



Sustainable Nuclear Energy helps Europe to meet its energy challenges

The HLM Research in The Strategic Research Agenda

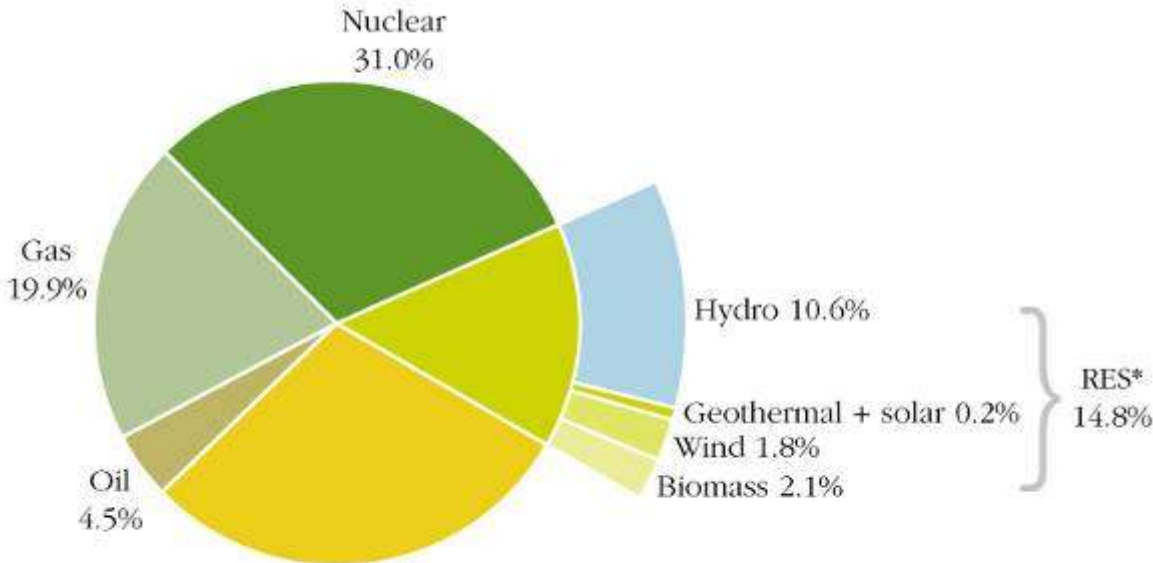
www.snetp.eu

H. Aït Abderrahim

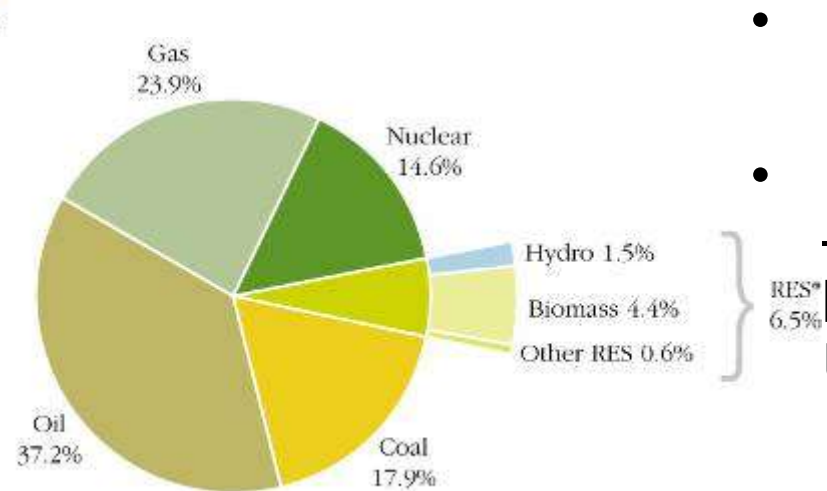
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Chairman of the SRA Group of SNETP

Nuclear energy in Europe



Electricity generation shares in EU-25 (2005)

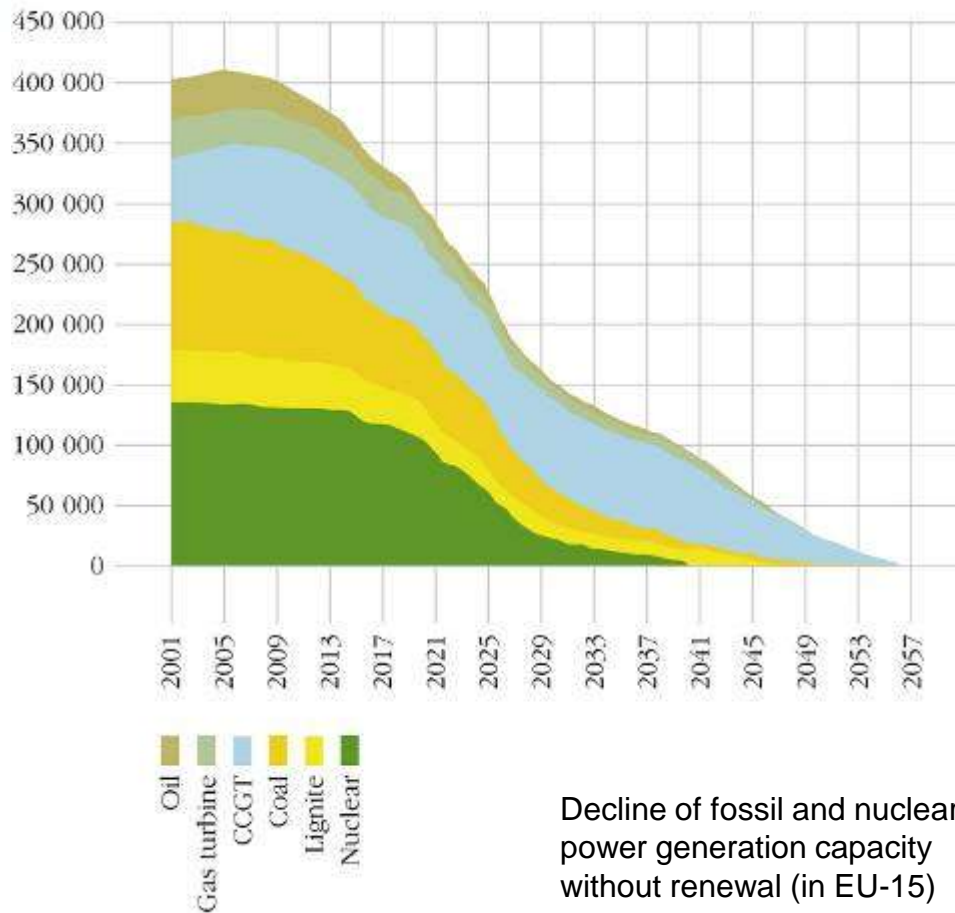


Energy consumption shares in EU-25 (2005)

- 152 reactors in 15 countries in EU-27, producing 31% of EU's electricity
- The largest source of low carbon energy
- Excellent safety record
- Europe, a world leader – but competition is building (Russia, Japan, USA, China, India)

Power generation infrastructures

Installed MW



- Fossil and nuclear power generation plants are ageing
- Need to invest in plant lifetime management and
- Large investments are necessary to build new plants to satisfy demand
 - For nuclear, Gen. III reactors (Finland, France)
- Action is needed now for paving the road for Gen.IV!



Nuclear Fission in Europe's low carbon energy policy

- Nuclear fission contributes 31% of EU electricity today – the largest low carbon energy source
 - **2020 : Maintain competitiveness in fission technology and provide long term waste management solutions**
 - For the longer term as indicated in the SET Plan, we need to act now to:
 - **complete the demonstration of Gen.IV with closed fuel cycle for increasing sustainability**
 - **enlarge the nuclear fission applications beyond electricity production, namely towards H₂, Heat, H₂O desalination**
- **Ambitious R&D and Demo programme need to start now to meet the required breakthroughs**

A collective vision: endorsers and contributors



<p>Utilities</p>	<p>Technology Providers</p> <p>Consultancy/Other industry</p>	<p>Research Organisations</p>	<p>Universities</p> <p>NGO</p>
<p>TSO</p>	<p>TSO</p>	<p>TSO</p>	<p>EU Organisations</p>

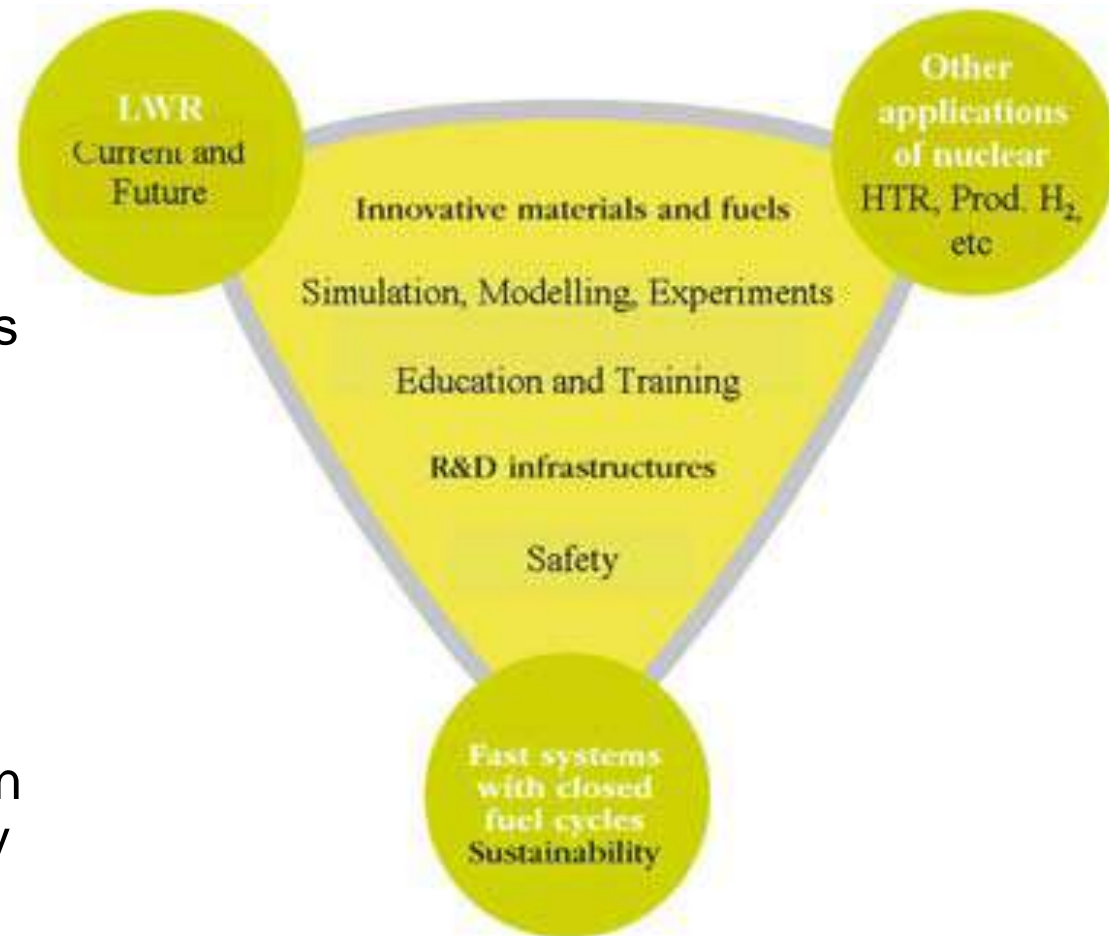


SNETP strategy structures the SRA

(Strategic Research Agenda)

SNETP Vision:

1. Maintain safety and competitiveness of today's technologies
2. Develop Gen.IV FR with closed cycle to enhance sustainability
3. Enlarge the nuclear fission portfolio beyond electricity production: H₂, Heat, H₂O desalination



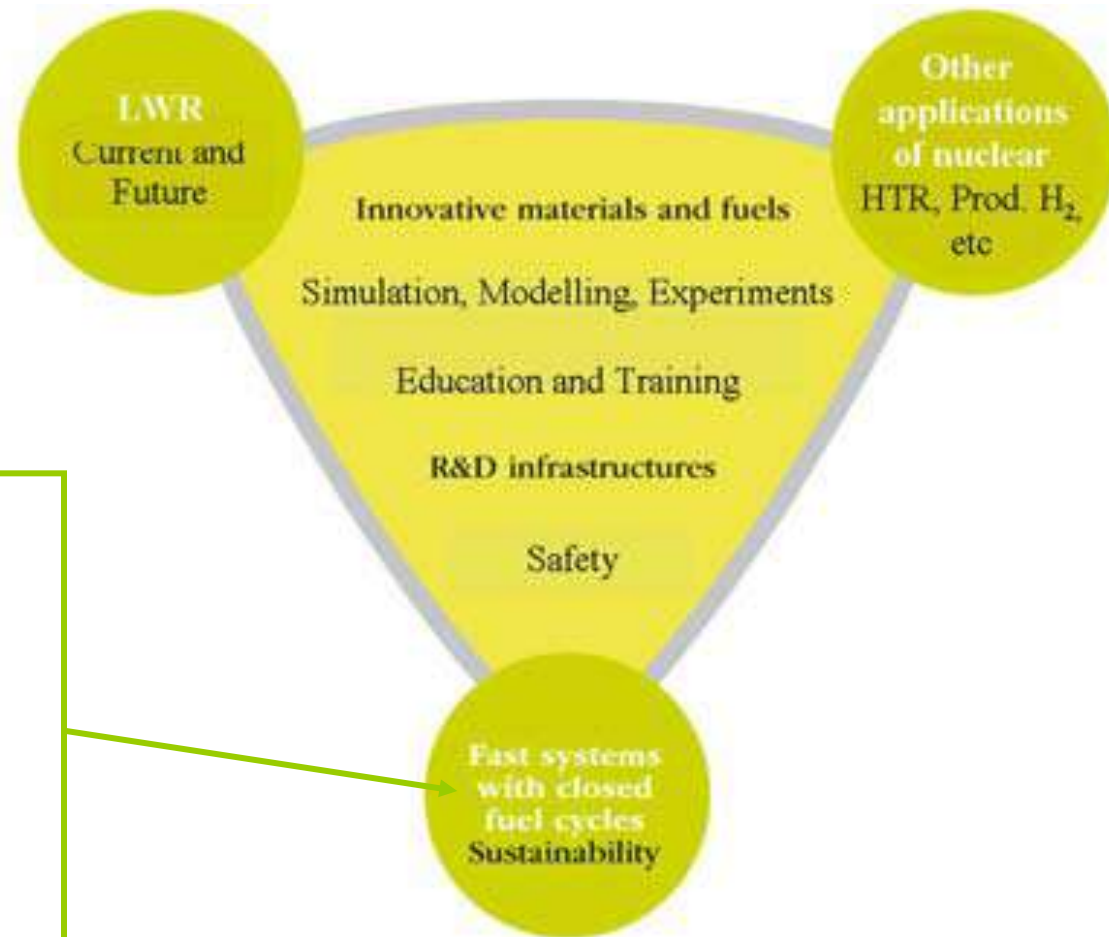
SNETP strategy structures the SRA

HLM research in the SRA



HLM Technology and associated R&D is present in:

1. Gen.IV LFR system
2. ADS LBE based system

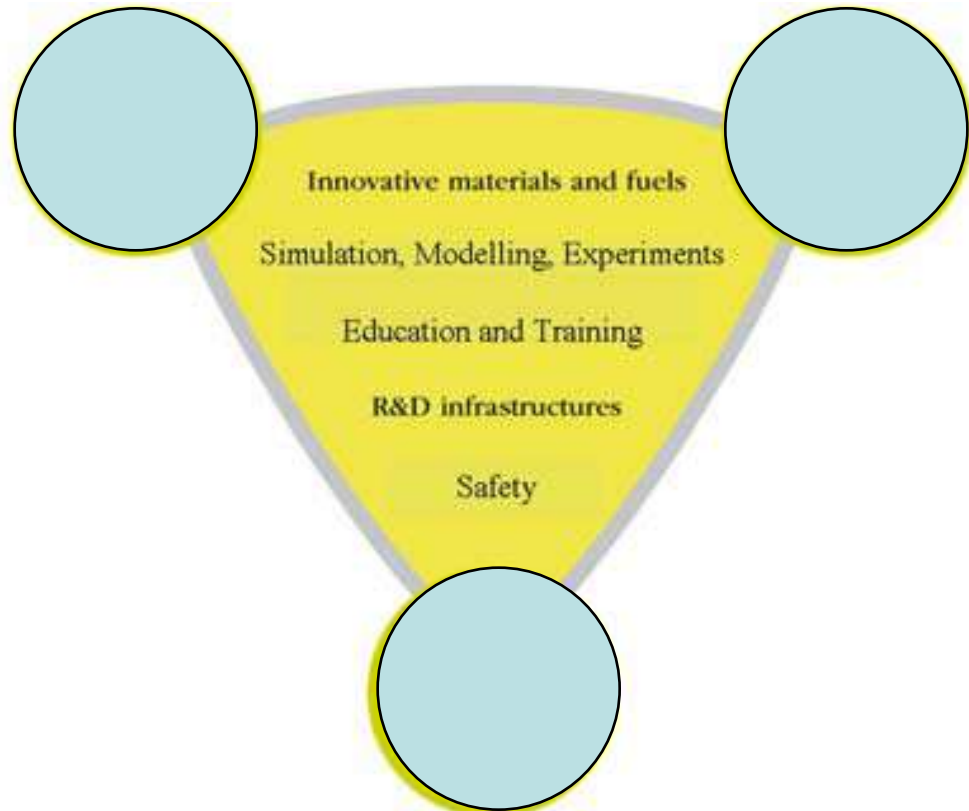




SNE-TP Strategy Structures the SRA

(Strategic Research Agenda)

- SNE-TP Vision:
- Beyond the 3 pillars, a common trunk activities:
- Material & Fuel research,
- Simulation, modelling and validation experiments,
- dedicated or multipurpose research facilities
- Last but not least well trained and educated specialists in the various fields related to nuclear fission

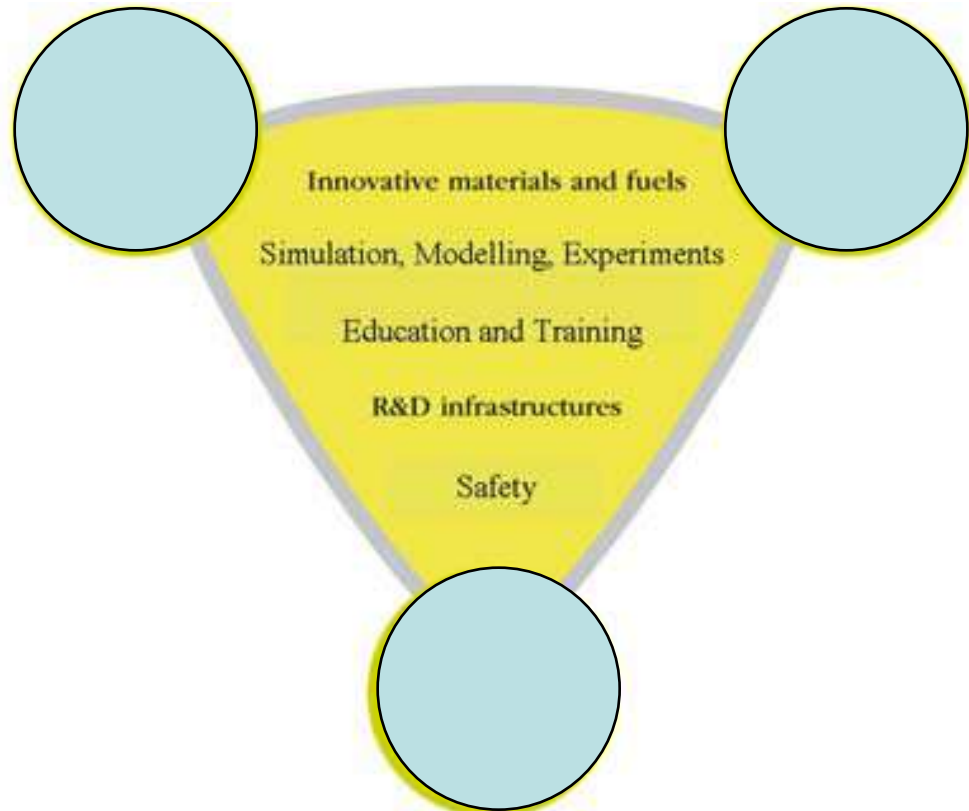


SNE-TP Strategy Structures the SRA

HLM research in the SRA



- SNE-TP Vision:
- Beyond in the LFR and ADS development, HLM R&D is also present in the common trunk activities:
- Material & Fuel research,
- Simulation, modelling and validation experiments,
- dedicated or multipurpose research facilities:
MYRRHA (EU), MTS (USA), TEF-T (J)
- Last but not least well trained and educated specialists in the various fields related to nuclear fission



Fission research in support of industrial needs



First Reactors



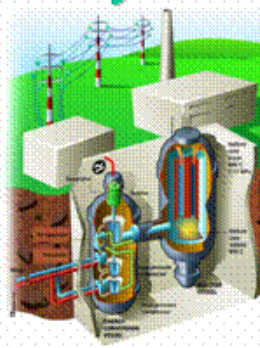
Current Reactors



Advanced Reactors



Future Systems



1950 1970 1990 2010 2030 2050 2070 2090



Generation I

Dismantling & clean-up

Generation II

Produces 31% of Europe's electricity

Generation III

New builds in Finland and France (EPR), others...

Generation IV

Start of industrial deployment in 2040-2050



*What R&D to support this vision?
SNE-TP SRA*



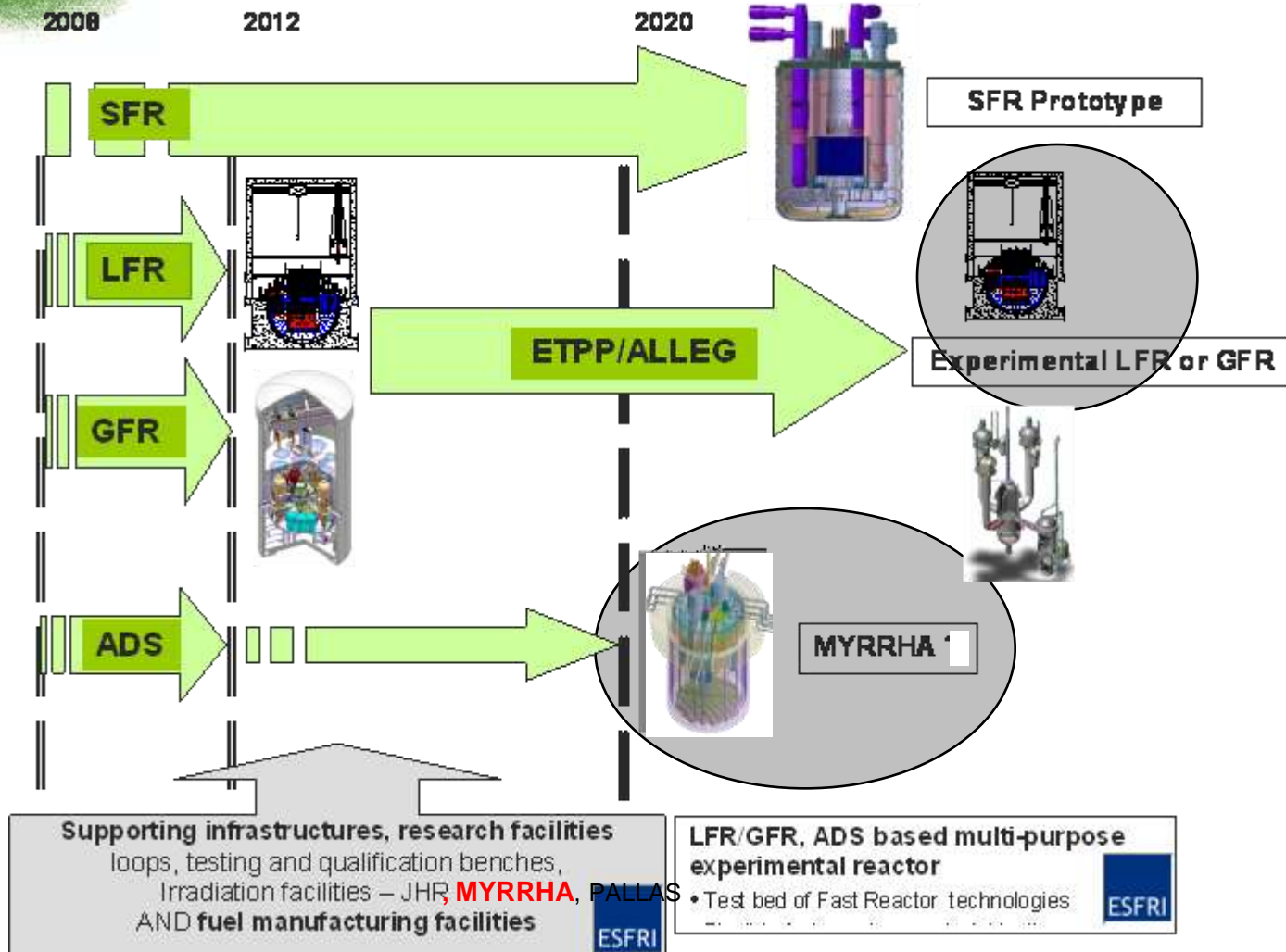
Utility Members of SNE-TP



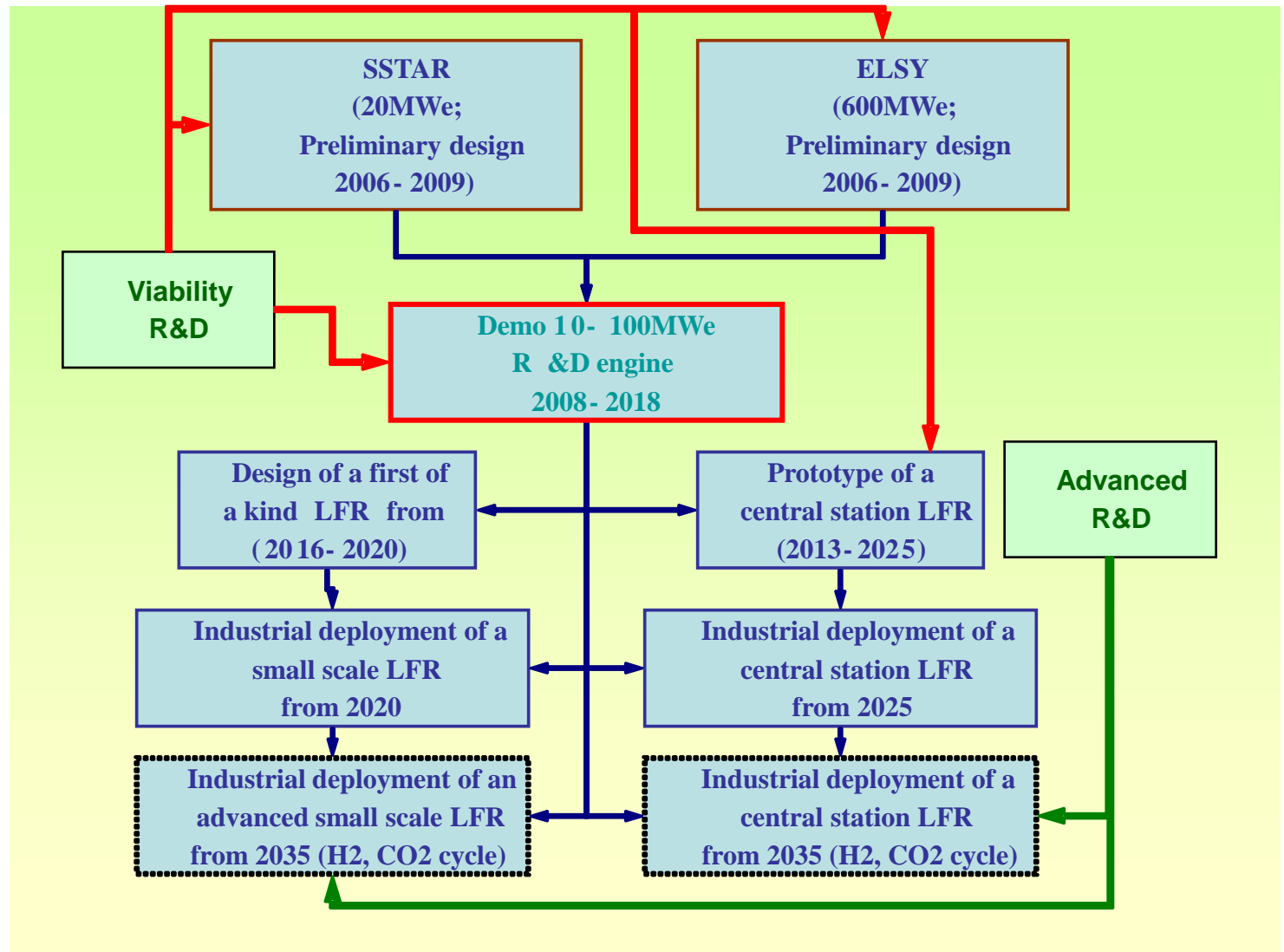
Generation IV Fast Neutron Reactors & Closed fuel cycle

- Recycling: Partitioning and Transmutation
- Innovative fuels (incl. MA-bearing) and core performance
- Improved materials
- Innovative heat exchangers and power conversion systems
- Advanced instrumentation, in-service inspection systems

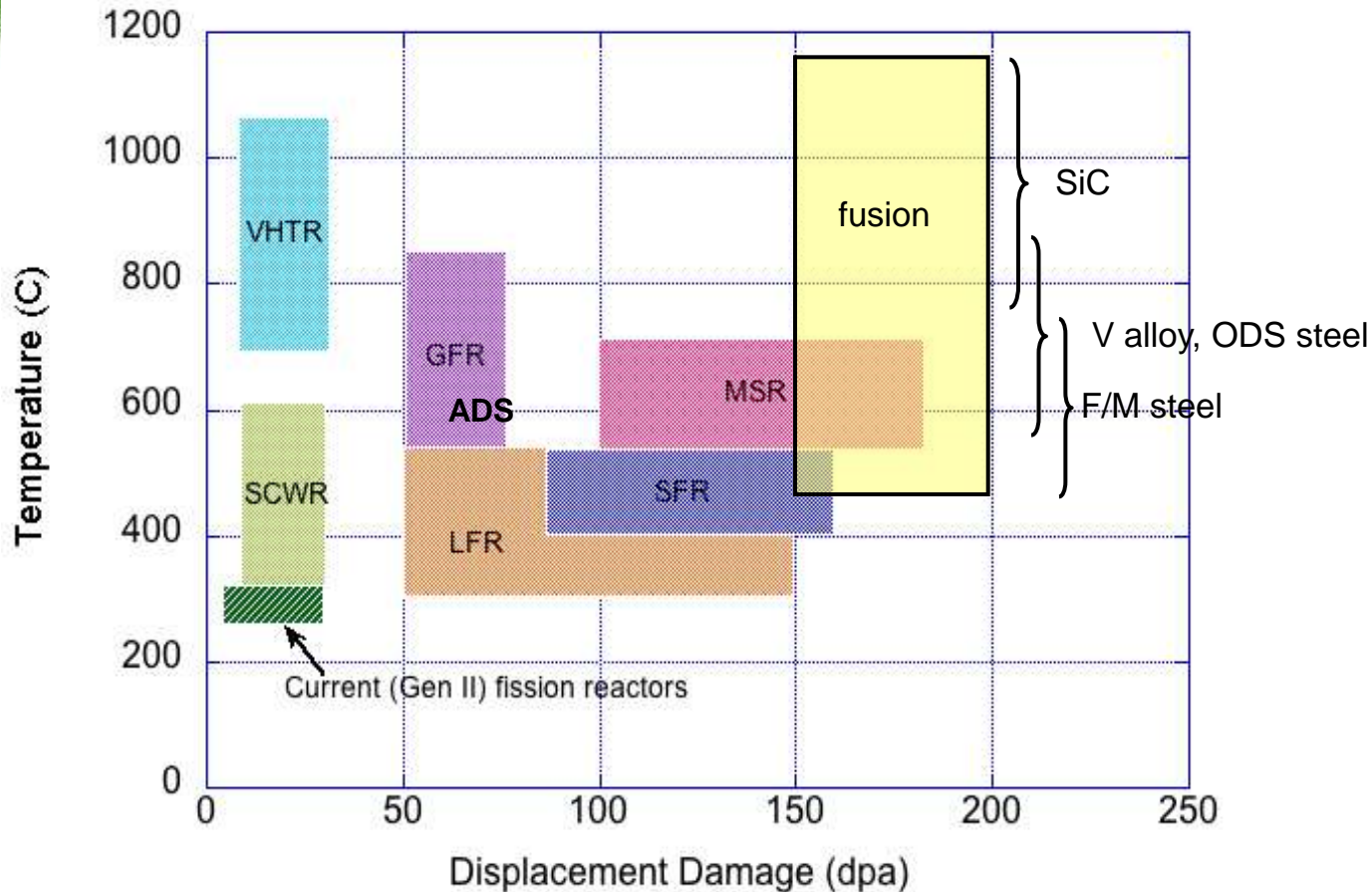
Technology Roadmap for sustainable nuclear development in SRA of SNE-TP



Link ADS – Gen. IV LFR



Introduction to Cross-Cutting Materials R&D



All Gen IV and Fusion concepts pose severe materials challenges

S. Zinkle, SMINS 2007, Karlsruhe



Fuel Research

Gen II and III

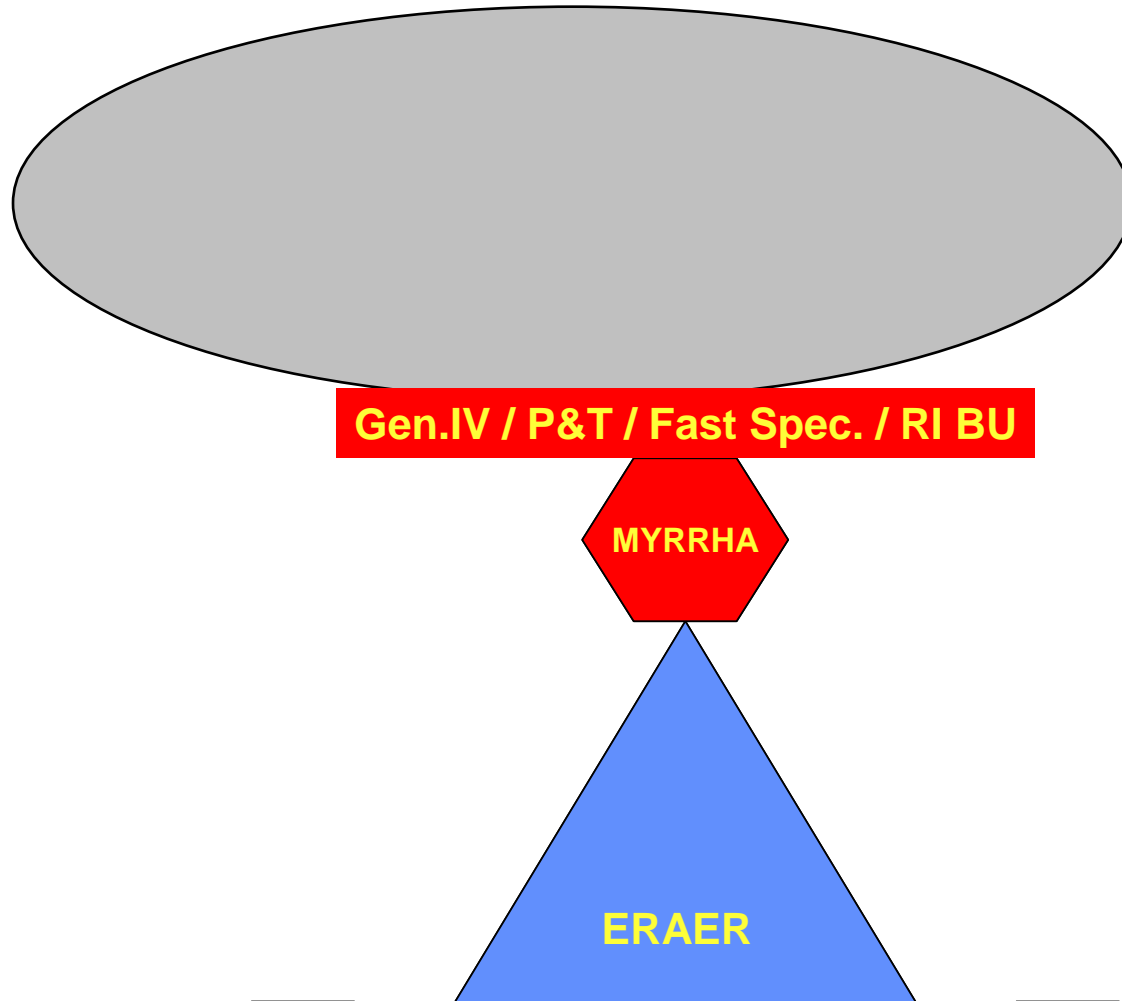
- Largest experience with UO₂ and MOX fuels
 - Provides data and best understanding so far
 - Challenges for higher BU

Gen IV FR, ADS and VHTR

- All reactors will need a DEMO (2020) and then a PROTOTYPE (2030+)
 - MOX fuel for FR and UO₂ for VHTR for DEMO (2020)
 - DEMO to provide ultimate qualification of advanced fuels for PROTOTYPE
 - Carbide/nitrides for FR and ADS
 - MA fuels for FR and ADS
 - UCO or TRU fuels or VHTR
 - Need to start today even if deployment after 2020
- Reactor system should cover fuel qualification and licensing
 - Package of fuel/cladding/assembly

Large Infrastructures (1)

Research Reactors



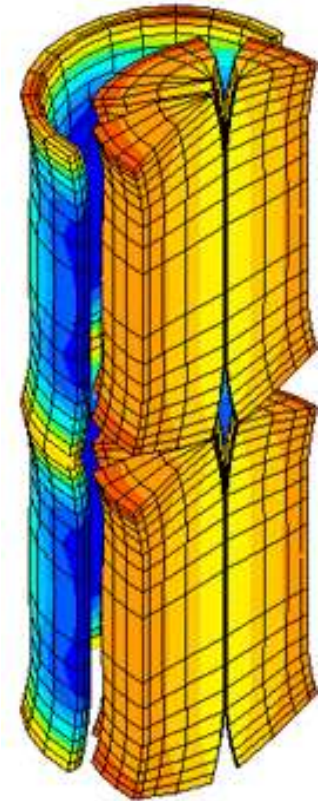
Large Infrastructures (2)

ERAER including the FR prototypes

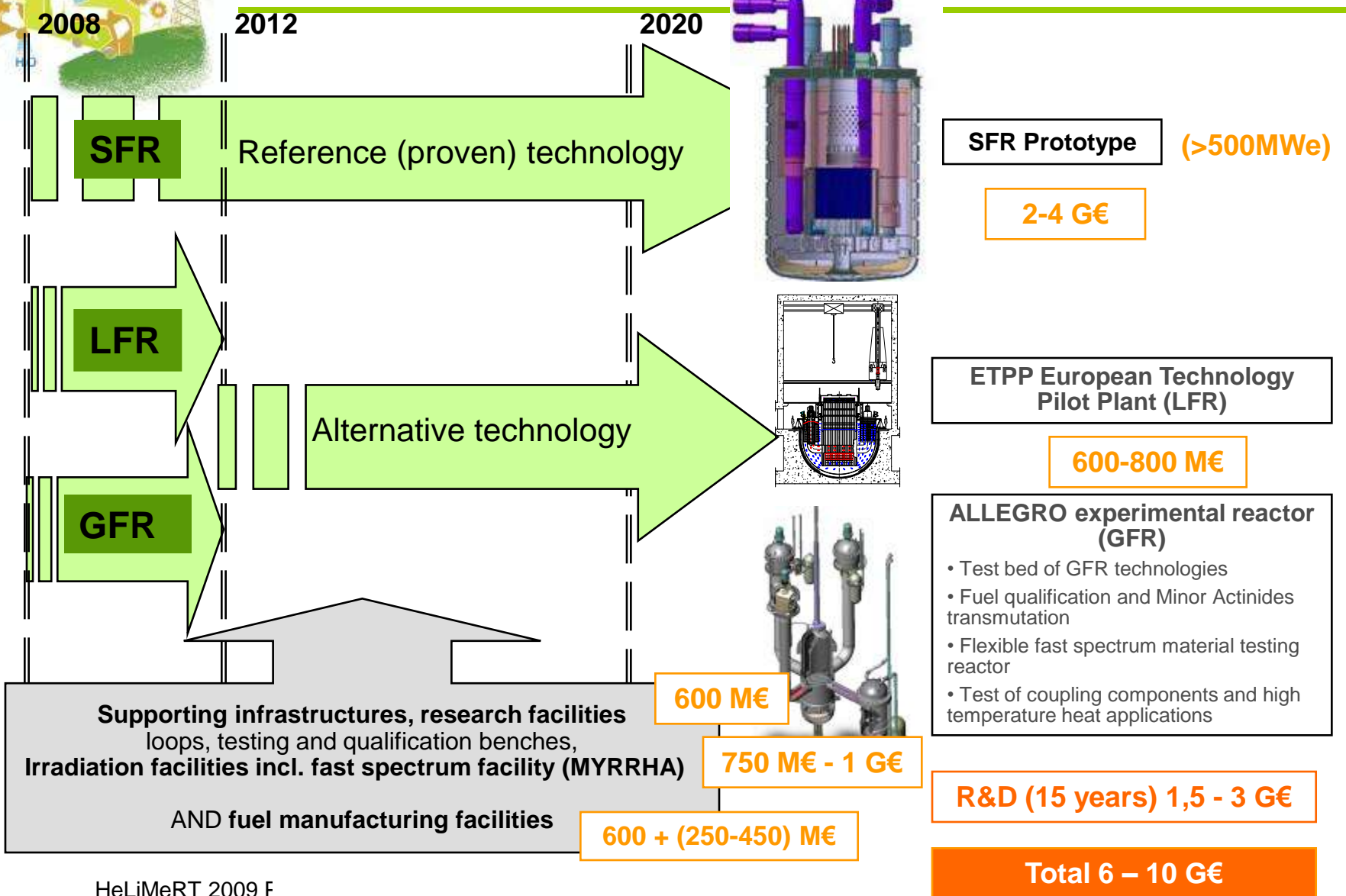


Modelling, Simulation & Methods

- Taking advantage of the increased computational power, development of more advanced physical models and computational approaches becomes possible for very detailed simulation of reactor behaviour in nominal, incidental and accidental conditions:
 - coupling thermal-hydraulics, neutronics and fuel performance codes,
 - best estimate methods with statistical analysis: mechanical analysis of components.
- To exploit fully the potential of these tools, we need:
 - new basic data
 - specific separate and integral effect validation experiments
 - advanced measurement techniques



EI « Sustainable Fission »



Implementation of the SRA

- Pre-competitive R&D projects co-funded under Euratom Framework Programme *The European Commission uses the SRA as a major input to the work programmes*
- Joint Programming between R&D organisations – *mainly suited to basic studies and cross-cutting topics. SNETP proposes “material research” as topic for EERA*
- **European Industrial Initiative (EII) of the SET Plan, devoted to the demonstration of Fast Neutron Reactor technologies with closed fuel** *Task Force of SNETP preparing EII to be launched at end of 2009 (PPF & EC funding)*
- Short & medium term R&D programmes to support LWR operators (utilities) and funded by them *First projects (on plant life management) before end 2009*





Summary

- **Europe is a world leader in nuclear energy** and SNETP helps holding this position
- **Nuclear energy is competitive** and is the largest **low carbon** source in the energy mix of Europe. It is **contributing to Europe's security of supply**.
- **Nuclear energy** path towards **sustainability**:
 - Today Gen.II = PLIM (→ 2040)
 - Tomorrow Gen.III = Deployment of a new fleet (2010 → 2030)
 - After-tomorrow = Gen IV + Advanced fuel cycle + beyond electricity application (R&D → 2020, prototype → 2030, deployment beyond)
- Industry & Utilities ready to invest in Gen. II & III but need a confidence climate
- **Private & Public Funding & EC contribution are needed for the Gen. IV EII through new financial vehicle**

Conclusion



- HLM technology is present in various R&D fields in the SRA:
 - Technology
 - Material
 - Reactor Design
 - Modeling & Simulation
 - Basic Physical Data



Thank you