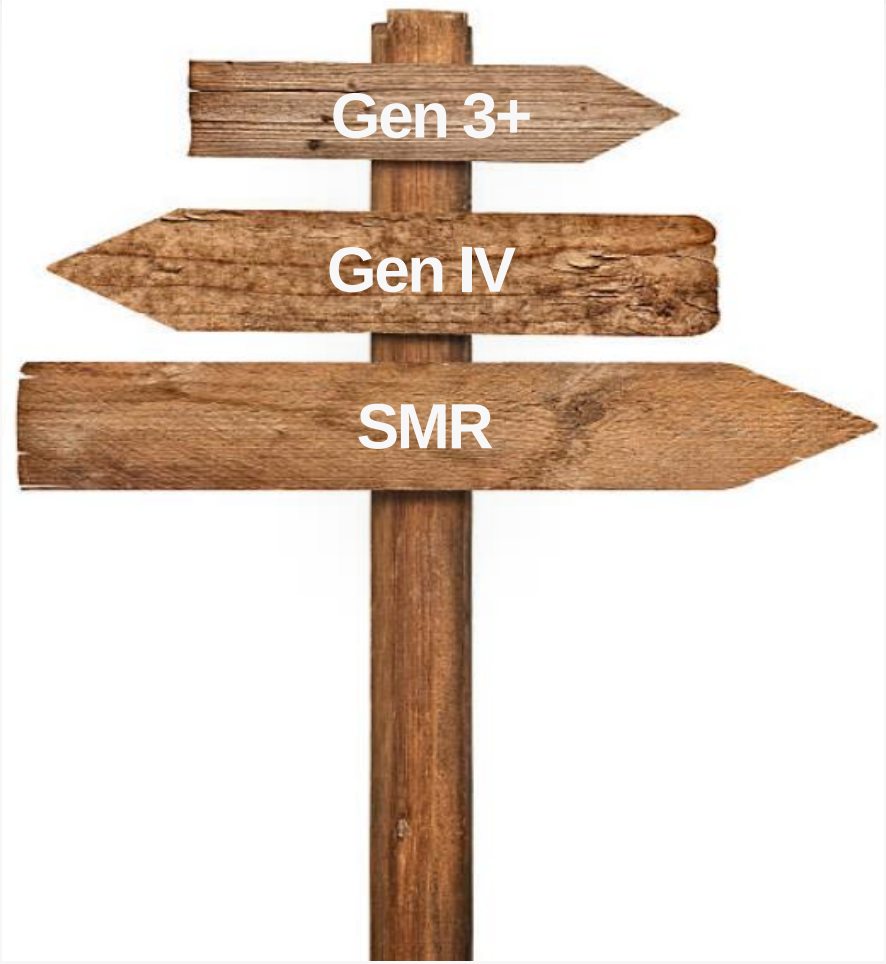
The future of NPPs



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NPP development, milestones

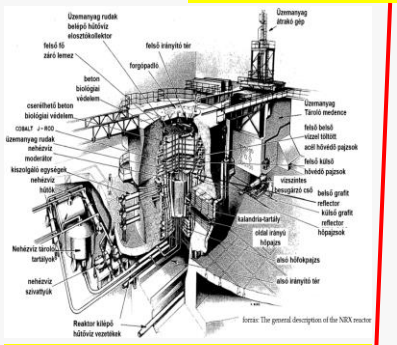
Levels of technological development:

- Gen-I NPPs (1950-60)
- Gen-II NPPs (90% of the global reactor fleet currently in operation)
- Gen-III NPPs (evolutionary types)
- Gen-IV NPPs (innovative types) – NPPs of the future


Windscale 1957

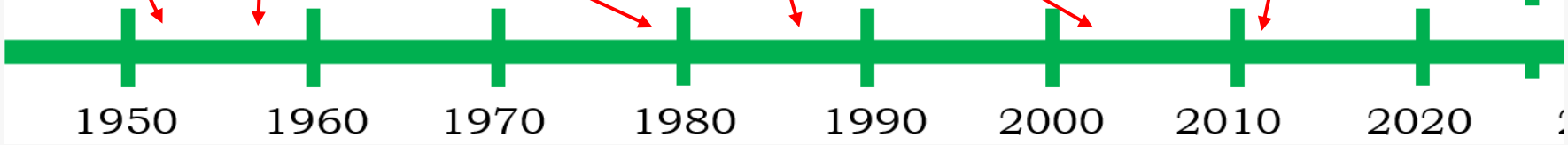

Csernobil 1986


Fukushima 2011


Chalk River 1952


Three Mile Island 1979


Davis-Besse 2002



GenIII (+,++)
GenIV
SMR

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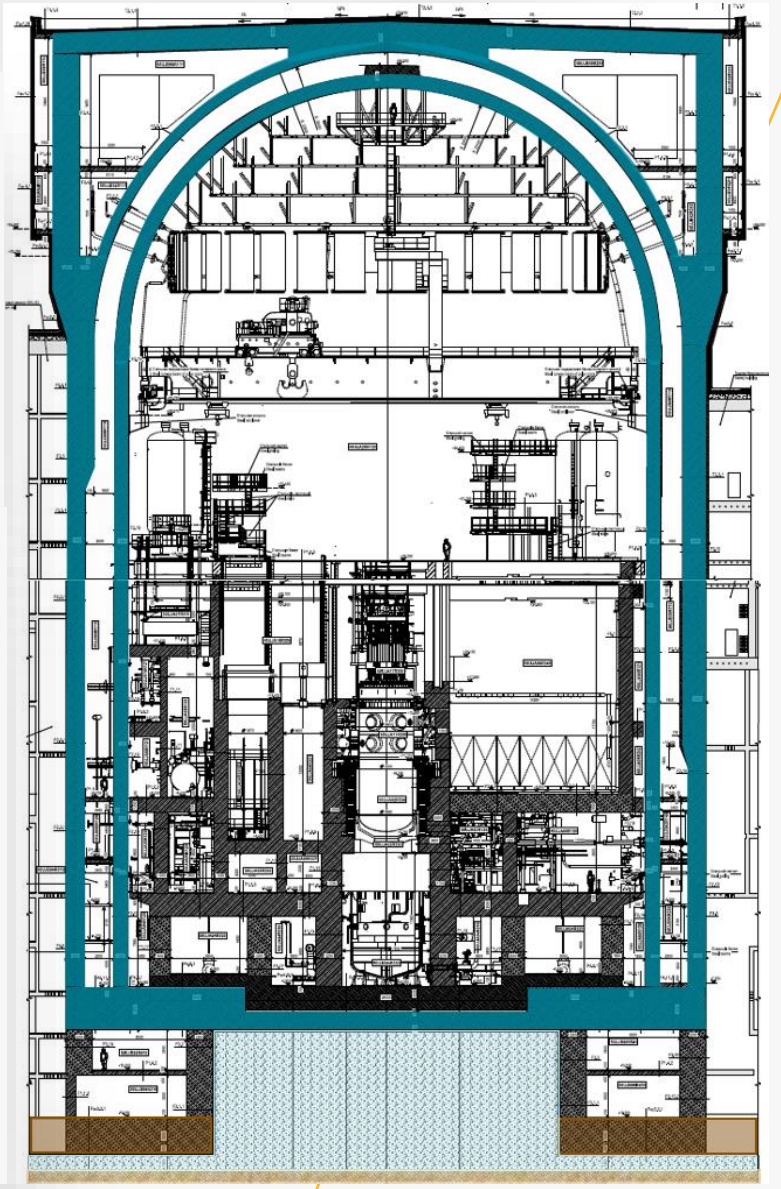
Gen-II (the heritage to manage) and Gen-III+ NPPs

Safety upgrade of 2nd generation NPPs:

- Correction of initial „deficiencies”;
- Compliance to the improved design basis – safety upgrades;
- Preparedness to severe accidents – refurbishment, processes

Requirements towards Gen-III+ NPPs:

- Compliance to the improved design basis;
- Design to manage severe accidents as well;
- Large release practically eliminated;
- Passive safety systems;
- Manoevring capability;
- MOX fuel application;



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Lessons from the past

Hyman Rickover, a US Navy Admiral said in 1953:

Characteristics of a reactor **design**:	Characteristics of a reactor under **construction**:
Simple;	1. Complex.
Small;	2. Large;
Cheap;	3. Very expensive;
Not heavy;	4. Heavy;
Short construction time;	5. Lengthy construction times caused by point No.6.;
Flexible to meet the project goals;	6. Huge R&D is essential even for simple questions;
No need for too much R&D;	7. Delays;
Uses components of mass production;	
The reactor is in test phase, **no need to construct**.	8. In construction;

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SMR expectations and promises

- Lower invetsment costs in the case of mass production;
- Simpler designs;
- Standardisation;
- Modularization and factory build;
- Easier and quicker construction;
- Smaller carbon footprint;
- Solution in the fight against climate change;
- Integrated technical solution – all components in one vessel;
- Passive safety systems;
- Safe agains external hazards – the plant is below the surface;

SMR expectations and promises

Above the sea level:

- Conceptual designs - too many concepts;
- Project preparation;
- Research, test reactors – demonstration is an important phase;

Below the surface:

- Incomplete designs - open ended decelopment tasks;
- Safety challenges need to be solved;
- ***Economy of scale…*** higher installed capacity is more feasible;
- Proliferation proof technology guaranteed?
- Lack of commissioning and operational experience yet;
- Financing is still a challenge;
- Reliable market?

Coice options

Construct a Gen-III+? *(available, with references)*

Wait for a Gen-IV? *(on the horizon, SNF reprocessing)*

Accept an SMR concept? *(search for the real advantages)*

The responsible choice is yours!

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