INTERNATIONAL PROJECT ON INNOVATIVE NUCLEAR REACTORS AND FUEL CYCLES (INPRO)

DRAFT DISCUSSION PAPER

"OPTIONS FOR NUCLEAR ENERGY SUSTAINABILITY"

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INPRO Section

INPRO Dialogue Forum 11 "Roadmaps for a transition to globally sustainable nuclear energy systems"

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ROADMAPS: Options for enhanced nuclear energy sustainability

For the purpose of scenario studies focussed on options of cooperation among countries, and taking into account overall known potential of nuclear technologies (both, proven and yet to be proved), INPRO Task 1 had defined generic options for enhanced nuclear energy sustainability in two directions:

- Enhancing Sustainability via Advanced Reactors and Fuel Cycles
- Collaborative Enhancements

The draft document was distributed for review to all participants of INPRO Dialogue Forum 11

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ROADMAPS: Options for enhanced nuclear energy sustainability

Enhancing Sustainability via Advanced Reactors and Fuel Cycles:

- Structured along generic fuel cycle options (limited number, well known), with generic reactor options linked to fuel cycle options
- Generic reactor technologies may be common for several generic fuel cycle options
- Present diverse set of generic options but avoid stating preferences or subjectively "picking winners and losers"
- Present the diversity of options in the broad sense that are inclusive of all Member States' positions
- Treat all options uniformly, in a balanced and objective manner

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ROADMAPS: Options for enhanced nuclear energy sustainability

Enhancing Sustainability via Advanced Reactors and Fuel Cycles: (given comments received to date, we suggest…)

Option A: Once-through fuel cycle

Option B: Recycle of used fuel without “reprocessing”

Option C: Limited recycling of used fuel

Option D: Complete recycle of used fuel

Option E: Minor actinide and/or fission product transmutation

Option F: Final geologic disposal of all nuclear wastes

Note: each generic fuel cycle option can be amended by adding option F (e.g., AF, BF, CF, etc…)

Brief characterization of each option: Status, (Targeted) Benefits, Arising issues

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Attribution of reactor lines (examples):

Option A: Once-through fuel cycle, including breed and in-situ burn schemes (e.g., thorium)

LWR, PHWR, ALWR, VHTR, SCWR

Option B: Recycle used fuel without reprocessing

LWR, ALWR to PHWR (DUPIC, other “physical repackaging”)

Option C: Limited recycling of used fuel

LWR, ALWR, PHWR, VHTR, etc.

Note: Option F (repository) applies to all other options

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Attribution of reactor lines (examples):

Option D: Complete recycle of used fuel, including ^{233}U-Th cycle

LWR, ALWR, VHTR, FR, MSR

Option E: Minor actinide/fission product transmutation

FR, MSR, ADS

Generic description of reactor technologies: Status, (Targeted) Benefits, Arising issues

Non-electrical applications (mentioned in a footnote): fit to all reactor technologies and offers potential to improve efficient use of nuclear fuel – limited progress currently observed

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ROADMAPS: Options for enhanced nuclear energy sustainability

Collaborative enhancements:

Description of the present status/specifics of nuclear trade

- Bilateral agreements, multiple bilateral agreements
- Multilateral agreements
- Competitive market conditions within nuclear trade?
- Amplifying the benefits of innovation through synergistic cooperation in nuclear fuel cycle

To be examined further: mechanisms of countries' collaboration in nuclear fuel cycle, to ensure they will remain sufficient assuming a substantial expansion in the international transfer of used fuels, reconstituted fresh fuels and waste materials

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Thank You!

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