Network of Excellence and Sustainable Association for Plant Life Assessment and Long Term Operation in Europe

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Salt Lake City, USA
Outline

- Framework of nuclear fission R&D in Europe
  - Policy framework – Strategic Energy Technology (SET) plan
  - Different instruments in EU level – ENEF, ENSREG, SNETP

- NULIFE Network of Excellence - R&D of PLIM/PLEX
  - What is NULIFE?
  - Governance and working methods
  - Activities with some achievements

- Future – sustainable NUGENIA Association
  - What is NUGENIA?
  - Governance and working methods
  - NUGENIA portfolio

- Summary
The European Context


- 20% reduction in GHG (compared to 1990)
- 20% renewable energies in energy mix
- 20% reduction in energy consumption

**Strategic Energy Technology (SET) Plan**

- On the longer term vision for low carbon society by 2050, the EC technology breakthroughs are needed
- Europe has rightly acknowledged the role of nuclear energy plays for a sustainable energy mix by listing it as one key low-carbon technology
Further development is contingent on:

- high level of nuclear safety & security - at large (technology, waste mgnt, emerg mgnt, liability,...)
- public acceptance + MS position on nuclear
- climate targets maintained + how well are "others" doing
- positive investment climate
- research and innovation critical – leadership/knowledge
- international cooperation and opportunities
Age of nuclear plants in Europe

Figure 1: Age of EU NPPs in 2012
Lifetime operation

Figure 2: LTO Effect on the NPP operating fleet in the EU

Assumptions:
- No LTO for the Belgian NPPs
- German NPPs shutdowns as forecasted
- No LTO for UK’s AG fleet

MW installed vs Years graph showing different scenarios for NPP operation with and without LTO.
New build forecast

Figure 3: EU NPP New Build Forecast in 2012

- Blue line: Under construction
- Red line: Under construction and Approved
- Green line: Under construction, approved and Planned

MW

Years

2014 2024 2034 2044
Working together at EU level

Towards a new nuclear governance
What is SNETP?

Sustainable Nuclear Energy Technology Platform

- SNETP is a **Europe-wide forum** gathering stakeholders building a common vision: nuclear industry, research centres, technical safety organisations, universities, NGOs, etc.

- The overall goal is to **support technological development** for enhancing nuclear fission in a sustainable energy mix
  - Low greenhouse gases emissions
  - Security of supply
  - Stable electricity prices

- R&D is necessary to **further enhance the safety and sustainability** of nuclear fission, and to **open new markets**

- SNETP has expressed its **strategic orientations** (Vision Report, Strategic Research Agenda, Deployment Strategy) and launched **task forces** to implement them
Vision of SNETP

SNETP vision: 3 ‘Pillars’

- Maintain safety and competitiveness of today’s technologies
- Develop Gen IV Fast Reactors with closed cycle to enhance sustainability
- Enlarge the nuclear fission portfolio beyond electricity production: cogeneration of heat & power
2007-2010: SNETP published its strategy documents

Vision Report
[ Sept 2007 ]

Strategic Research Agenda
[ June 2009 ]

Deployment Strategy
[ May 2010 ]

Education & Training
[ Dec 2010 ]

All documents are available for download on www.snetp.eu and prints upon request (secretariat@snetp.eu)
The first pillar of nuclear energy

TWG GenII&III

NULIFE NoE (Plant Life Prediction)

SARNET NoE (Severe Accident)

ENIQ coordinated by JRC (Inspection)

NUGENIA

« Nuclear Cogeneration » Towards Industrial Initiative NC2I

« ESNII » European Sustainable Nuclear Industrial Initiative

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NULIFE Network of Excellence
R&D on PLIM/PLEX
Create a single organisation structure, capable of providing harmonised R&D at European level to the nuclear power industry and to safety authorities in the area of lifetime evaluation methods for structural components.

Vision is to create a **Virtual Institute**
- Integrated R&D platform
  - Embracing all European stakeholders
  - Completely new structure with improved and efficient use of public and private RTD funding
- Sustainable forum for realizing harmonized technical methodologies
  - Impact for Nuclear energy industry, National regulators and European Regulatory Working Groups
- R&D service provider
  - Sustainable source of qualified expertise for all nuclear stakeholders
  - Innovator and executor of R&D projects

- Time schedule 10.2006 - 6.2012, 5.5 years
- Funded by EC and members
- VTT coordinator

- 11 Core contract members
- 26 other associate members
- 15 collaborators
  - National research institutes
  - Industrial research centres
  - Vendors, plant providers
  - Service providers
  - Power companies

**More information:** [http://nulife.vtt.fi](http://nulife.vtt.fi)
Organizational Groups and decision-making bodies

- Governing Board
- Executive Group
- Regulators
- National and international programmes
- Management
- Contractors, Associate Contributors, Collaborators
- Expert Groups
  - Materials performance
  - Integrity assessment
  - Ageing management
  - Safety and reliability

Infra Group
End User Group
Evolution process

NUGENIA Association

Beyond 5 years

NU LifE Association
• with customer-driven programme

Transition plan for permanent entity
- 2011

- Permanent management structure
- Long term business plan
- Acknowledged solution provider

Creation of Virtual Institute
- 2010

- Structure with permanent entity features
- Joint use of facilities
- Investment policy

Consolidation of integration plan
- 2009

- Launching of new RTD projects
- Development and application of procedures and best practices

Preparation of business plan
- 2008

- Business plan, Updated structure
- Links with national programmes
- Approaches to training, knowledge and comm.

Integration plan
- 2007

- Viable expert groups
- Coherent structure
- Communication methods
NULIFE approach for road map

Top down and bottom up prioritizations for the road map.
Top priority research areas defined by the NULIFE utilities

1. European harmonised plant design and safety justification methodology
2. Integrity assessment
3. Ageing mechanisms of Structures-Systems-Components
4. Ageing monitoring
5. Prevention and mitigation of ageing
6. Pre-normative research, codes and standards
7. Safety issues in instrumentation & control and electrical systems
8. Human factors and man-machine interaction
NULIFE approach for project creation

- SNETP SRA and DS
- OPERA road map
- NULIFE Project creation process

- Research areas, targets and topics
- NULIFE Research targets and topics
- Research topic proposals
- Other bottom up proposals

NULIFE project
## NULIFE Project Portfolio

<table>
<thead>
<tr>
<th>Year</th>
<th>2006...</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NESC VII</strong> - Application of WPS in RPV assessment including biaxial loading</td>
<td>P</td>
<td>N</td>
<td>N</td>
<td>P</td>
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<tr>
<td><strong>SCC</strong> - Stress corrosion cracking</td>
<td>N</td>
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<tr>
<td><strong>TF</strong> - Thermal fatigue</td>
<td>N</td>
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<tr>
<td><strong>I&amp;C</strong> - Instrumentation &amp; Control</td>
<td>N</td>
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<td><strong>DMW</strong> - Dissimilar metal welds</td>
<td>N</td>
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<tr>
<td><strong>VERLIFE</strong> - Unified procedure for WWER components</td>
<td>N</td>
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<tr>
<td><strong>LBB</strong> - Probabilistic approach of leak-before-break</td>
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<tr>
<td><strong>MMOTION</strong> - Man-machine-organisation through innovative orientations for nuclear</td>
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<td>EC</td>
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<td><strong>PERFORM60</strong> - Prediction of the effects of radiation for RPV and in-core materials using MSM-60 years foreseen plant life time</td>
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<td>EC</td>
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<tr>
<td><strong>LONGLIFE</strong> - Treatment of long term irradiation embrittlement effects in RPV safety assessment</td>
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<tr>
<td><strong>STYLE</strong> - Structural integrity for lifetime management - non-RPV components</td>
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<td>EC</td>
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<tr>
<td><strong>CABINET</strong> - Constraint and biaxial loading effects and their interaction considering thermal transients</td>
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<tr>
<td><strong>ADVANCE</strong> - Ageing diagnostics and prognostics of low-voltage I&amp;C cables</td>
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<td>EC</td>
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<tr>
<td><strong>HARMONICS</strong> - Harmonised assessment of reliability of modern nuclear I&amp;C software</td>
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<td>EC</td>
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<tr>
<td><strong>ACCEPPT</strong> - Ageing of concrete and civil structures in nuclear power plants</td>
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<td><strong>MOTHER</strong> - Modelling of T-junction heat transfer</td>
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</tr>
</tbody>
</table>

- **P**: Funded by the partners
- **N**: NULIFE pilot projects
- **EC**: Funded in part by EC

IAEA Conference on PLIM Salt Lake City 14-18 May 2012
Projects presented at IAEA PLIM Conference 2012

- **NULIFE Session – four projects presented**
  - FP7 Project LONGLIFE: Treatment of Long-Term Irradiation Embrittlement Effects in RPV Safety Assessment
  - NESC VII Project: A European Project for Application of WPS in RPV Assessment Including Biaxial Loading
  - NULIFE Project CABINET: RPV Assessment Under Consideration of constraint and Warm Pre-Stress Effects
  - IAEA NULIFE Project VERLIFE: Procedure for Integrity and Lifetime Assessment of Components and Piping in WWER NPPs During Operation – A Tool for LTO

- **Poster Session**
  - MULTIMETAL: Structural performance of Multimetal Components
  - STYLE: A European Project on Structural Integrity: Progress of the Works After 2 Years
Publicly available at http://nulife.vtt.fi

- **Reports**
  - Pilot study on stress corrosion crack growth rates of Ni-based alloys in BWRs and PWRs
  - Studies on Load History Effects on Crack Driving Force
  - Studies on Improved Methods for Dealing with Combined Primary and Secondary Stresses in Defect Assessments
  - Safety impact of passive components
  - Road map (OPERA)

- **Presentations, brochure, poster, bulletins**

- **NUGENIA information**
Examples of reports/activities for NULIFE members only

- Asset management review
- Probabilistic Approach of Leak-Before-Break
- Framework for Harmonization of Plant Life Extension Methodologies
- Joint IAEA – HOTLAB – NULIFEPINE database for test facilities and software tools
- Review of Assesment Tools Used in Nuclear Plant Life Management
- Guideline for the Development of High Quality Stress Corrosion Crack Growth Data
- Synthesis and Results of Thermal Fatigue Activity
- State of the Art Review of Reactor Safety and Risk Assessment Practices in European Countries
- Feasibilities for Instrumentation & Control and Dissimilar Metal Welds
Reports for NUGENIA establishment

- Internal rules
- Business plan
- Road map (OPERA)
- Project consortium agreement model
- Report on End User Group (EUG) needs
NUGENIA

Future direction and position

"An association open to all"
What is NUGENIA?

- NUGENIA is an International non-profitmaking association according to Belgian legislation established Nov 14, 2011, and launched in March 19, 2012.
- NUGENIA is dedicated to the research and development of nuclear fission technologies, with a focus on Generation II and III nuclear plants.
- Already 50+ members from 20 countries, bringing together major European nuclear stakeholders from industry, utilities, research institutions and technical safety organisations.
Mission

- To be the integrated framework between industry, research and safety organisations for safe, reliable and competitive Gen II & III fission

Services

- To run an open innovation marketplace
- To promote the emergence of joint research
- To facilitate the implementation and dissemination of R&D results

Our products

- R&D roadmap and coordinated project portfolio
- Advanced scientific and technical base for Gen II & III technology
- Support to harmonisation at European level, in particular for safety requirements
Governance structure
NUGENIA porfolio

- Concerning 8 technical areas:
  - Plant safety and risk
  - Severe accidents
  - Core and reactor operation
  - System and component integrity
  - Fuel, waste and decommissioning
  - Innovative Gen III design
  - Harmonisation
  - Inspection

- Growing from initial contributions by NULIFE, SARNET, ENIQ and GEN II/III SNETP working group
NULIFE project portfolio – basis for R&D start-up

MMOTION (Man - machine)

ACCEPT (Concrete)

HARMONICS (I&C software)

ADVANCE (I&C cables)

LBB (Probabilistic approach of leak-before-break)

STYLE (Welds and pipes)

MOTHER (T-junction heat transfer)

PERFORM60 (Pressure vessel + internals)

LONGLIFE, NESC VII, CABINET (Pressure vessel)
The roadmap integrates the research areas and targets defined in the strategic research agenda (SRA) of the sustainable nuclear energy technology platform (SNETP), and prioritized by NULIFE, SARNET, ENIQ, TWG Gen II & III.

Definition of detailed roadmaps and R&D priorities for all 8 technical areas in currently under way

- Facilitate the emergence of projects implementing R&D in the field of Gen II & III
- Identify all relevant funding sources for Gen II & III R&D
- Generally promote European nuclear Gen II & III collaborative R&D by integrating national research programs
- Facilitate cooperation with international counterparts on Gen II & III R&D
- Consider the recommendations of SNETP TF on Fukushima and results of European stress tests

Roadmaps and its implementation is based on the strong cooperation of utilities, vendors, suppliers, other industrial organisations and research organizations.
NUGENIA position

NUGENIA is mandated by SNETP to coordinate nuclear Generation II & III R&D. Mandate signed by SNETP Chair and NUGENIA President in March 21st, 2012
Summary

- LTO of NPPs in EU member states will play important role in meeting the targets for climate change mitigation
- NULIFE NoE has proven a structure and operating model to manage the LTO/PLIM/PLEX research and development work in Europe.
- Sustainable Nuclear Energy Technology Platform (SNETP) supported the integration process between its Gen II & III TWG, the NULIFE network, the SARNET network and the ENIQ Network
  ➔ This resulted in the creation of NUGENIA Association, to coordinate Gen II/III R&D at EU level based on the model of NULIFE
- A new R&D roadmap and coordinated project portfolio will be defined based on the work already done in the GEN II&III TWG, NULIFE, SARNET and ENIQ. Safe and efficient long term operation of the existing NPPs is one of the key R&D priorities.
- Interaction and collaboration between different international organisations like FORATOM R&D, ETSON, IAEA, OECD, ENEN, ENEF, IFRAM is foreseen and welcome.
Thank You for Your attention

More information: www.nugenia.org