Innovation and Education: a Virtuous Circle

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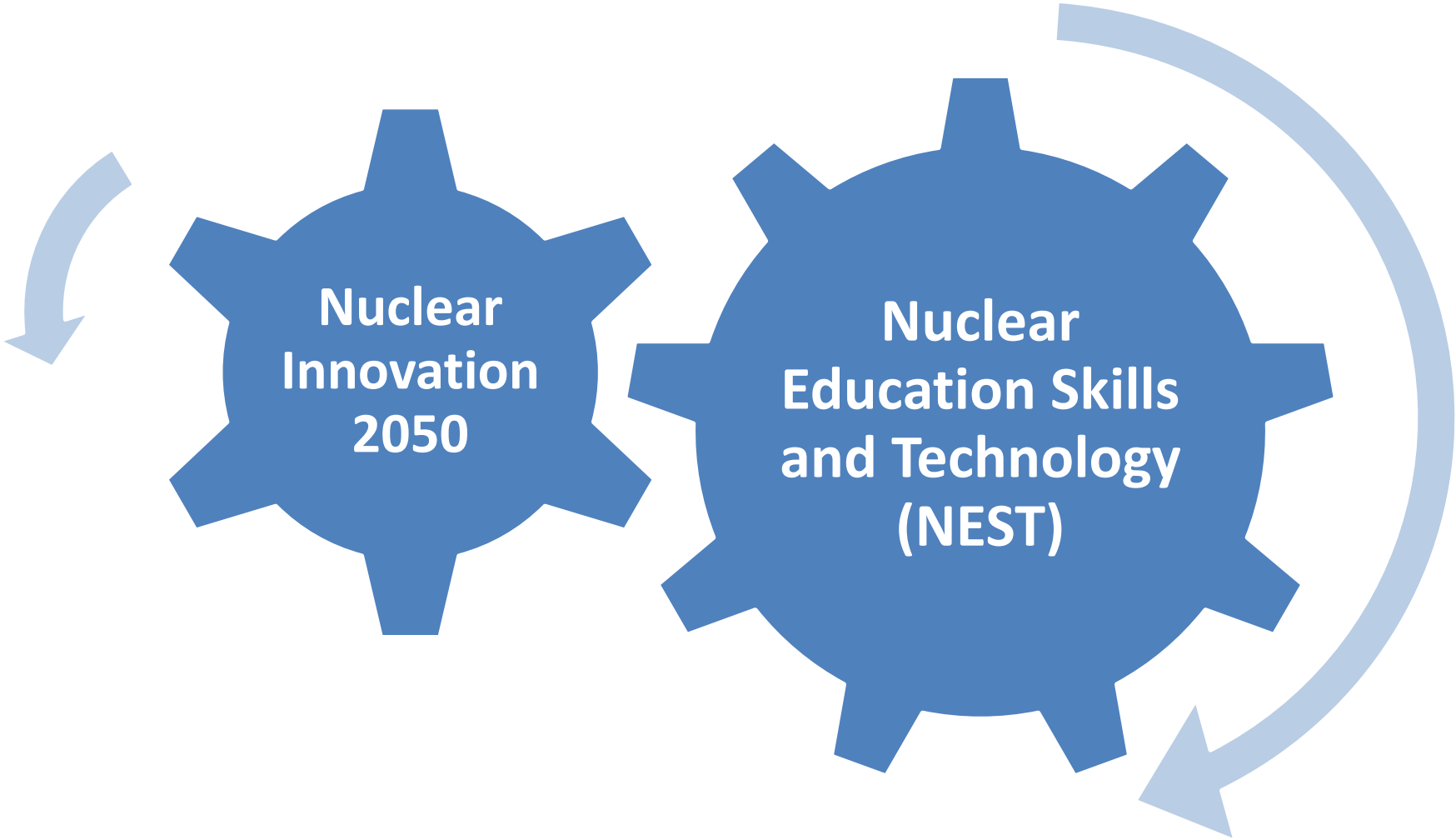
15th Anniversary of the ENEN Association on 1 March 2018
Hosted by the Royal Flemish Academy of Belgium for Science and the Arts
Hertogsstraat 1, Brussels

Two initiatives launched by the NEA



Innovation is needed to make the long-term role of nuclear energy possible

- **Improving cost effectiveness and flexibility**
- **Furthering safety, AND at lower cost**
- **Assuring a sustainable, fuel cycle while addressing policymaker concerns about nuclear proliferation**
- **Resolving questions about nuclear waste and environmental impacts**
- **In general: It is necessary to assure that nuclear fits in the future, as yet uncertain, global energy framework.**

But the global capacity to develop and deploy innovative nuclear energy technology is contracting at a time of greatest need

Advanced fuel concepts

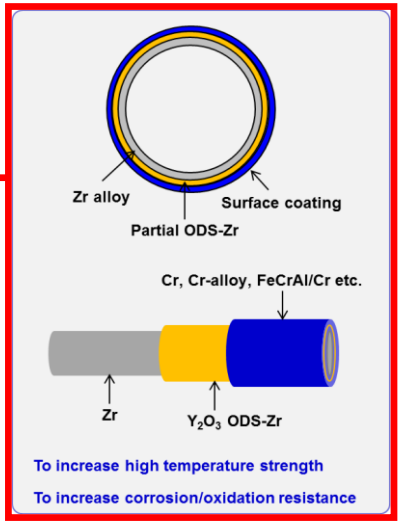
① Coated and improved Zr-alloys
- Metallic (Cr, Cr-alloys, FeCrAl, Cr/FeCrAl)
- Ceramic (MAX, Nitrides)

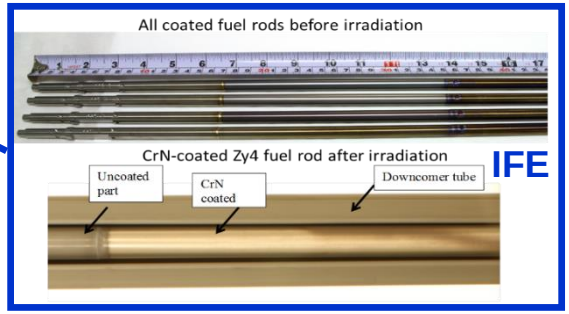
② Advanced steels (FeCrAl)

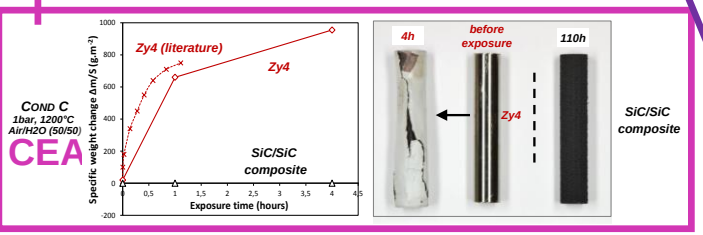
③ Refractory metals (Mo)

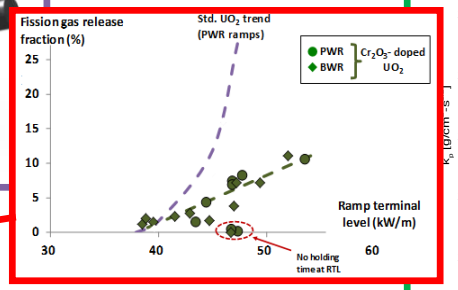
④ SiC and SiC/SiC

KAERI









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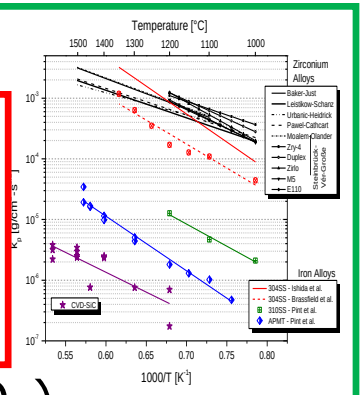
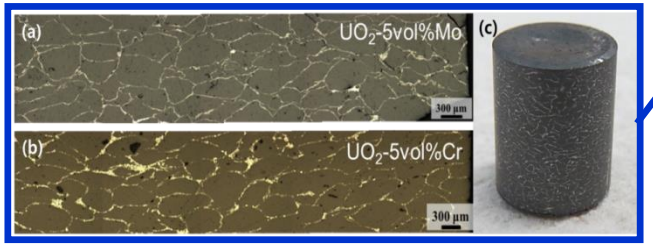


① Improved UO_2
- Doped UO_2 (Cr_2O_3, Al_2O_3-Cr_2O_3, Ceramic microcell UO_2)
- High thermal conductivity UO_2, Metallic additive (CERMET, Mo, Metallic microcell), Ceramic additive (BeO, SiC)

② High density (Si, N, C, Metal)

③ Encapsulated fuel



Enhancing innovation in nuclear

- Making possible, economically and timely, the deployment of novel technologies, while maintaining/ strengthening and demonstrating safety

- Necessary to improve the interaction among industry, research and safety community on the innovative process
  - Sharing the drivers in the area of safety AND economics
  - Implementing a shared validation/qualification route
  - Improving technical capacities: research infrastructure, experimental technology, data and advanced simulation
  - Involving new generations in the right way

Who will implement these technologies?

- The global current talent base in nuclear technology has been built over several decades on challenging projects.
- The most experienced core of nuclear technologists were involved in nuclear research and projects in the late 1960s through the 1980s.

- **A very large portion of the 2nd generation is nearing retirement**

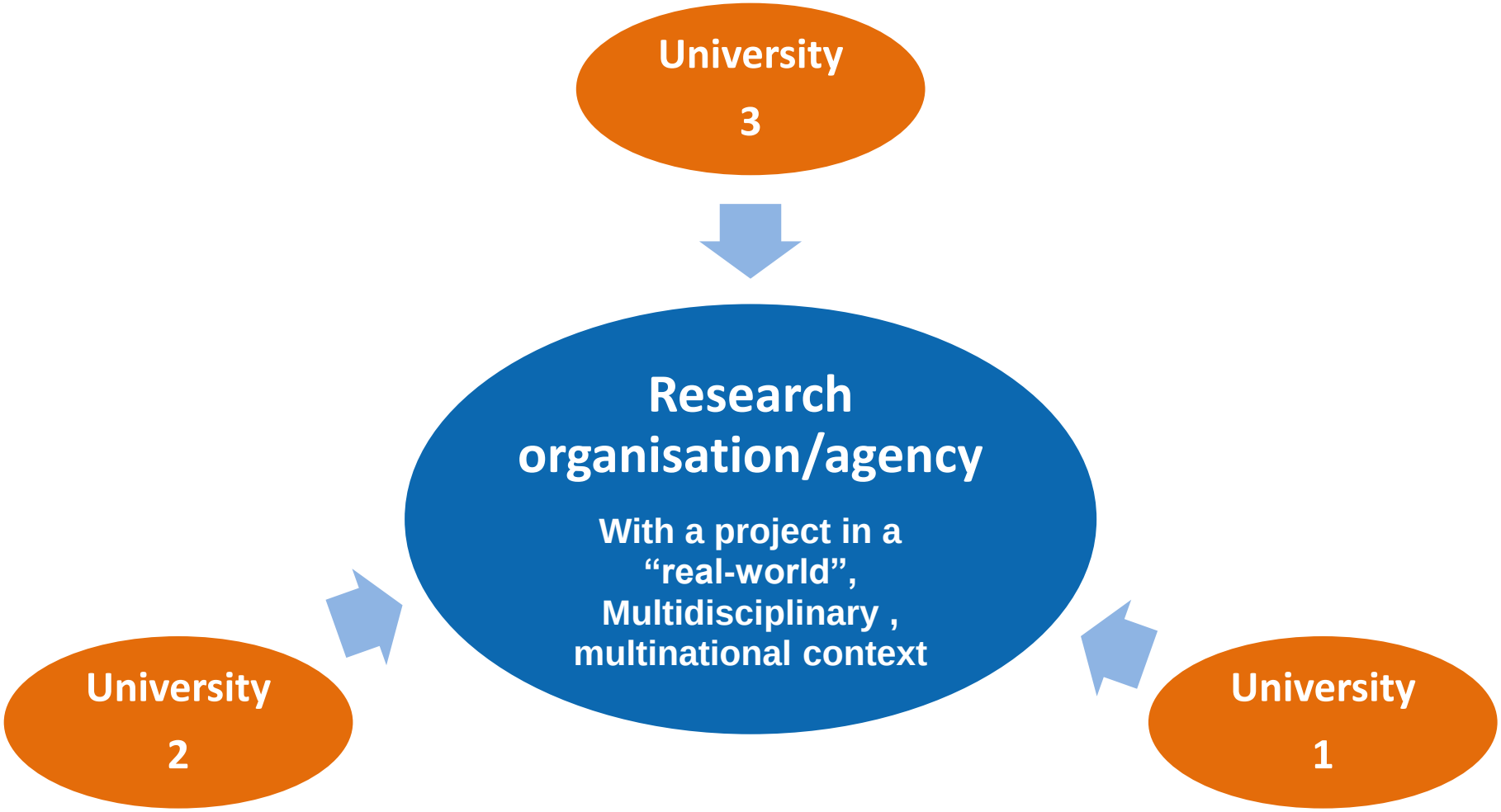
Continued use of nuclear energy urgently needs highly-trained scientists and technologists to support present technology, to develop the technologies of the future and to manage nuclear legacies over the decades to come.

The NEA Nuclear Education, Skills and Technology Programme (NEST)

- SKILLS are necessary to develop innovations AND
  Innovative projects are necessary to develop SKILLS

- NEST, a multinational framework between interested countries, intends to energize young engineers and scientists to pursue careers in nuclear technology by:
  - Attracting young fellows by addressing Demanding and Innovative activities
  - Working on Real-world problems alongside experienced practitioners
  - Establishing links between Universities, Research Institutes, Industry and Regulatory bodies
  - Offering Hands-on activities in Multidisciplinary and Multinational contexts
  - complemented by training sessions to get a broad nuclear culture

The existing model



The NEST international model

Nuclear technology management, a change in the paradigm

- Technology evolution is mandatory not only to match needs BUT ALSO

  to attract and train new generations by the challenges of the today world - which in turn will make possible the innovation

- Complementary to the academic education, to the training by research,

training through innovation is NEST