AnsaldoNucleare
A Finmeccanica Company

NUCLEAR POWER PLANTS: GEN3+ DESIGN & FUEL

Ing. Enrico Mainardi Ph.D.

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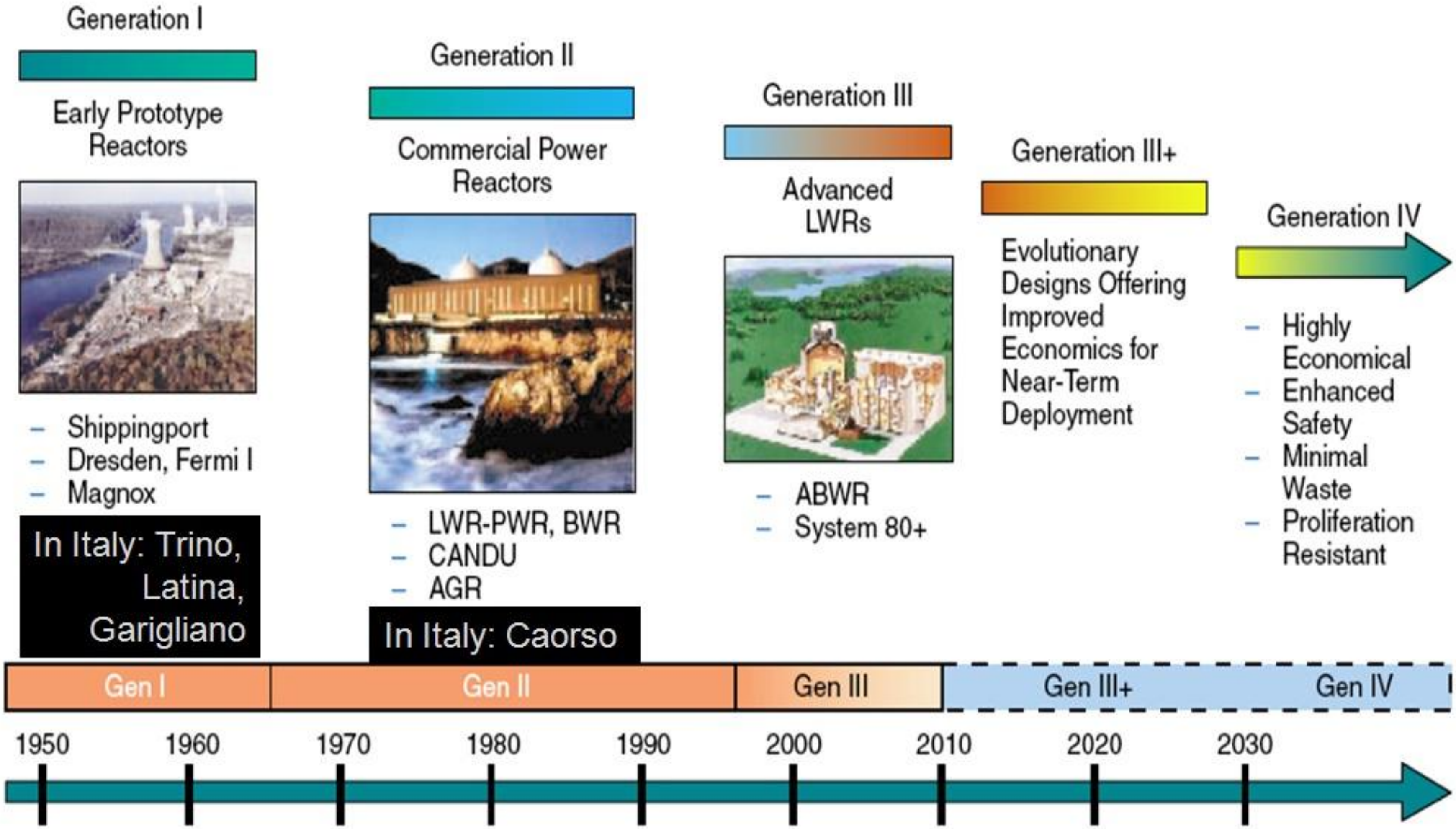
EVOLUTION OF NUCLEAR REACTORS:



Generation I

Early Prototype Reactors

- Shippingport
- Dresden, Fermi I
- Magnox

In Italy: Trino, Latina, Garigliano

Generation II

Commercial Power Reactors

- LWR-PWR, BWR
- CANDU
- AGR

In Italy: Caorso

Generation III

Advanced LWRs

- ABWR
- System 80+

Generation III+

Evolutionary Designs Offering Improved Economics for Near-Term Deployment

Generation IV

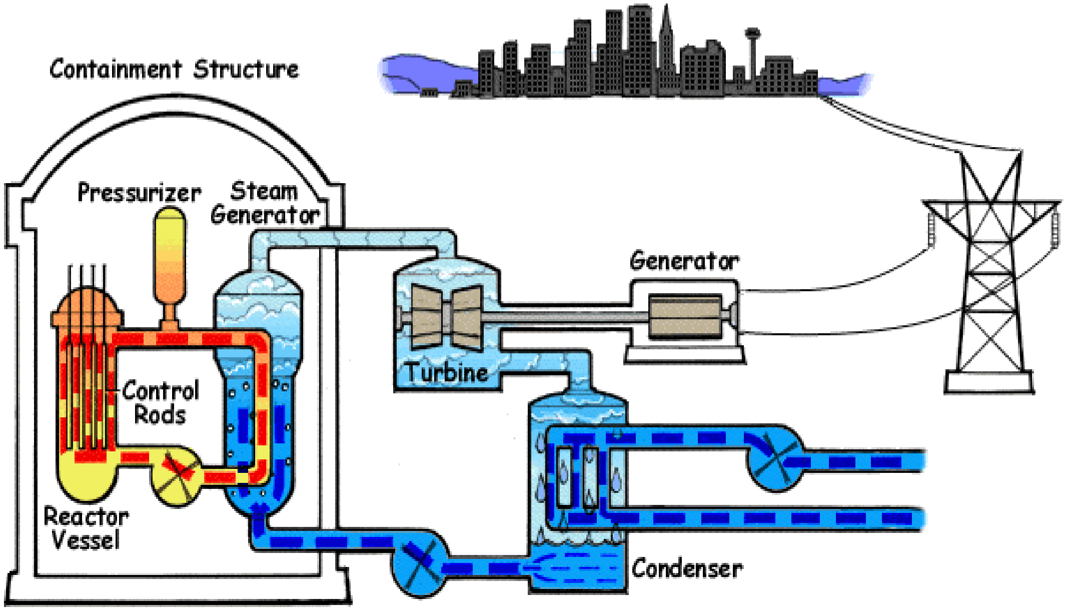
- Highly Economical
- Enhanced Safety
- Minimal Waste
- Proliferation Resistant

GENERATION III+ REACTORS

- Design largely based on a probabilistic safety approach and on lessons learned from Three Miles Island and Chernobyl accidents

- They are a consistent step forward in the technology, extensively tested and reviewed by safety authorities through a ten years long process

- Two main types of design approach:
  - Evolutionary approach: improvement of redundancy and independence of «standard» safety features (EPR from AREVA)
  - Alternate approach: extensive use of passive safety features to prevent common mode failures and/or operator errors (AP1000, Westinghouse)



Both EPR and AP1000 are Pressurized Water Reactors

Now under construction:
4 EPR, 8 AP1000

GENERATION III+ REACTORS

Improved Defense in Depth

the containment system is designed to withstand core melt scenarios through:

- retention & cooling of corium (in vessel or through core catcher)
- Hydrogen control (igniters and/or recombiners)
- Independent cooling systems (totally passive in the case of AP1000)

so ensuring independence towards other barriers

Lower risk of Total station Blackout

The AP1000 has no need of diesels to withstand an accident

Lower dependance on operator action

The AP1000 doesn’t require any operator action for 72 hours after an accident.

Generation3 & 3+ reactors are addressing many of the safety issues raIsed by the Fukushima accident.

Acceptability requires reduced socio-economic consequences

FUEL LOADED INTO A NPP:

- About 435 reactors (370 GWe), require 78,000 tUO2 concentrate, containing 66,000 tU from mines or secondary sources each year.

•Capacity is growing slowly and reactors are being run more productively, with higher capacity factors, and reactor power levels.
•From 1970 there was a 25% reduction in uranium demand per kWh output in Europe due to Increased efficiencies.

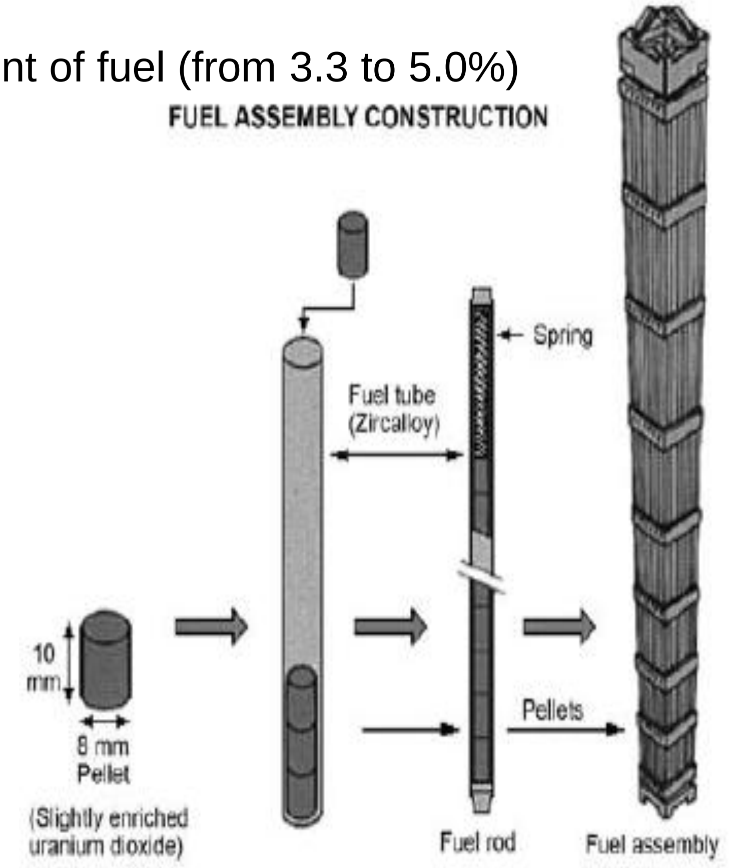
•Many utilities are increasing the initial enrichment of fuel (from 3.3 to 5.0%) and then burning it longer.

Cost of the fuel loaded into NPPs (UxC data 2013):

- About 1/2 cost of U supply (mine or secondary).
- About 1/2 cost of enrichment & fuel fabrication, with a small element for uranium conversion.

•In the past it was 1/3 for U supply, 2/3 for the rest.

•Demand for Ufuel more predictable (than other mineral commodity) because of the cost structure of nuclear power generation (high capital, low fuel costs).

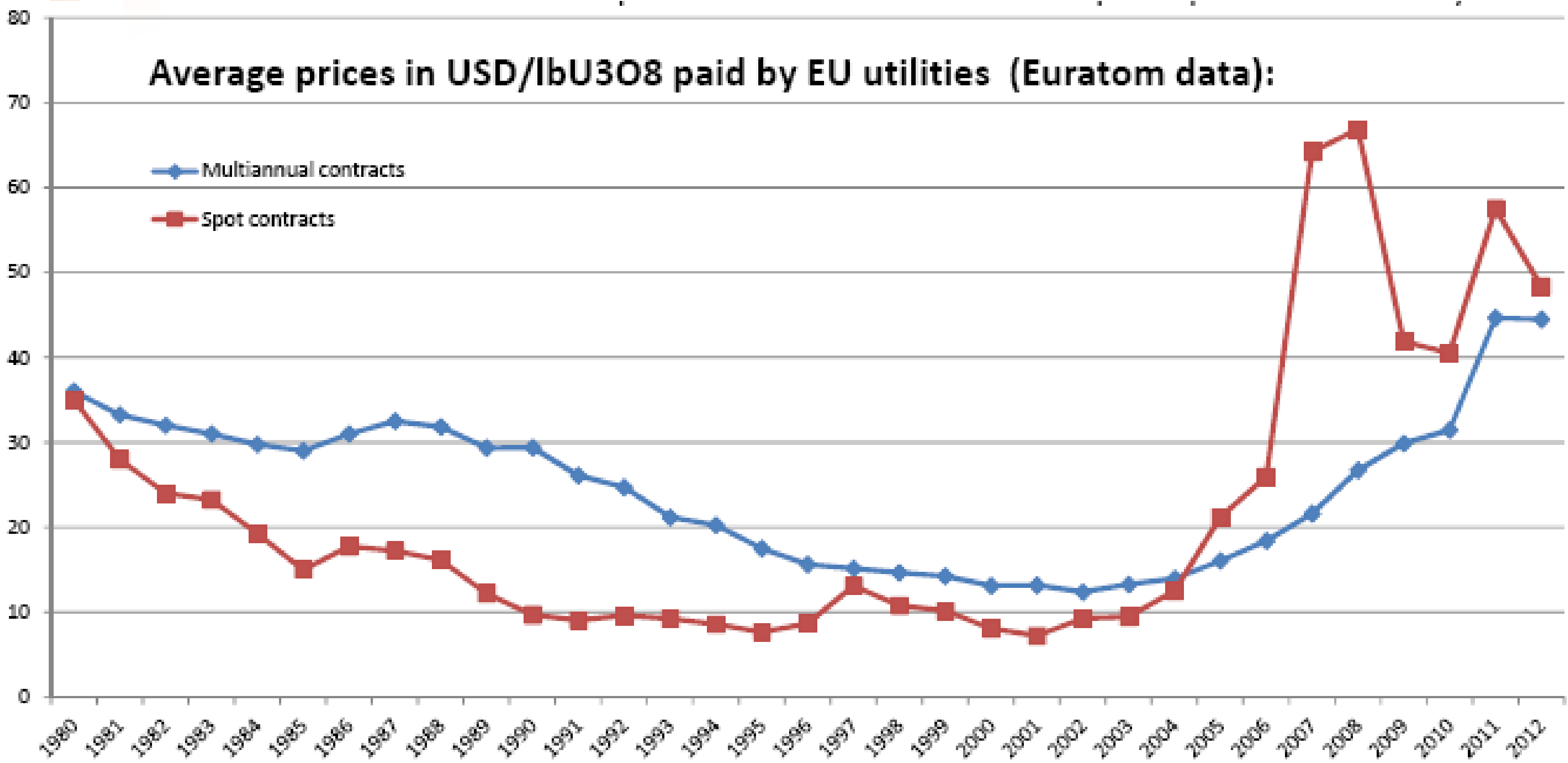


REQUIREMENTS OF POWER UTILITIES IN 2013:

- 85% from world uranium mines
- 15% from secondary supplies

(principally by ex-military material)

Fluctuation in U mineral prices relate to demand and perceptions of scarcity.



Average prices in USD/lbU3O8 paid by EU utilities (Euratom data):

Most trade is via 3-15 year term contracts. Euratom price is the average price of U3O8 delivered into the EU that year under long term contracts (often related to the spot price at the time of delivery)

Thank you for your attention!