Nuclear Innovation Cooperation

In the Low-Carbon Perspective

NEA NI2050 Initiative Survey Process

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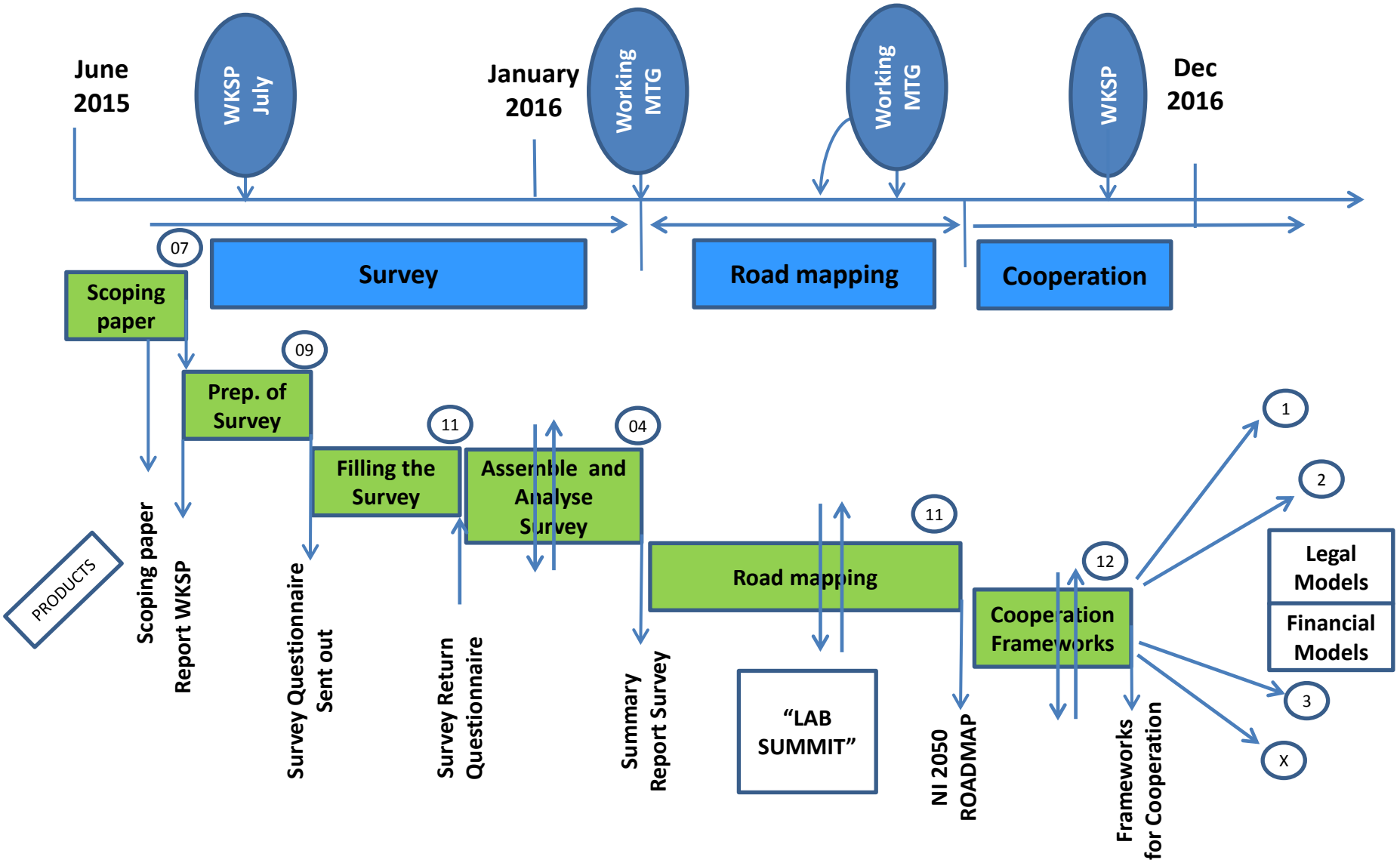
NI2050 Workshop July 2015

NI 2050 Process and timeline



IEA Yearly Data Collection

Gov't RD&D funding in the field of Energy

Nuclear Energy:

NUCLEAR FISSION RESEARCH BUDGETS in million USD									
	2005	2006	2007	2008	2009	2010	2011	2012	2013
Australia	23	18	15	24	3	3	3	11	8
Canada	242	229	260	216	341	332	125	91	16
France	690	673	645	621	589	532	592	681	
Germany	32	37	39	44	99	99	100	101	101
Italy	60	49	49	42	55	61	54		
Japan	2464	2318	2347	2343	2310	2269	1628		
Korea	217	228	231	67	79	85	112		
Netherland	13	13	14	13	10	12	11	7	
Norway	16	15	15	14	16	15	15	15	15
Sweden	6	6	6	6	7	7	2	2	2
Switzerland	26	29	29	31	30	30	28	28	28
USA	556	422	579	720	380	495	873	379	371
TOTAL	4345	4037	4229	4141	3919	3940	3543		

IEA « Nuclear Categories »

- **4 Nuclear**
  - **41 Nuclear Fission**
    - **411 Light Water Reactors**
    - **412 Other Converter Reactors**
      - **4121 HWRs**
      - **4122 Others**
    - **Unallocated 412**
    - **413 Fuel Cycle**
      - **4131 Fissile Material recycling/reprocessing**
      - **4132 Nuclear waste management**
      - **4133 Others**
    - **Unallocated 413**
    - **414 Nuclear Supporting Technologies**
      - **4141 Plant Safety and Integrity**
      - **4142 Environmental protection**
      - **4143 Decommissioning**
      - **4144 Others**
    - **Unallocated 414**
    - **415 Nuclear Breeder**
    - **416 Other**
  - **Unallocated 41**

NI 2050- SURVEY

1/PAST - PRESENT (actual) +
2/FUTURE (perspectives)

Categories and Subcategories

For each of them:
- Box for Description (+ annexes)
- Box for Budget (Million USD)
- Box for Manpower (man-years)

actual per year for past/present, perspective with timeline and expected necessary budget/manpower for future

NI 2050- SURVEY Categories

FISSION – scope and budget/manpower per year

RI Programmes on Reactor Technology and Safety
RI Programmes on Energy Scenarios and Fuel Cycles
RI Programmes on Waste Management and Decomm
Cross-cutting RI Programmes

RI programmes on Non-Electricity Applications
E&T, KM, Public Awareness Programmes in relation with RI

Large Infrastructures in support of RI Programmes

FUSION – just a budget figure per year

NI 2050- SURVEY Categories

RI Programmes on Reactor Technology and Safety

R&I Programmes on Reactor Technology and Safety

Large GEN II and III reactors:
(define which reactor technology/type is concerned by your reply)
- Core Physics and Thermal Hydraulics
- Design optimisation/performance improvements of Systems, Structures and Components
- Optimisation of operation and maintenance
- Design Basis Safety Analysis and safety improvements – Deterministic/Probabilistic
- Beyond Design Basis Safety Analyses and Severe Accidents (phenomenons, consequences PSA Level 1/2/3, Emergency Management) and safety improvements
- Other (qualify)

Gen IV reactors and SMRs:
(define which reactor technology/type is concerned by your reply)
- Core Physics and Thermal Hydraulics
- Development and verification of systems concepts
- Design of Systems, Structures and Components
- Safety Analyses
- Other (qualify)

Other (qualify)

NI 2050- SURVEY Categories

RI Programmes on Energy Scenarios and Fuel Cycles

R&I Programmes on Energy Scenarios and Fuel Cycle

(define which cycle U/Pu - Th/U; and which type of fuel and fuel technology is concerned by your reply. Fuel type: oxide, metal, nitride, carbide,…; fuel technology: pellets; coated particles;…)

- Energy Scenarios and role of nuclear (ia flexibility in grid)
- Fuel Cycle Strategies and Policies
- Front End Technologies (Mining, Processing, Conversion, Enrichment)
- Fuel/Cladding design and fabrication; improvement of existing and new (innovative) fuel development
- Fuel irradiation and PIE, analysis of Fuel/Cladding behaviour
- Back End Technologies: Spent Fuel Management (when not considered as waste): Storage, Reprocessing and Recycling (define the nature of reprocessing and recycling: single vs multiple, partitioning and transmutation of Minor Actinides,…)
- Others (qualify)

NI 2050- SURVEY Categories

RI Programmes on Waste Management and Decomm

R&I Programmes on Waste Management and Decommissioning

- Decommissioning (excluding waste management) (decontamination, dismantling processes and tools, land and environment restoration,…)
- High/Medium/Low Level Waste Management and Storage (including SNF as waste) before final disposal
- Final and Geological Disposal
- Other (qualify)

NI 2050- SURVEY Categories

Cross-cutting RI Programmes

Crosscutting R&I Programmes

- Multiphysics and multiscale modelling of fuels and materials, and validation/benchmarking
- Existing materials ageing (except fuel covered above): testing and prediction of behaviour, in-service inspection – for metal, concrete, polymers, others.
- New (innovative) material development (except fuel covered above): define which material, what objective pursued: ia thermal properties, mechanical properties, nuclear properties,…)
- Equipment manufacturing and assembling, modular construction
- Instrumentation and Control (ia digital)
- Harmonisation, Codes and Standards: prenormative research
- Regulatory aspects and Licensing
- Health Effects of radiation and Radiation Protection, Shielding and Transport
- Human factors
- Others (qualify)

NI 2050- SURVEY Categories

RI programmes on Non-Electricity Applications
E&T, KM, Public Awareness Programmes in relation with RI

R&I Programmes for Non Electricity Applications: qualify

Radioisotopes for medical and industry, Cogeneration, Process Heat for industry uses, Hydrogen,…

E&T, Knowledge Management, and public awareness Programmes in relation with Research

- Number and level of students/postdocs engaged in research programmes (described above)
- Infrastructures (described above or others) used for E&T purposes
- Knowledge Management policies and tools
- Public Communication

NI 2050- SURVEY Categories

Large Infrastructures in support of RI Programmes

Large Research Infrastructures (hardware tools of generic nature/multipurpose in support to R&I Programmes) - use of existing, upgrade and/or new build (on going or planned)

(give details on the nature, type and scope of the facility, as well as the associated timeline)

- Critical Zero Power Facilities
- Research Reactors (indicate more precise type and power level)
- Large Demonstrators/Prototypes
- Accelerators
- Large test loops and benches, integral and/or partial experiments
- Fuel Fabrication facility
- Hot Cells
- Fuel Reprocessing facility
- Large calculators/super computers
- Others (qualify)

NI 2050- SURVEY Process: Guide

WHAT ? Technical scope and budgets for the defined categories

Q: Technical Scope?... From basic research to applied and experimental, up to « demonstration » (of technical, industrial, licensing feasibility)… + Cooperation ?

Q: Budgets? Public **vs Private (PPPs)?...** National commitment per year

Q: Which Costs? Capital and current costs (running and labor costs) when they occur (no depreciation and no VAT)

Q: How far in the past?... 2005? Aggregation

Q: Future « perspectives » and estimated budgets… first input for roadmapping…

NI 2050- SURVEY Process: Guide

HOW to avoid « double counting »?

1. Programmes versus Infrastructures:

cost of specific use of infrastructures to be reported under Programmes ⟶

limit reported cost of infrastructures to « generic » costs for design/construction/O&M/dismantling of infrastructures, not attributable to a specific Programme

NI 2050- SURVEY Process: Guide

HOW to avoid « double counting »?

2. Country A – Country B

Ex: country A using a facility in country B – Country A should report the cost of usage under its corresponding Programme

3. Specific case: Euratom Programmes

Commission is asked to report on full cost of projects = Euratom financing + consortia' members contributions, and to provide the figures per MS

NI 2050- Open Questions for Discussion

- *Categories and process for step 1 survey?*
- *How far in past + future perspective?*
- *Views for step 2 roadmapping process?*
- *Level for interest for step 3?*
- *China/India?*
- *E&T, KM, HRM?*
- *Public vs Private?*
- *Involve Industry and TSOs?*
- *Visibility of NI2050?*

NI 2050: to be succesful:

Need commitment by Member Countries:

- to provide inputs to the survey (Step 1)
- to interact during the roadmapping (Step 2)
- to be potentially interested in cooperation frameworks (tbd) (Step 3)

Nomination of (one) contact point per MC.

Interactions/Meetings/Consultants?

NI 2050 Process and timeline