

***International Conference on Opportunities  
and Challenges for Water-cooled Reactors  
in the 21st Century  
IAEA, Vienna – 27/30 October 2009***

# **Nuclear Energy Status and Trends**

## **Role of Water-cooled Reactors**

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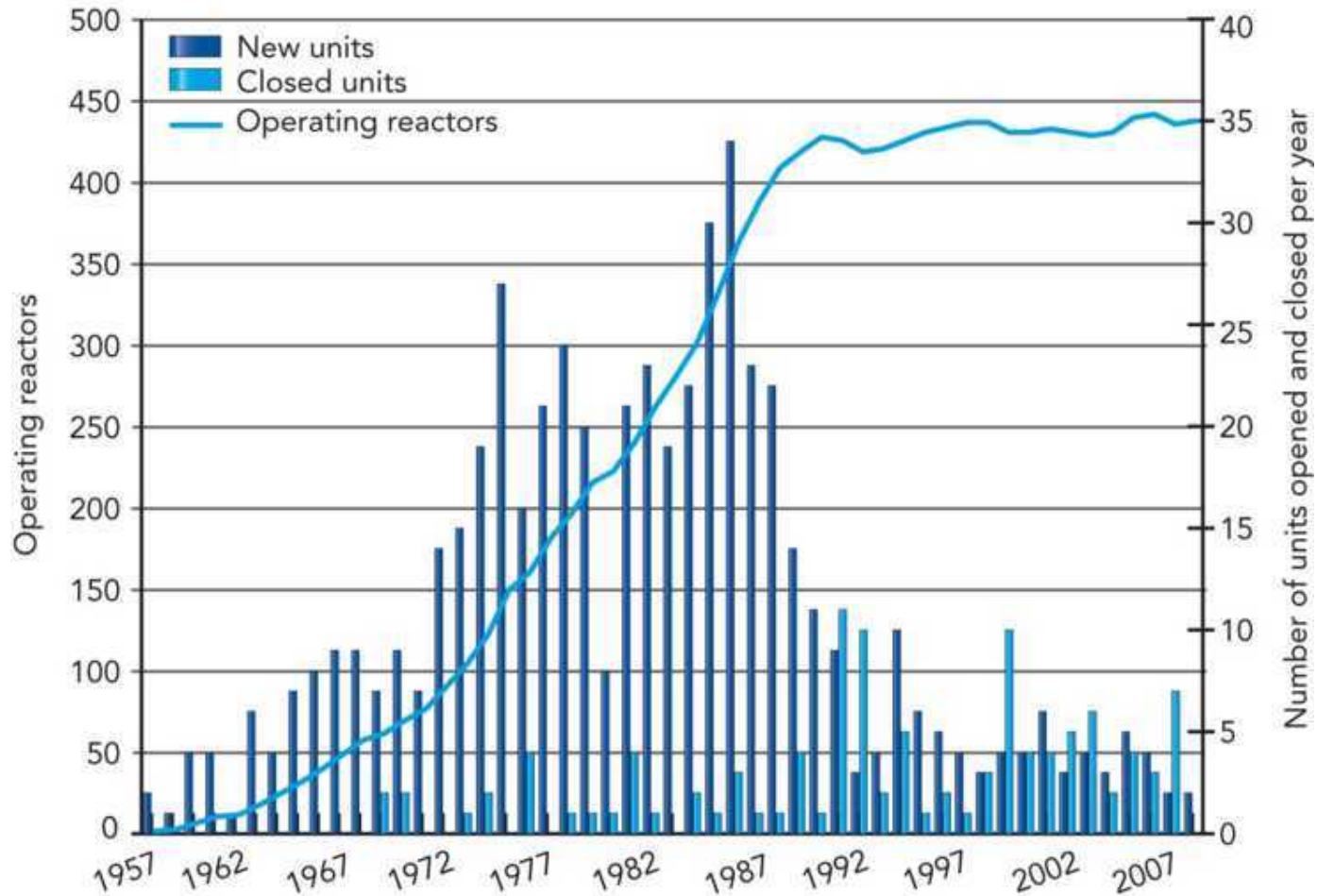
# Overview

- ❑ **Nuclear Energy Status & Outlook**
- ❑ **Financing New Builds**
- ❑ **MDEP**
- ❑ **Global Energy Policy**

# Nuclear Energy Status

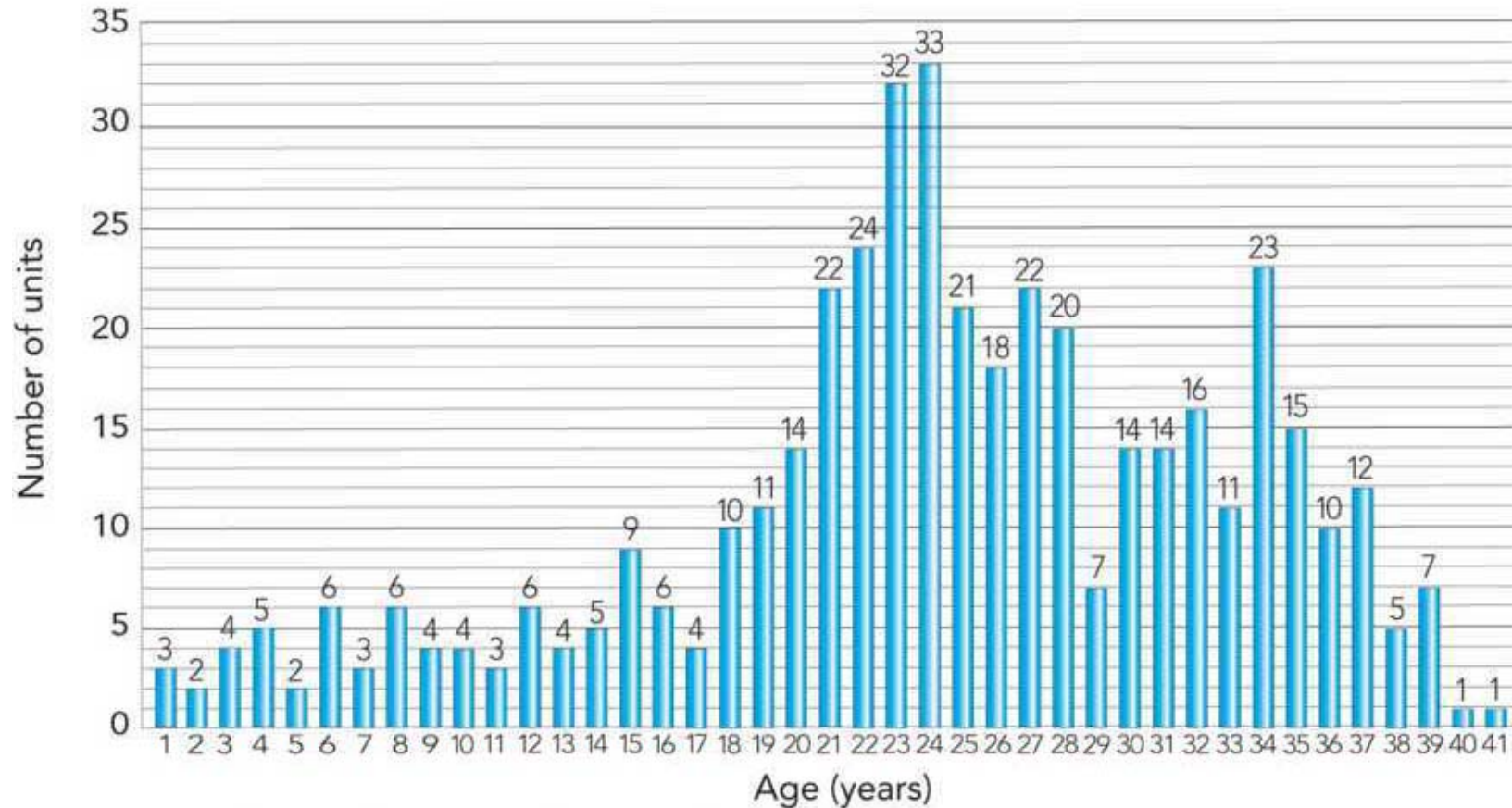
- ❑ **15 % of the world electricity supply (2008)**
  - **22 % for OECD countries**
- ❑ **438 reactors in operation – 372 GWe**
- ❑ **> 90 % of the fleet: water-cooled reactors**
- ❑ **Accumulated operating experience**  
**~14.000 reactor.years**
- ❑ **High average availability factor**
  - **>90% in Finland, South Korea, US**
- ❑ **> 50% less than 25 years old**

# History of Worldwide Reactor Additions and Closures - 1957 to 2007



Sources: based on data taken from NEA (2006a) and NEA (2008a).

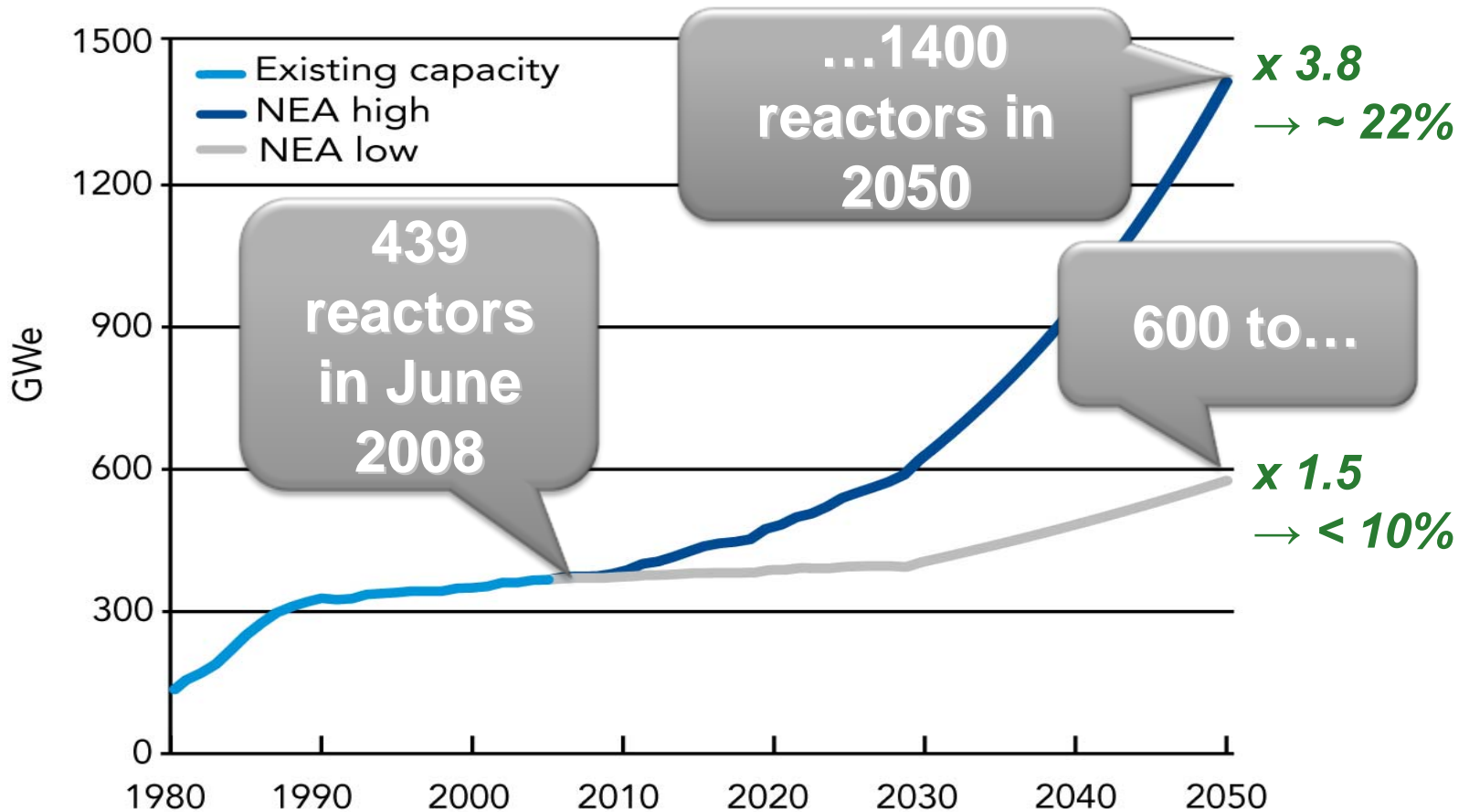
# Number of Operating Reactors by Age (as of Jan 2008)



Note: The age of a reactor is determined by its first grid connection.  
Source: IAEA (2008a).

# Nuclear Energy Outlook (NEO)

Global nuclear capacity in the NEA high and low scenarios



***This expansion will mainly rely on Gen III/III+ LWRs***

# Challenges and Future Trends

- ❑ **Financing capital-intensive nuclear units**
- ❑ **Enhancing economic and safety performance simultaneously**
- ❑ **Implementing HLW repositories**
- ❑ **Strengthening involvement of civil society on nuclear energy issues**
- ❑ **Developing innovative reactors and fuel cycles**
- ❑ **Penetrating new markets (hydrogen, heat, potable water)**
- ❑ **Securing qualified human resources**



# Financing NPPs (1) - Risk Factors

- ❑ **Political and policy support**
- ❑ **Licensing and regulatory system**
- ❑ **Nuclear liability & insurance**
- ❑ **Construction risks**
  - **High capital costs (60/25/15) & technical complexity**
- ❑ **Electricity market conditions/regulation**
  - **High capacity factors needed (baseload)**
- ❑ **Plant operating performance**
- ❑ **Nuclear fuel supply**
- ❑ **Spent fuel, waste & decommissioning**
  - **Need for clear solutions**



## Financing NPPs (2)

- ❑ **In many countries, NPP investment is too large for private sector utilities**
  - **Twin-unit ~10 G\$ , with risks of overruns**
  - **Only a few US utilities have sufficient market capitalisation to take such risks**
  - **Some European utilities are larger**
  - **Credit ratings & share prices could be hit**
- ❑ **Evolutionary designs, but still FOAK risks**
- ❑ **Financial risks of delays during construction**
- ❑ **Likely to be more difficult in deregulated electricity markets (*long repayment period*)**
- ❑ **Non-recourse (project) financing very unlikely in many countries**

# Key Role for Governments

- ❑ Clear and sustained policy support, as part of long-term national energy strategy (*broad-based*)
- ❑ Mitigate or remove risks in their control
  - Efficient & effective regulatory system
  - Plan for waste & spent fuel managt, with clear fin. arrangements
  - Liability
- ❑ Cost of capital is key
  - Government guarantees or other support
  - Export Credit Agencies could also help
  - In non-OECD countries, World Bank & other multilateral lenders
- ❑ Work with utilities, investors & industry to facilitate nuclear projects
- ❑ Electricity market appropriate for LT investments
- ❑ Suitable CO<sub>2</sub> pricing/trading arrangements

*To help reducing the risks*

## **Impact of Present Financial Crisis**

- ❑ Does not alter basic findings of report, NPP financing issues remain the same**
- ❑ But both public & private sector finance will be tight in next few years**
- ❑ Will also reduce energy demand, and has led to lower oil & gas prices**
- ❑ May lead to delays in decision-making**
- ❑ Commodity & labour prices may moderate**
- ❑ Governments may be more willing to invest in strategic industries**

# Multinational Design Evaluation Programme (MDEP)

*A multinational initiative to develop innovative approaches to leverage the resources and knowledge of mature, experienced national authorities who are, or will shortly be, undertaking the review of new power reactor designs*

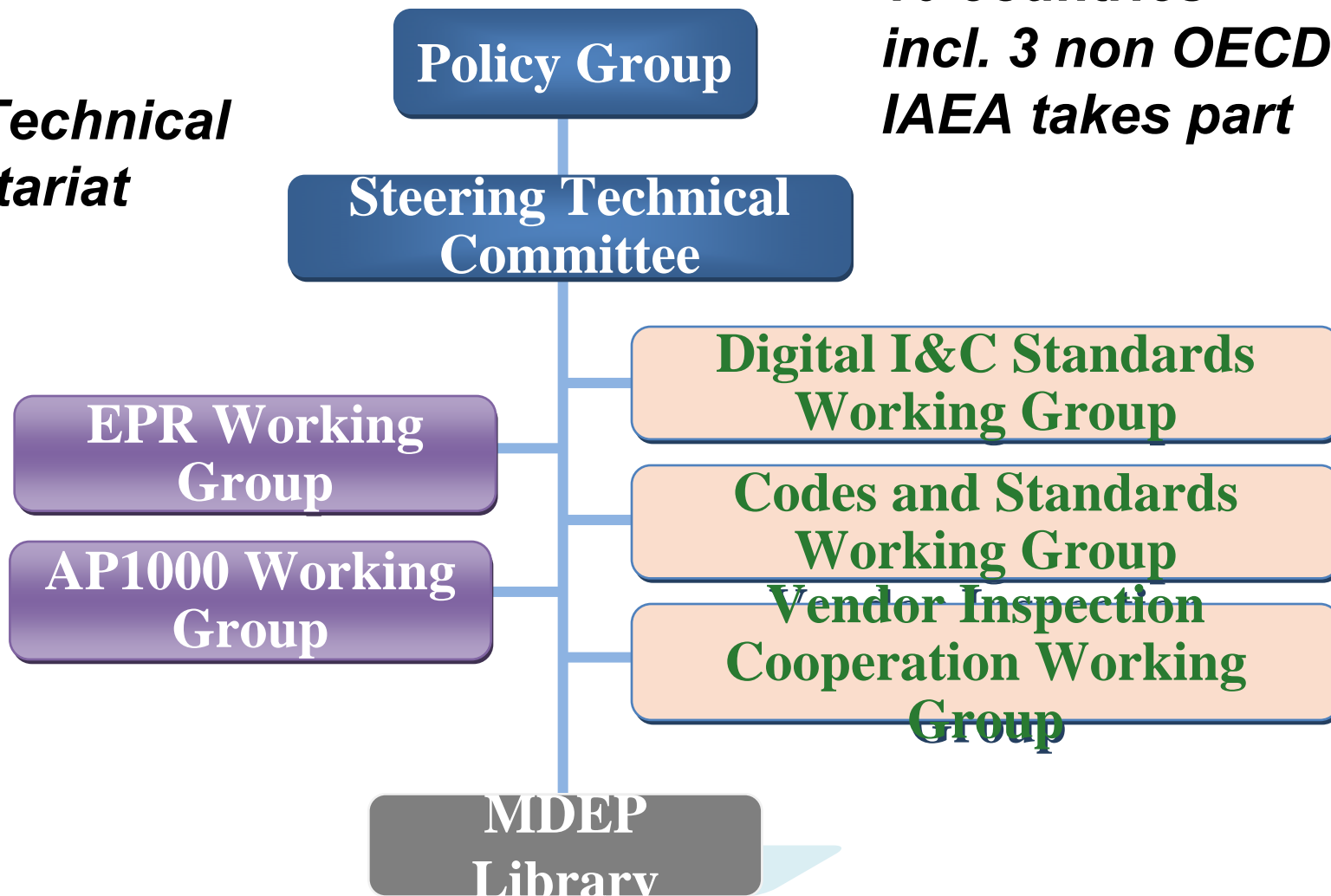
**Expected outcomes: Setting up an enhanced cooperation among regulators**

- To improve the effectiveness and efficiency of regulatory design reviews
- To raise the safety assessment quality and the safety level
- To facilitate convergence of regulatory requirements
- To recommend « good practices »

# MDEP Organisation

**NEA Technical Secretariat**

**10 countries  
incl. 3 non OECD  
IAEA takes part**



# Some MDEP Highlights

- ❑ First joint vendor inspection
- ❑ Development of common positions in area of digital I&C
- ❑ Identification of similarities and differences in codes for pressure vessels
- ❑ MDEP library
- ❑ First MDEP conference – 10/11 Sept 09, Paris
  - non MDEP regulators, industry rep., standards developmt. org.

*MDEP structure and process are an effective tool*

*National regulators retain sovereign authority for all licensing and regulatory decisions*

# *Global energy policy*

## Current world energy model not sustainable

- It prepares a “**dirty, unsecure and expensive**” future
- The challenge for all countries is to put in motion a transition to a more secure, **lower- carbon energy system**, without undermining economic and social development.” *World Energy Outlook 2007 (OECD/IEA)*

## Economics of climate change

- “**Doing nothing is not an option**, because its costs and consequences are a multiple of the known costs of action” *Angel Gurría, OECD Secretary-General*

## There is no “silver bullet”

It is essential to keep all low-carbon energy options open and to avoid idolising or demonising any technology



# ***Nuclear energy must contribute***

**Nuclear energy is part of the solution (**triple win**)**

- **Reduction of CO2 emissions**
- **Increased security of energy supply**
- **Economics benefits**

**In this context, it seems crucial to reconsider the role of nuclear energy and to drop its exclusion from the flexibility mechanisms of the Kyoto Protocol”**

*Angel Gurría, OECD Secretary-General*

*IAEA Ministerial Conference, Beijing, April 2009*

# Concluding Remarks

## **Governments have clear responsibilities:**

- **ensure maintenance of the skills base**
- **maintain continued effective safety regulation**
- **foster progress on facilities for waste disposal**
- **maintain and reinforce international non-proliferation arrangements**
- **provide the stability (policy, regulatory, fiscal) investors require**  
**to enable nuclear energy's role in future sustainable energy mixes**

***Thank you for your attention***