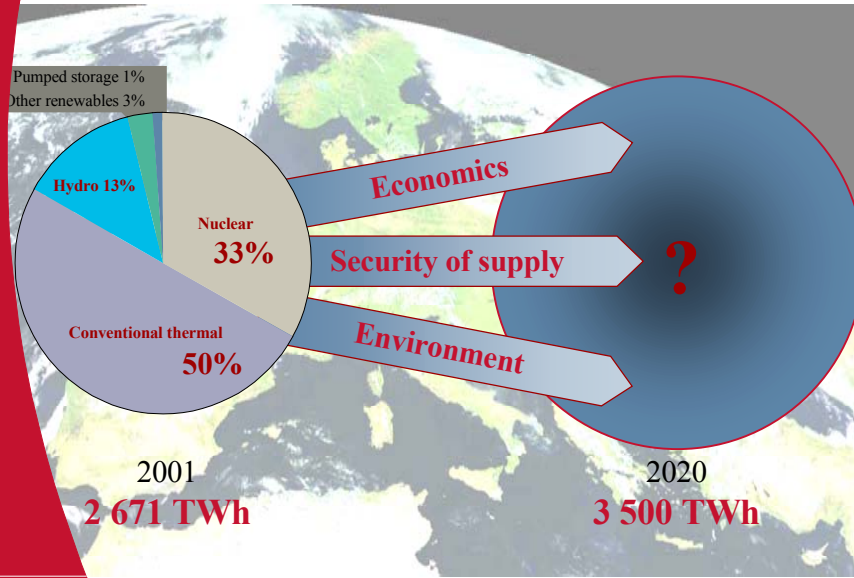
## Age Structure of Power Plants in the EU-15 (of steam turbine, nuclear and combined-cycle power plants)



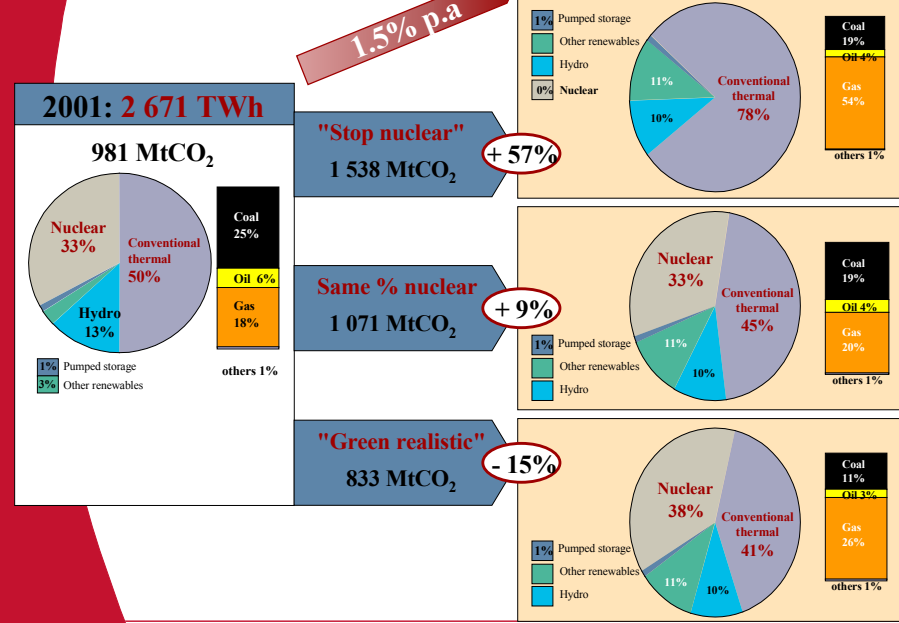
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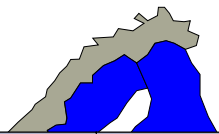
# Gross Electricity Generation in EU-15



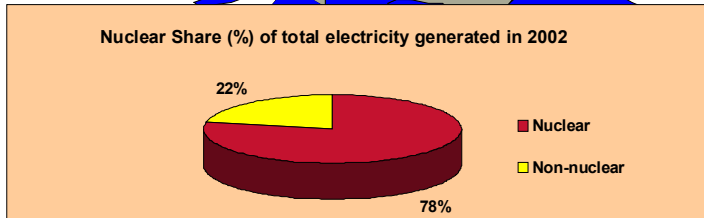
# 3 Scenarios for 2020



# France



	Number of units in operation	Net capacity MWe	Number of units under construction	Net capacity MWe
France	59	63,363	-	-

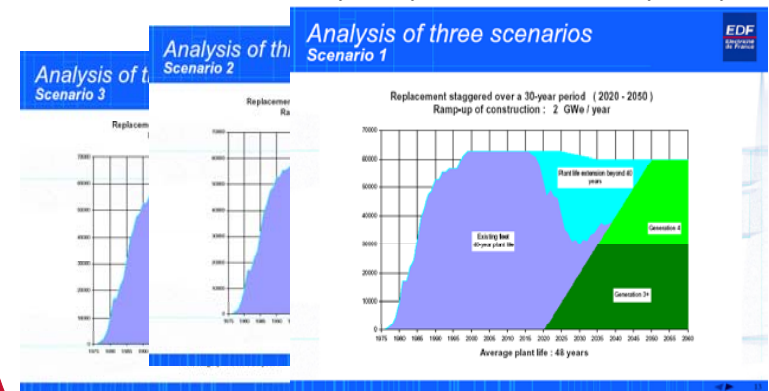


# France

## EDF's View Point (German Atomic Forum 2004)

### Three scenarios

- Parameter 1: average plant life (48, 53 or 58 years)
- Parameter 2: beginning of the replacement plan (2020, 2025 or 2035)
- Parameters 3&4: duration of the replacement plan (20 or 30 yrs) & ramp-up of construction (2 or 3 GWe/yr.)
- 2 alternatives to replace ~60 GWe: 'fast track' = 3 GWe/yr. x 20 yr or 'slow track' = 2 GWe/yr. x 30 yr



## France

### The Economics of Nuclear Power Generation

► Electricity generation prices ac. to EDF/Ampère Commission:

	Average kWh cost	CO <sub>2</sub> emissions per kW (in g)
<b>Nuclear</b>	<b>3 cts € *</b>	<b>6</b>
Hydro	3 cts €	4
Combined cycle gas	4 cts €	427
Wind	7 cts €	3-22
Coal	9 cts €	978
Oil	10 cts €	891
Solar	> 45 cts €	60-150

\* Cost including reprocessing and waste management costs

Taking into account environmental impacts would further increase competitiveness of Nuclear Power Generation

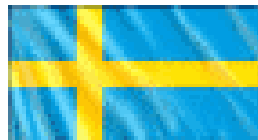
## France

### The « EPR Demonstrator »

- 2003 energy debate proves clear appreciation of nuclear power
- Start of replacement of ageing units by EPR 2012
- A first demonstration unit for the subsequent series to be constructed at the site of Flamanville
- Start of construction: 2007
- Buyer & Architect Engineer: EDF
- Scope: 1 unit PWR 3<sup>rd</sup> Gen., 1.600 MWe
- EPR « quasi » design approval by French Safety Authorities given on Sept. 28, 2004



## Sweden



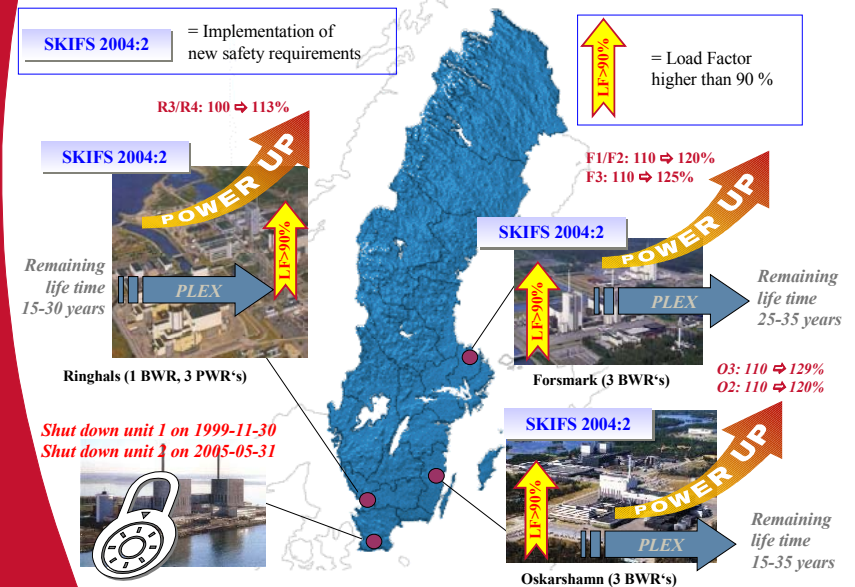
Despite the official phase-out policy 25 years ago a 83 % of the Swedish population favour the use of nuclear power in the future

	Number of units in operation	Net capacity MWe	Number of units under construction	Net capacity MWe
Sweden	9	8,851	-	-

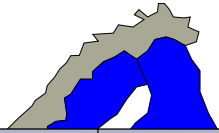
Nuclear Share (%) of total electricity generated in 2002



## Sweden

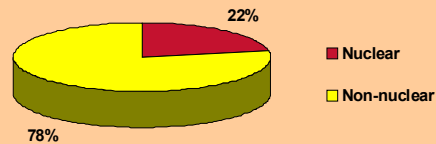


## United Kingdom



	Number of units in operation	Net capacity MWe	Number of units under construction	Net capacity MWe
UK	23	11,852	-	-

Nuclear Share (%) of total electricity generated in 2002



## United Kingdom



### UK science chief backs new nuclear plants

London, England, May. 12, 2005 (UPI) – **Nuclear power may be the only way Britain can meet its targets on tackling climate change, the government's chief scientific adviser has said.**

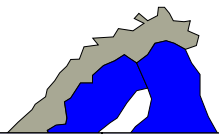
In an interview with the Independent published Thursday, **Sir David King said one more generation of nuclear plants may be needed to keep Britain's plans to reduce greenhouse gas emissions on course.**

His comments came three weeks after it was reported Prime Minister Tony Blair is drawing up plans to revive the nuclear option.

King said nuclear power should not be viewed as an indefinite solution, and in the future renewable energy sources combined with increased efficiency should be sufficient to cut carbon emissions.

However, due to the "energy gap" - the "imminent" period when Britain's existing atomic power stations which provide almost a quarter of the nation's energy start to be retired - **the government may not be able to meet its target of providing 20 percent of energy from non-fossil fuel sources by 2020 unless a new generation of nuclear plants is built,** he said.

## Switzerland



	Number of units in operation	Net capacity MWe	Number of units under construction	Net capacity MWe
Switzerland	5	3,220	-	-

Nuclear Share (%) of total electricity generated in 2002



## Switzerland

### National vote confirms nuclear energy as part of the Swiss electricity mix

**On 18th May, 2003,** a clear majority of Swiss voters defeated two so called "popular initiatives", which were aimed at phasing-out nuclear energy from the country's energy mix.

The 1st initiative, "Electricity without nuclear", asked to close down the older Swiss nuclear power plants Beznau-1/2, and Muehleberg, no later than two years after the vote – and to close down the newer ones, Goesgen and Leibstadt, no later than after 30 years of operation. It would have also forbidden reprocessing of nuclear fuel and imports of nuclear-generated electricity.

The 2nd initiative, "Moratorium plus" would have limited the operating lifetime of the existing Swiss NPPs to 40 years, with the possibility of 10-yearly extensions subject to a national vote. It also asked for a 10-year extension of the Moratorium 1990-2000, forbidding licenses for new NPPs.

#### Results:

"Electricity without nuclear" was defeated with 66.3 percent "No" votes, "Moratorium plus" was rejected with 58.4 percent "No" votes.

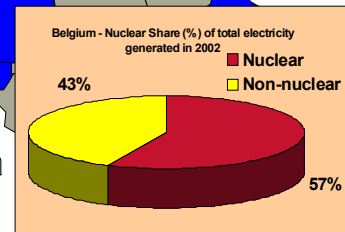
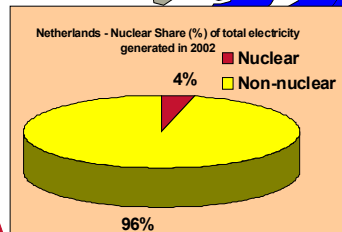


[NB04.17-9] **Switzerland:** The possibility of constructing a new nuclear power plant in the country, to come on line by 2025, is being considered by an interim working group at AXPO, an umbrella organisation of the main utilities serving north-eastern and central Switzerland. Such a plant would compensate for the loss of the 1132 MWe at the Beznau-1 and -2 units and the Muhleberg plant, which are seen as reaching the ends of their lifetimes after some 50 years of operation. Hans Rudolf Gubser, leader of the interim group and former head of the nuclear section of Nordostschweizerische Kraftwerke AG (NOK), said that **a future nuclear plant looks 'viable'**. The process for licensing and constructing a new power plant in Switzerland takes some 20 years.

## The Netherlands, Belgium



	Number of units in operation	Net capacity MWe	Number of units under construction	Net capacity MWe
Netherlands	1	0,449	-	-
Belgium	7	5,801	-	-



## The Netherlands, Belgium

### The Netherlands

- In 2003 the new three-party coalition government of The Netherlands has decided to keep the last Dutch NPP, Borssele, open until at least 2013 (40 years of operation). Officially, the text of the government agreement reads: "The nuclear power plant Borssele will be closed when its technical design lifetime has ended (at the end of 2013)".
- EPZ aims for 50 (or more) years total operation time, a PLEX program is under development.

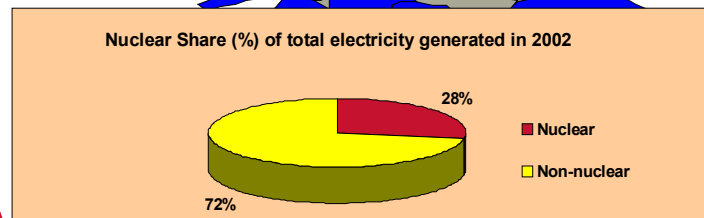
### Belgium

- The nuclear generation is controlled by law since 31st January 2003:
  - Prohibition of construction of new NPPs
  - Limitation of the operation life of the plants to 40 years
  - The Authorities could authorize exceptions to the law
- With the Kyoto targets, Belgium needs nuclear energy generation to balance its generation portfolio.
- Electrabel is presently not conducting nuclear lobbying with the Belgian political authorities. Nevertheless, Electrabel might consider a participation in a French EPR, in order to increase its resource base in France and maintain its presence in nuclear.
- Secretary of State for Trade and Industry intends to cancel phasing out decision from 2003.

## Spain



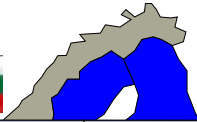
	Number of units in operation	Net capacity MWe	Number of units under construction	Net capacity MWe
Spain	9	8,851	-	-



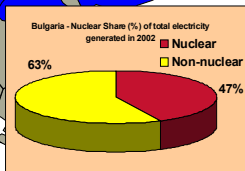
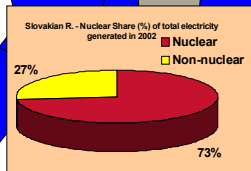
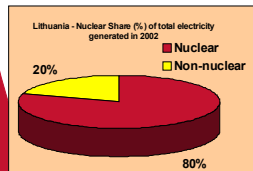
## Spain

- ▶ Current government policy calls for steady shut down of the operating NPPs
- ▶ The government further characterised that «this will be done whenever possible»
- ▶ Current trend as far as the compliance with the Kyoto protocol makes this very unlikely, thus:
  - ◆ Zorita will definitely shut down in April-2006
  - ◆ The other 8 plants will apply for a license extension beyond design life and power up-rating
- ▶ Consequently, we see:
  - ◆ Moderate activity in PLIM, PLEX, power up-rating
  - ◆ High business activity in the second part of the fuel cycle (saturation of spent fuel pools, return to Spain of wastes at Sellafield and La Hague, construction of an intermediate interim fuel storage, storage casks fabrication, etc...)

## Lithuania, Slovak Republic, Bulgaria



	Number of units in operation	Net capacity MWe	Number of units under construction	Net capacity MWe
Lithuania	1	1,185	-	-
Slovakian R.	6	2,442	-	-
Bulgaria	4	2,722	-	-



## Lithuania, Slovak Republic, Bulgaria

### Lithuania

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

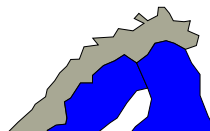
### Slovak Republic

- ◆ Italian ENEL, the new owner of „Slovenska Elektrarne“ is analyzing the feasibility to complete 2 VVER 440 MWe Units at Mochovce

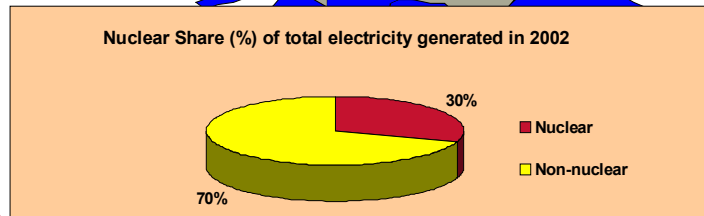
### Bulgaria

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

## Germany



	Number of units in operation	Net capacity MWe	Number of units under construction	Net capacity MWe
Germany	17	20,303	-	-



## Germany

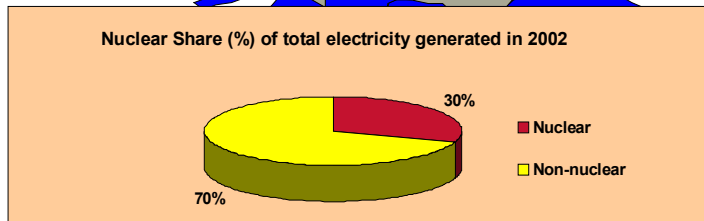
- ▶ According to the red-green government, among other reasons the phase-out decision is based on the fact that a huge majority of Germans refuse the use of nuclear power

The recently published Allensbach opinion poll shows a different picture:

- ◆ 52 % of Germans believe that within the next 20 years the share of nuclear power in Germany will remain stable or even increase.
- ◆ 80 % of Germans believe that this is even more true for Europe and the world
- ▶ But: A responsible and reliable waste management including well-defined solutions for final storage of high level radioactive waste is needed
  - ◆ 81 % of Germans believe that nuclear power plants involve risks resulting from the waste produced.
  - ◆ 71 % of Germans believe that the question of waste disposal has not been resolved.
- ▶ Due to a crisis of the recent red-green government new elections in Germany are likely to be performed on September 18th, 2005. The conservatives are clearly in favour of nuclear and the phase-out decision will be re-discussed.



	Number of units in operation	Net capacity MWe	Number of units under construction	Net capacity MWe
Finland	4	2,656	1	1,600



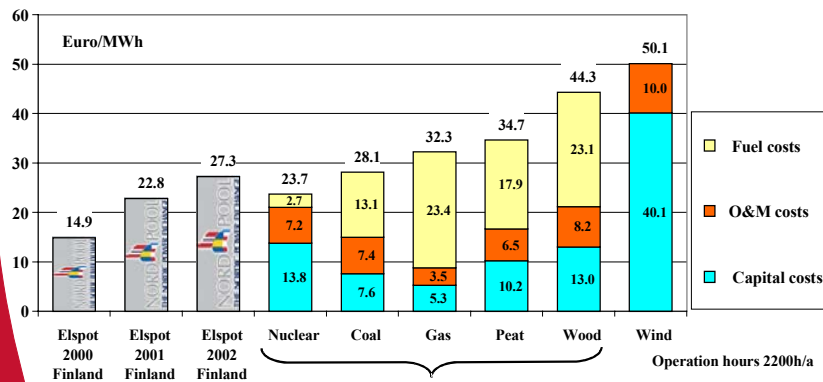
**Why additional Nuclear Power?**



**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

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

**The EPR Competitiveness**



**The EPR-generated MWh cost is 10% lower than in the most recent reactors in operation**

## Finland Olkiluoto 3 Project – Time Schedule

- ▶ Oct. 1, 2002 TVO issues invitation to tender for fifth nuclear power plant
- ▶ March 31, 2003 Tenders submitted to TVO by various vendors
- ▶ Oct. 15, 2003 TVO declares the Framatome ANP / Siemens consortium as the preferred vendor
- ▶ Dec. 18, 2003 Signing of contract
- ▶ Jan. 1, 2004 Contract comes into effect
- ▶ Feb. 17, 2005 Construction license issued by the Finnish government
- ▶ 2009 Start of commercial operation

## Project Olkiluoto 3 Project Status (1/5)

### Procurement of Primary Components

- ◆ Reactor Pressure Vessel Forgings at Japan Steel Works (JSW)

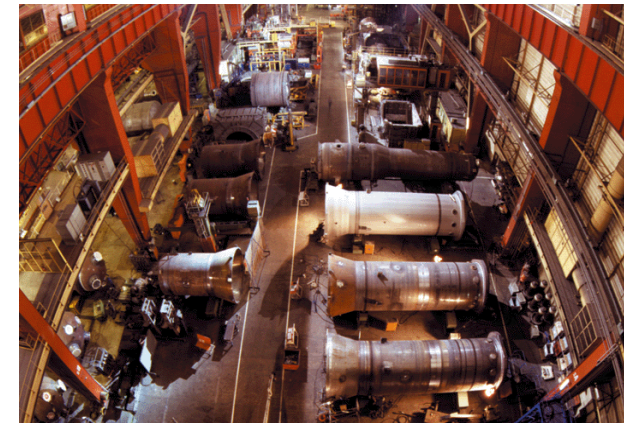


## Project Olkiluoto 3 Project Status (2/5)

- ▶ Manufacturing of steam generator tube plate and main steam dome at Framatome ANP Chalon Works

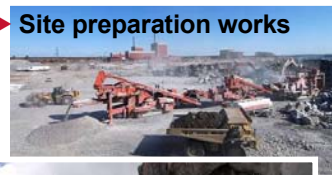


## Project Olkiluoto 3 Project Status (3/5)



## Project Olkiluoto 3 Project Status (4/5)

### ▶ Site preparation works



- ▶ Excavation and site preparation works (Owner's scope)
- ▶ Since October 2004 permanent personnel of the Consortium is present on site

## Project Olkiluoto 3 Project Status (5/5)

Supplier's site offices 1/05



Erection of heavy crane 3/05



Reinforcement for base slab 4/05



Precast elements for gallery 5/05



## OLKILUOTO, 2009



## Perspectives for New NPPs

### ● 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) as one of the keys for
- ▶ Public acceptance

## Nuclear power as part of an energy mix

### Advantages of nuclear power

- Safe operation of nuclear power plants
- Production costs competitive with gas and coal
- Influence of fuel costs comparably small
- No greenhouse gas emissions

Part of an energy mix: nuclear power is contributing to climate protection and fits into the target of “sustainable development”)

## Prominent Environmentalists Support Nuclear Energy

**„Global warming is now advancing so swiftly that only a massive expansion of nuclear power as the world’s main energy source can prevent it overwhelming civilisation“**

*James Lovelock, leading environmentalist, creator of the Gaia theory, The Independent, May 24, 2004*

**„I have been a committed environmentalist for many years. It is because of this commitment and the graveness of the consequences of global warming for the planet that I have now come to the conclusion that the solution is to make more use of nuclear energy.“**

*Hugh Montefiore, former Bishop of Birmingham and former chairman and trustee for Friends of the Earth, The Tablet, October 23, 2004*

**„Nuclear energy is the only nongreenhouse gas-emitting power source that can effectively replace fossil fuels and satisfy global demand“**

*Patrick Moore, Founder of Greenpeace, The Miami Herald, January 30, 2005*