

Global nuclear energy initiatives
– new opportunities for
addressing non-proliferation
challenges through optimum use
of institutional and technical
measures

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Topics:

1. Global nuclear energy challenges in non-proliferation area
2. International nuclear energy initiatives (INPRO, GIF IV, MNA, GNEP)
3. Opportunities for addressing non-proliferation challenges through optimum use of institutional and technical measures

Energy for global sustainable development

Challenges:

- To satisfy growing global energy needs within resource and environmental constraints

Parts of global response:

- Increase energy efficiency
 - Increase renewables input
 - Increase nuclear input
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Global nuclear energy

1. Controversial views on NE
 2. NE for world sustainable development. Challenges real or perceived?
 - Economics
 - Safety
 - Nuclear waste
 - Non-proliferation
 - Resources
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Fig.1 Nuclear power system with LWR

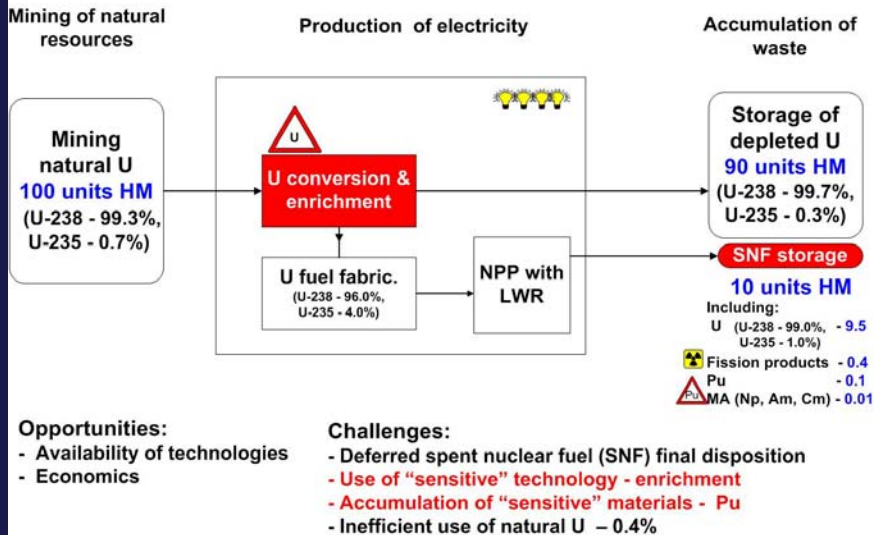


Fig. 2 Challenges for Global Nuclear Energy development on the basis of LWR systems

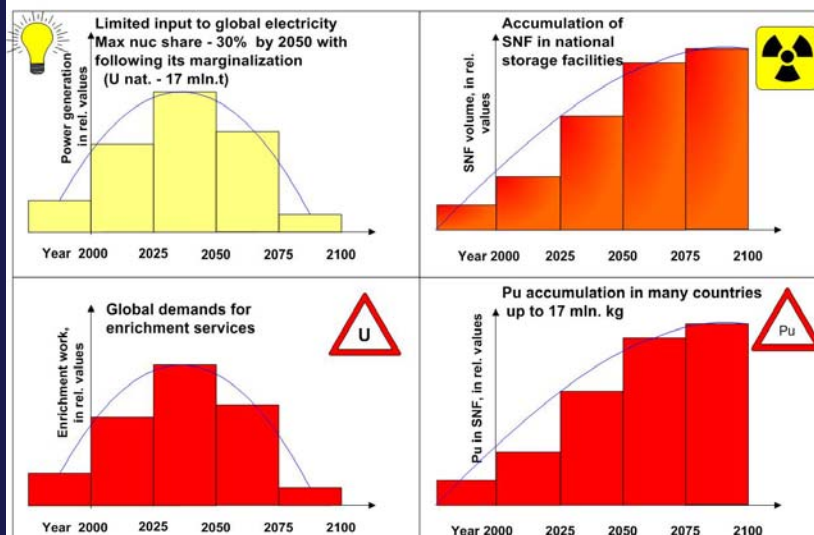
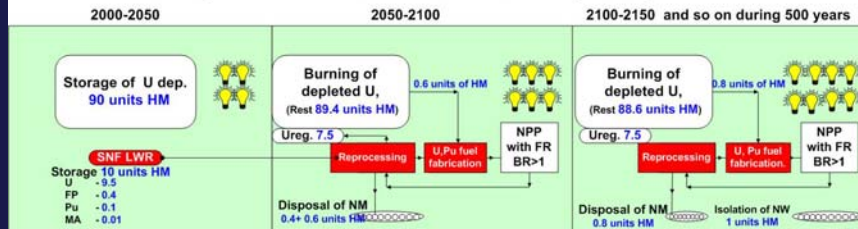


Fig. 3 Long term SNF management options.

Option 1. Reprocessing with objectives to:
 - to burn U-238 through U-Pu recycling in Fast Reactors with BR >1 and
 - to dispose consolidated nuclear waste in repository



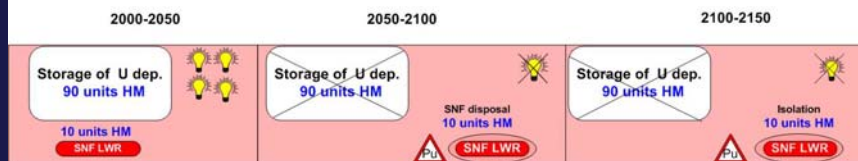
Opportunities:

- Tremendous increase of NE resources base (from 0.4 up to 80% of U nat.)
- No need for enrichment services
- Availability of reprocessing technologies (reprocessing and vitrification)
- Commercialization of FR >1 is needed only in long term perspectives
- Reduction of NW for disposal

Challenges:

- This option does not provide solutions for non-proliferation issues related to enrichment use and Pu accumulation in medium term perspectives
- Requirements to FR in safety and waste management areas would significantly increase in future with increased use of NE
- This is one-component-system
- FR system might have specific challenges in non-proliferation area due to use of Pu based fuel

Fig.4 Long term SNF management options.
Option 2. Disposal of SNF in repositories



Opportunities:

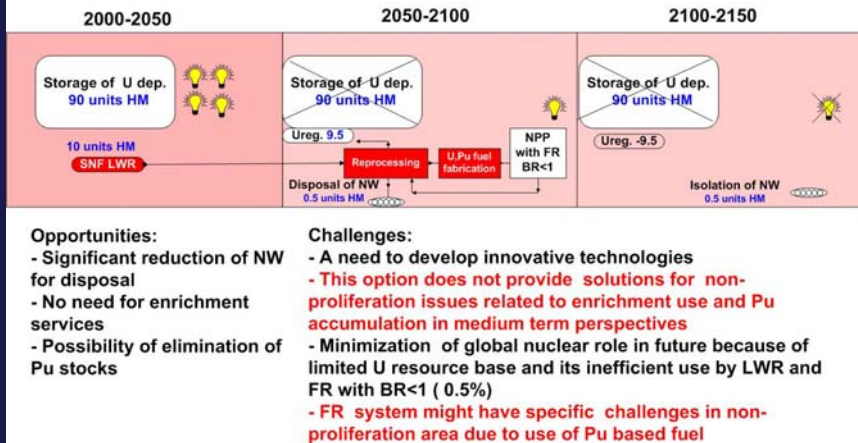
- Available technologies
- Relat. cost effectiveness
- Repositories are needed in long term perspectives

Challenges:

- This option does not provide solutions for non-proliferation issues related to enrichment use and Pu accumulation in medium term perspectives
- Limited favorable repository places for national repositories
- Minimization of global nuclear role in future because of limited U resource base and its inefficient use by LWR (0.4%)
- Creation of Pu mines for ever

Fig. 5 Long term SNF management options.

Option 3. Reprocessing with objectives to:
 - to burn Pu+MA through U-TRU recycling in Fast Reactors with BR <1 and
 - to dispose consolidated nuclear waste in repository



President Putin initiative on international cooperation to develop innovative nuclear energy systems UN Summit 2000

IAEA INPRO project in 2 phases

1. Develop user requirements in nuclear areas of concern
2. Cooperate in R&D

INPRO status:

- Phase 1 finished
- Challenge to define INES for cooperation

INPRO main findings:

- Fast reactors in closed fuel cycle would be essential for global sustainable development, but
- At national levels different other systems might be applicable
- No clear vision on global non-proliferation challenge and possible technological solutions

EI Baradei group on Multilateral Nuclear Approaches - 2005

Objective – to analyze advantages and disadvantages of different multilateral approaches in addressing current non-proliferation challenge

Finding:

Group did not indicate principle advantage of multinational fuel cycle facilities ownership over national ownership from non-proliferation perspectives

Group did indicate conditions, that might reduce incentives of some countries to develop national fuel cycle technologies – this is a possibility to get guaranteed complete fuel cycle services for their NPPs at international level

President Putin new initiative on global NE infrastructure – January 2006

Objective:

- At national level – increase nuclear input from current 16 to 20-25% by 2025 through building 40 new VVER and developing new technological basis – fast reactors to burn U-238, with relevant fuel fabrication and reprocessing technologies
- At global level – to address current non-proliferation challenges through establishment of International fuel cycle centers, to provide global fuel cycle services - first of all in enrichment area

No details on initiative

Global Nuclear Energy Partnership – President Bush new initiative Feb. 2006

At national level – increase nuclear energy input through building new LWR, reduce significantly nuclear waste for disposal through developing fast reactors – burners of Pu and MA, as well as relevant reprocessing and fuel fabrication technologies

At global level - to address current non-proliferation challenges through establishment of fuel cycle FC countries Consortium, that would lease fresh fuel to reactor countries and would take back spent fuel for disposition in FC countries

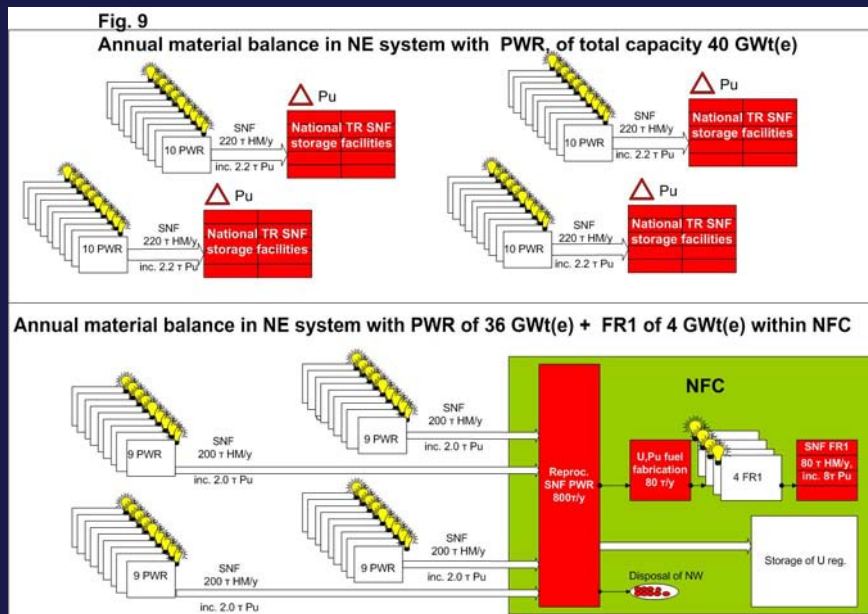
Overall assessment of international initiatives from non-proliferation perspectives

- Increasing understanding that U or PU related non-proliferation challenges could not be resolved through pure technological solutions particular in near or medium term perspectives.
- Most promising institutional approach to mitigate non-proliferation concerns today is US idea on FC countries Consortium
- If this idea is supported by other FC countries, than there is a chance to minimize stimulus for developing national enrichment in near or medium term perspectives
- As for Pu related non-proliferation concerns the above initiatives envision only long-term solutions

Is there any possibility to find medium term solution to global Pu problem?

IPPE preliminary assessment shows that one can find such possibility

as a combination of USA institutional approach of Consortium with traditional FR technological basis.



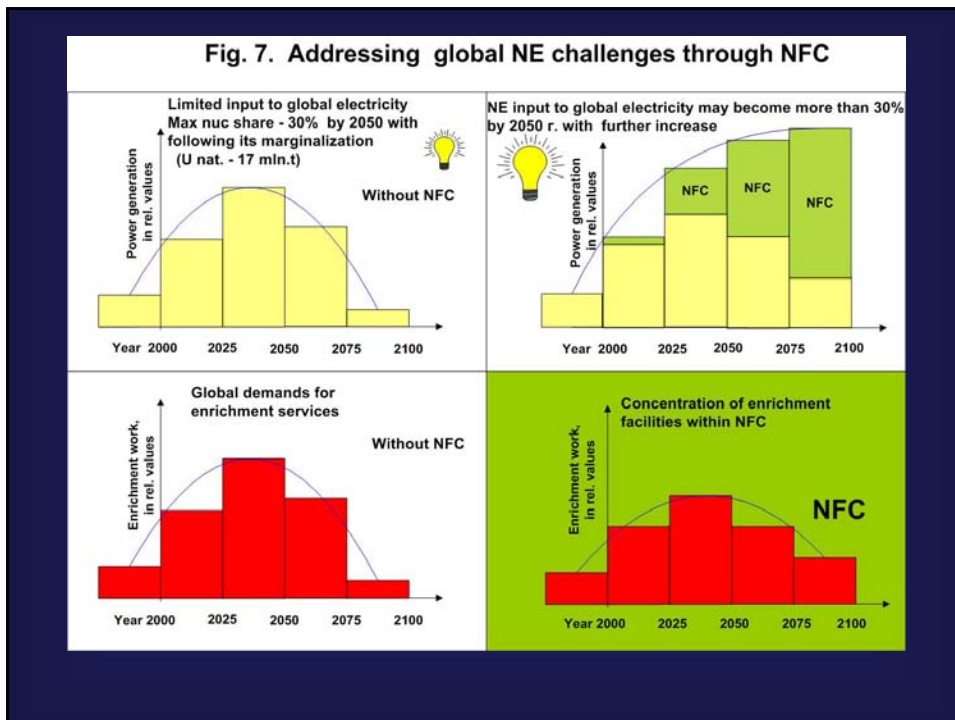
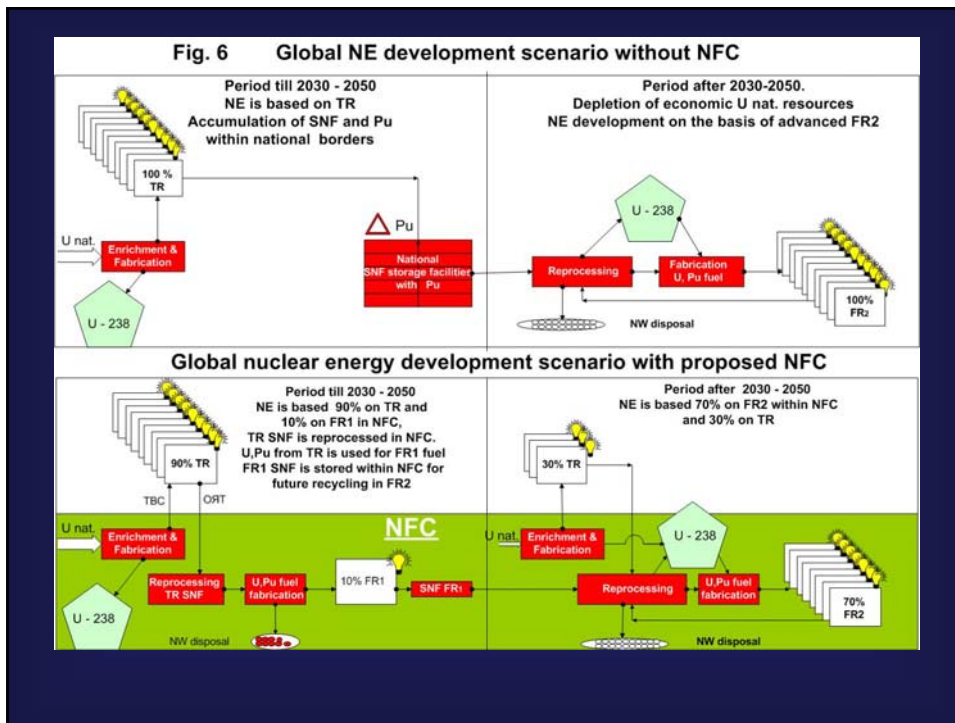
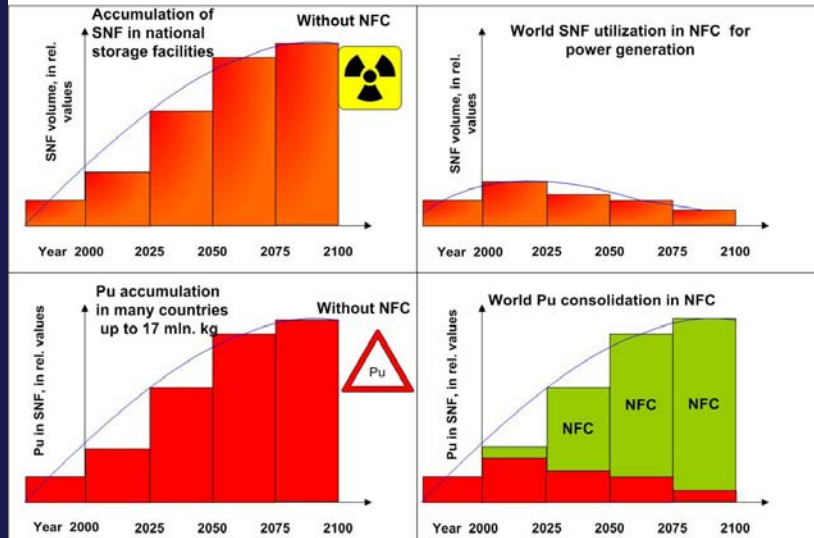


Fig. 8. Addressing global NE challenges through NFC (cont)



New opportunities for global nuclear energy

1. **Demonstration in medium term of efficient solution of both U and Pu related global non-proliferation challenges**
2. **Establishment of new Global Nuclear Energy Partnership and Infrastructure for world sustainable development**
3. **Extended use of uranium reactors in developing countries**

Issues to clarify

- 1. Understand optimum structure, capacity and macro - system requirements to NFC as whole and to each its element, including fast reactors, fuel fabrication facility, spent fuel reprocessing, taking into account :**
 - national objectives in economic, resource, safety and waste management areas, and
 - global related to U and Pu non-proliferation concerns
 - 2. Define minimum requirements from non-proliferation view to technologies and nuclear materials those used in FC countries and those exported to reactor countries**
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