NUCLEAR INNOVATION 2050

NI2050

Adv Panel Sept 2017

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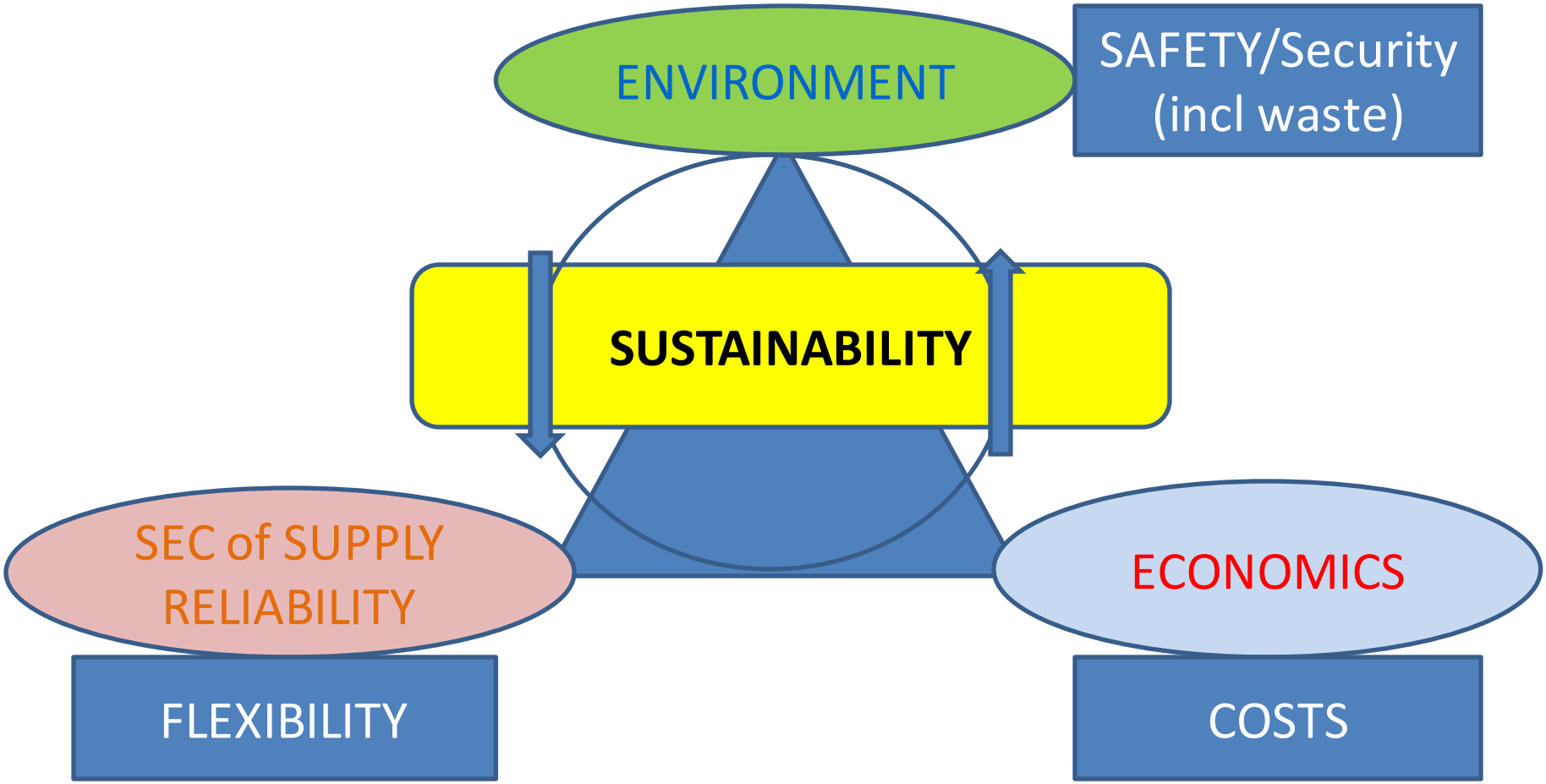
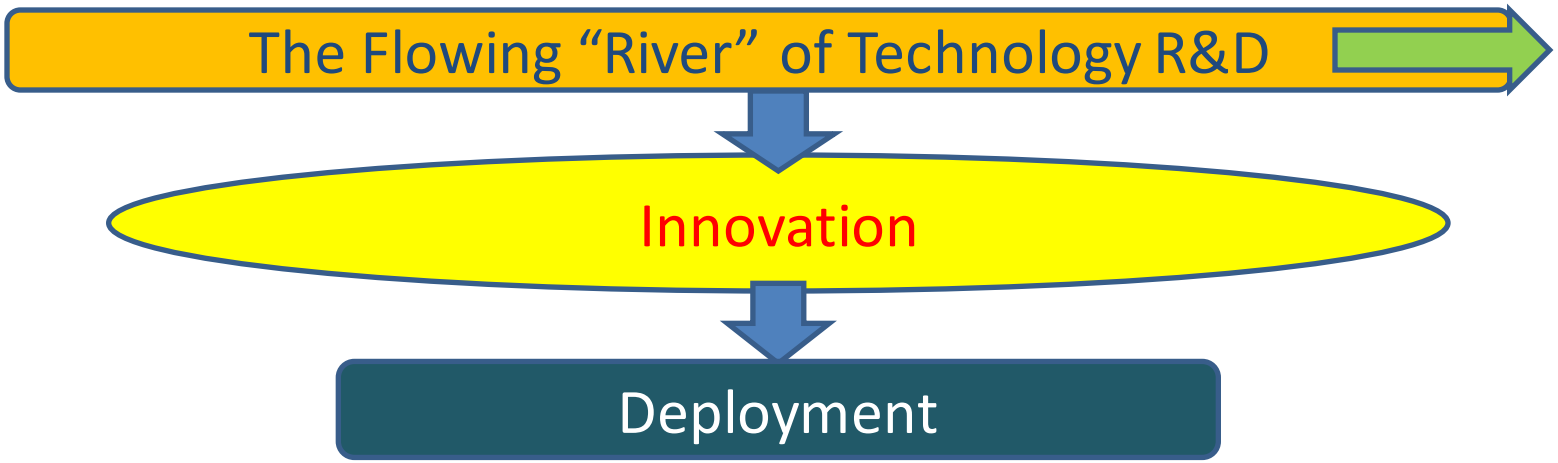
CO2… and beyond: Global Challenges

Triangle for NUCLEAR Energy POLICY



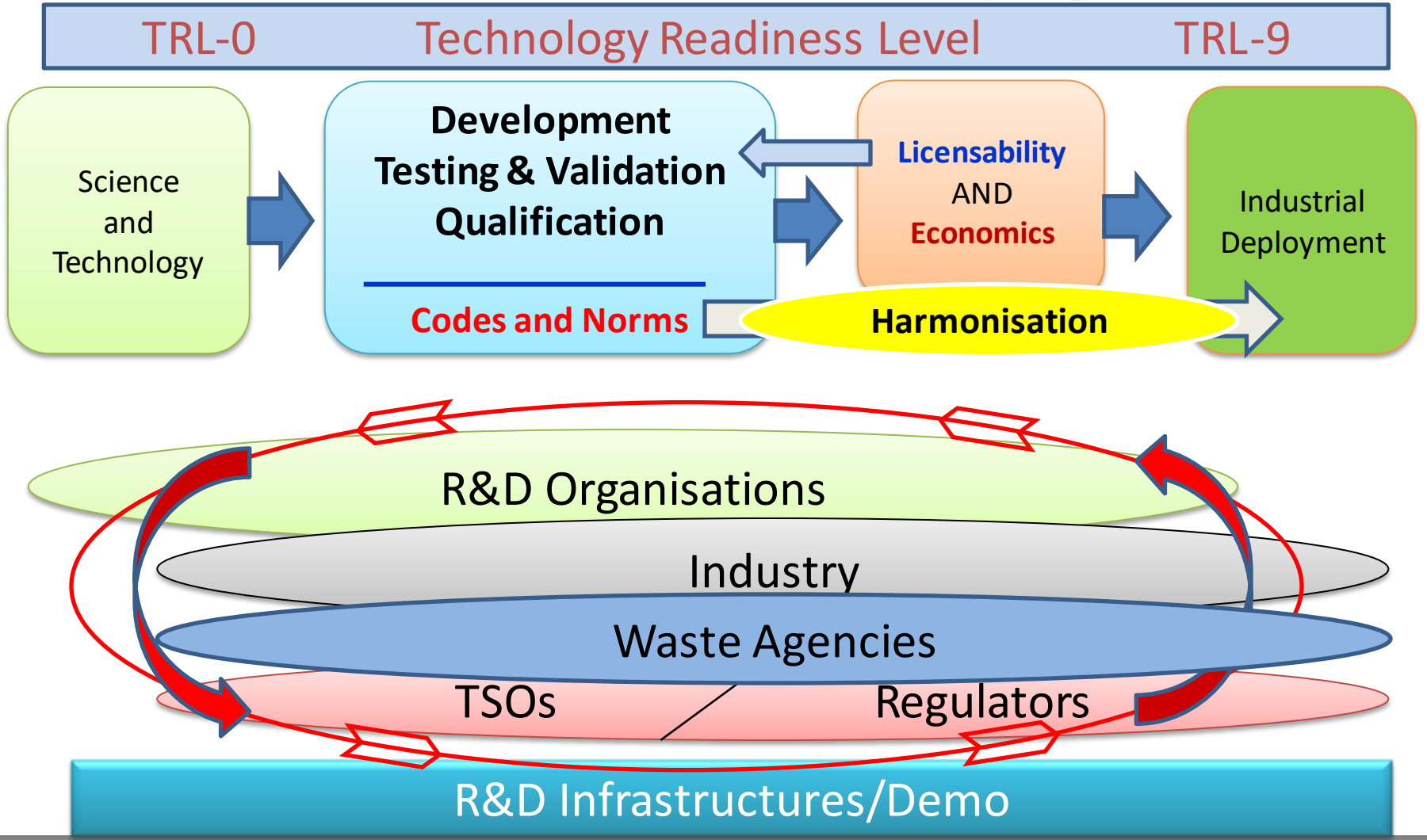
NI2050 CHALLENGE:
How to Move from Research to Innovation

- Most countries have ongoing technology R&D in both government and in the private sector.
- Financial constraints, deployment timelines, infrastructure limitations, and other factors inhibit the progression from R&D to the successful deployment of innovation.



NI2050 CONCEPT:

From science to market deployment



At NI2050 CORE: Dev/Test/Valide & Qualify

- Shared, and built through iterations, between
  - **Science community**, aware of the characteristics of the proposed new technology (ex fuels and materials)
  - **Industry community**, aware of the expected conditions of deployment of this technology (ia economic requirements)
  - **Safety community**, aware of criteria for accepting the former technology and of the risk analysis for the new one (ia safety requirements)
- A **sequential approach** is far too **long**, too **risky**
- Collaboration on technologies
  - **Mutualises costs, create confidence, open the market**
  - **BUT leave competition open on final products**

NI2050 PROCESS: boosting innovation in nuclear fission

NI2050 – Nuclear Innovation 2050 is a broad NEA Initiative

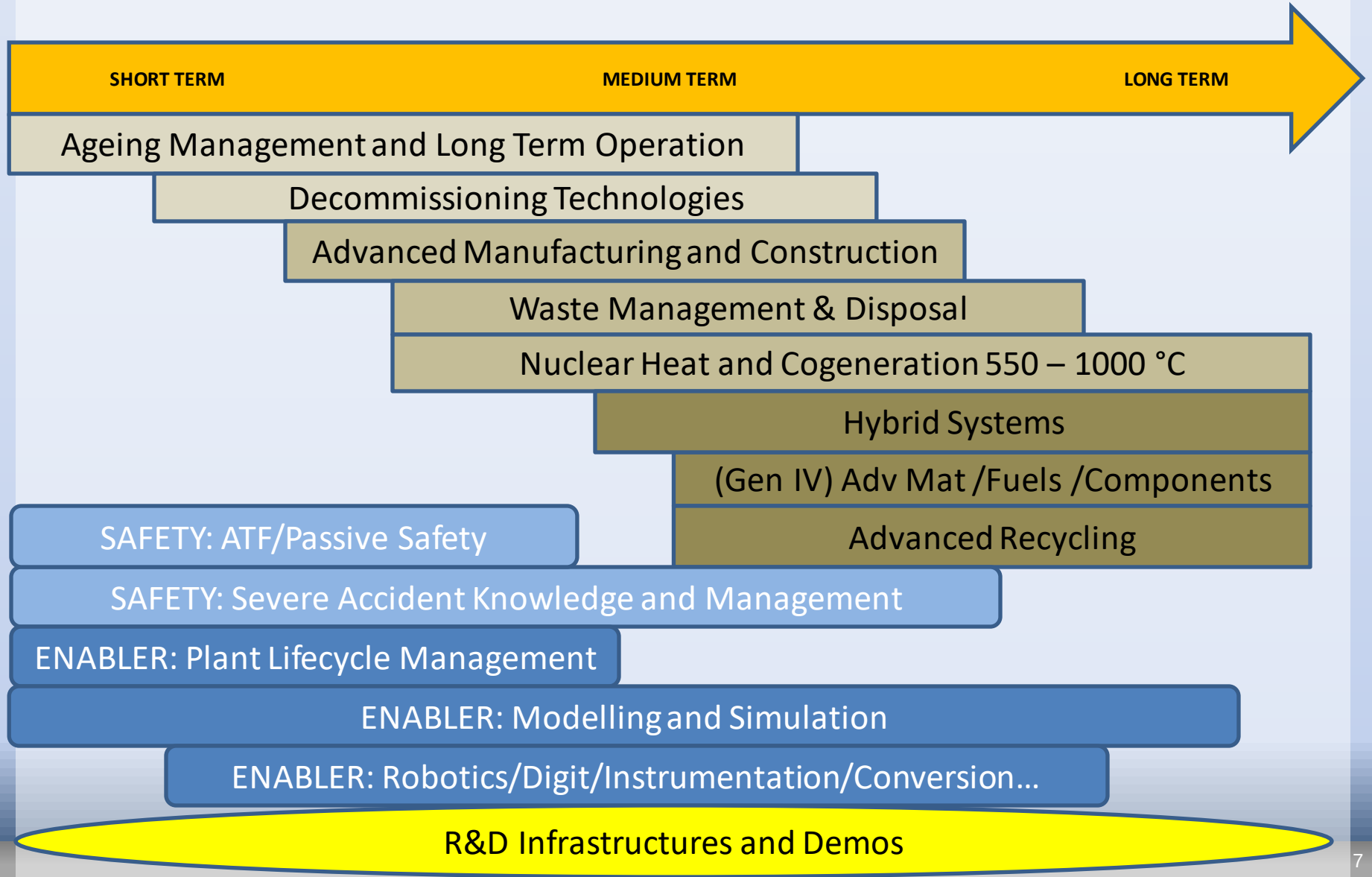
1a - aiming at selecting and developing large scale R&D and market uptake programmes of actions (sequence of projects and infrastructures),

1b – pooling the interest of stakeholders (R&D bodies, industry, TSOs and regulators, waste agencies) around these programmes of actions

2 - for proposing them for further implementation by stakeholders (including above + governments and financial institutions)

- to accelerate the readiness of innovative technologies and help them reach competitive deployment in time to contribute to the sustainability of nuclear energy in the short/medium (2030) to long term (2050)

NI2050 TARGETS for Innovation



NI2050 PROGRAMS of Actions Currently Underway

Target Area/TOPIC	Leaders	Groups Engaged
Accident Tolerant Fuels	K. Pasamehmetoglu, INL	NSC (EGATFL), CSNI (WGFS)
Severe Accident Knowledge and Management	G. Bruna/D Jacquemain, IRSN	CSNI (SAREF, WGAMA) ETSON, NUGENIA
Passive Safety Systems	G. Bruna/JM Evrard, IRSN	CSNI (WGAMA) ETSON
LTO Gen II 80 Years: Ageing Management	A. Al Mazouzi, EDF	CSNI (WIAGE) NUGENIA
Advanced Fuels and Materials (Gen IV)	N. Chauvin (Fuels), CEA L. Malerba (Materials), SCKCEN	NSC (WPFC, WPMM), EERA JPNM, GIF
Advanced Components (Gen IV)	H. Kamide, JAEA	GIF, CSNI/CNRA (GSAR/WGRNR)
Fuel Cycle Chemistry/Recycling (P&T)	H. Ait Abderrahim, SCKCEN	NSC (WPFC), CSNI (WGFCS)
Heat Production and Cogeneration	D. Hittner, NC2I	PRIME/GEMINI (NC2I, NGNP, JAEA, KAERI)
Modelling and Simulation	T. Valentine, ORNL	NSC (WPMM, EGMPEBV)
Measures and Instrumentation	G. Bignan, CEA	ANIMMA, NSC Wkshp
Infrastructures and Demos	All	NSC, CSNI (ia TAREF), DB (RTFDB)

NDC – NUCLEAR DEVELOPMENT COMMITEE

NSC – NUCLEAR SCIENCE COMMITEE

CSNI – COMMITEE ON THE SAFETY OF NUCLEAR INSTALLATIONS

CNRA – COMMITTEE ON NUCLEAR REGULATORY ACTIVITIES (Regulators)

DATABANK

WGFS – CSNI Working Group on Fuel Safety

WGFCS – CSNI Working Group on Fuel Cycle Safety

WPFC – NSC Working Party on Fuel Cycle

WGAMA – CSNI Working Group on Analysis and Management of Accidents

WGIAGE – CSNI Working Group on Integrity and Ageing of Components and Structures

WPMM – NSC Working Party on Multi-Scale Modelling for Fuels and Structural Materials

WGRNR – CNRA Working Group on the Regulation of New Reactors

GSAR – CSNI/CNRA AdHoc Group on the Safety of Advanced Reactors

EGATFL – NSC Expert Group Accident Tolerant Fuels for LWRs

SAREF – CSNI Senior Expert Group on Safety Research Opportunities Post-Fukushima

TAREF – CSNI Task Group on Advanced Reactor Experimental Facilities

EGMPEBV – CSNI Expert Group on Multiphysics Experimental Data, Benchmarks, Validation

RTFDB – DATABANK Research and Test Facilities DataBase

…

NUGENIA, ETSON, EERA JPNM, GIF, PRIME/GEMINI/NC2I/NGNP, ANIMMA,…

NI2050 TOOL: Template

- **1. Justification of the selection**

  Based on a list of selection criteria, explain why this topic is an opportunity for innovation

- **2. The issue (Challenge/Opportunity) to tackle and objectives to reach**

  Explain what are the problems to be solved and the associated objectives to reach.

- **3. What is done/exist already, who is doing what, what are the means (resources and infrastructures), what are the bottlenecks, why does it not go faster…**

  In most cases, R&D and/or demonstration/validation/qualification programmes and infrastructures already exist and can be briefly described. The reason why more is necessary, identifying in particular difficulties, delays and bottlenecks, justifying the inclusion of the topic in NI2050, should be explained.

- **4. What can be done to improve/accelerate (ia through cooperation)**

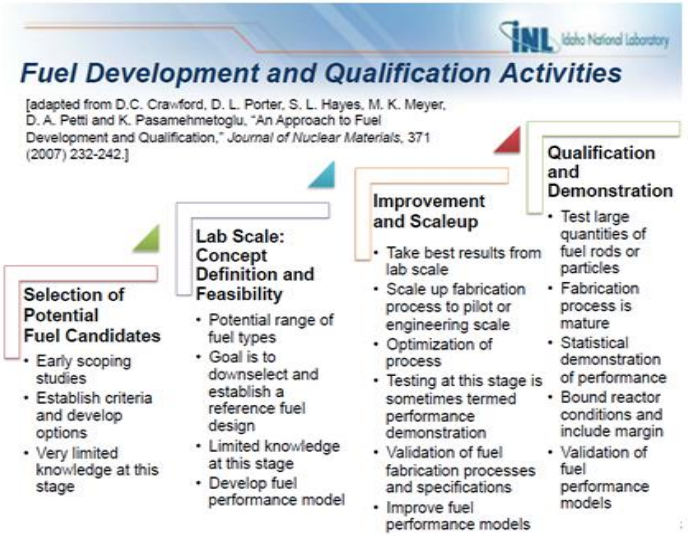
  Explain conceptually how to go beyond what is done under 3, what are the game changers to overcome difficulties, delays, bottlenecks, to improve and accelerate R&D and market deployment.

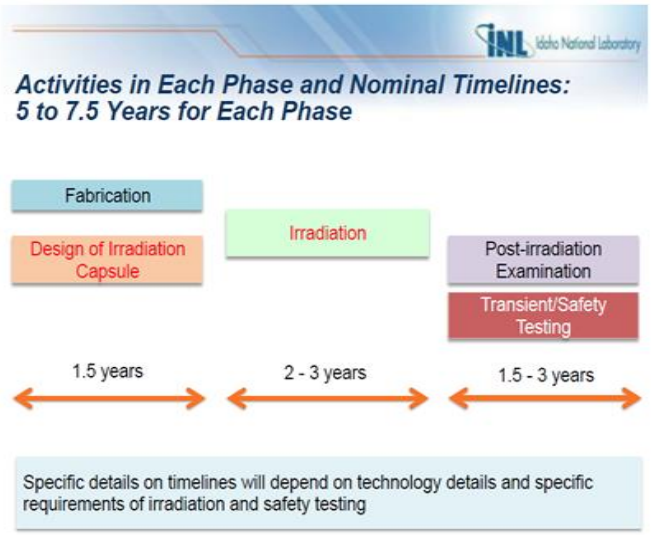
- **5. Action plan and necessary means (resources and infrastructures)**

  Provide an Plan of Actions (scope, sequence and timeline) to implement the concepts described in 4. This should allow the extraction of concrete projects, with definition of necessary means and infrastructures for implementation.

NI2050 Moving towards IMPLEMENTATION

Example: ATF/Advanced Fuels





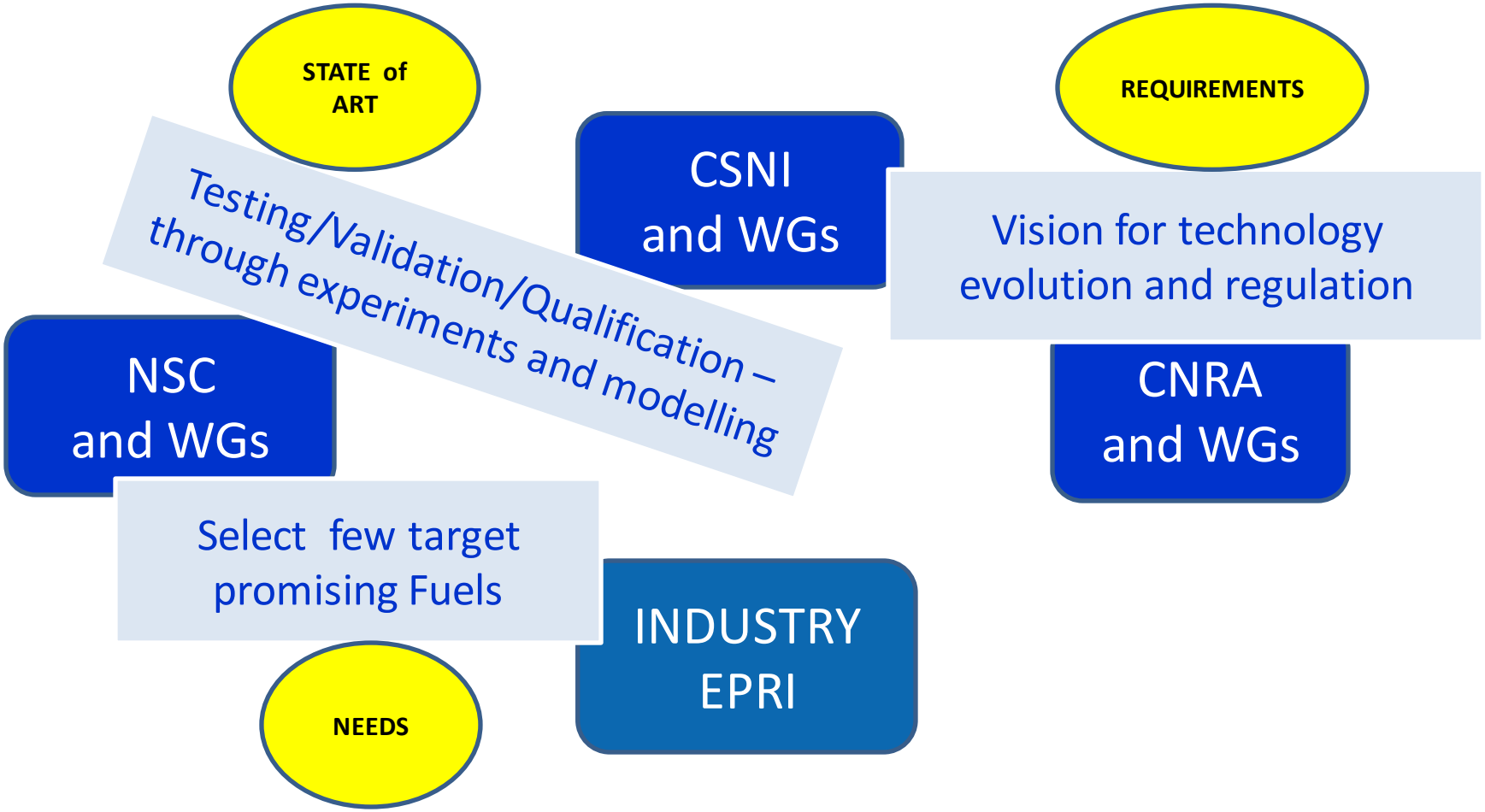
- Define what to do: Programme of Actions, including sequence of activities (STEPS) and necessary infrastructure and facilities – improving/accelerating the « technical » process
- Define how to implement:
  - Who does what, fostering the interaction between the stakeholders (R&D, industry, regulators) to accelerate the « institutional » process
  - Which needed infrastructure/facilities are available/accessible or necessary to be built
  - Who pays for what
  - Which legal cooperative framework

NI2050 interactions for Fuels reducing risk/cost/timeline for innovation

Through the NEA structure, improve the interaction between Research, Industry and Regulation

- Inviting research and industry to agree on needs and state-of-the-art
  - To identify few promising technologies that will meet the needs
  - (With involvement of TSOs) To consolidate a shared approach on the state-of-the-art for testing and validation of the promising technologies through experiments and modelling & simulation, identify the needs in research infrastructures
- Inviting Regulatory Bodies and TSOs to increase their involvement on promising technologies – early definition of requirements for qualification (Licensing)
  - International co-operation allows early insight in safety aspect of technology evolutions (promising innovative technologies) without compromising regulatory independence
- Inviting research and TSOs to establish a shared manageable qualification method and process (for licensing)

NI2050 Moving towards IMPLEMENT – ex Fuels



CONCLUSIONS

- Innovation is essential for nuclear energy to continue to advance and to play a substantial role in the long-term future.
- We are not implementing innovative concepts as rapidly as we have in the past and not quickly enough to meet future challenges.
- Long development/qualification times, high costs, and infrastructure limitations are among the challenges to new nuclear innovation.
- Multilateral efforts can help mitigate some of these barriers, but focused and coordinated action is needed.
- **NI2050 is designed to support researchers, industry, regulators, and governments around the world to come together to find ways to implement innovation in critical areas of nuclear energy technology**