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TOWARDS A NEW RESEARCH REACTOR IN SLOVENIA

Jan Malec, Anže Pungerčič, Bor Kos, Klemen Ambrožič, Andrej Žohar, Vladimir Radulović, Anže Jazbec, Sebastjan Rupnik, Vid Merljak, Aljaž Čufar, Žiga Štancar, Luka Snoj

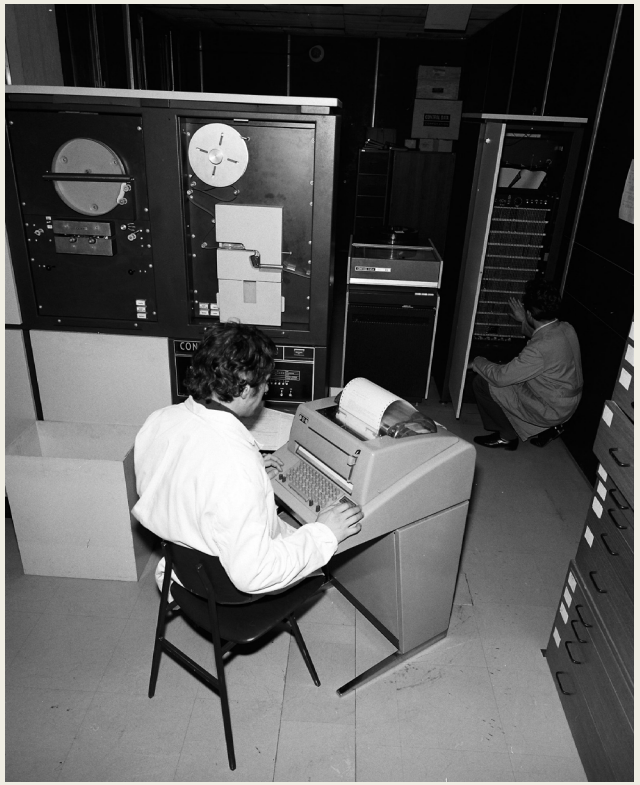
Jožef Stefan Institute

Overview

- TRIGA Mark II in Ljubljana
- Motivation
- Technology
- Next steps

Research reactor → Development of science

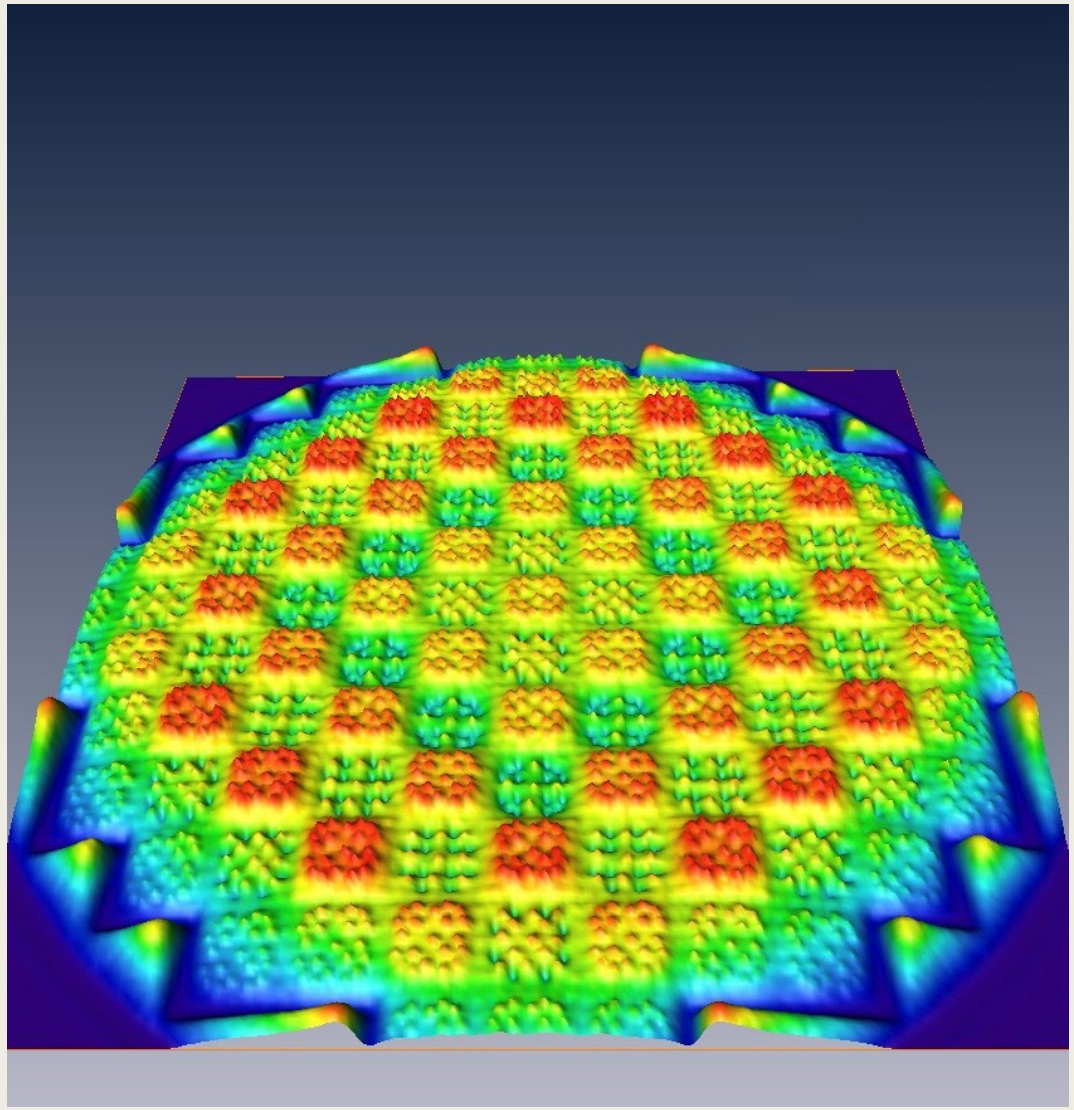
- Nuclear Institute Jožef Stefan -> Institute Jožef Stefan
- Computer science, nuclear and reactor physics, nuclear medicine, reactor technology, nuclear chemistry, analytical chemistry



Some other achievements of TRIGA in Ljubljana

- Isotope production in Yugoslavia
- NEK support – reduce outage and fuel management costs (DMR43, CORD2)
- Education and training of practically all Slovenian nuclear experts
- Detector and radiation hardness testing for NATO, CEA
- Reference laboratory for radiation hardness for CERN

Dr. Aleš Fajgelj in Jože Novak ob napravi za pridobivanje tehnecija za uporabo v Univerzitetnem kliničnem Centru Ljubljana in Onkološkem inštitutu Ljubljana.

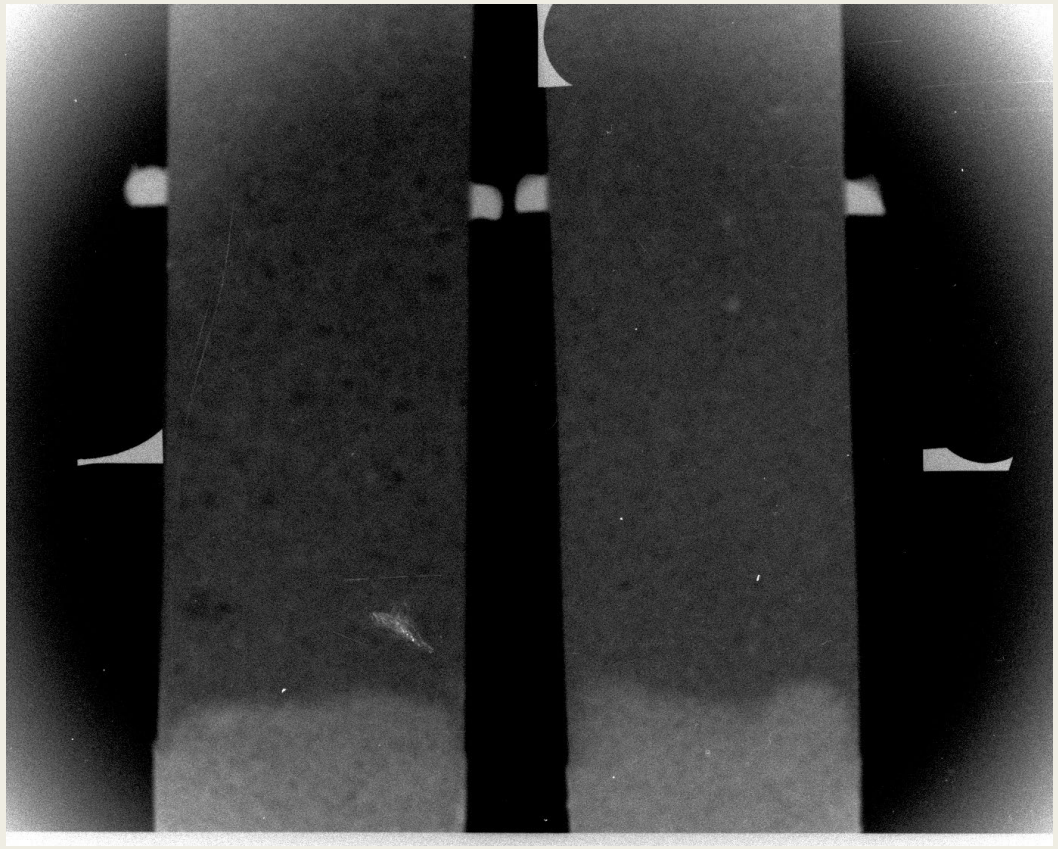


Motivation for a new reactor – Research

- Attract new generations of researchers
- Nuclear physics and technology interesting and relevant
- Keep advancing research in the next 60 years!

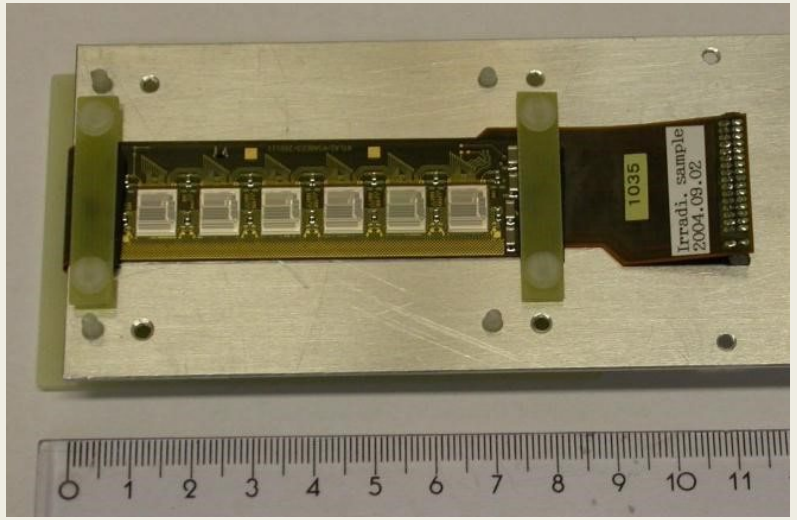
Motivation – Research 2

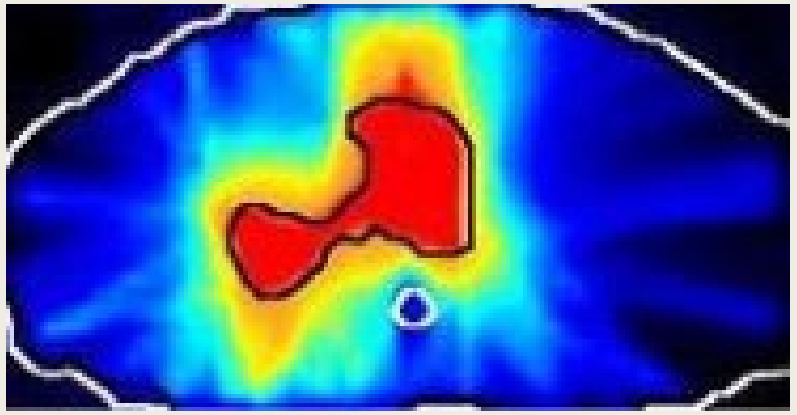
- Europe: 35 reactors in decommissioning, 2 reactors planned
- The 2 reactors planned not flexible enough for education or wide range of experiments
- Support for Myrrha, Jules Horowitz Reactor
- Support for other big European projects
- Complementaries with fusion



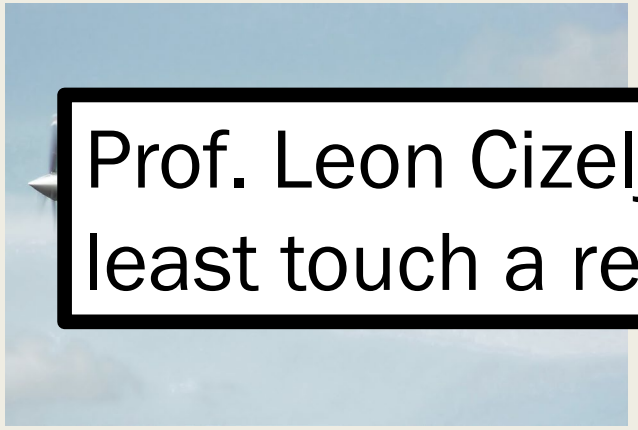
Motivation – Industry and Healthcare support

- Partners (CEA, Rolls-Royce, ..)
- Support for NEK (staff AND research)
- European NPP
- Nuclear medicine
- Agriculture
- Environmental sciences
- Neutron imaging
- NEK2? (SLO net importer, rising demand)





Motivation – Training and Education

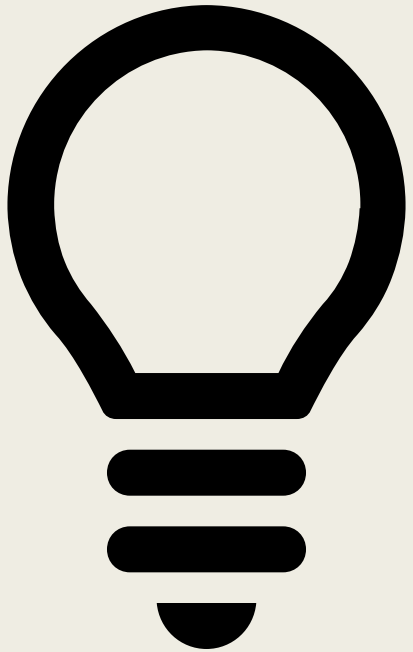


Prof. Leon Cizelj: „Every nuclear physics student should at least touch a reactor“

Rosatom training program: 17 years for newcomer country to a powerplant

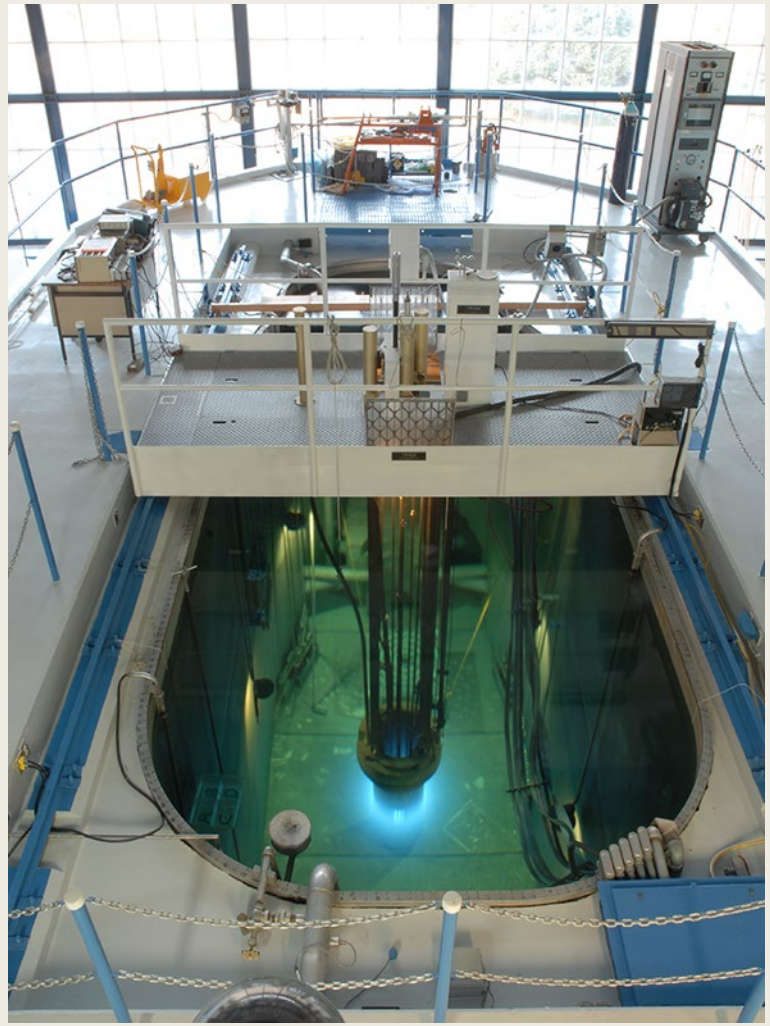
Technology – reactor for research?

- Reactor use case → design characteristics
- Characteristics for research?
- Flexible, easy to use, easy to operate, new technology, accessible core
- Not all above are compatible
- Small improvements or radically new technology?



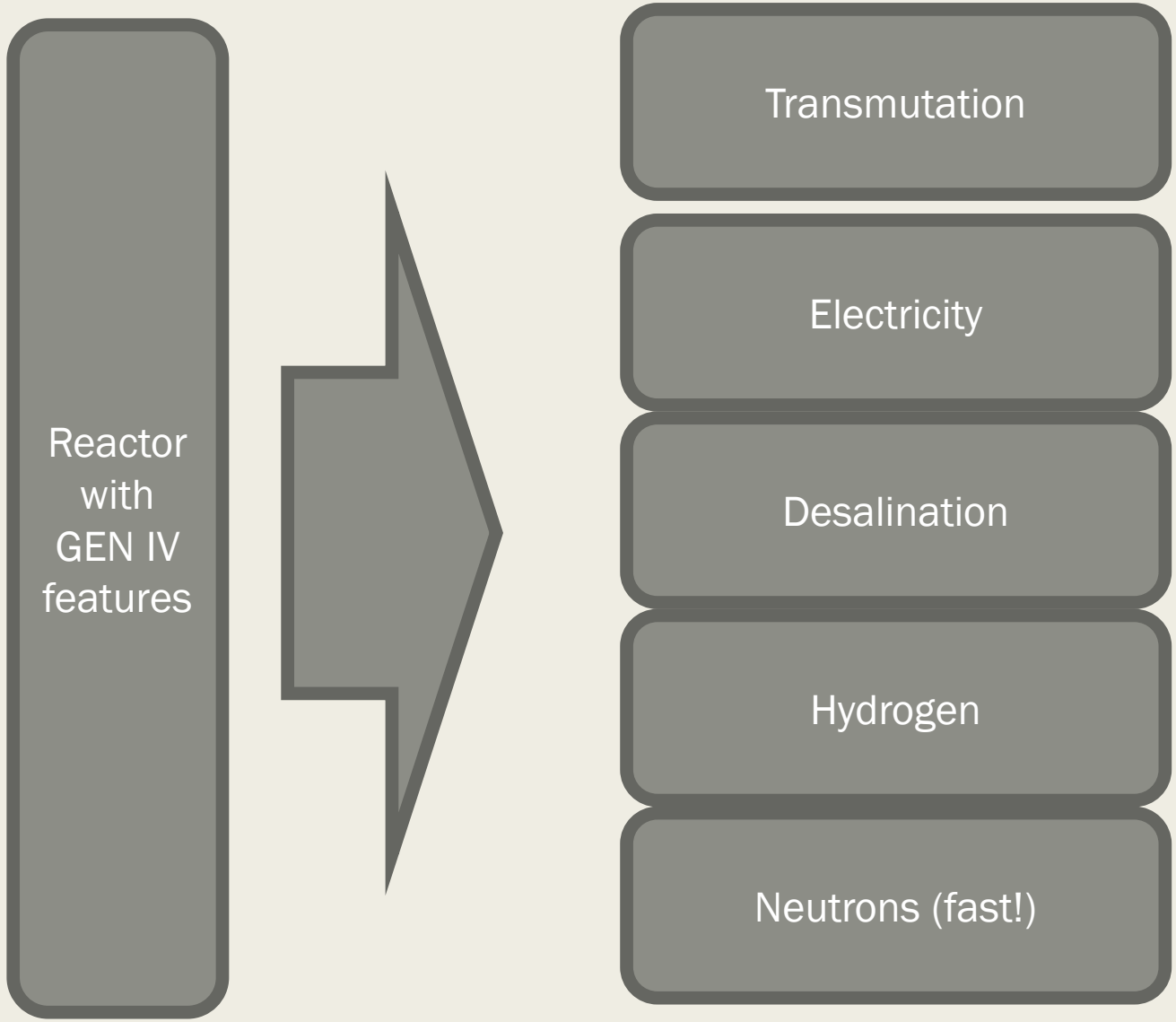
Technology – A new light water reactor

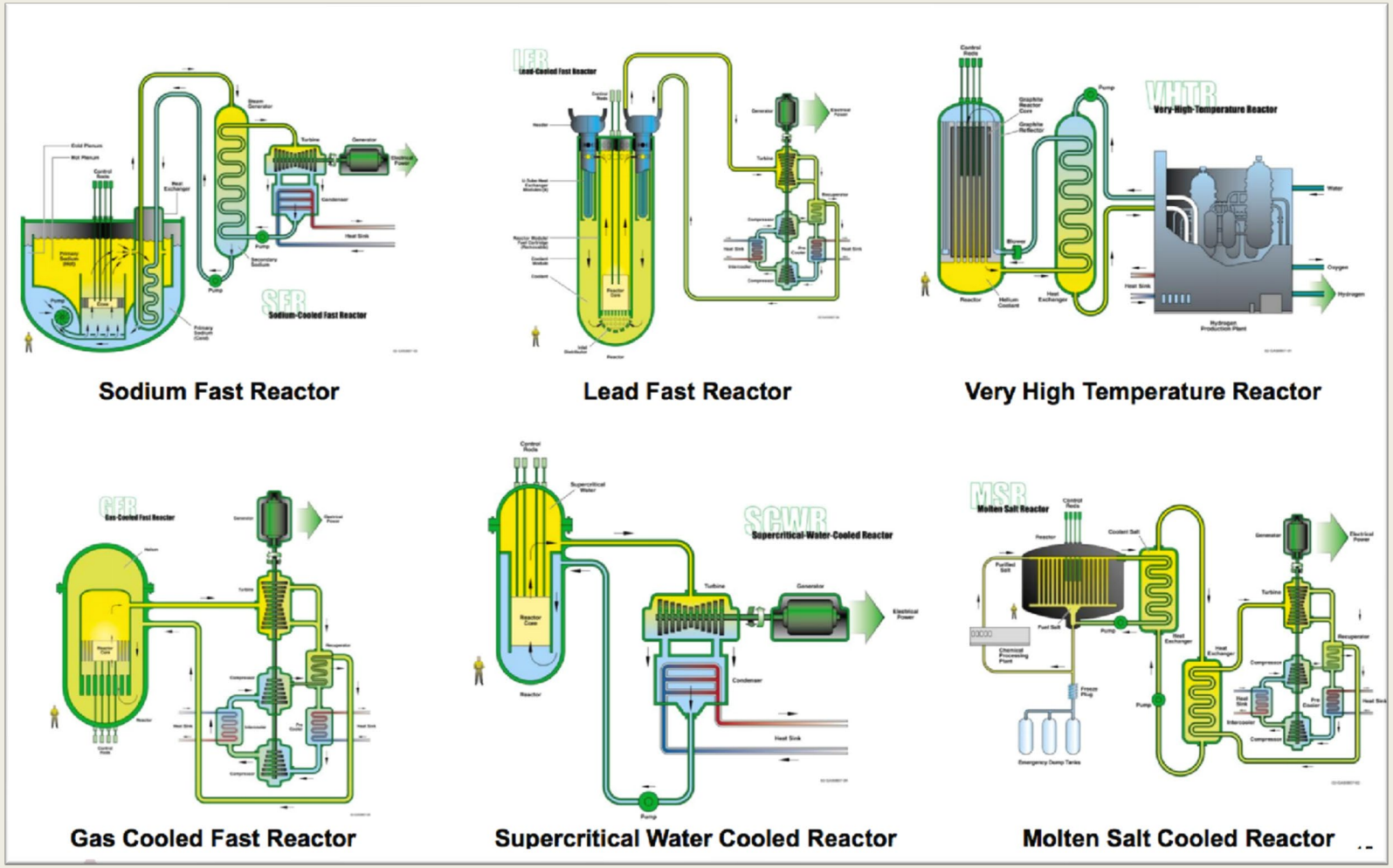
- Support ageing European nuclear fleet of PWR - direct support AND research!,
- Commercially available,
- Easier to build and license than radical designs,
- Possible features:
  - *A bigger pool*
  - *Higher flux than current reactor*
  - *Advanced diagnostics*
  - *Exotic fuel (U-Al, U-Mo)*
  - *Two reactors: zero power and high flux*



Technology – GEN IV

- Cutting edge research!
- Myrrha, ASTRID, ALFRED support
- Is Slovenia ready?
- Simple enough for education?



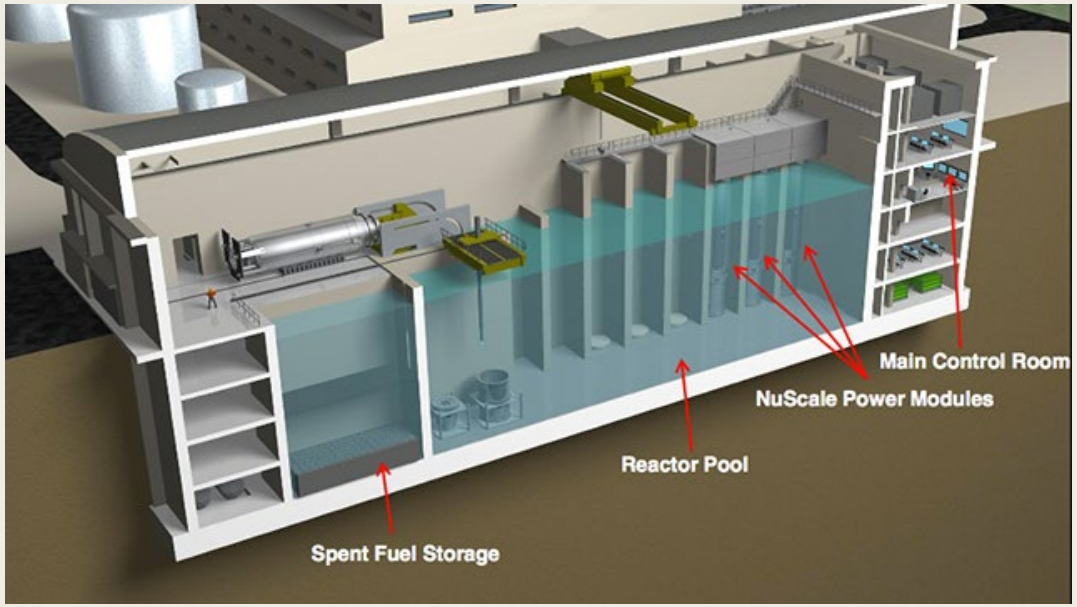


Technology – GEN IV Considerations

- Some are more suitable for researchers
- Reprocessing
- Pressure
- Accessible/visible core
- Accelerator driven system?
- Dual fluid reactor?

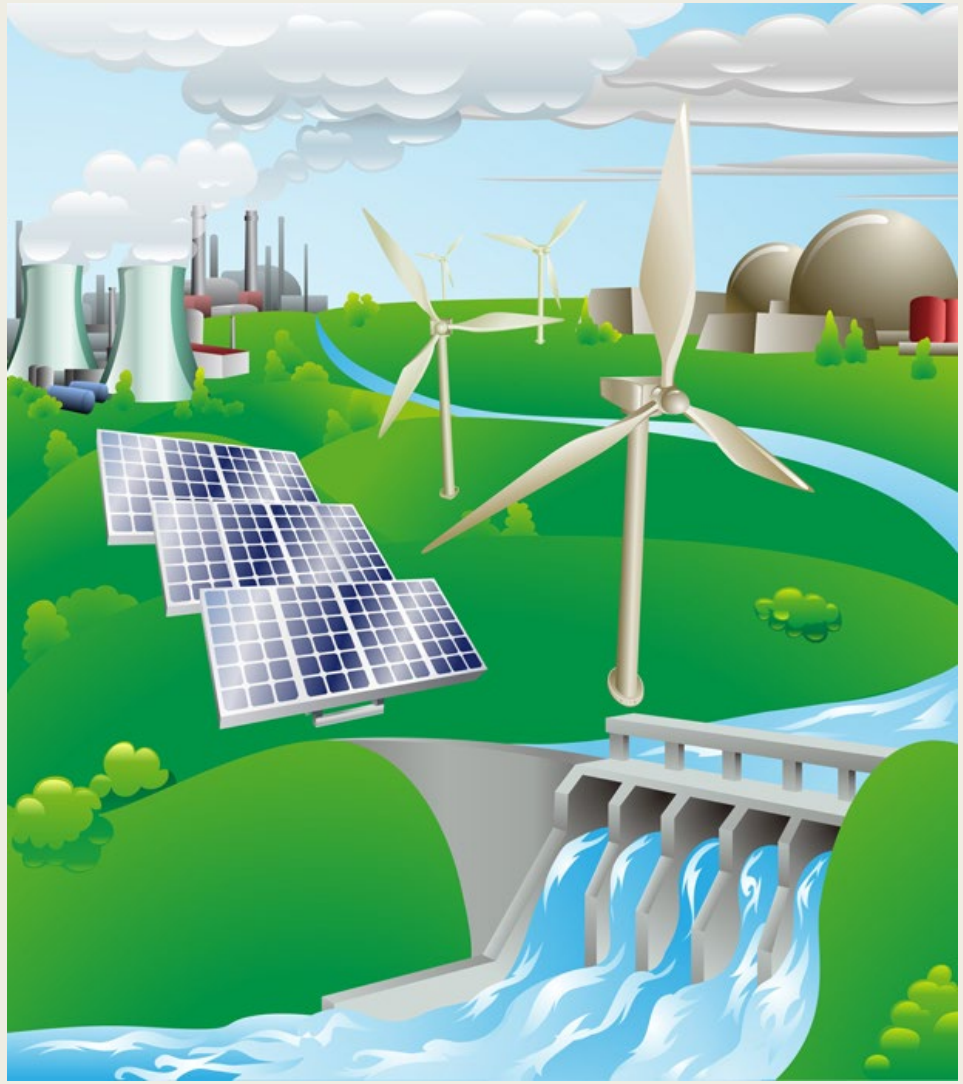
Technology - SMR

- Support transition to SMR?
- SMR promise:
  - *Mass production → lower cost*
  - *Delivery on site*
  - *Lower initial investment*
- Closed SMR → Not for reactor core/neutronics research?
- SMR mockup – like SMR but accessible core/irradiation channels



Technology – hybrid system

- Slovenia has:
  - Land dense with rivers
  - Highway
  - Potential locations for research and power reactors
- Energy development center with:
  - Hydroelectric power
  - Solar, Wind
  - Hydrogen production
  - Storage
  - District heating
- Connect nuclear, environmental sciences, energy, electric mobility, ..

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642


Cerklje na Gorenjskem
Kranj
E61
Kamnik
Snovik
Vransko
E57
Žalec
Prebold
Celje
Štore
Šentjur
Trojane
Lukovica pri Domžalah
1 h 36 min
101 km
Laško
Medvode
Domžale
Moravče
Rimske Toplice
5
Planina pri Sevnici
E57
108
60,00 km
108
Litija
72km
Ljubljana
40,00 km
Radeče
Ledina
Brezovica pri Ljubljani
Senovo
106
20,00 km
5
Brestanica
Arto
Šentrupert
Čatež
A2
Ig
Grosuplje
Ivančna Gorica
1 h 5 min
101 km
Škocjan
Rakitna
Turjak
Krka
A2
Šmarješke Toplice
A2
Videm
Kostanjevica na Krki
Velike Lašče
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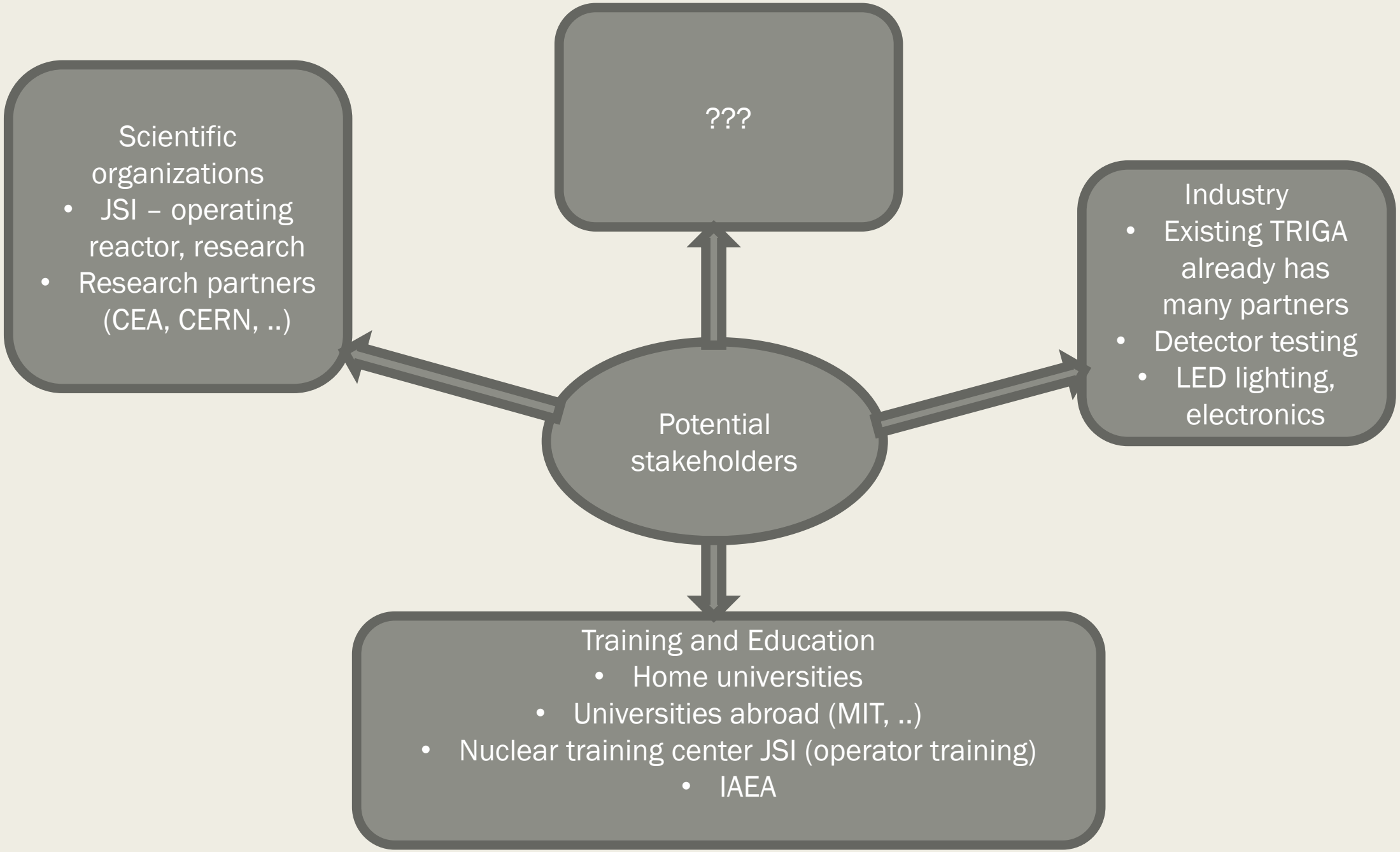
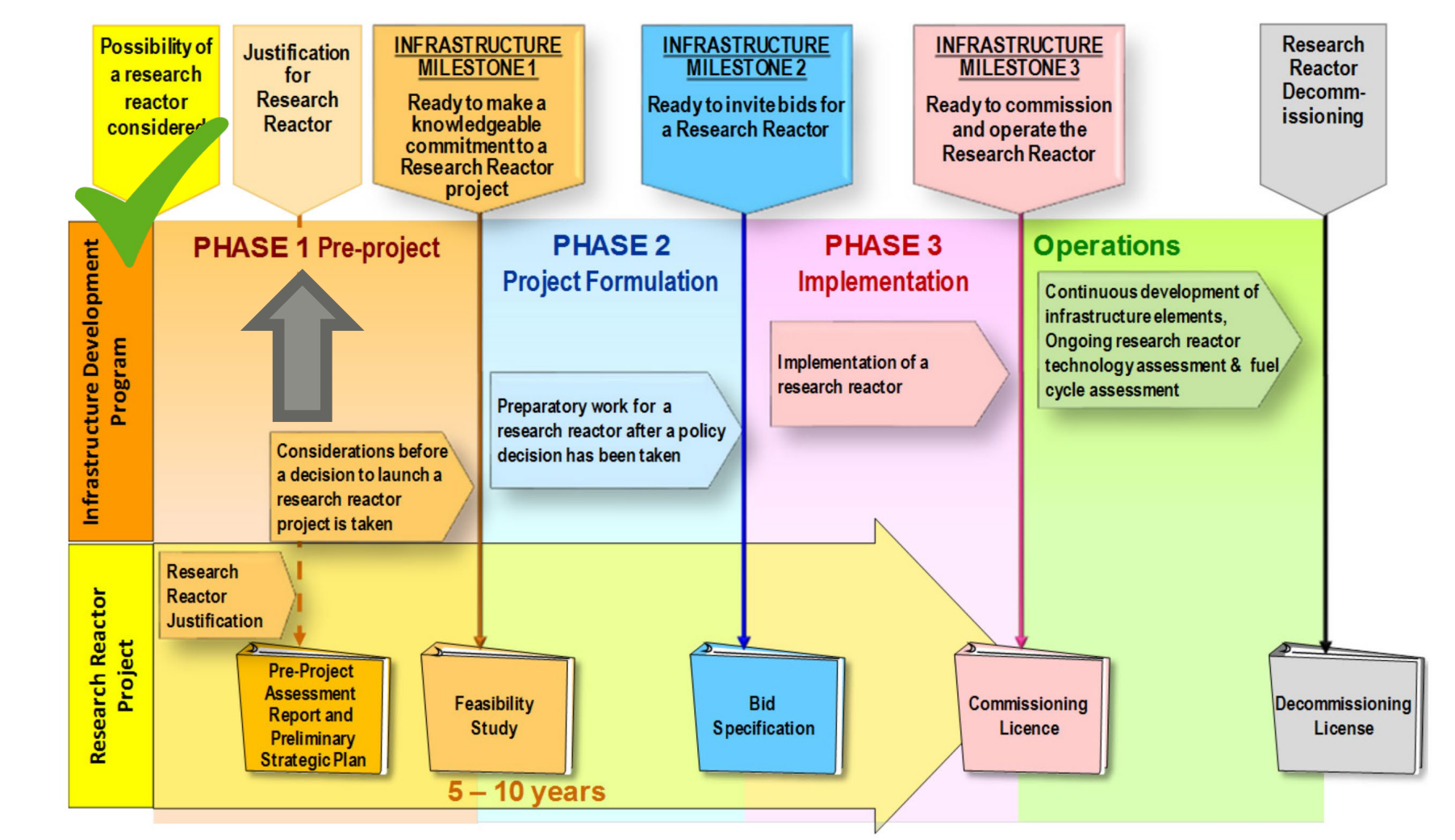
Otočec


???
Scientific organizations
• JSI – operating reactor, research
• Research partners (CEA, CERN, ..)
Industry
• Existing TRIGA already has many partners
• Detector testing
• LED lighting, electronics
Potential stakeholders
Training and Education
• Home universities
• Universities abroad (MIT, ..)
• Nuclear training center JSI (operator training)
• IAEA

What's next



IAEA: Feasibility Study Preparation for New Research Reactor Programmes

Conclusion

- Slovenia: Potential locations, infrastructure, tradition
- Nuclear expertise and research necessary with or without NEK2!
- Big impact on non-nuclear fields
- Plan ready for realization in 3 years
- Let’s talk about it!