

Nuclear development and waste management from the SNETP perspective SNETP

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IGD-TP 4th Exchange Forum

Prague , October 29-30th 2013

1. **SNETP from a nutshell**
2. New challenges (EUROPE 2020, SET-Plan, Horizon 2020)
3. Recommendation for R&D in nuclear fission
4. SNETP - new challenges
5. SNETP – IGD-TP cooperation
6. **NUGENIA – R&D for GEN II and III A. Laciok**

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About SNETP



- **Set up in 2007 under the auspices of the European Commission**, to gather stakeholders building a common vision: industry, research centres, safety organisations, universities, non-governmental organisations, SMEs, etc.
- Its official **ETP character was confirmed in 2013** by the European Commission after that a self-assessment was carried out.
- The overall goal is to **support technological development** for enhancing safe and competitive nuclear fission in a sustainable energy mix, as part of the EU's **SET-Plan**
 - Low greenhouse gas emissions
 - Security of energy supply for Europe
 - Stable electricity prices
- R&D is necessary to **further enhance the safety and sustainability** of nuclear fission, and to **open new markets**
- SNETP expresses its **strategic orientations** around **3 technology pillars**, and launched **task forces** to implement them

Research & Technology Organisations



Industry



Academia



Non-governmental Organisations



Others



Technical Safety Organisations



Members (October 2013)

RTOs 33
Industry & Services 46
Academia 23
NGOs 4
TSOs 4
Networks / Others 6

Total 116
from 21 countries

*And more applying
continuously*

SNETP Vision: aligned with the SET-Plan



*“Maintain competitiveness
in fission technologies,
together with long-term
waste management
solutions” (*)*

LWR
Gen. II and III

Innovative materials and fuels

Simulation and experiments:
reactor design, safety, materials
and fuels

R&D infrastructures

Safety standards

**Fast systems
with closed
fuel cycles
Sustainability**

(V)HTR
Process heat,
electricity
and H₂

NC2I

Nuclear Cogeneration
Industrial Initiative

*“The first co-generation
reactors could (...) appear
within the next decade as
demonstration projects to
test the technology for
coupling with industrial
processes” (**)*

ESNII

European Sustainable Nuclear
Industrial Initiative

*“Complete the preparations for the
demonstration of a new generation
(Gen-IV) of fission reactors for
increased sustainability” (*)*

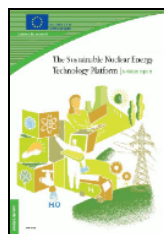
EC communications on the SET-Plan:

(*) [COM/2007/0723 final]

(**) [COM/2009/0519 final]

SNETP's main milestones

- Sept 2007: SNETP launch with Commissioners for Research and Energy, publication of ***Vision Report***
- June 2009: ***Strategic Research Agenda*** (*Annex 1* 2011, *Annex 2* 2012)
- May 2010: ***Deployment Strategy***
- Nov 2010: Launch of ESNII
- Jan 2011: ***Education & Training Strategy***
- Oct 2011: 100th member of SNETP
- March 2012: Launch of NUGENIA
- Jan 2013: Publication of "***Identification of Research Areas in Response to the Fukushima Accident***"
- Feb 2013: Updated ***Strategic Research & Innovation Agenda***



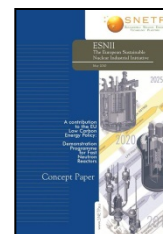
Vision
Report



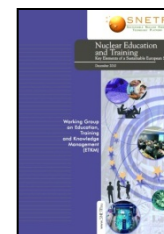
SRA



DS



ESNII
Concept
Paper



E&T



Implications
of
Fukushima



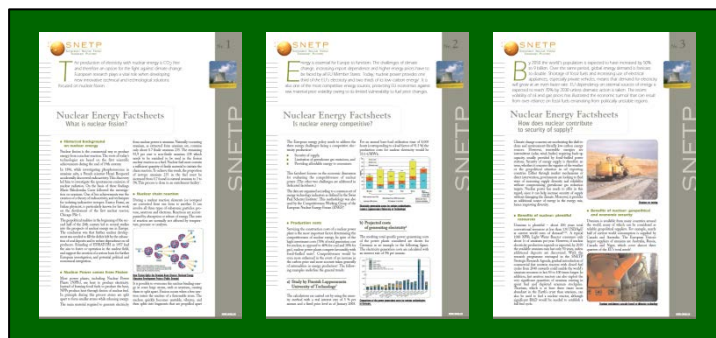
Updated
SRIA

Other publication

11 Newsletters



Factsheets



Position Papers

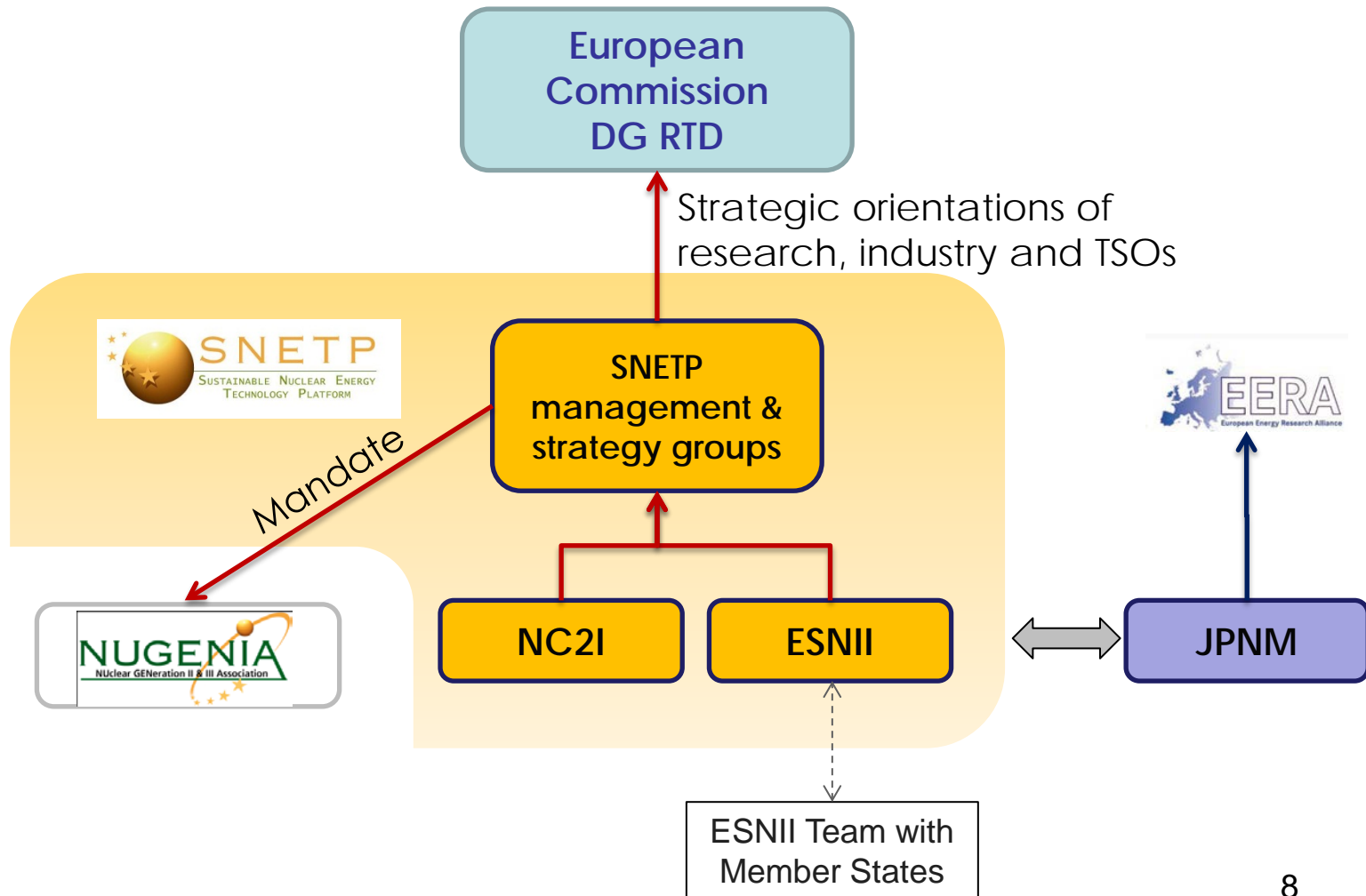


Current organisation

- NUGENIA: NUCLEAR GENERATION II & III ASSOCIATION
- ESNII: EUROPEAN SUSTAINABLE NUCLEAR INDUSTRIAL INITIATIVE
- NC2I: NUCLEAR COGENERATION INDUSTRIAL INITIATIVE

IMPLEMENTATION STRATEGY

www.SNETP.eu



ESNII Task Force

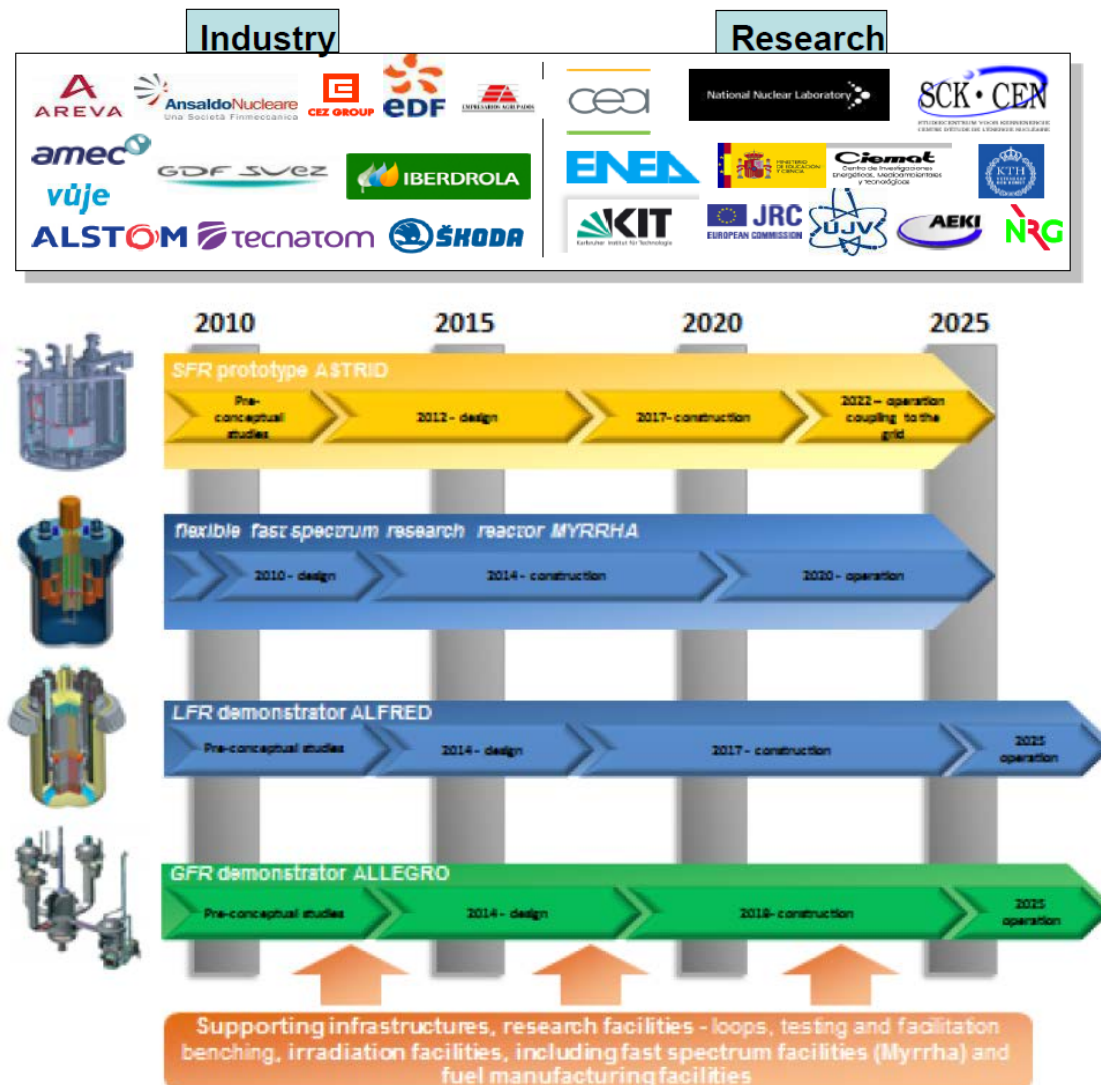
Memorandum of Understanding - 24 members, 12 industry, 12 research

The main goal of ESNII is to design, license, construct, commission and put into operation before 2025:

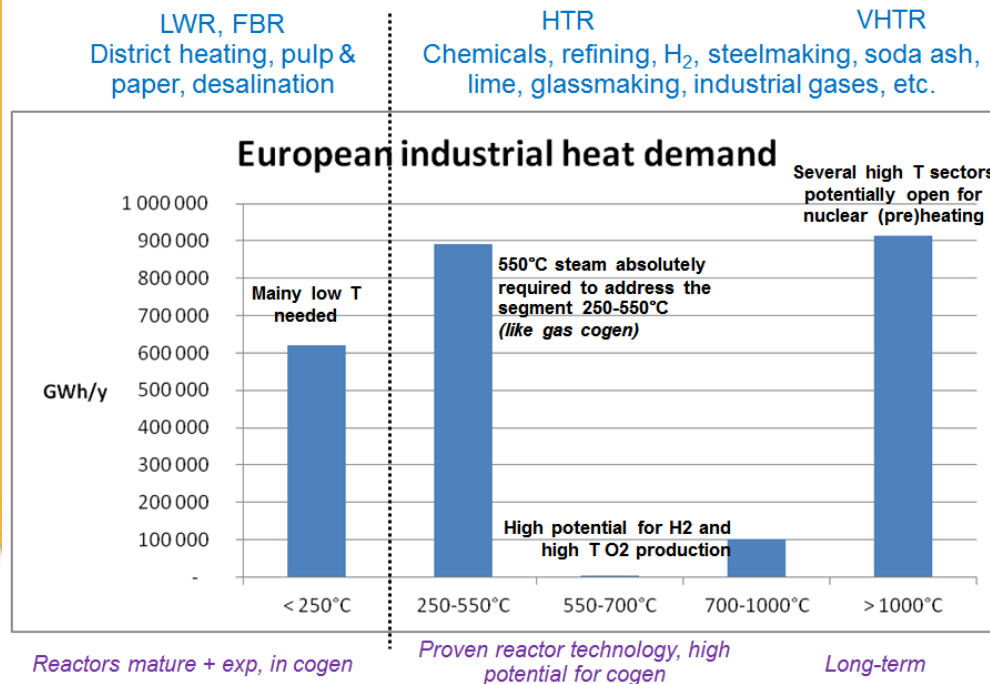
- the Sodium Fast Reactor Prototype reactor called **ASTRID**
- the flexible fast spectrum irradiation facility **MYRRHA**

while investigating the feasibility and deployment of the two other projects, ALFRED and ALLEGRO.

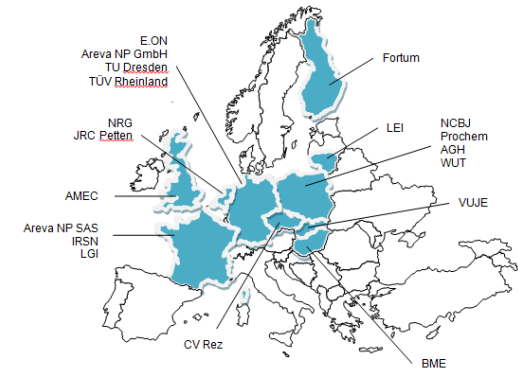
ESNII submission of "Implementation Plan 2013-2015" (submitted in March 2013 to the EC and SETIS)



NC2I - Nuclear Cogeneration Industrial Initiative Focuses on HTR demonstration



Source: EUROPAIRS study on the European industrial heat market



- Structuration of NC2I
- Infrastructures and competences
- Safety and licensing
- End user focus & deployment scenarios
- Civil society interactions

NC2I gathers energy intensive companies, technology developers, utilities, companies, universities and research centres

A Task Force has been set up under the auspices of SNETP to prepare for NC2I. NC2I TF gathers energy intensive companies, technology developers, utilities, engineering companies, universities and research centres.

Other activities

ETKM - Education, Training and Knowledge Management

Education, training and the maintenance of competencies i.e. knowledge management in engineering and sciences is a cornerstone in Europe's vision for the development of nuclear energy. If one is going to deliver the long term goal of sustainable nuclear fission, it will be necessary to have an adequate resource of well educated and trained young professionals coming into the field, whilst retaining the expertise and competencies. Therefore, in parallel with the development of the Strategic Research Agenda (SRA) and Deployment Strategy (DS), it was agreed that work on education, training and knowledge management should be an important cross-cutting activity within SNETP.

The ETKM Working Group includes stakeholders from research institutions, industry and EU organisations, with essential support from the [European Nuclear Education Network \(ENEN\)](#).

EERA - European Energy Research Alliance

SNETP cooperates with EERA in the nuclear field and many EERA organisations are SNETP members.

ETP in Energy

SNETP supports cooperation with nuclear ETPs (IGD-TP, MELODI...) and non-nuclear initiatives (other SET-Plan ETPs; Fuel Cell & Hydrogen JU; Steelmaking; Materials; etc.)

ENEF

Acts as European voice for fission R&D / technology, interacting with ENEF for the political level

Benefits of nuclear fission for Europe



Nuclear fission...

- Is the largest low-carbon energy source in the EU energy mix
- Contributes to security of energy supply for Europe
- Has an excellent safety record in Europe
- Minimizes its waste with the new generations of nuclear plants
- Benefits from distributed and geopolitically stable uranium supply
- Offers operational availability above 90 %
- Provides economic energy for a competitive European industry and affordable electricity for consumers, independently from fossil fuel price volatility
- Is a sector where Europe has industrial leadership which needs to be maintained

External fuel cycle – EU leading position in closed fuel cycle

- EU has implemented both open and closed fuel cycle
- Both as a matured commercial technology

Deep Geological Repository – EU leading position

- In progress is the preparation of deep geological repositories in Finland and Sweden, in countries with open fuel cycle
- France is preparing deep geological repository (country with closed fuel cycle with LWRs)

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New challenges – EUROPE 2020

Europe 2020 is the EU's growth strategy for the coming decade.

*In a changing world, we want the EU to become a **smart, sustainable and inclusive economy**. These **three mutually reinforcing priorities** should help the EU and the Member States deliver high levels of **employment, productivity and social cohesion**.*

*Concretely, the Union has set five ambitious objectives - **on employment, innovation, education, social inclusion and climate/energy** - to be reached by 2020. Each Member State has adopted its own national targets in each of these areas. Concrete actions at EU and national levels underpin the strategy.*

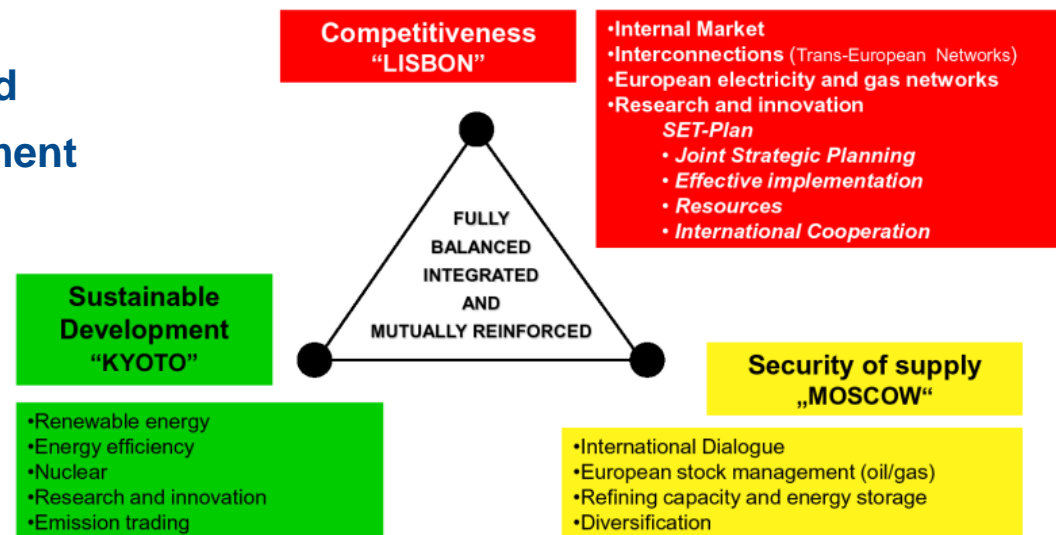
José Manuel Barroso President of the European Commission

EU Energy Policy is based on the tree pillars:

- Competitiveness
- Security of supply and
- Sustainable Development

Within the EU 2020 frame:

- Smart,
- Sustainable, and
- Inclusive economy



New challenges – SET Plan

EC Communication on Energy Technologies and Innovation:

The SET Plan remains the core instrument to deliver on the energy challenges. It provides the reference point for EU, national, regional and private investments in energy research and innovation.

However, the SET Plan also needs reinforcing, to respond to the new challenges and to better consolidate research and innovation capacity and resources across Europe. For this purpose, the following changes are proposed:

To address energy system and innovation chain integration, an **Integrated Roadmap** should be developed,

Based on the Integrated Roadmap, the Member States and the Commission should develop an **Action Plan** that lays down coordinated and/or joint investments by individual Member States, between Member States and with the EU. These investments should go beyond grant programmes and include financial engineering instruments and procurements.

A robust reporting system based on the **Strategic Energy Technologies Information System (SETIS)** of the SET Plan would monitor the implementation of the Integrated Roadmap and the Action Plan.

A **coordination structure** should be established under the Steering Group of the SET Plan to promote investments in research and innovation on energy efficiency.

Scoping Paper. Integrated Roadmap

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Nuclear fission R&D

Major recommendations to nuclear fission R&D were collected based on:

- **2012 Interdisciplinary Study. Benefits and limitations of nuclear fission for a low-carbon economy.**
- **2013 Symposium on Nuclear Fission Research for a Low Carbon Economy**
- **The EGE in Science and New Technologies: Opinion No. 27.**

The most challenging recommendation for us are:

1. EU **societal challenges** including economic crisis, food security, protection of the environment, climate change and energy dependency. **Energy availability**, security of supply, sustainability and safety issues and social welfare, **all require R&D effort, within the energy supply context**;
2. **Public and the private sector to invest in R&D** in all forms of sustainable energy to ensure an equitable transition to a low carbon economy, fulfilling the EU Energy policy goals - Sustainability, Security and Reliability of Supply; Competitiveness and Affordability);
3. Fukushima - **research cannot be “business as usual” more focused on safety, risk-mitigation, safeguards and security**, as well as waste management and decommissioning; towards a **wider systemic approach and integrated with other policy streams**;
4. Nuclear fission is an important **political issue** in most MSs and for the general public. **Nuclear research** must be considered as a joint endeavour involving the **research community, politicians and the public**;
5. **New technologies need to be promoted** not only to support safety and security but also to develop innovative areas such as nuclear medicine;
6. Euratom should take a full part **in international discussions**, forming partnerships where there is advantage in working with other regions of the world.

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SNETP new challenges

The three SNETP pillars remains the most important part of our activity as:

- The support continuation of profit EU has from existing fleet of NPPs and its potential extension,
- By commercializing Fast Reactor we increase the sustainability of nuclear energy, increasing by two orders the utilisation of Uranium and making EU independent on external resources, and
- By commercializing HTR, it extends potential utilization of nuclear energy also to non electric applications.

They must be complemented by some other less expensive, but also very important part as a response to this new challenges:

- System integration
- Social and economical impacts assessments

Results of this activities should:

Bring feedback to our activities

SNETP supports cooperation with nuclear ETPs (IGD-TP, MELODI...)

Harmonise effort with other ETPs

SNETP supports cooperation with non-nuclear initiatives (other SET-Plan ETPs; Fuel Cell & Hydrogen JU; Steelmaking; Materials; etc.)

Serve citizens and politicians

To better understand the energy sector, and consider it in their opinion.

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Interactions

Each pillar of our activity produce spent fuel and/or waste for Deep Geological Repository:

Feedback to our activities

We need feedback to our activities (Repository must be safe, there is no compromise), major feedback will be impact on:

- ☐ capacity, and
- ☐ cost of construction and operation,
of the repositories

Factsheets for discussion with citizens and politicians

As recommended, we must communicate with citizens and politicians in a way they can understand us, our Fact sheets must correspond to our common opinion, and must be properly written.

For this we need formalised cooperation

On working level we shear more than 25 member organisations



NUGENIA

Short introduction

NUGENIA is mandated by SNETP to coordinate
nuclear Generation II & III R&D

What is NUGENIA?

- NUGENIA is an **international non-profit association** founded under Belgian legislation in November 2011 and launched in March 2012
- NUGENIA is dedicated to the research and development of nuclear fission technologies, with a focus on Generation II and III nuclear plants



Why NUGENIA?



■ Mission

- **To be an integrated framework for safe, reliable and competitive Gen II & III fission technologies, which:**
 - Fosters collaboration between industry, SMEs, RTOs, academia and technical safety organisations
 - Builds knowledge and expertise
 - Generates results with added value

■ Products

- R&D roadmap with strategic prioritisations
- Online marketplace for seekers and solvers (NOIP)
- NUGENIA label for most promising projects
- Portfolio of ongoing projects
- Annual Forum gathering all NUGENIA stakeholders

■ Services

- Promote and initiate the emergence of joint research projects
- Support harmonisation at European level, in particular for safety requirements
- Facilitate the implementation and dissemination of R&D results
- Monitor project's outputs and valorise their results
- Strengthen existing networks and build new ones

Who is NUGENIA?

- **Members: major nuclear stakeholders**
 - Approx. 70 members from 20 countries (*as of August 2013*)
 - Industry, utilities, research institutions, SMEs and technical safety organisations



- **Honorary Members**



NUGENIA+ FP7 project



■ NUGENIA+

- Launched in September 2013 with 3-years duration
- EUR 6 millions contribution from the FP7 EURAROM-programme

■ Main objectives

- Optimize and strengthen the synergy within the NUGENIA Association, its members and with national and European authorities,
- Map traditional and new R&D projects funding sources and channels,
- Encourage public-public and public-private co-programming
- Valorise the R&D results
- Launch pilots calls for R&D projects

NUGENIA+ project objectives



NUGENIA+ will help NUGENIA to foster:


- Strong **involvement** of utilities, vendors, suppliers, safety and R&D
- Annual **work plans** setting priorities, involving public authorities and private organisations
- A multiannual **financial plan** including public and private sources
- A transparent **open-innovation process**: NUGENIA facilitates the bottom-up emergence of projects within the roadmap
- Smart use of the **expertise**, know-how and infrastructures available and to be developed among the NUGENIA members
- Balanced cooperation with **international counterparts**
- Preparing the **next generation** of researchers and engineers
- Future **structuring** within public-private (PPP) and/or public-public partnerships (P2P)
- To play a **driving role** in the implementation of **H2020** objectives

Technical scope: 8 technical areas (TAs)

1. Safety and risk of NPPs
2. Severe accidents
3. Core and reactor operation
4. System and component integrity
5. Fuel, waste and decommissioning
6. Innovative LWR design & technology
7. Harmonisation
8. Inspection, Qualification and Risk-Informed Inspection Planning (ENIQ)

Each TA comprises a set of sub-area challenges

Fuel Development, Waste and decommissioning - SUBAREAS

- 
- 1 Fuel development for existing, advanced and innovative fuel designs – Steve Napier NNL
- 2 Fuel behaviour mechanisms and computational codes
- François Barre IRSN
- 3 Fuel treatment, transportation and interim storage (spent fuel management) - David Hambley NNL
- 4 Waste and spent fuel management
- 5 Dismantling and decommissioning

TA5 objectives

- to increase fuel safety margins;
- to reduce reactor operating costs (including fuel costs);
- to reduce the amount and/or radiotoxicity of spent fuel;
- to recycle existing waste from prior processing operations;
- to increase sustainability and reduce waste volumes;
- to improve proliferation resistance.

Waste and spent fuel management

- Minimisation of source term
- Control of the mobilisation, transport and deposition of the source material in the primary circuit
- Development of simple remediation technologies to clean/decontaminate primary circuit materials and/or fuel
- Treatment of radioactive waste to reduce volume, improve its stability and recover materials for reuse

Dismantling and decommissioning

- Remote dismantling
- Dose minimisation
- Minimisation of secondary waste

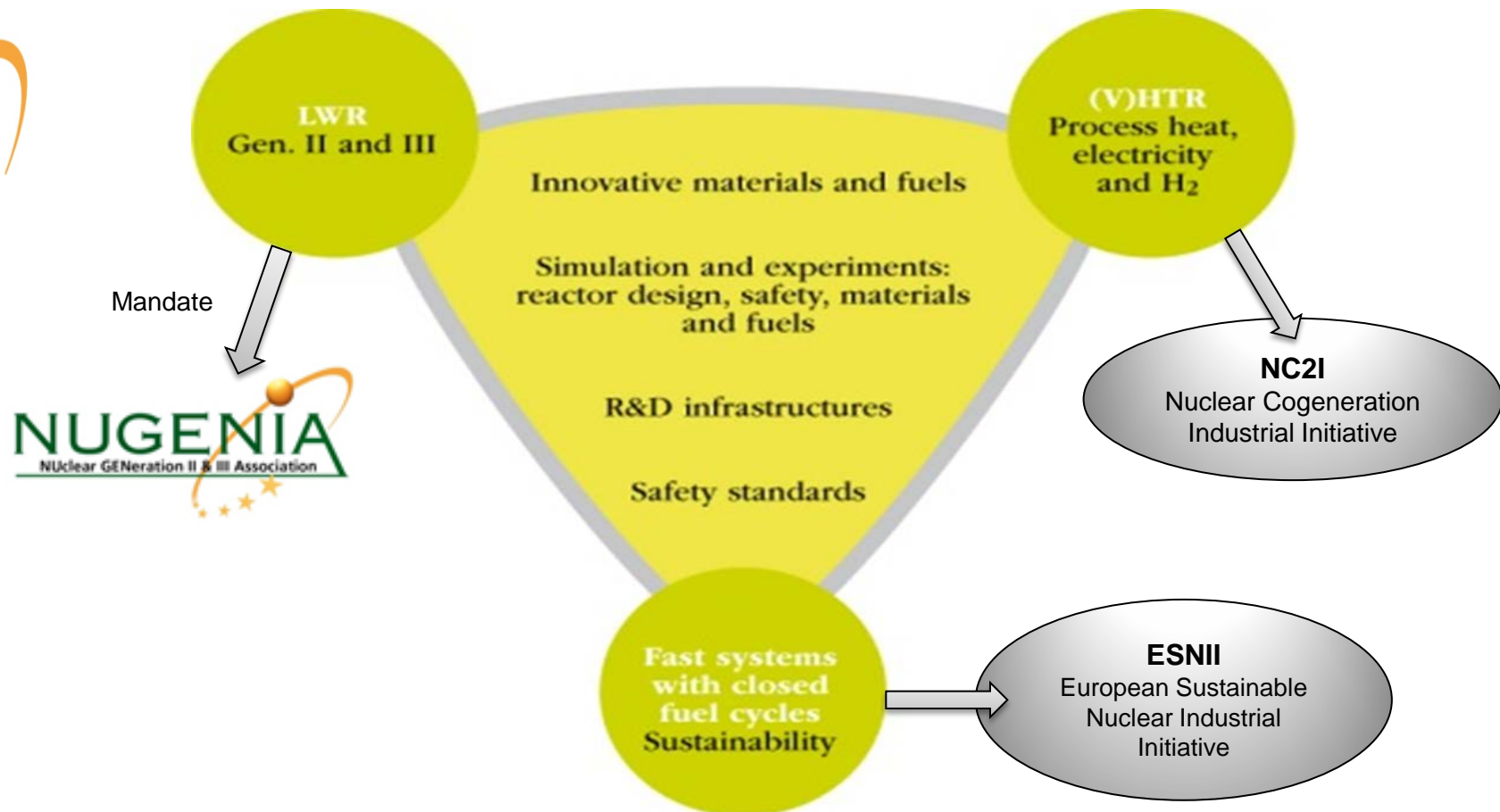
Thank you for your attention

Backup slides

NUGENIA in the SNETP frame



The *Sustainable Nuclear Energy Technology Platform* is the European forum dedicated to nuclear fission technologies, with a focus on three strategic pillars:



NUGENIA is an **international non-profit association** founded under Belgian legislation in November 2011 and launched in March 2012, approx. 80 members from 20 countries (*as of August 2013*).

Its mission is to be an integrated framework for **safe, reliable and competitive Gen II & III fission technologies**, which:

- Fosters collaboration between industry, SMEs, RTOs, academia and technical safety organisations
- Builds knowledge and expertise
- Generates results with added value

8 technical areas (TAs):

1. Safety
 2. Severe accidents
 3. Core and reactor operation
 4. System and component integrity
 5. Fuel, waste and decommissioning
 6. Innovative LWR design & technology
 7. Harmonisation
 8. Inspection, Qualification and Risk-Informed Inspection Planning (ENIQ)
- September 2013: ExCom invited EPRI to become an honorary member**
- October 2013: Publication of the NUGENIA Roadmap**

New challenges – HORIZON 2020

Nonnuclear part of Horizon 2020 defines a new structure of priorities as reaction to EUROPE 2020:

- (1) Excellent Science - bottom-up based on **science opportunities** - funded on the basis of excellence.
- (2) Industrial Leadership - industrial leadership - stimulate private sector research and development and innovation investment, with a **business driven agenda and accelerate the development of new technologies which will underpin future businesses and economic growth** - focusing on excellent research and innovation.
- (3) Societal Challenges - should increase the effectiveness of research and innovation in responding to **key societal challenges** – focusing on excellent research and innovation activities. **Challenge based approach** which brings **together resources and knowledge across different fields, technologies and disciplines. Social sciences and humanities research is an important element for addressing all of the challenges.** The activities should cover the **full range of research and innovation** with an emphasis on innovation-related activities such as **piloting, demonstration, test-beds, and support for public procurement, pre-normative research and standard setting, and market uptake** of innovations. The activities should **support directly the corresponding sectorial policy competences at Union level.** All challenges should contribute to the overarching **objective of sustainable development.**

Nuclear energy is not isolated technology, it is an integral part of energy sector, lot of R&D must be done in cooperation under this programme (system integration, crosscutting issues, assessment of societal challenges etc.).