

Nuclear Risks

Steven TANG
Head of Construction APAC

Nicolas COURTOIS
Construction Underwriter APAC

26th May 2025

SCOR
The Art & Science of Risk

Nuclear risks
Summary

1 Overview and Perspective

2 SCOR and the construction of nuclear power plants

3 Underwriting

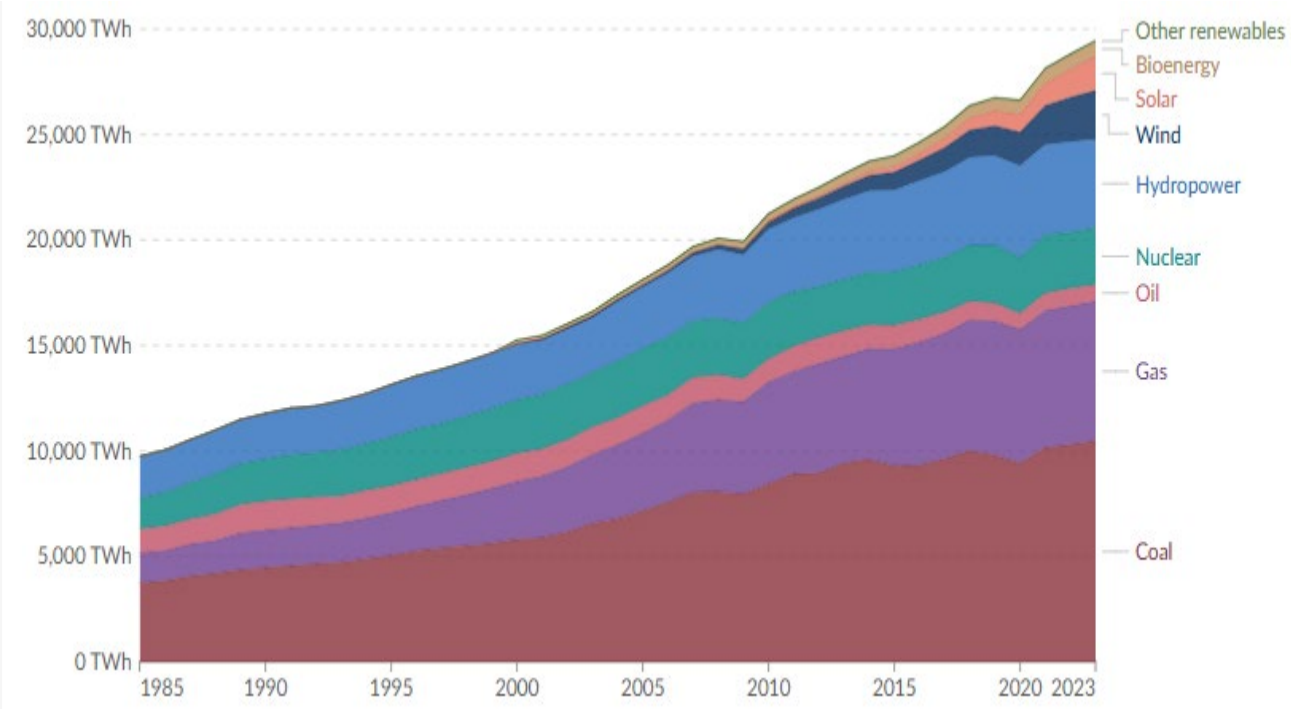
SCOR
The Art & Science of Risk

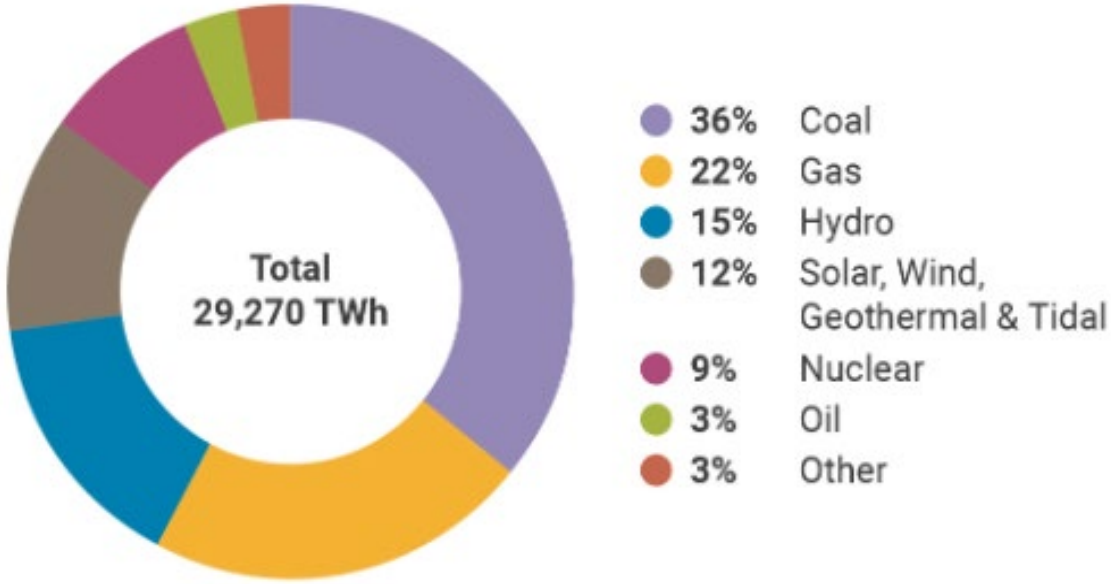
1. Overview and Perspective

Overview and Perspectives

Nuclear Power in the world today

- Nuclear energy provides about 9 % of the world's electricity.



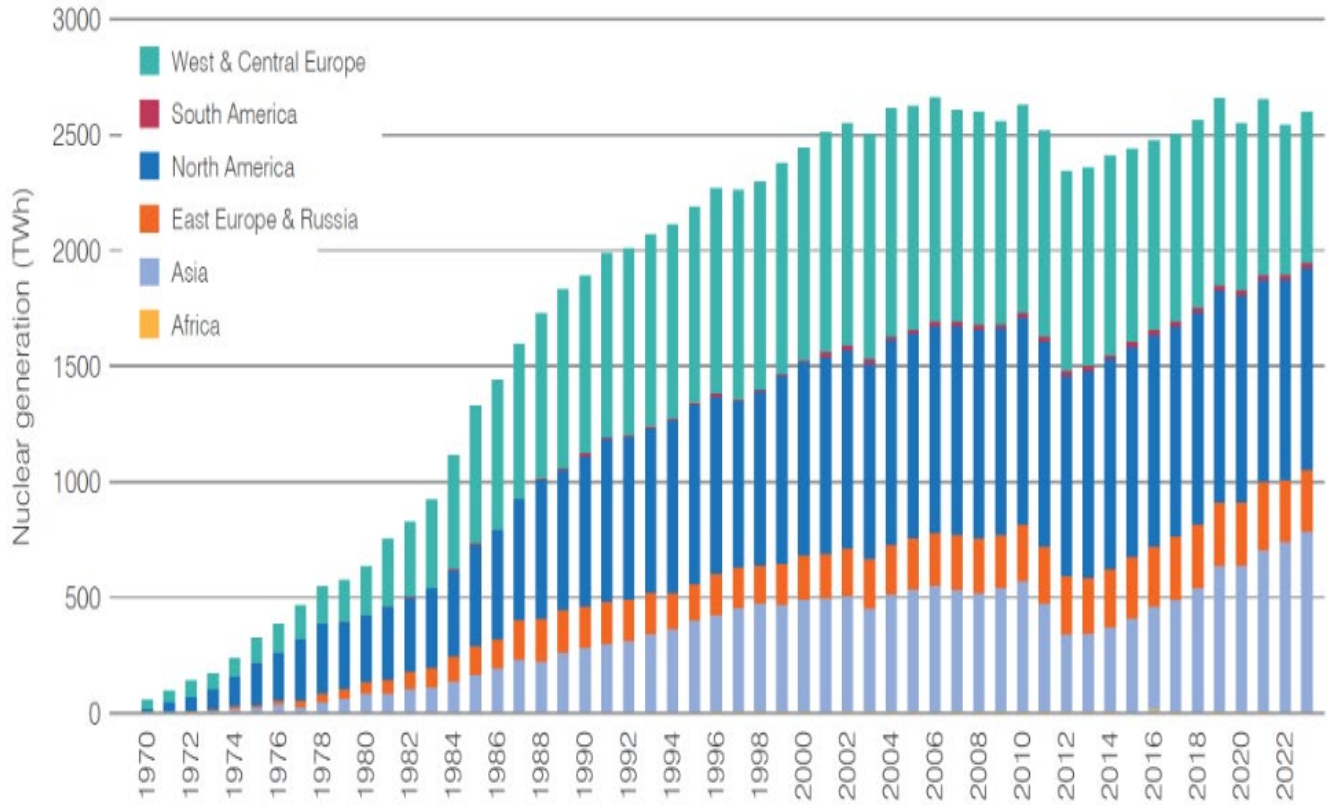


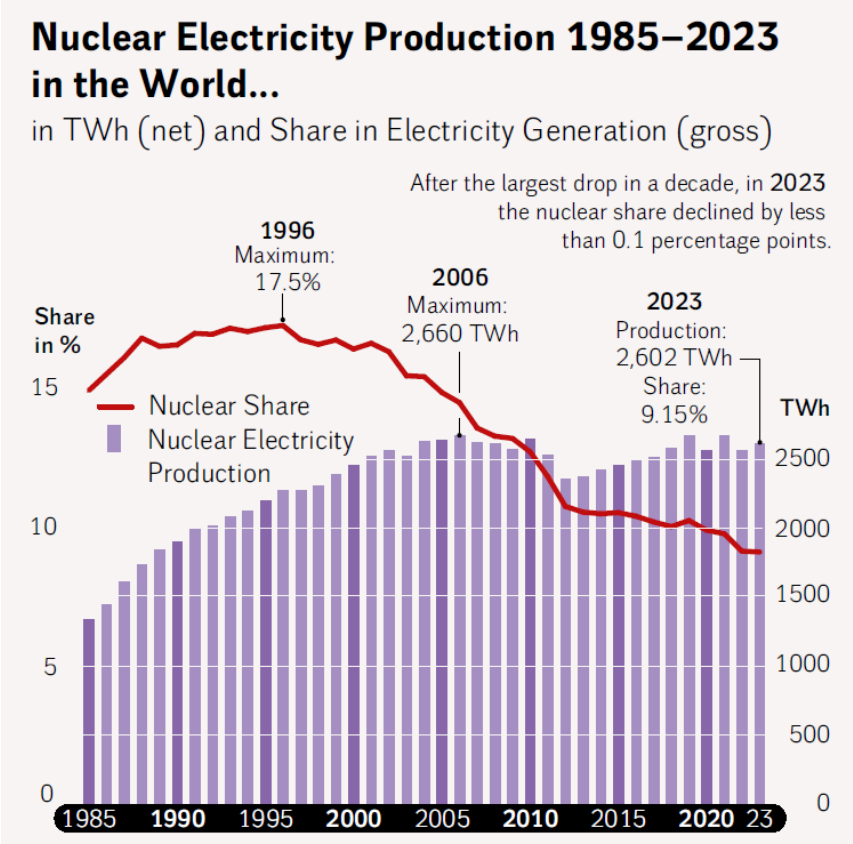
SCOR
The Art & Science of Risk

Overview and Perspectives

Nuclear Power in the world today

- 400 nuclear reactors in activity and for about 2600 TWh in 2023



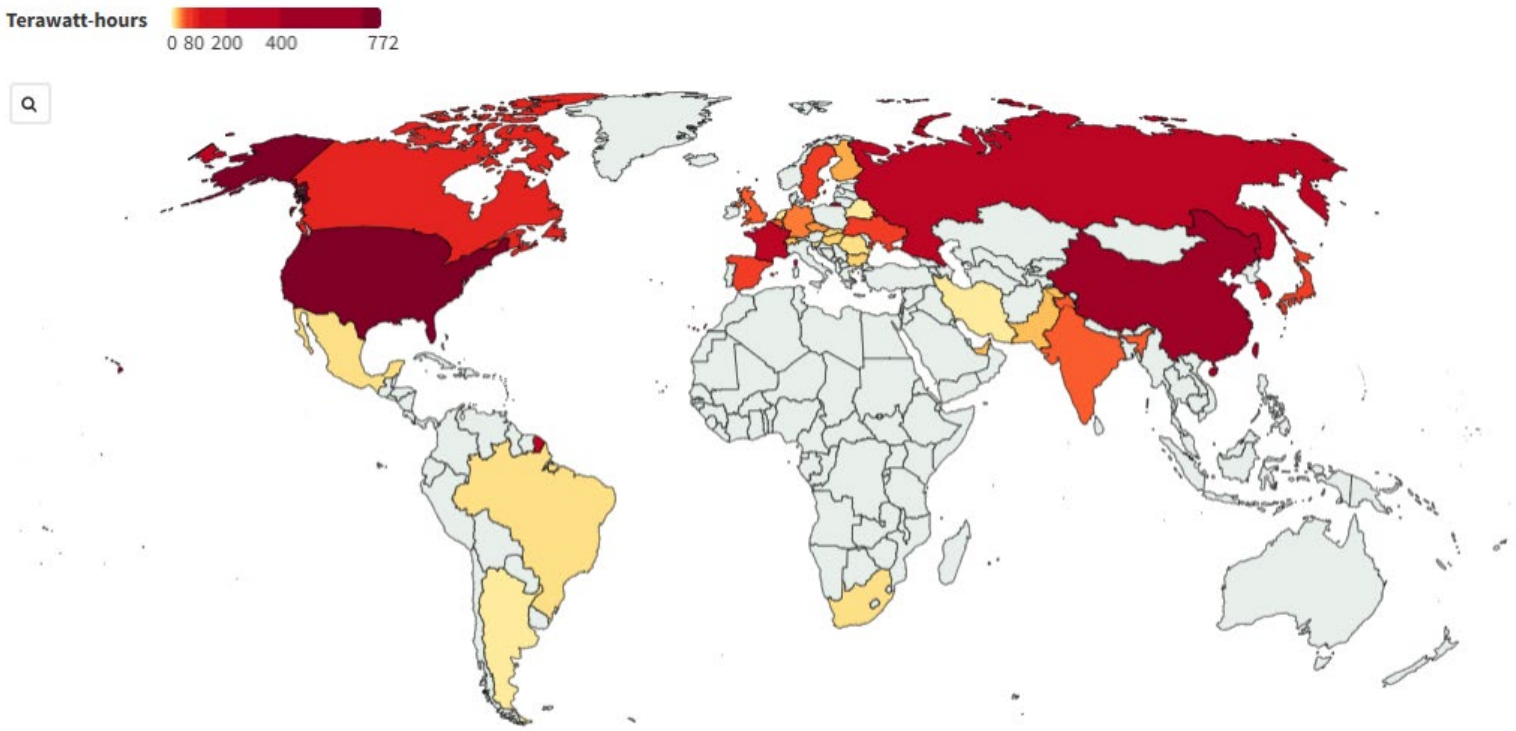


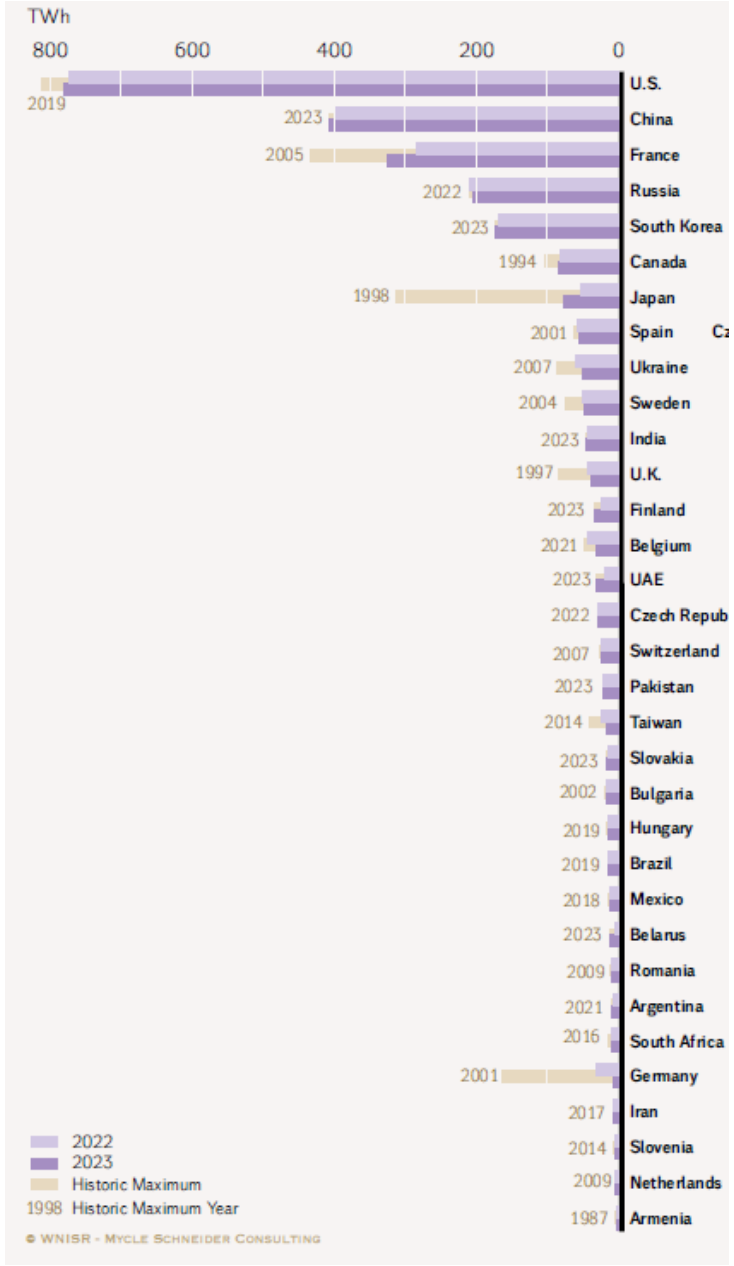
SCOR
The Art & Science of Risk

Overview and Perspectives

Nuclear Power in the World Today

- Nuclear electricity production in TWh in 2023



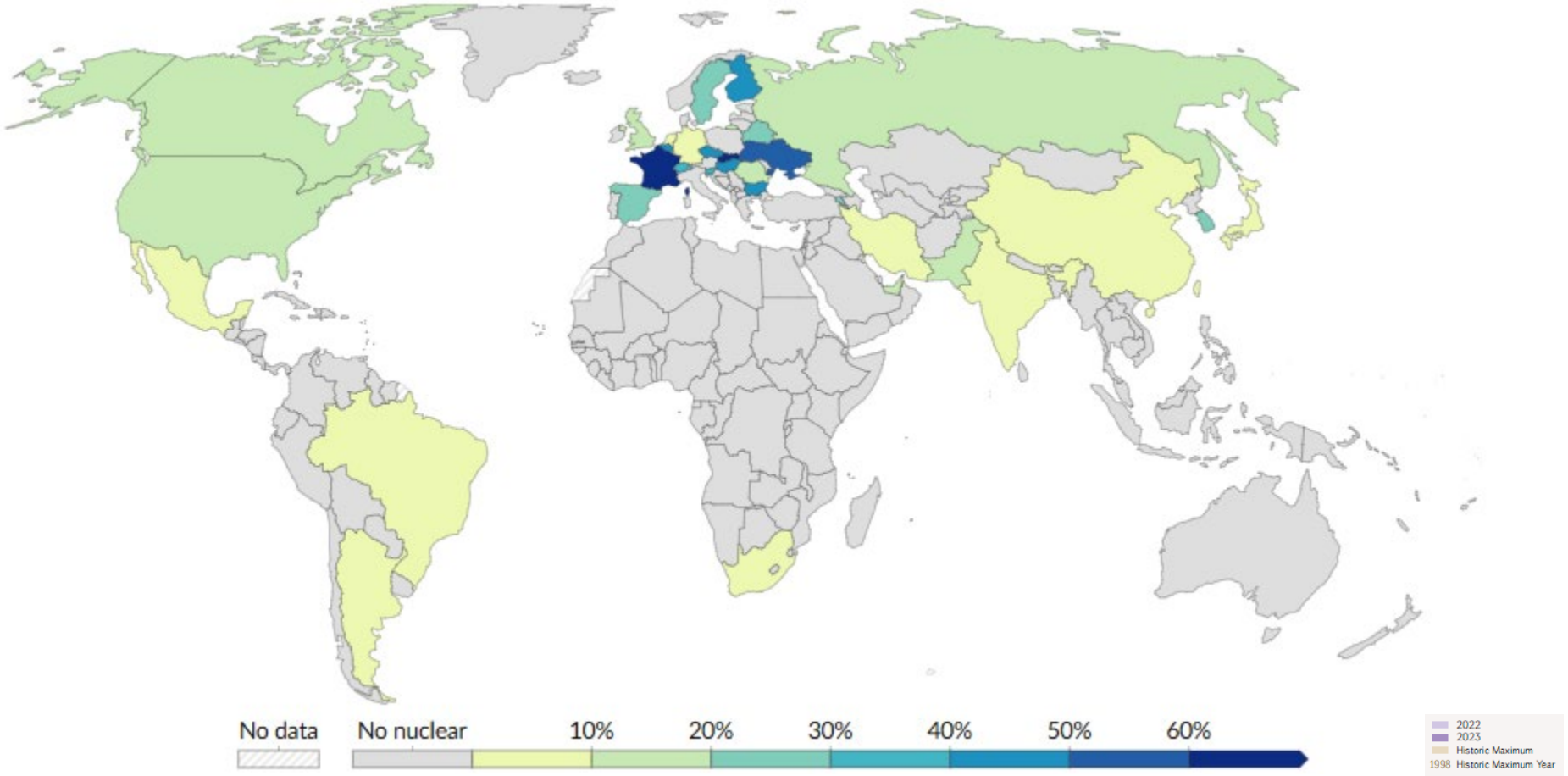


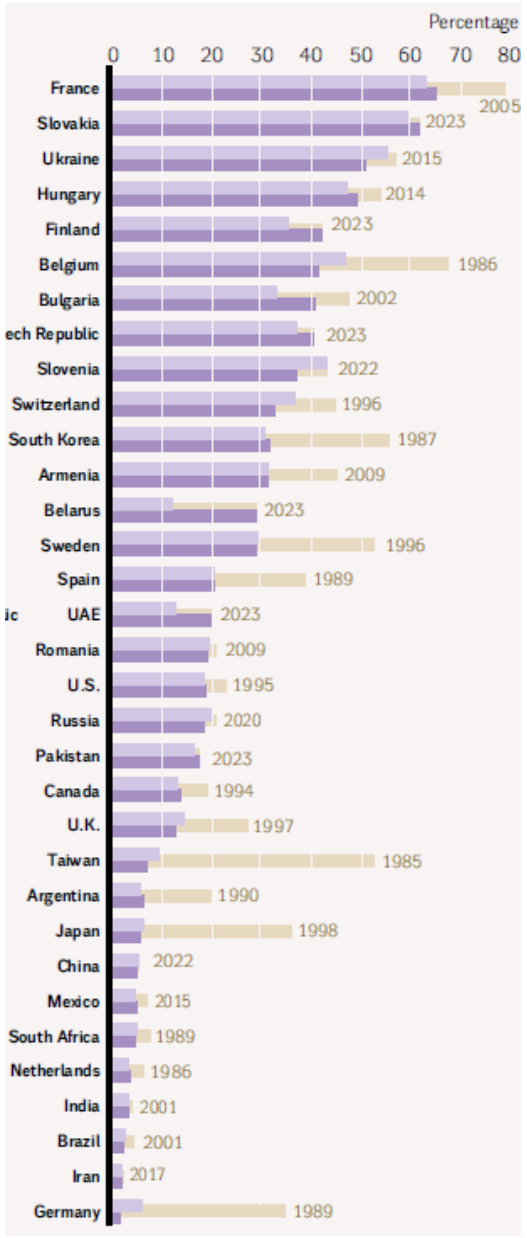
SCOR
The Art & Science of Risk

Overview and Perspectives

Nuclear Power in the world today

- Nuclear share of electricity (%) in 2023



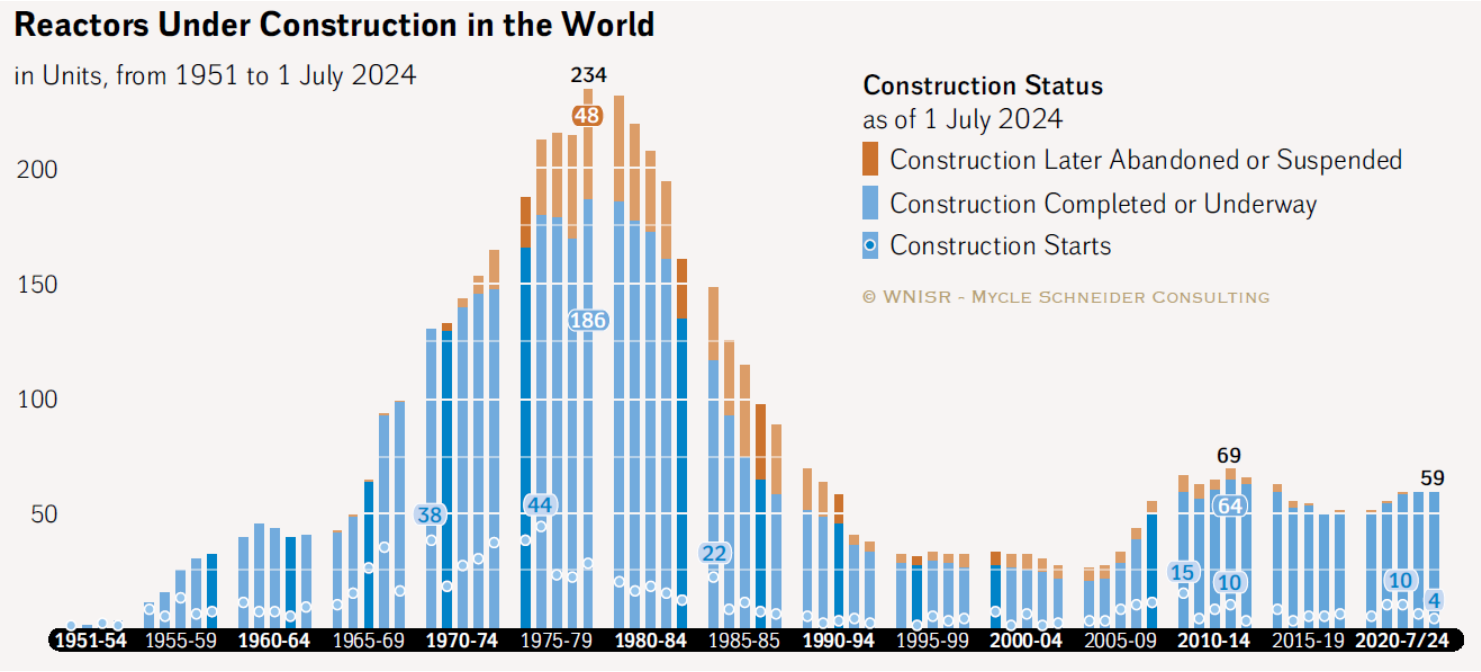


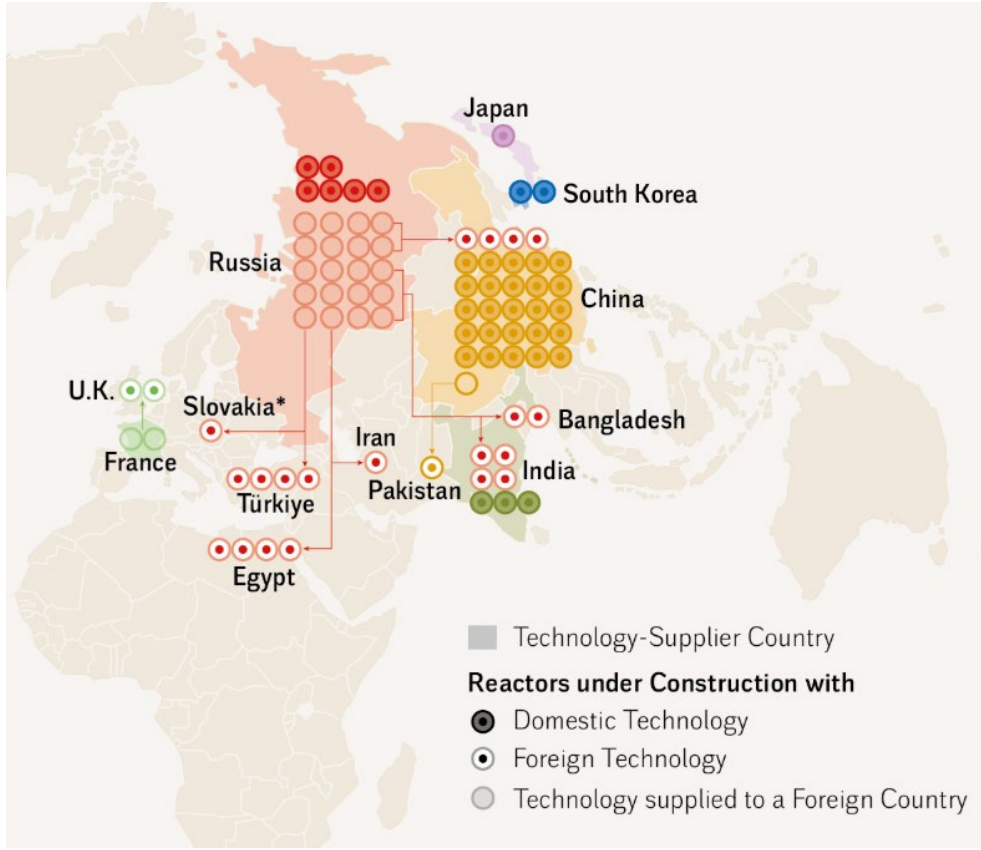
SCOR
The Art & Science of Risk

Overview and Perspectives

Plans for new reactors worldwide

- About 60 reactors are under construction across the world. About 100 further reactors are planned.
- Most reactors under construction or planned are in Asia (mainly China, Russia and India)



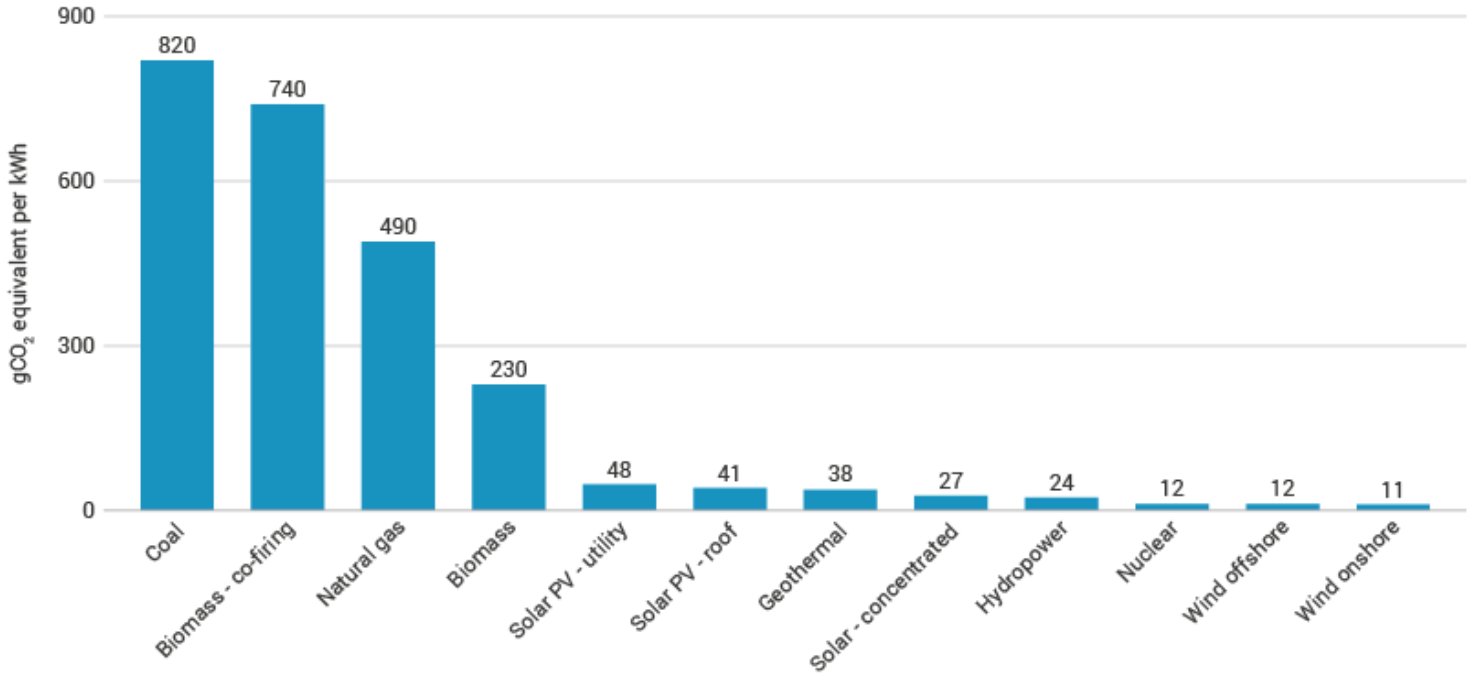


SCOR
The Art & Science of Risk

Overview and Perspectives

Is nuclear a green energy ?

- Nuclear fission does not produce any CO2. For both nuclear and renewable generation, emissions are produced indirectly, for example during the construction of the plant
- Over its life-cycle, nuclear produces about the same amount of CO2-equivalent emissions per unit of electricity as wind, and about one-third that of solar
- Nuclear provides about one-quarter of the world's low-carbon electricity.

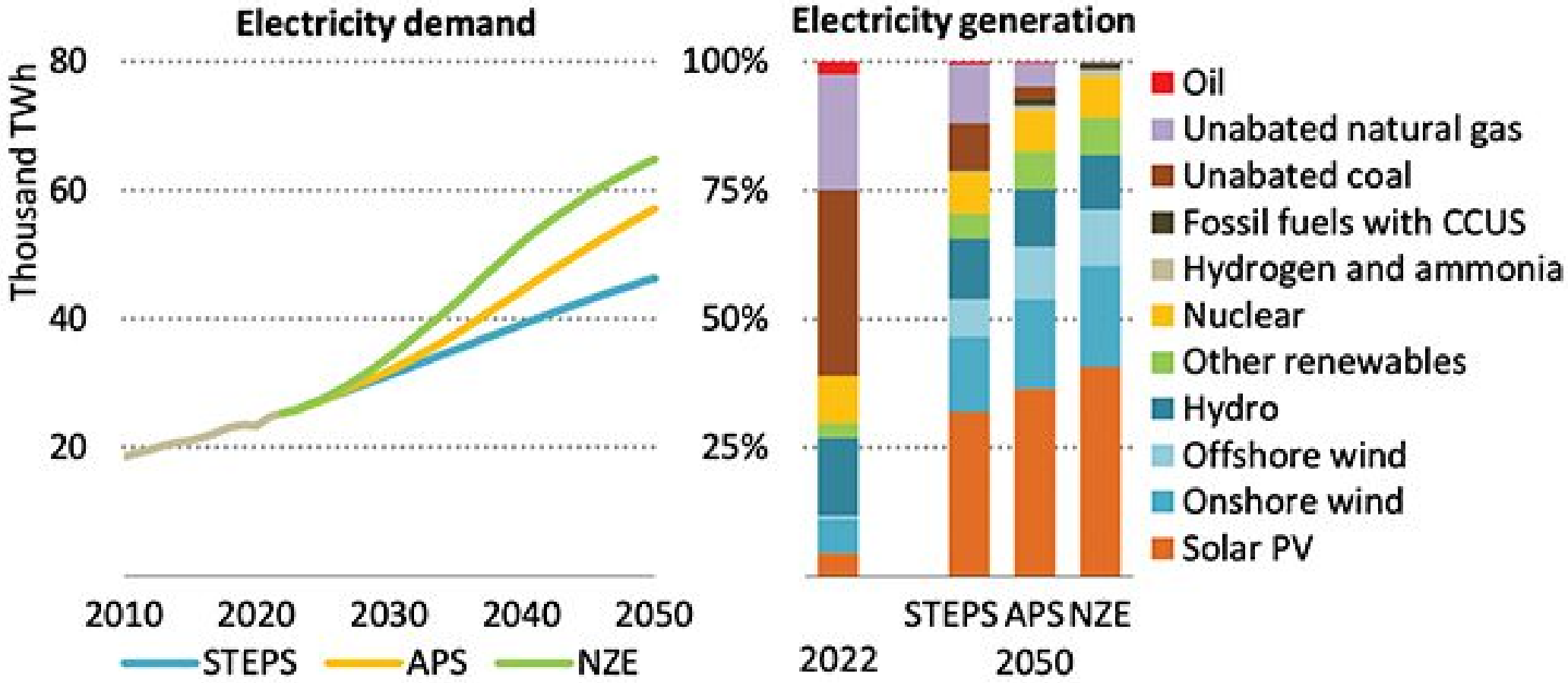


SCOR
The Art & Science of Risk

Overview and Perspectives

More nuclear in the future? Not really…

- While the global electricity demand will grow, the part of nuclear electricity production will remain the same.

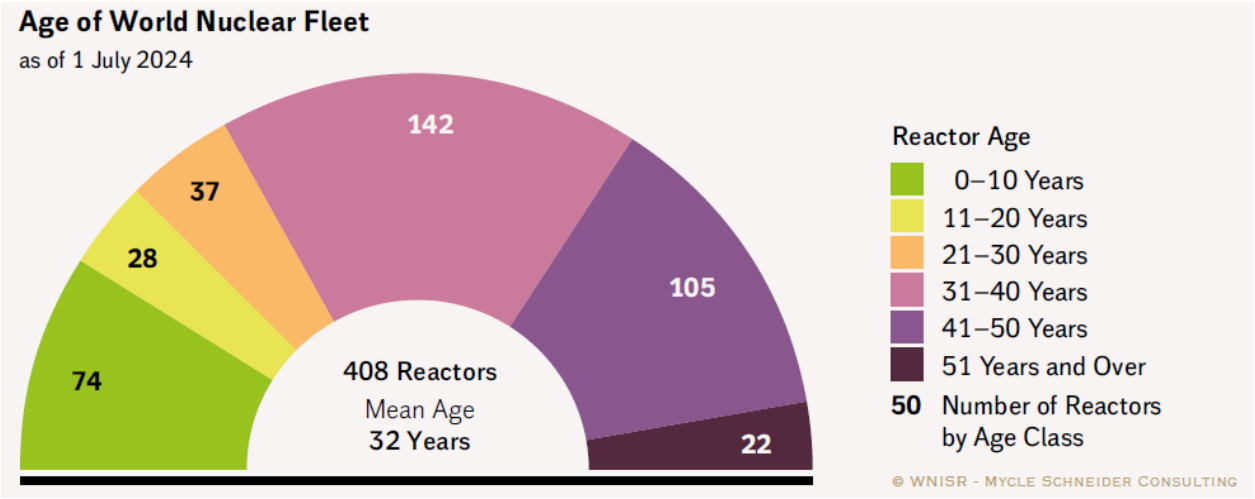


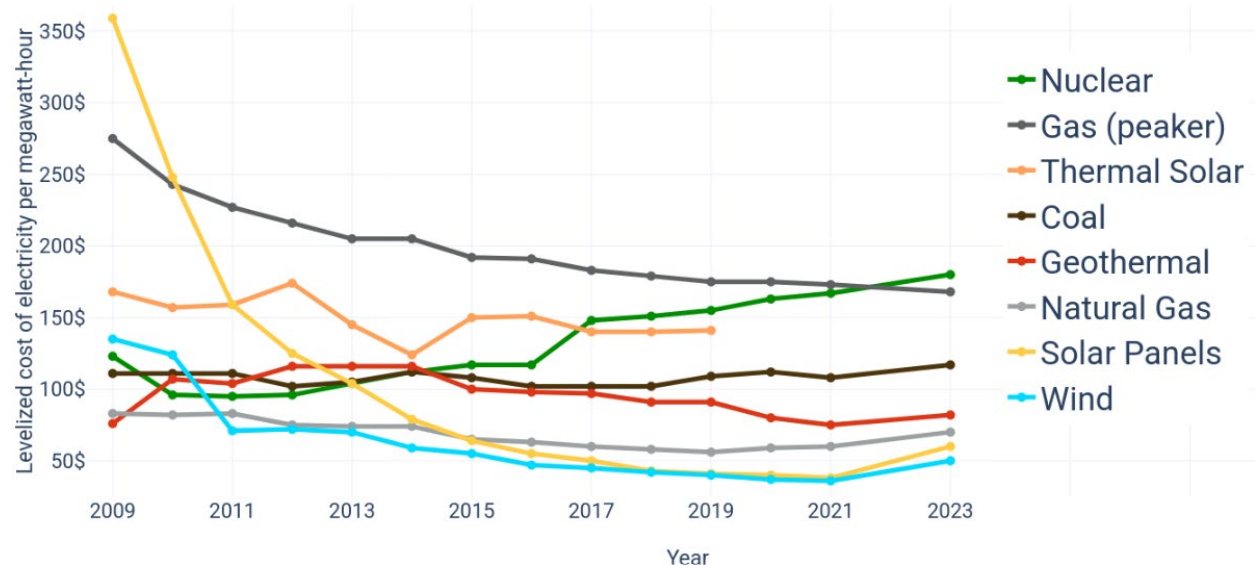
SCOR
The Art & Science of Risk

Overview and Perspectives

But why?

- We are building less NPP and the old NPP need to be replaced
- Security Threat (Terrorism)
- Radioactive wastes to deal with
- Potential nuclear accident with catastrophic consequences on the environment and to the people
- "non-renewable“ energy
- Political issues
- Expensive to build
- Long time to build
- Required high skilled people to design, build and operate





SCOR
The Art & Science of Risk

2. SCOR and the construction of nuclear power plants

SCOR and the construction of nuclear power plants

Overview

- SCOR experience: more than 35 years in writing NPP.
- Project value: from 1 B USD to 35 B USD.
- Project duration: from 3 years to almost 20 years
- Project location: India, China, Korea, France, UK, Finland, Russia, Eastern Europe,…
- Project technology: Chinese, French, Russian, Japanese, Canadian
- SCOR share: up to 25 %

=> **SCOR is a reputable leader with expert underwriters / risk engineers**

SCOR
The Art & Science of Risk

SCOR and the construction of nuclear power plants

One example: EPR Flamanville III in France

- Construction start: summer 2006
- POI at inception: 6 years
- CEAR sum insured at inception: 2 800 M€
- Commercial operation: 2025 ?
- POI: almost 20 years including the extensions
- Current CEAR sum insured: 8 300 M
- Owner : Electricite de France
- Other insureds: Bouygues Construction, Alstom, Areva
- Technology : EPR
- Capacity : 1600 MW
- Scor share: 20% at inception, 27% now (co-lead)



⇒ **SCOR commitment for about 20 years (underwriting, risk engineering, claims, capacity…)**

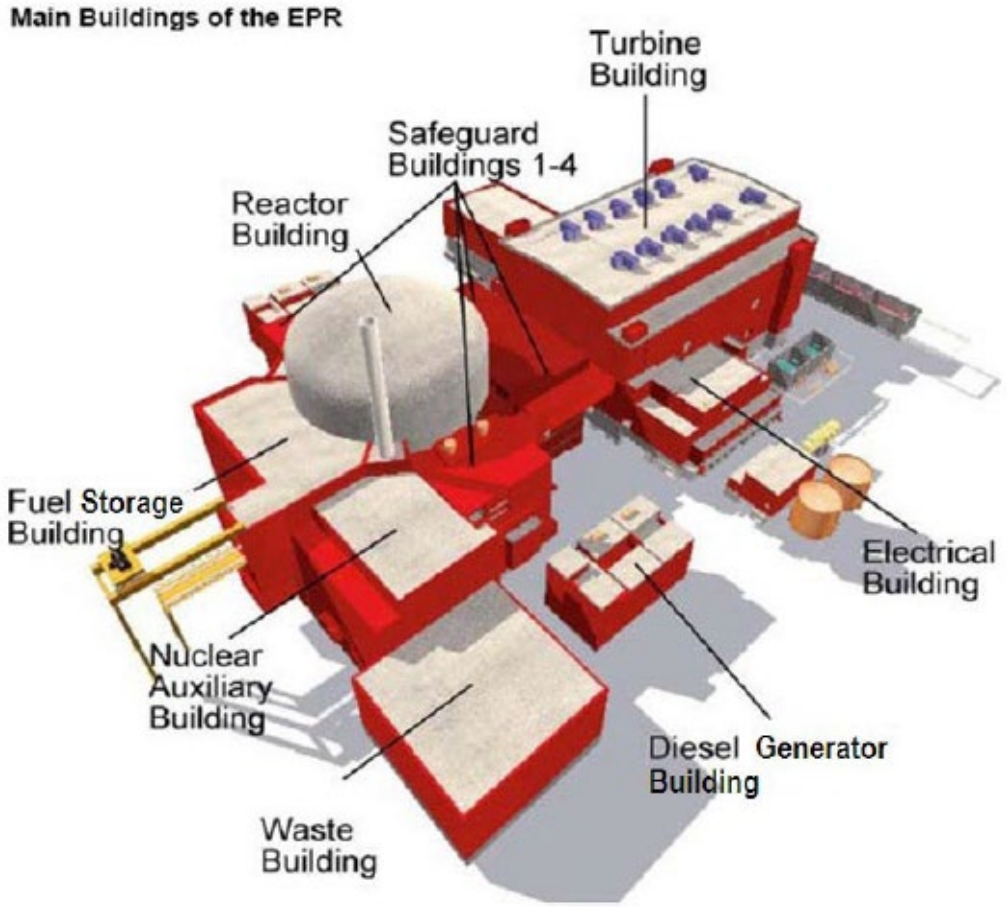
SCOR
The Art & Science of Risk

SCOR and the construction of nuclear power plants

What went wrong

- Delays in nuclear island component delivery mainly due to nuclear regulations evolved during the construction phase being more stringent.
- Poor material and workmanship (reactor vessel, welding, concreting, rebars…) leading with nonconformity, construction stops, investigations, reports, mitigation measures, repairs and hence delays.
- Lack of subcontractors' and suppliers' management
- Confusion between the major roles in project management (project team, owner, contractors)
- Generalized loss of skills in the French nuclear industry, with no reactor having been built for 16 years.
- Underestimation of the challenges of a new technology: size and complexity led to significant additional complexity for engineering and construction.

=> But no loss



SCOR The Art & Science of Risk

SCOR and the construction of nuclear power plants

The evolutions and innovations are numerous

- Conventional island with the turbine elements / generator: increase in power output, technology
- Bigger and more complex ventilation and control systems

The evolutions of the standards are currently raised

- Earthquake (example of Japan)
- Terrorism: airplane impact
- Environmental concerns

SCOR
The Art & Science of Risk

SCOR and the construction of nuclear power plants

Historically, the nuclear industry has a common issue for cost overrun and prolonged construction period due to the following reasons:

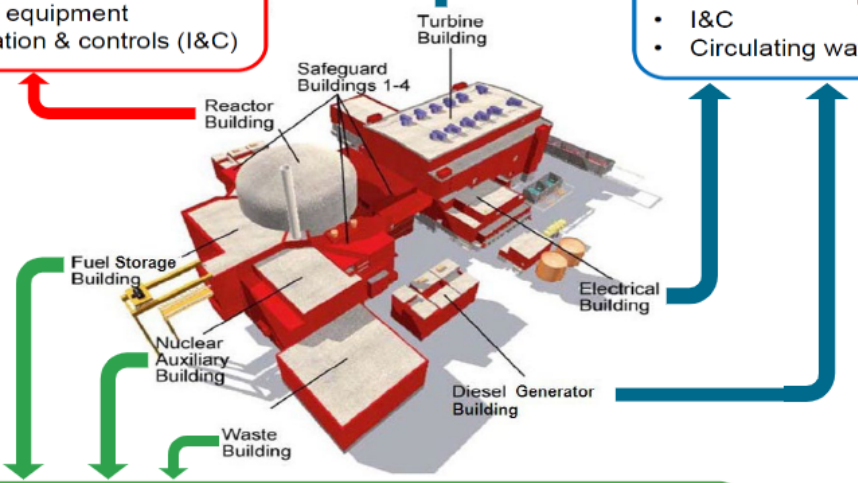
- Changes in the regulatory environment which lead to design changes and supply chain issues;
- Lack of standardized engineering solutions with evolving technology often not proven
- Overly ambitious cost and schedule targets set by investors/owners at project planning stage; and
- Political instability contributes to nuclear development and start-stop construction as well as inexperience by contractors after long period of inactivity.

3. Underwriting

Underwriting

Nuclear Island
- Reactor, fuel handling, and primary coolant systems
- Primary containment, structural & support systems
- Electrical equipment
- Mechanical equipment
- Instrumentation & controls (I&C)

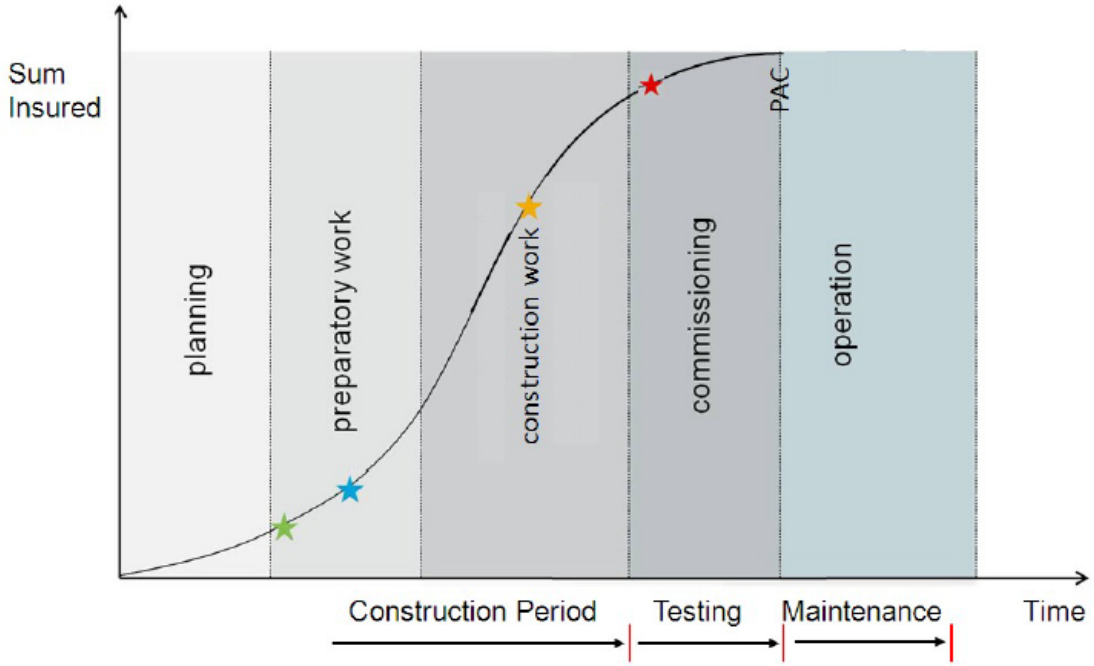
Conventional Island
- Turbines, generators, & condensers
- Secondary steam systems
- Electrical equipment
- Mechanical equipment
- I&C
- Circulating water systems



Balance of Plant
- Structural and support systems
- Electrical, mechanical and I&C equipment
- Site preparation, civil construction, and auxiliary buildings

Important milestones in the NPP construction project

- Storage on site
- Wet works
- Dome lifting
- Fuel loading



SCOR The Art & Science of Risk

Underwriting

Risk Assessment

- Civil works is comparatively higher than other typical EAR/power projects
- Technology used, in particular for steam turbine/non-nuclear equipment
- QA/QC, in particular for concrete and welding works
- Long period => inflation, storage, corrosion, preservation
- Nat cat exposures and secondary perils
- Fire protection
- Heavy lifting and handling
- Wet works and tunneling works for water intakes and outfalls
- Temporary warehouse and goods storage
- Testing and Commissioning
- Long lead time for key critical equipment [limited number of suppliers]
- Sanctions

SCOR
The Art & Science of Risk

Underwriting

The Parties Involved / Who ?

- Contractors and Nuclear Reactor Vendors
- Public authority, regulators and licensors
- Principal / future owner
- Project Management Team
- Main contractor / EPC contractor & sub-contractors
- Investors / lenders

The Location Factors / Where ?

- Natural Perils (Earthquake/Tsunami/Storm/Flood)
- Ground Conditions
- Local workforce
- Transit
- Political Considerations

SCOR
The Art & Science of Risk

Underwriting

Specific / What ?

- Heavy lifting and handling
- Commissioning of Steam Turbines
- Technology
- QA/QC: Concreting and welding quality issues
- Heavy wet works and tunneling works









SCOR
The Art & Science of Risk

Underwriting

Underwriting considerations

- Quality Assurance / Quality Control
- What are the manufacturers competences and references ?
- Quality and availability of suppliers / sub-contractors and associated constructional plants
- Is qualified work force available for the site? Are trainings available on site?
- Has the new design been qualified with all site procedure?
- Defect exclusion for the technology
- Relevant clauses on the civil works like tunnel and wet work clause
- Corrosion/erosion clause and preservation clause for long period project
- Valuation & Average Clause

SCOR
The Art & Science of Risk

Underwriting

Information requirements:

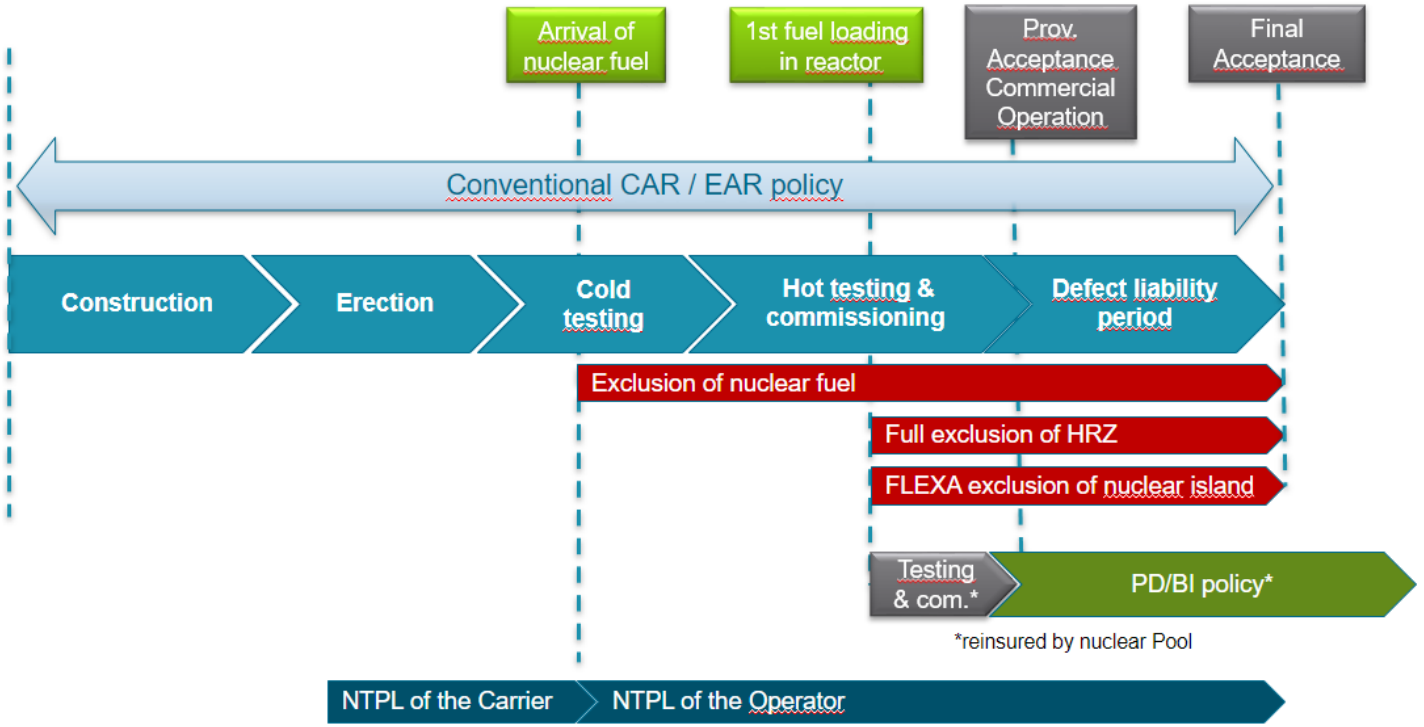
- Information regarding Participants
- Natural Hazards / Site Location
- Project Details / Scope of Work
- Detailed Time Schedule of Construction Works and Testing / Commissioning
- Quality Assurance / Control Aspects
- Organization charts of various parties involved, critical paths, risk register and risk management measures.
- Transit / Storage
- Value Breakdown
- Advance Loss of Profit Information
- Third Party Liability

SCOR
The Art & Science of Risk

Underwriting

Wording

=> NUCLEAR ENERGY EXCLUSION CLAUSE 1994 - NMA 1975 is the standard clause



Criticality wording exclusion.

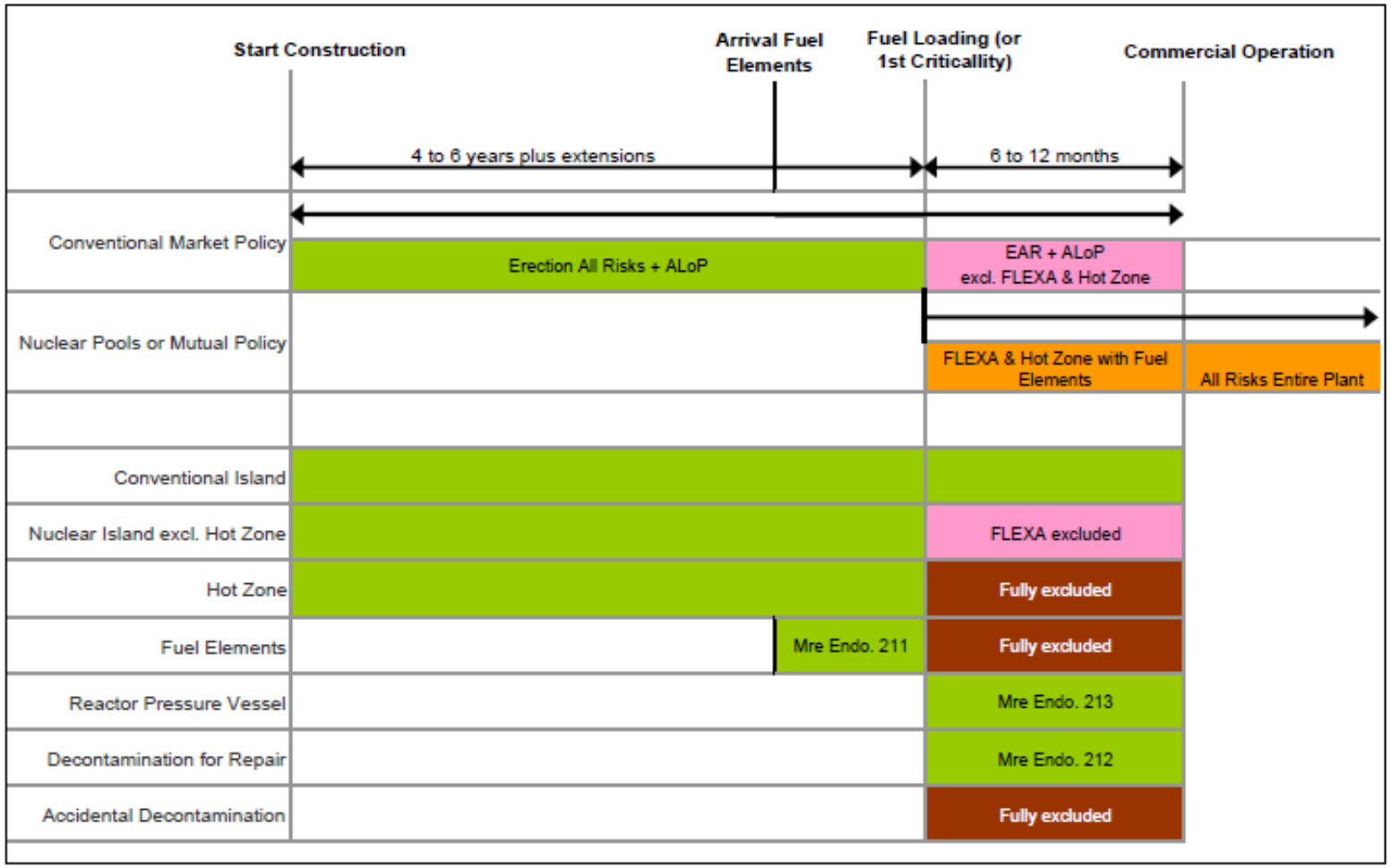
Importance of the key definitions:

- First Criticality or Fuel Loading or Insertion of the first fuel assembly
- Nuclear Island ?
- Convectional Island ?
- Hot Zone or High Radioactive Zone (HRZ) ?
- Fuel Elements or Nuclear Fuel or Nuclear Material ?

SCOR The Art & Science of Risk

Underwriting

Wording



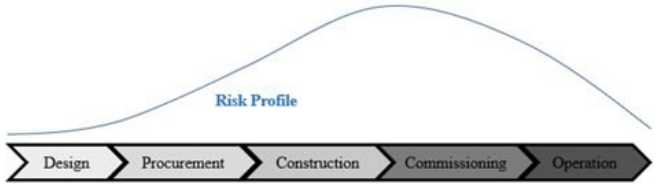
- Prior to fuel loading hot testing are covered by the construction policy
- The criticality as such is not covered by the construction policy but the nuclear pool takes over
- But the hot testing of the conventional island (turbine, generator …) are of course still covered by the construction policy

First Criticality is defined as the moment when, initiated by a neutron source, the reactor achieves a self-sustaining nuclear reaction chain first time.

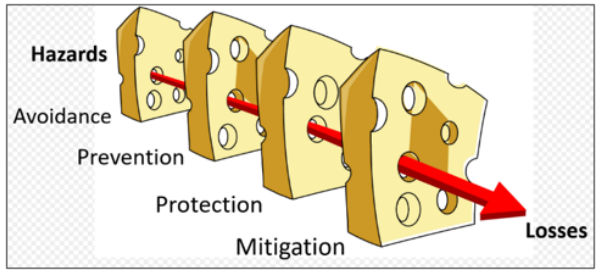
SCOR The Art & Science of Risk

Underwriting

What we usually do in regular Risk Engineering Surveys:



- Review risk management procedures & their practical implementation on site
- Work collaboratively & build on the project risk management processes
- Give loss prevention advice to prevent material damage to constructed assets
- Share loss experience / lessons learnt
- Aim is to share experiences & best practices to benefit the project



For Nuclear Power projects in particular:

- Require Engineers with specific Nuclear experience which is rare in the market, such as Bruno Gerard and Didier Combes
- Need to expand this expert pool to other technologies, i.e. AP and VVER
- Share “unofficial” feedback from the different projects and issues encountered during various stages including testing and commissioning

SCOR
The Art & Science of Risk

Q&A



Thank You

SCOR
The Art & Science of Risk