

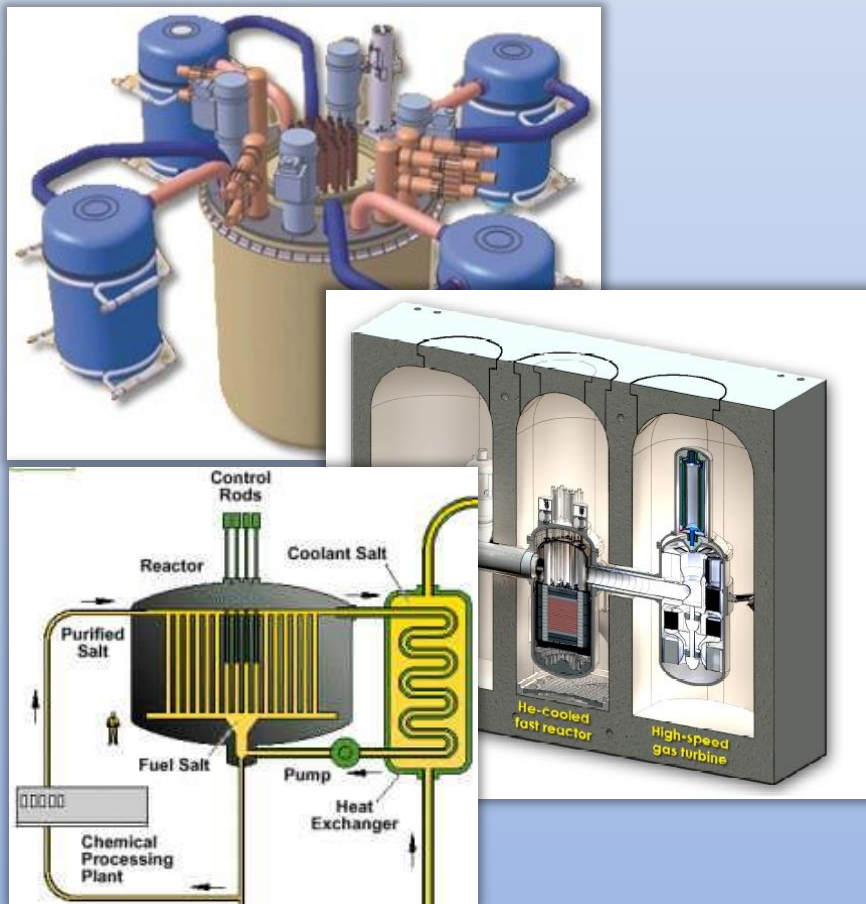
# **Nuclear Innovation Cooperation**

*In the Low-Carbon Perspective*

**NEA NI2050 Initiative  
OUTCOMES OF ADV PANEL OCT 2015**

*Marc Deffrennes*

## *Nuclear Innovation 2050 – A Roadmap for the Future of Nuclear Fission Technology*



- What technologies will be needed in the coming decades to meet growing demand and align with policy goals?
- What research and development is needed to make these technologies available?
- Is the global community doing the R&D needed to prepare for the future? What and How to do better?



# Technology Roadmap

Nuclear Energy

2015 edition

2035

2040

2045

2050



## ***Launching Workshop: Paris 7 and 8 July: NDC AND THE HEADS OF MAIN R&D ORG***

### ***NI 2050 – Scope and Approach***

**Step 1: Survey – scope (Prog and Infrastructures) and budgets (*NDD PoW item 5.6*)**

**Step 2: Roadmap/Priorities and Analysis/Gaps**

**Step 3: Cooperation Frameworks as appropriate**

## *Outcomes of the Launching Workshop:*

### *- Discussion on the Survey Categories and Process:*

#### ***Bottom-up step of NI2050***

*No return in past = focus actual situation (last 5 years) +*

*« Plans for future » already in pipe*

*Focus on technical content + budget/manpower*

*Few changes in proposed Categories*

*Single contact points in MC (via NDC)*

*Public + Private Financing (and Share: request IEA)*

### *- The Survey was sent out on the 23 September – Return 16 November*

## *Outcomes of the Launching Workshop:*

*- Discussion on the « roadmapping » of priorities*

### *Top-down step of NI2050*

*Need far-reaching long term vision 2050+ associated with long term sustainability of nuclear energy (NTR and ETP 2DS)*

*Need high level experts support + involve industry and regulators*

*Set up an Advisory Panel (with possible expert meetings)*

*Keep Roadmapping separate from Survey and start without delay*

*Integrate outcomes of Survey once priorities are defined and possible gaps can be indicated*

*Need of ToRs (for roadmapping and Adv Panel)*

*NEA Staff to initiate the process*

*- First Meeting of the Adv Panel took place on 5 and 6 October 2015 in Paris.*

## *Outcomes of the Launching Workshop:*

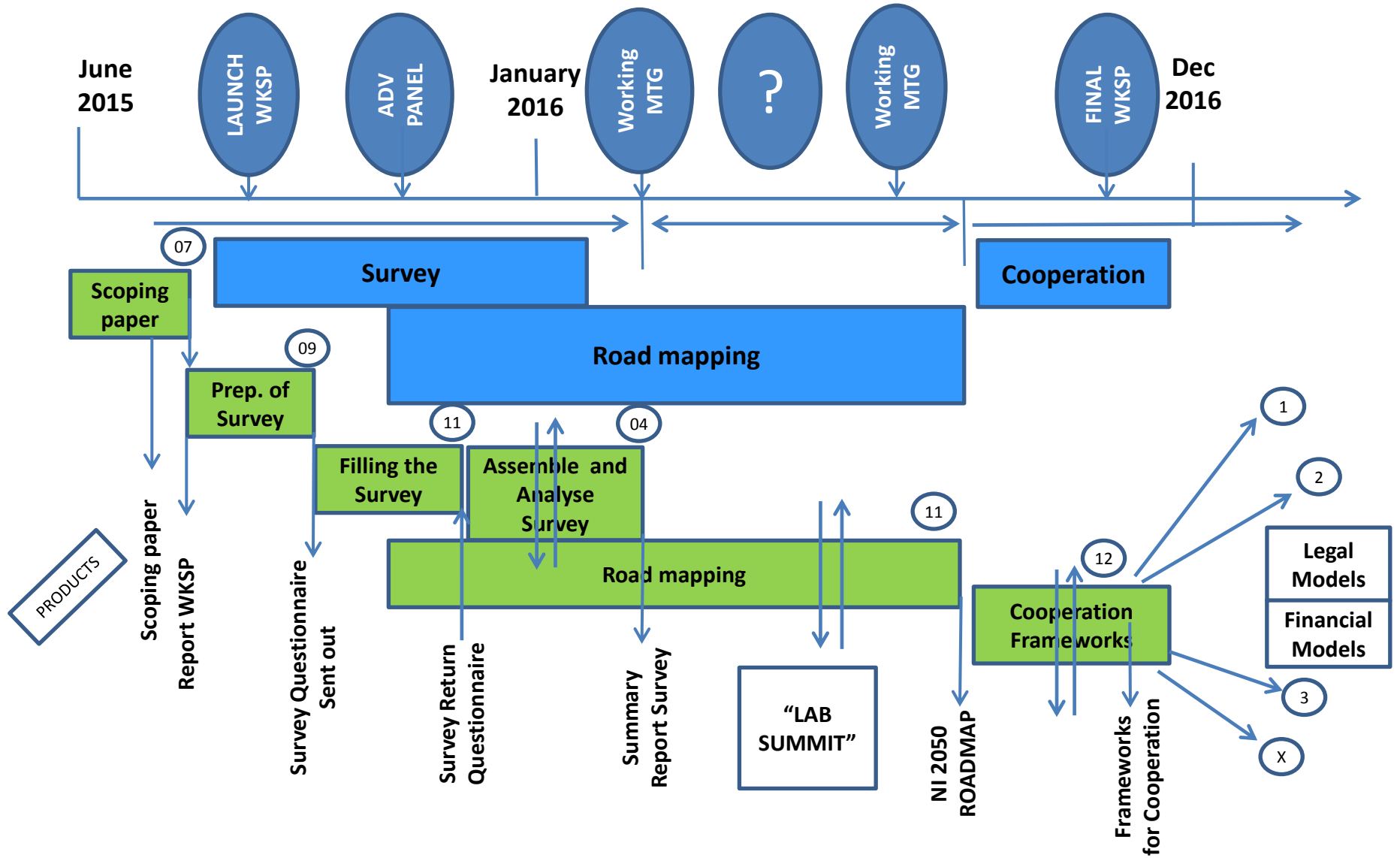
### *- Discussion on Cooperation*

*Last step (and concrete outcome of) of NI2050 first year and a half (end 2016)*

*No objection to flag « cooperation » as a possible result/followup of the roadmapping*

*But can only be as an initiation of dialogue among stakeholders and NEA serving as a facilitation framework if appropriate*  
*Could focus on few concrete cases (gaps in infrastructures?)*

## NI 2050 Process and timeline





## ***Objective of the Adv Panel Meeting OCT 2015:***

***Define Objectives, Scope, Methodology, Process of the NI2050 Roadmapping (Top-Down Step 2) – inputs for ToRs***

## ***Agenda of the Meeting:***

- ***International and National Roadmaps as examples***
  - GIF; SNETP (Nugenia, ESNII, NC2I)***
  - US Innovation Workshops (+ 2 topics)***
  - Other national presentations (JP, KR, RF, CA)***
  - UK NIRAB***
- ***Brainstorming on **Obj, Scope, Method, Process*****
- ***Elements for ToRs (for Roadmapping and Adv Panel)***

## *Participants to first Adv Panel Meeting:*

Fiona Rayment (Chair) UK NNL and NIRAB

Eric van Walle BE SCKCEN (Chair of the Launch Conference)

Robert Speranzini CA NCL/AECL

Sylvestre Pivet FR CEA + Fanny Bazile CEA

Ono Kiyoshi JP JAEA + Shigeaki Okajima JAEA + Tomoyasu Mizuno JAEA

Ik Jeong KR KAERI

Grzegorz Wrochna PO NCBJ and Chair of EU NC2I roadmap

Sergei Vorobyev RF Rosatom + Ludmylla Andreeva Rosatom

Kemal Pasamehmetoglu - USA DOE/INL + Roald Wigeland INL (by tel conf)

Jean-Claude Bouchter GIF Policy Director

Enrique Gonzales Chair EU SNETP roadmap

Noel Camarcat Chair EU ESNII roadmap

Giovanni Bruna ETSO for EU NUGENIA roadmap

Jonathan Cobb as observer for World Nuclear Association (nominated by DG Agneta Rising)

Thierry Dujardin in advisory role for NEA processes

NEA Secretariat NDD + NSC (Ha, Deffrennes, Henderson, Sozionuk, Noh, Gulliford, Ivanova)

Support Helene Dery

## ***OBJECTIVES*** of the Roadmapping of RD&D priorities

*(Nuclear) Energy Sustainability goal: nuclear in support of sustainable development but also sustainability of the nuclear sector*

*Timeline and Assumption: 2050 targets ETP 2DS (930 GWe), and beyond*

*Level of detail: global and high level, realise the workload over 1,5 years, can be a first phase but need concrete outcomes, might be extended with more details later*

*Use of existing roadmaps: may require compatibility*

*Compatibility with Survey: to define gaps*

*Reach concrete outcomes: consensus on main priorities/gaps for message to MC authorities and leading to a few possible cases for cooperation in the coming years*

## ***SCOPE (technical) of the Roadmapping:***

***Full coverage associated with sustainability and timeline:***

***2015-2050-2100+: LTO, new built, burners/breeders, HLW, new energy system...***

***Main Categories: 1. Reactors, 2. Fuel, 3. Recycling and Waste Mgmt, 4. Emerging Technologies in new Energy System(s), 5. Cross Cutting Issues***

***See next slide for 1 to 4***

***Crosscutting issues: simulation, I&C, C&S harmonisation, licensing, materials, ISI/NDE, robotics, radiation protection, construction planning, E&T/knowledge, public involvement,...***

***Programmes and Infrastructures: sequence? Or put focus?***

***Think out of the box: other energy sectors, other sectors beyond energy: ICT, nanotechnologies, biotechnologies, ...***

## SCOPE

2015 (375GWe)

2050(930 Gwe)

2100

### REACTOR

GENII LTO AGEING D&D

GENIII NEW BUILD

GENIV SFR/LFR/SC

GENIV VHTR/GFR/MSR

SMR DEMO

### FUEL

ATF AND FUEL EFFICIENCY

FNR FUEL

MA FUEL

SMR/CPF

### RECYCLE/ WASTE

AQUAEOUS

MULTI/P&T(ia ADS)

PYRO

EXTEND STORE

GEOLOGICAL DISPOSAL

### EMRGNG ENERGY SYSTEMS

HYBRID SYSTEMS

THORIUM FUEL CYCLES

### CROSS C

Timeline for technology readiness (for commercial deployment)

## ***METHODOLOGY*** for the Roadmapping:

*Need for « strict methodology »? Ex: GIF methodology, US Innovation Workshops, US INL Fuel Cycle methodology, SNETP methodology, UK NIRAB methodology... all very time consuming... no time to create own methodology... Use existing roadmaps to max extend.*

*Experts brainstorming on defined « categories»: Adv Panel vs Expert meetings? Need to integrate people who were engaged in roadmappings + some « visionnary » outsiders for balance, neutrality and new ideas: who?*

*BUT need « criteria » for setting priorities (not gaps yet – comes later after inputs from survey): to be defined by the Adv Panel, could look at criteria in existing roadmaps, research vs industry (TRL), need for new infrastructures, 2050 perspective low carbon new energy system, cost,...*

## ***PROCESS (organisational) for the Roadmapping:***

***Timing: have « some » priorities defined and agreed for September 2016, and « some » gaps for November 2016 - proposals for cooperation as input for step 3 and Final Workshop end 2016***

***Advisory Panel: define criteria, chair Expert Workshops, reassemble outcomes of ExpMeets and cross cutting topics, to produce final priorities.***

***Expert meetings: on the 4 categories above***

***Support by the NEA Staff***

***Number of meetings and time periods:***

***Advisory Panel: January, June, October***

***Exp Groups (tentative 1meet/category): Feb-May***

## ***ToRs for Roadmapping NI2050 and Adv Panel/Expert Meet:***

***Explain background NI2050 – Step 2: top-down roadmapping of fission RD&D priorities/gaps; result of NDC June 2015/Launching Workshop (« mandate »); Objectives, Scope, Methodology, Process (Adv Panel and Expert meetings)***

***Adv Panel: role, actual members + China + chairs NEA Committees, chairperson***

***Expert meetings: role, chairs volunteer from the Adv Panel, participants proposed by Adv Panel members***

***NEA Staff: role***

***Meetings planning and location***

***NEA Staff reporting to NDC and informing Steering Committee***

***Lifetime for the Adv Panel and Expert meetings – until NDC meeting mid 2017 – extendable or revised if so agreed by NDC***



## *The 2 Sustainability Triangles of NI2050 Objectives*

