Agence pour l'énergie nucléaire
Nuclear Energy Agency

ENERGY FOR THE 21ST CENTURY

the Potential for Nuclear Power

Luis Echávarri
Director-General, OECD Nuclear Energy Agency

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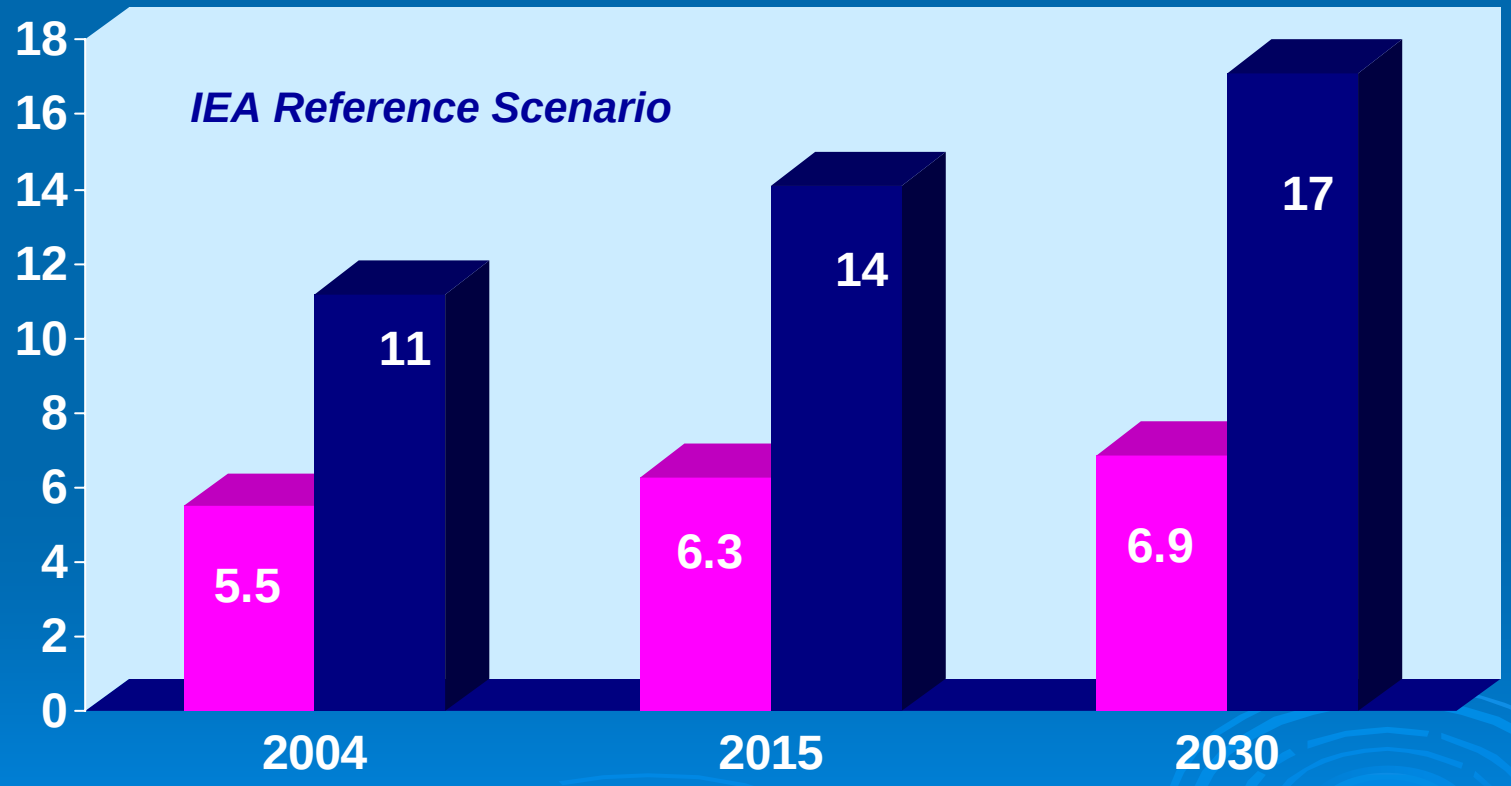
Outline

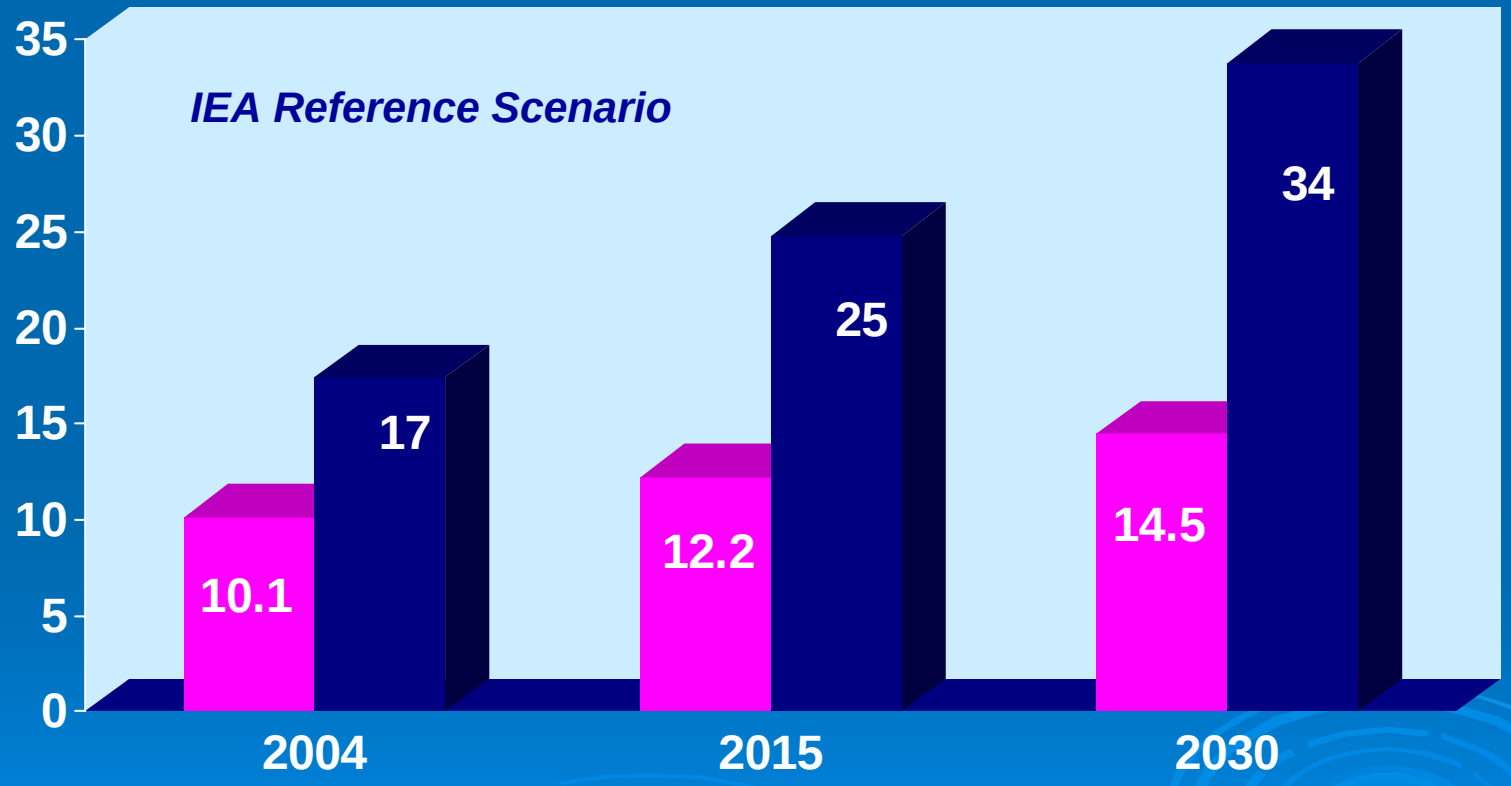
- Energy demand and supply
- Potential for nuclear energy
  - *Resources and security of supply*
  - *Addressing climate change concerns*
  - *Competitiveness*
- Challenges
  - *Implementation of coherent policies*
  - *Building infrastructure*
  - *Financing*
- R&D
  - *Towards the 4th generation of nuclear systems*
- Concluding remarks

Primary Energy Demand (Gtoe)



Source: IEA 2006

Electricity generation (10^3 TWh)

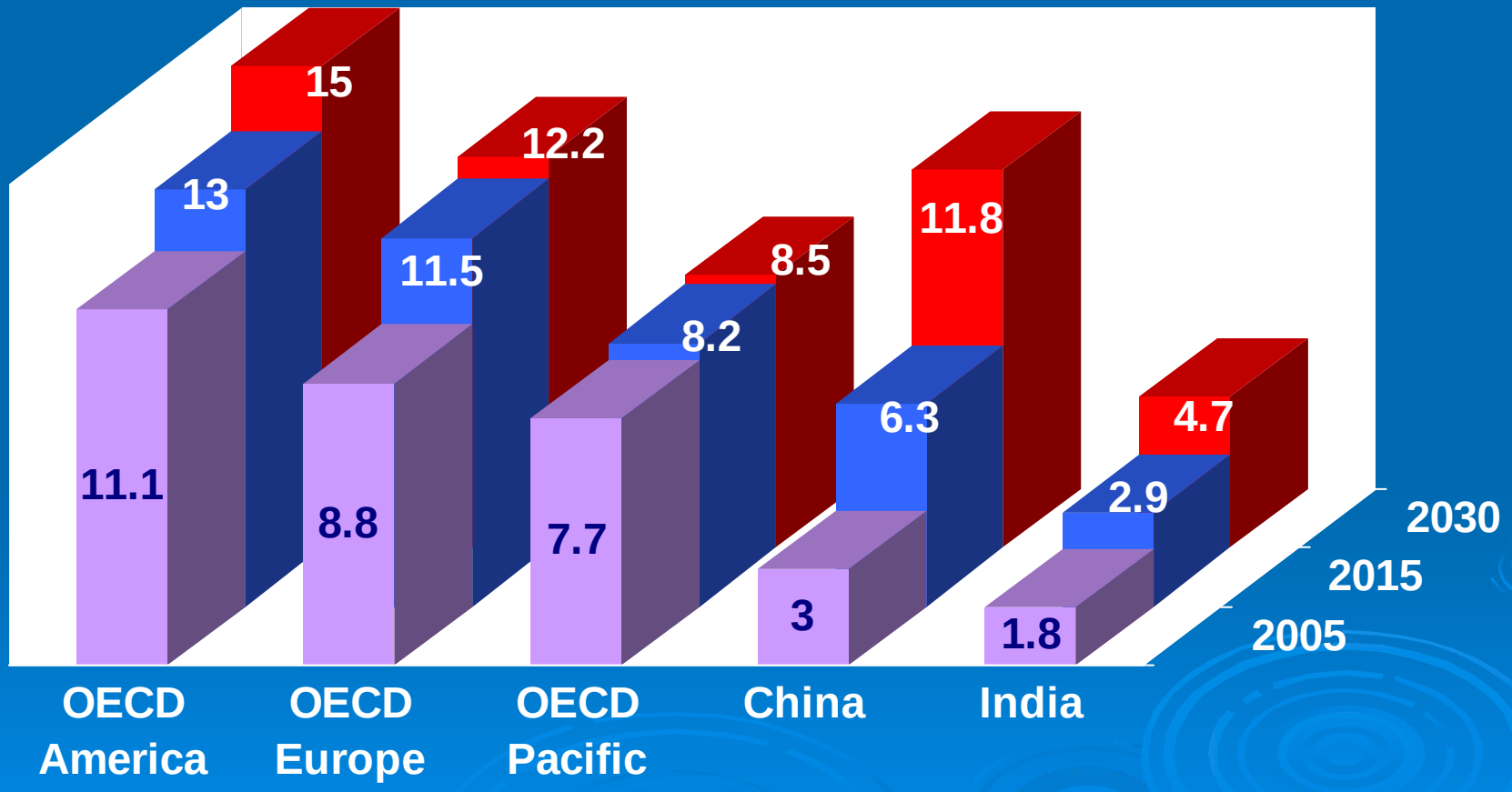


Source: IEA 2006

Nuclear energy & security of supply

- Nuclear energy is essentially a domestic source
- Fuel resources are plentiful and well distributed worldwide
- Natural uranium price is not a major driver in nuclear electricity generation cost

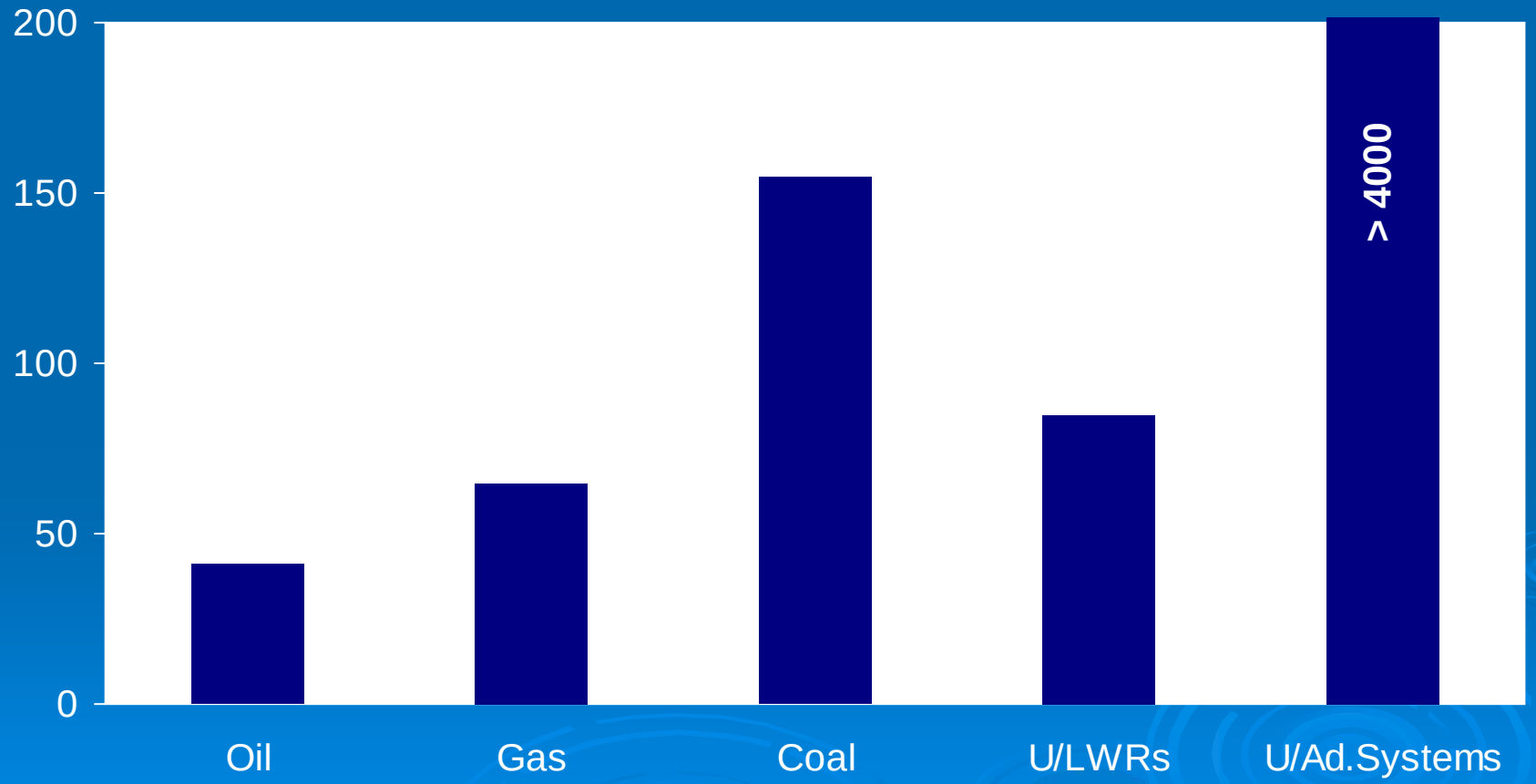
Net oil imports (mb/d)



Source: IEA 2006

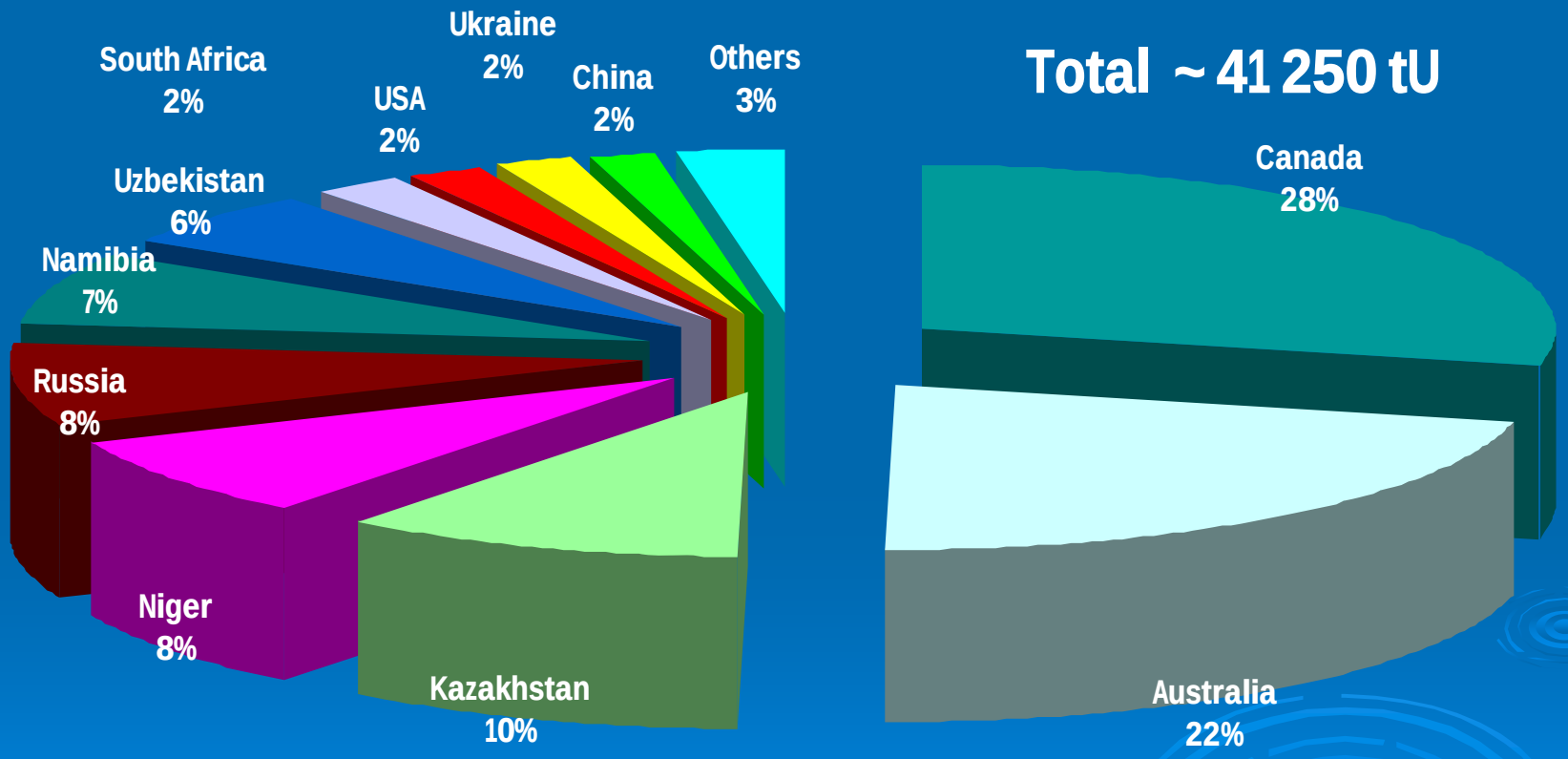
Lifetime of energy resources

(years of 2005 demand)



Sources: NEA/IAEA 2006, BP 2006

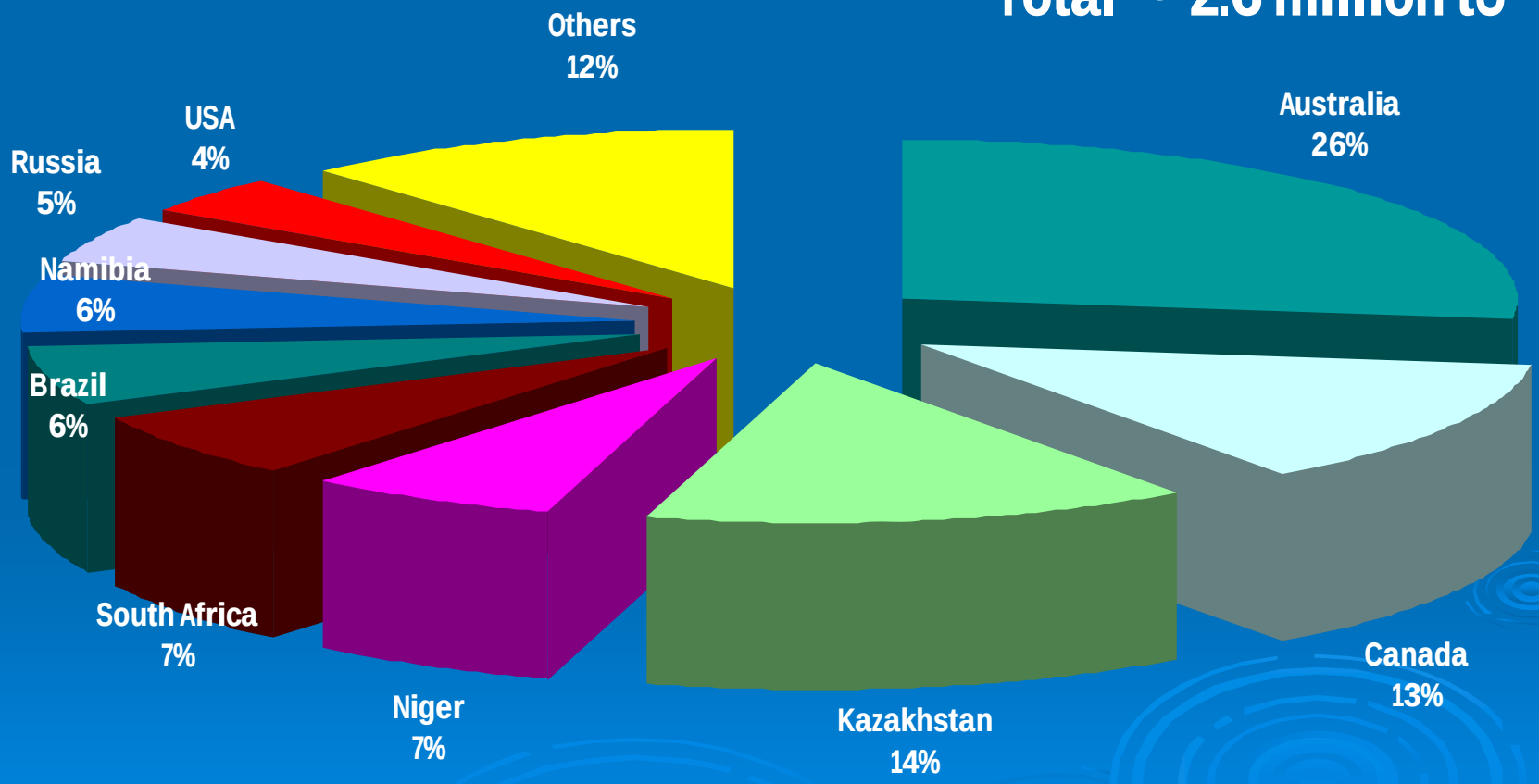
Uranium production 2005



Source: NEA & IAEA 2006

Uranium Reserves (RAR<80$/kgU)

Total ~ 2.6 million tU

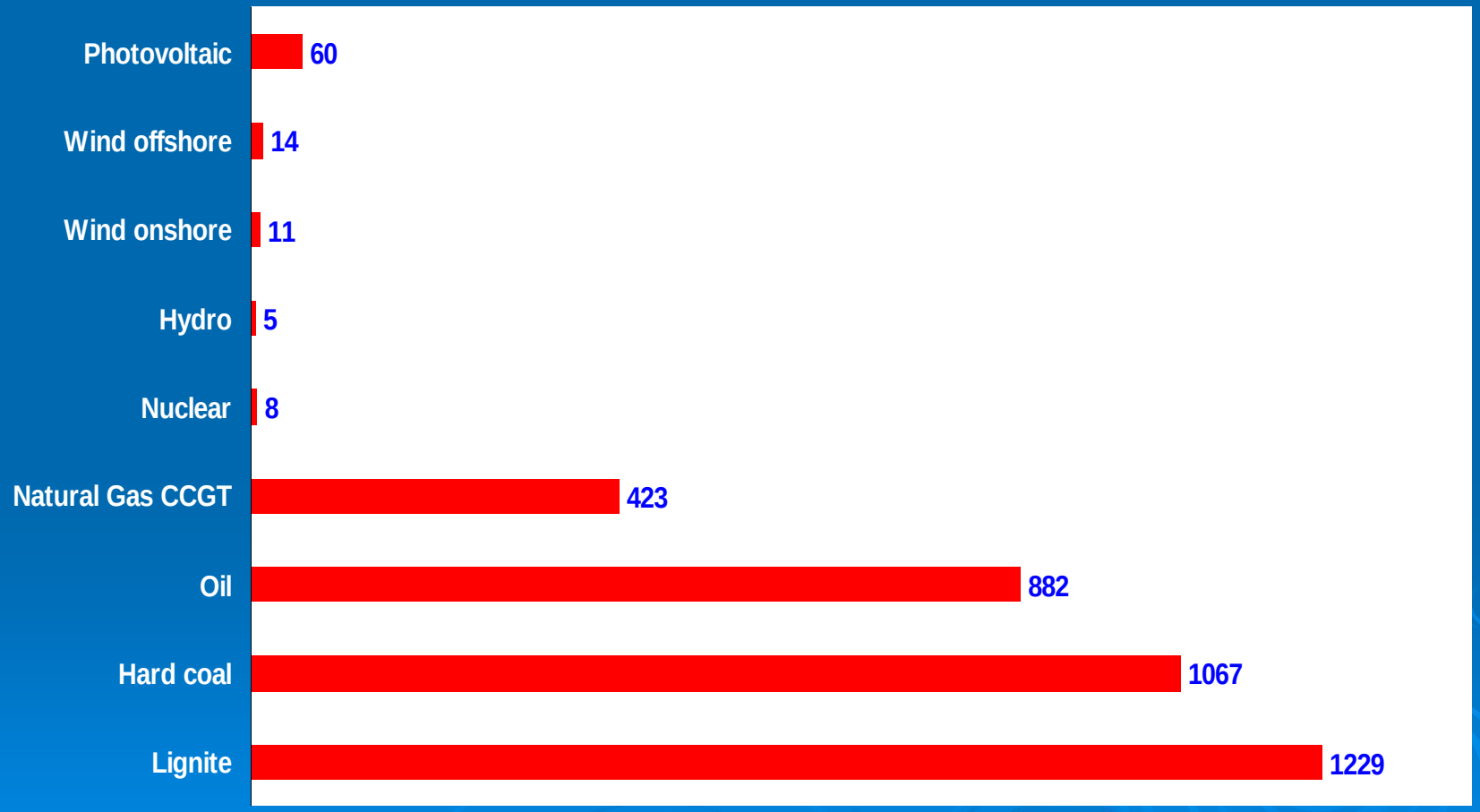


Source: NEA & IAEA 2006

Nuclear energy & global warming

- Nuclear energy is nearly carbon free
- Nuclear energy is one of the cost effective options available today for reducing carbon emissions
- The Kyoto targets are unlikely to be met
- In the long-term, nuclear energy systems could make a significant contribution to less carbon intensive economies

Average GHG emissions from electricity chains in Europe (g CO_2 eq./kWh)

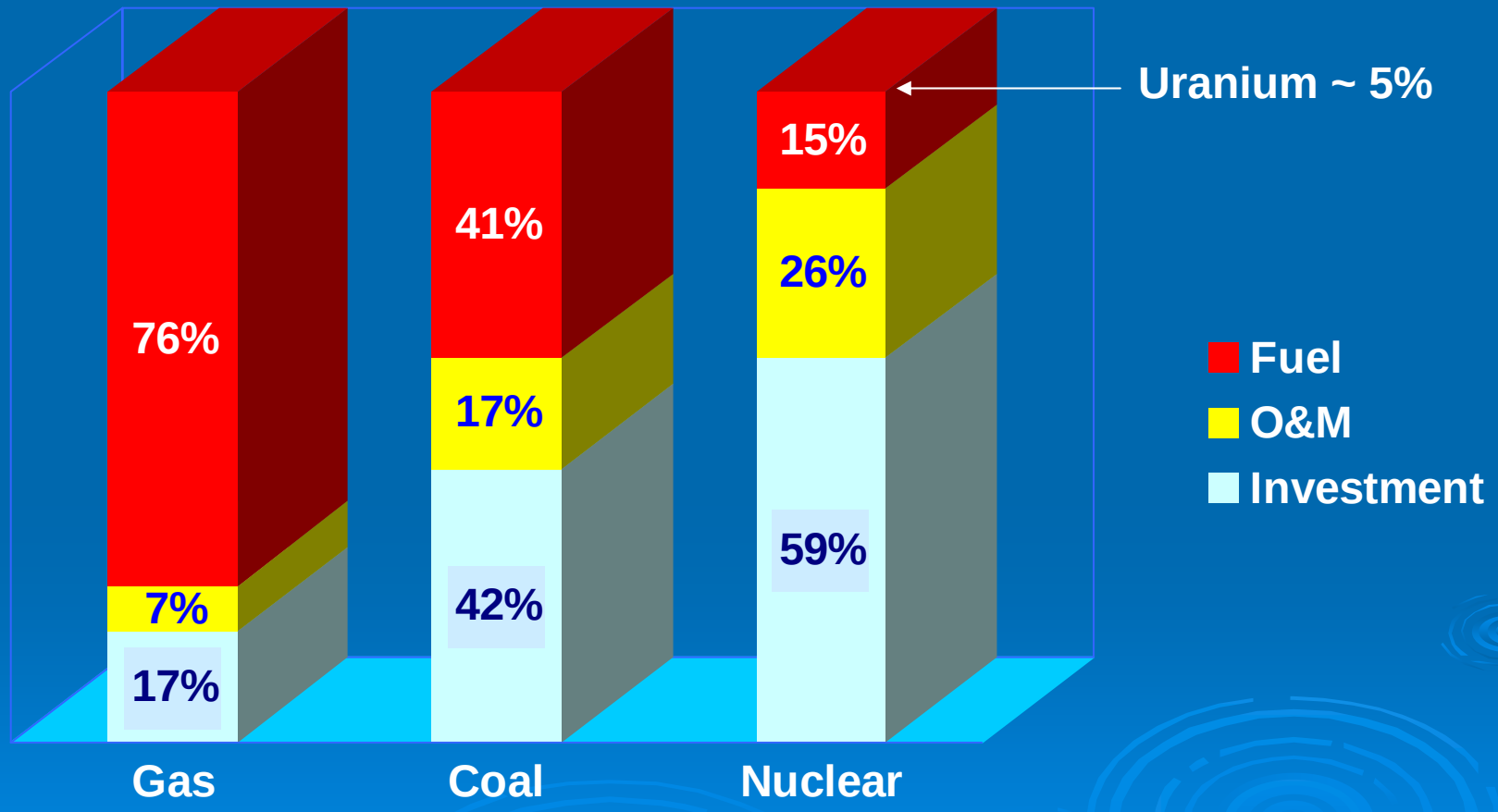


Source: NEA 2007

Economics

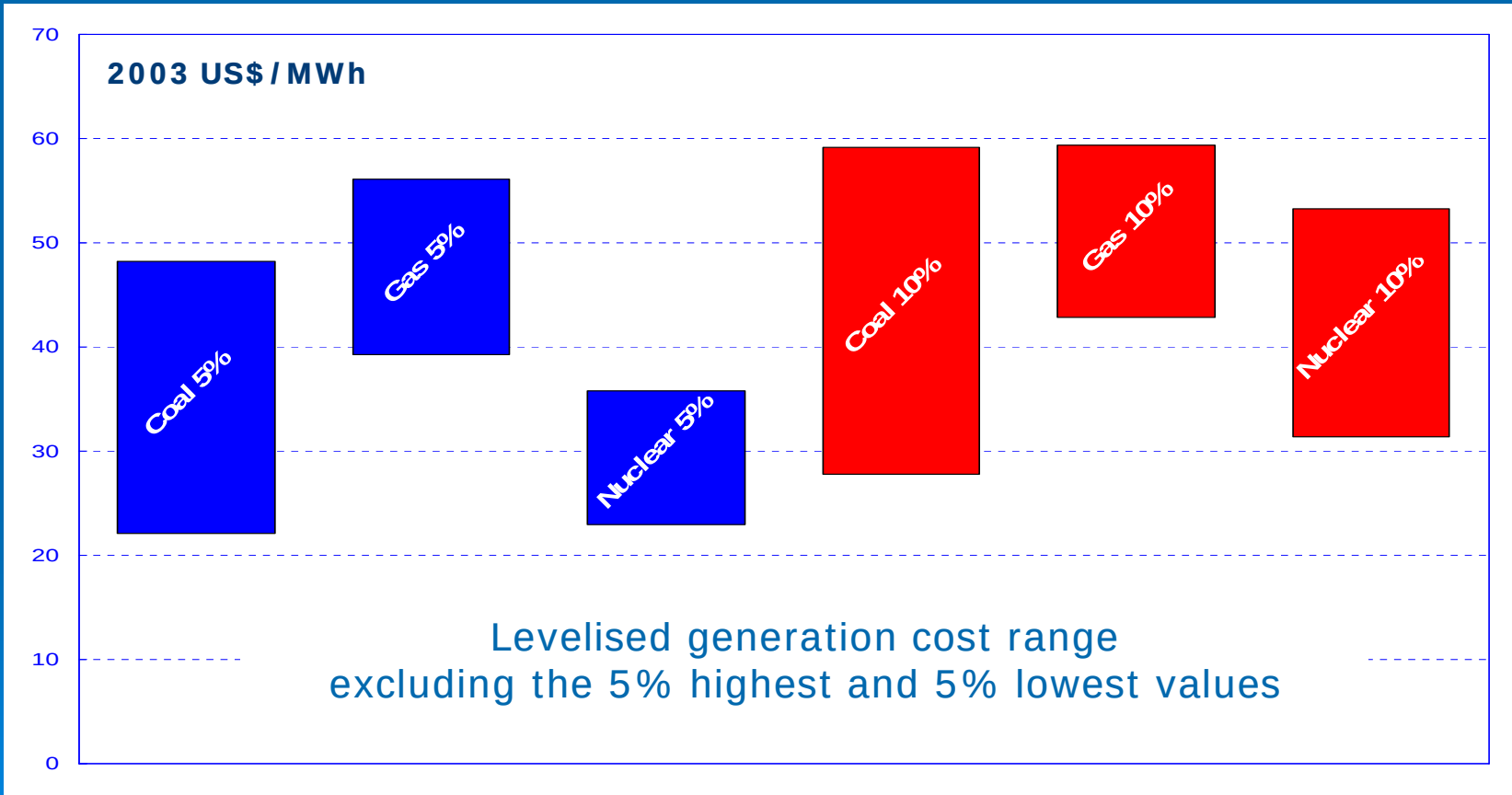
- Nuclear energy is competitive
- The cost structure of nuclear electricity guarantees long-term stability
- Most externalities have been internalised in nuclear generation costs
  - *Adding a carbon value to fossil fuelled electricity would enhance the competitive margin of nuclear*
- Capital costs are high, not easy to finance

Generation cost structure



Source: NEA & IEA 2005

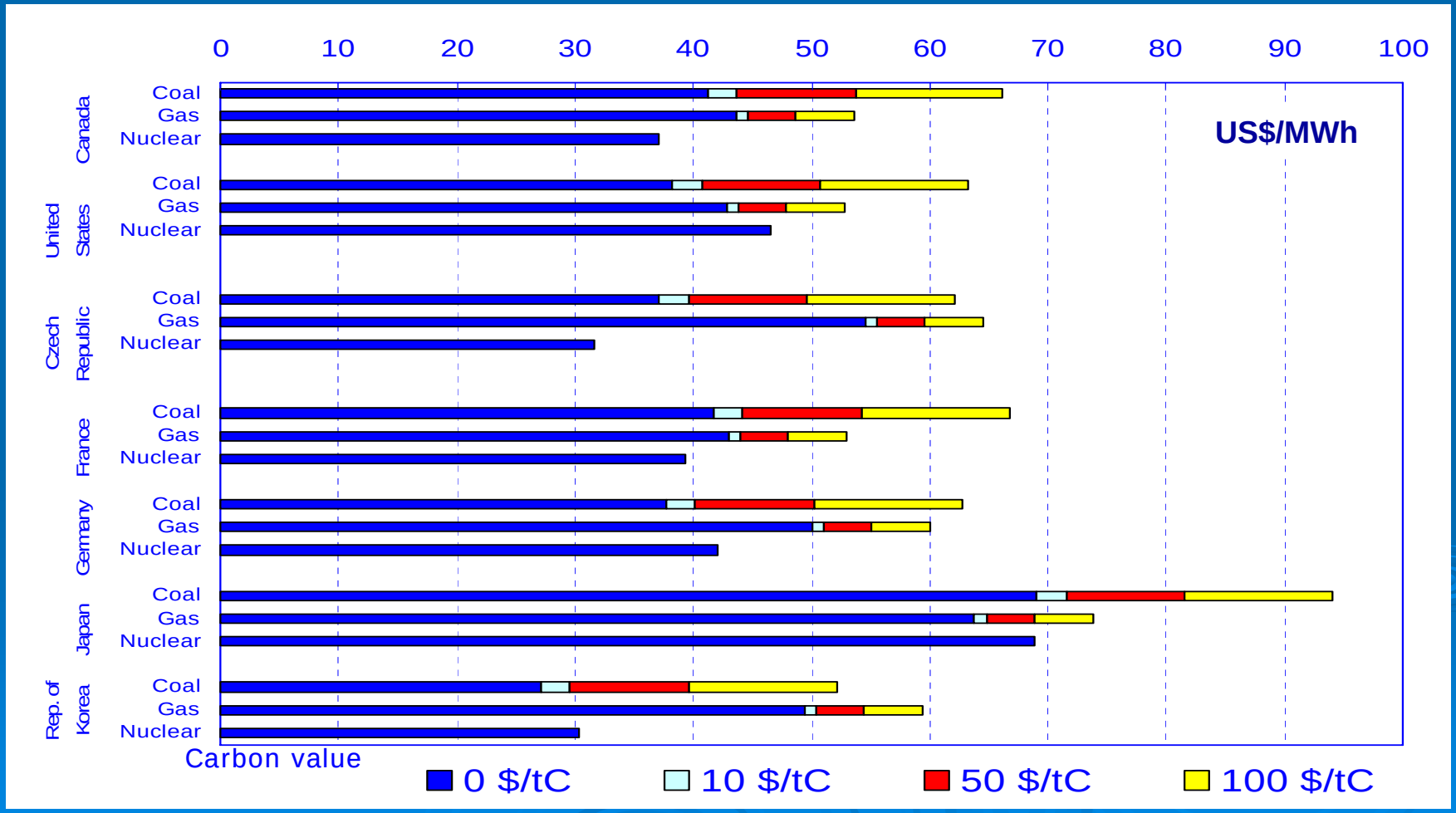
Projected costs of generating electricity - 2005 OECD study



Source: NEA & IEA 2005

Impact of carbon values on generation costs

at 10% discount rate



Signs of nuclear renaissance

- Olkiluoto 3 (4) in Finland
- Flamanville 3 in France
- US Energy Act, GNEP
- Moves towards new orders in Canada
- UK White Paper 2007
- GIF and INPRO
- Nuclear programmes in China, India, Japan, Korea, Russia
- Many emerging countries showing interest in nuclear

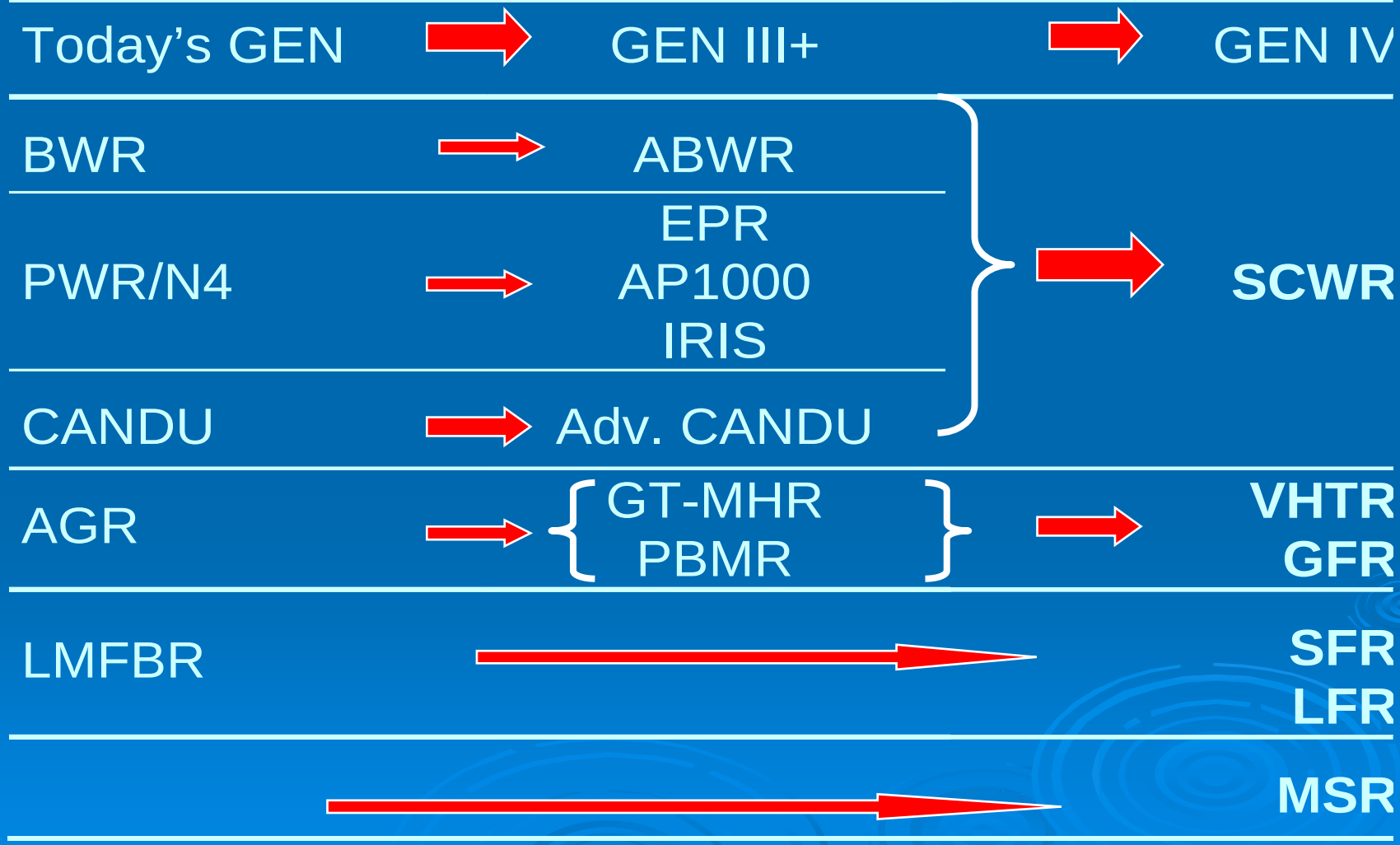
Challenges

- Policy issues
  - *Coherent regulatory framework and energy policy*
  - *Involvement of stakeholders in decision making*
  - *Implementation of HLW repositories*
- Infrastructure and financing
  - *Education and training, knowledge management*
  - *Building industrial capability*
  - *Financing reactors and fuel cycle facilities*

Nuclear energy R&D goals

- Even better economics
- Enhanced safety and reliability
- Sustainable resource utilisation
  - ✓Lower U consumption
  - ✓Smaller volume and lower toxicity of waste
- Strengthened physical protection and proliferation resistance

Evolution of nuclear energy systems



International cooperation

- Joint R&D efforts to develop innovative nuclear systems (e.g., GIF, INPRO)
- International approaches for enhancing security of nuclear fuel supply while reducing proliferation risks (e.g., GNEP, RI)
- Cooperation to seek and achieve convergence on reference regulatory practices (e.g., MDEP)

Concluding remarks

- Nuclear energy can play a significant role in energy supply during the 21st century
- Key factors for the future include
  - Energy policies
  - Industrial capacity building
  - R&D in support of current and next generations of nuclear systems
- International cooperation enhances the effectiveness of national efforts