

THE 2014 NUCLEAR ROADMAP

Technology Roadmap

Nuclear Energy

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2010 Nuclear Roadmap

The major topics covered were:

- Status and near-term deployment of current designs
- Required growth to fulfil the Blue Map requirements
- Technology developments to 2050
- Policy, financial and social aspects
- Action Plan
- Technology development included:
 - Near-term evolutions, waste, Gen IV, SMRs and co-generation
- Policy, financial and social covered:
 - Legal and regulatory
 - Financing
 - Civil society
 - Capacity building
 - Safeguards and security



Key findings 2010 roadmap

- Nuclear is a proven technology and can play an important role in a low-carbon strategy
- Installed capacity could reach 1 200 GW and supply 24% of the world's electricity in 2050 (ETP 2010)
- Political support and public acceptance are key for implementation of a nuclear programme
- Financing nuclear is another key challenge
- Expansion of nuclear industry capacities and skilled workforce
- In the longer term, GEN IV technologies could reduce costs and improve performance and security



Developments since 2010

- The Fukushima Daiichi accident :
 - Affects on development rates
 - Decisions on accelerating phasing out nuclear capacity
 - Stress tests and associated safety upgrades
 - Impact on costs of upgrading, new build and LTO
- Status of the existing fleet:
 - Capacity affected by phase-outs and premature shutdowns
 - Life extension decisions
 - Accelerated move to Generation III reactors
 - Slow progress of Generation IV
 - Revitalised interest in SMRs, especially in the US
- Fuel cycle:
 - Fuel developments
 - Waste repository progress and EU directive



Developments since 2010

- The increased attention to decommissioning :
 - From shutdown reactors
 - Progress with technologies
 - Funding
 - Waste management
- Financing and markets:
 - Impact of liberalised markets and utility capitalisation
 - Assuring price stability - UK 'strike price' approach
 - BOO financing and increased equity deals
- Fuel cycle – uranium supply:
 - End of Russian-US agreement
 - Large increase in reserves
 - Increased attention to tailings
 - Slow progress on new mines

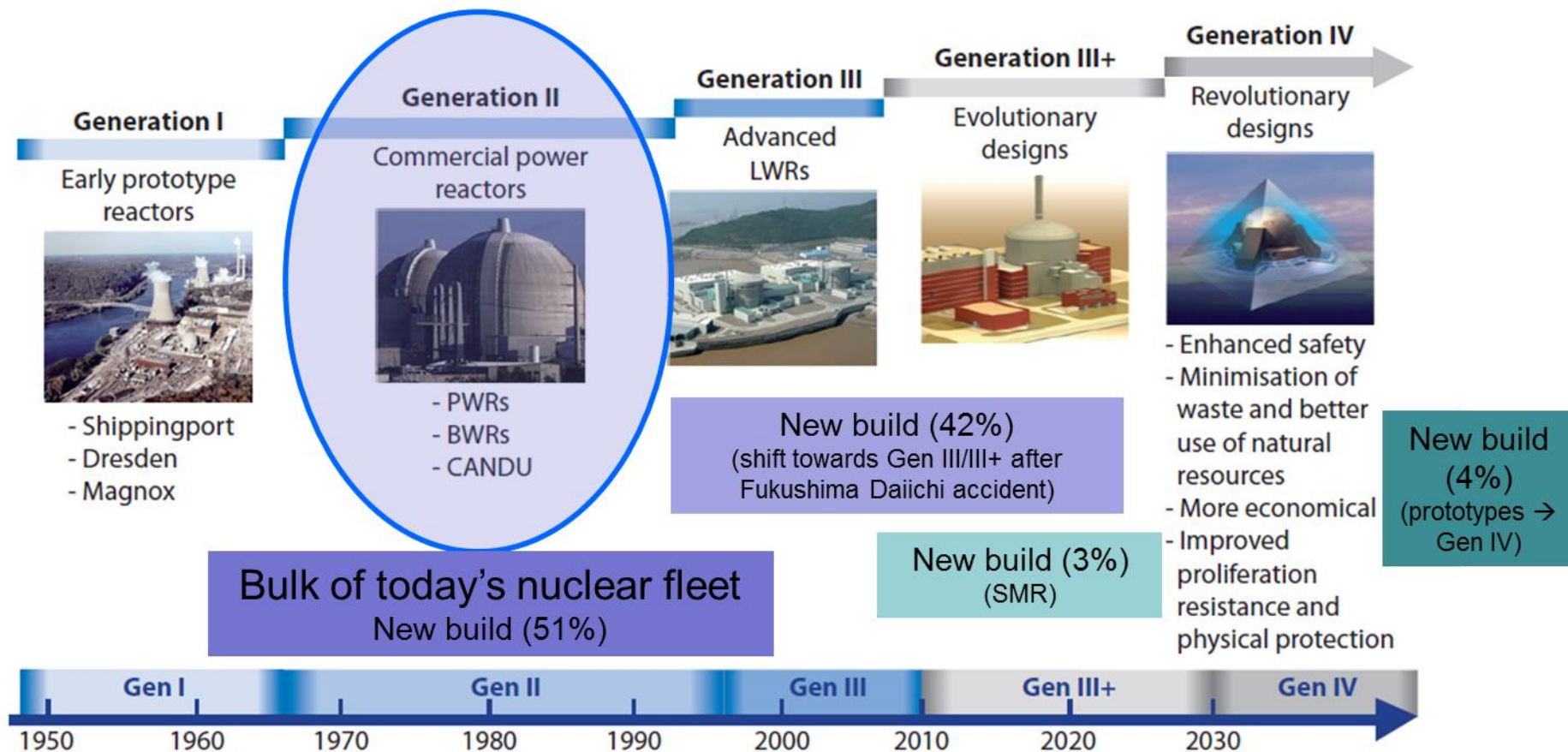


Developments since 2010

- The trends in public acceptability:
 - From steep decline to slow return to support in many countries
 - Waste management
- Climate Change:
 - At political level, lower levels of commitment to reducing GHG emissions – hence potentially less importance to role of nuclear
 - At the same time, growing awareness of extreme weather events, pollution (China) → need for clean, low C technologies will grow
- Vendors:
 - New vendors emerging: ROSATOM foreign sales, China's ambitions
- Financial crisis:
 - Low demand, over capacity (generation), reduced investment capabilities



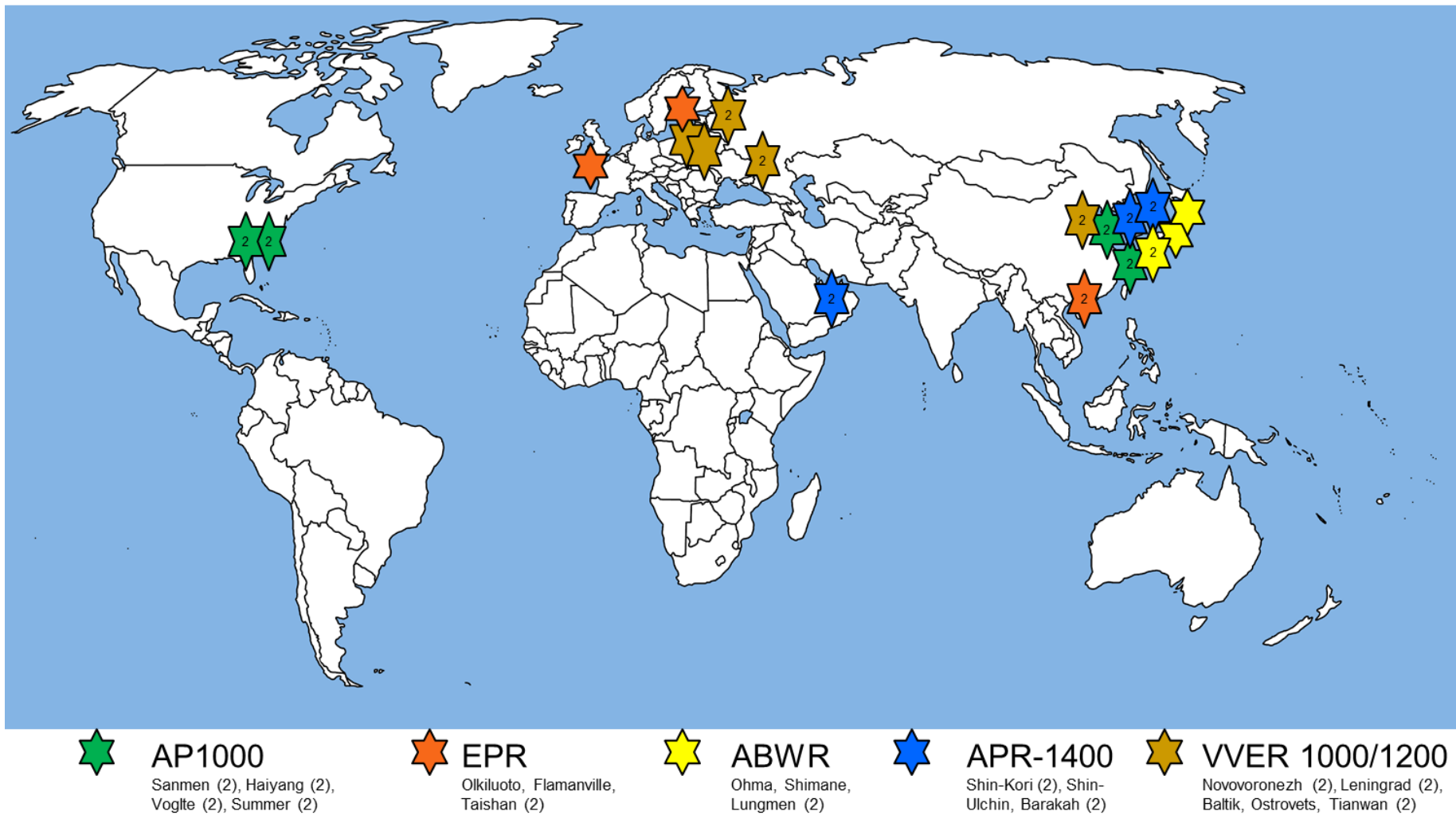
Nuclear Reactors: Generations I to IV





Gen III/III+ reactors under construction

In IAEA/PRIS database (end 2013): 30 out of 72 reactors under construction are Gen III/GenIII+





Objectives of this workshop

- Discuss the latest developments and how they are influencing the nuclear energy sector
- Identify issues that we have not mentioned
- Identify game changers, technological improvements, R&D that can lead to:
 - Faster deployment rate of new build
 - Wider implementation of geological disposal solutions for HLW
 - Safe and cost-efficient decommissioning of shut down facilities
 - Improved economics and competitiveness while maintaining highest levels of safety
- Views of industry, utilities on future prospects, technology evolutions
- Recommendations to policy makers



Discussion: what role for nuclear in Asia?

Reactor:

- Gen II & Gen III/III+ **Session 1a**
- Long Term Operation for existing fleet
- Impact of Fukushima (upgrades, design)
- Small (Modular) Reactors
- Gen IV technologies **Session 1b**
- Non-electric applications ...

Fuel cycle:

- Front end
- Back end:
 - Waste management
 - reprocessing
- Decommissioning ...

Economics & Finance **Session 2/I**

- Competitiveness
- Electricity markets
- Financing mechanisms

Safety & Regulation **Session 2/II**

- Safety standards, requirements, research
- Regulation
- Institutional aspects (new comer countries)

Barriers to Deployment: **Session 3**

- Standardisation
- Harmonisation
- Licensing
- Supply chain
- Human resources ...