



Horizon 2020
Programme

GENIORS

Research and Innovation Action (RIA)

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<http://geniors.eu/>

GENIORS

Project website

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GEN IV Integrated Oxide fuels recycling strategies Roger Garbil

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Summary

The GENIORS Public Website was designed and developed to serve as a dynamic information and communication tool, as well as a platform for the project team. It acts as the main channel for news and updates with the aim to address the key questions that external visitors are expected to have, these include: ? What the project is about ? What the project is delivering, and why ? Who the partners of the project are ? Where to find more information on the topic or related topics Google Analytics is being employed as a tool to monitor the statistics of the website and make changes to the content architecture if necessary. The GENIORS website was officially launched in August 2017. It will be continuously updated and will evolve with the lifecycle of the project, according to the dissemination and communication policy of the project.

Approval

Date	By
2017-09-07 15:26:30	Mrs. Chloe CHAVARDES (LGI)
2017-09-07 15:33:41	Mr. Stéphane BOURG (CEA)
2017-09-07 15:33:53	Mr. Stéphane BOURG (CEA)



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EXECUTIVE SUMMARY

The GENIORS Public Website was designed and developed to serve as a dynamic information and communication tool, as well as a platform for the project team. It acts as the main channel for news and updates with the aim to address the key questions that external visitors are expected to have, these include:

- What the project is about
- What the project is delivering, and why
- Who the partners of the project are
- Where to find more information on the topic or related topics

Google Analytics is being employed as a tool to monitor the statistics of the website and make changes to the content architecture if necessary.

The GENIORS website was officially launched in August 2017. It will be continuously updated and will evolve with the lifecycle of the project, according to the dissemination and communication policy of the project.

INTRODUCTION

The key objectives of GENIORS in terms of public communication are to:

- Raise awareness about GENIORS and its aim to facilitate radioactive waste management by reducing its volume and radiotoxicity, contributing to a more efficient utilisation of natural resources.
- Centralise and make available all possible relevant public reports and results.
- Ensure European and international visibility for GENIORS and its associated activities.

The public website for GENIORS will contribute to achieving these objectives by serving as the main channel for news and updates, as well as a repository for all the project's public deliverables such as reports and communication and promotional material (flyer, poster, etc.)

It also provides access to the private area for GENIORS partners. This platform allows partners to share documents and work in a collaborative way.

This document outlines the main sections and technical characteristics of the website.

CONTENT

The public GENIORS website will promote the European and international visibility of the project, communicate on the progress achieved and disseminate the results stemming from the project.

To make useful and relevant information available to the general public, it was decided that the website should address the needs and the questions that would most likely interest external stakeholders or visitors, such as:

- What the project is about
- What the project is delivering, and why, including its vision
- Who the partners of the project are
- Where to find more information on the topic or related topics

HOMEPAGE

All of the important information on the project can be accessed directly from the homepage and highlights of each section or topic are displayed.

It represents the central point of information and aims to provide general information about the project and the expected results and impacts, which are to improve the multiple recycling of spent fuels, use less natural uranium and produce less and shorter-lived radioactive waste.

Therefore, visitors have direct access to information on:

- The project and its context
- The activities carried out
- The expected results and impacts
- The latest news and events
- All published resources
- The partners of the consortium
- The link to the partner area

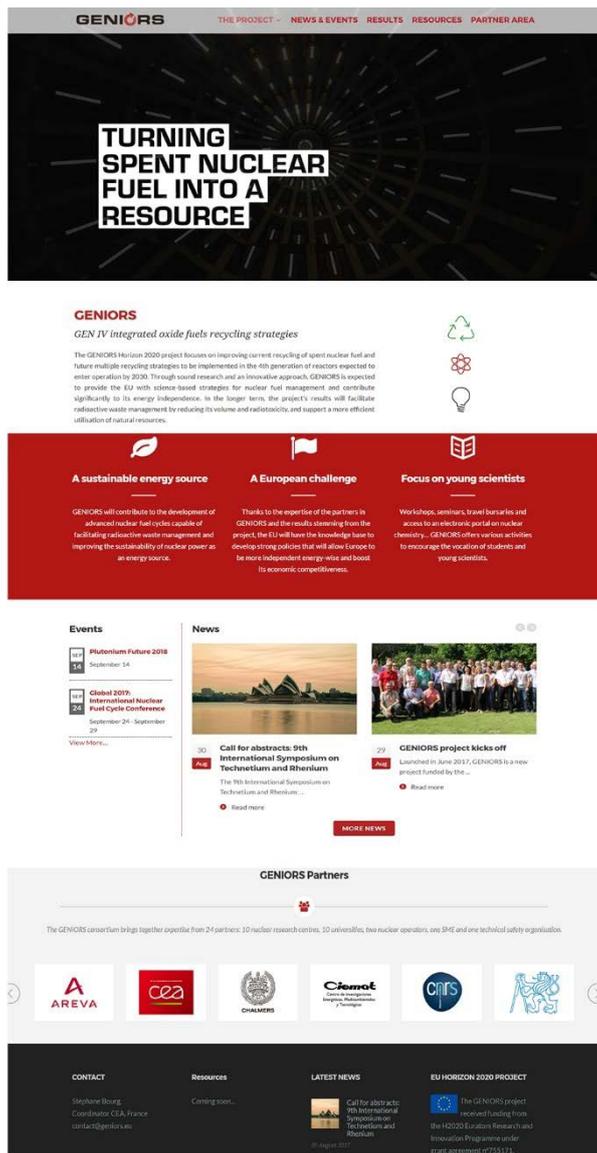


Figure 1: Screenshot of the Homepage

THE CONTEXT OF THE PROJECT

The “Context of the project” page explains the current position of nuclear energy in the EU dialogue, the focus on the 4th generation of reactors and the key role of actinides to reduce volume and radiotoxicity of waste. Visitors can also access all of the pages on the website directly from the header and the right sidebar titled *The project/Background information* which includes links to key sections of the website. In the footer, users can find the latest news and upcoming events, and other key details about the project (*this is the case on all pages*).

GENIORS
THE PROJECT - NEWS & EVENTS RESULTS RESOURCES PARTNER AREA

Context
Home > Context

Context of the project

Nuclear power plays an essential role in limiting the EU's greenhouse gas emissions, and contributes significantly to improving the EU's independence, security and diversity of energy supply.

However, nuclear energy remains controversial in the EU energy dialogue, mainly due to:

- its low efficiency in terms of the amount of uranium mined versus the amount of uranium actually consumed in an open fuel cycle
- its social acceptance which is inextricably linked to enhanced safety management, including the safe management of long-lived radioactive waste

The fuel cycle can be closed by recovering the plutonium from the spent nuclear fuel made up of uranium oxide (UOX) and recycling it into Mixed Oxide (MOX) fuel. This process, which is already implemented today in some light water reactors (LWR) in France, improves the efficiency of uranium

by about 20%. As MOX can substitute for fresh UOX, it also cuts down on uranium needs at the front end of the fuel cycle, thus reducing the environmental impact of nuclear energy – the front end being the main contributor to most environmental indicators.

Finally, this recycling process reduces the amount of high level waste (i.e. spent reactor fuel or waste materials remaining after the spent fuel is reprocessed) to dispose of by a factor of 4, which eases its interim storage and reduces the volume needed in the final waste repository by a factor of 4 as well.

Boosting efficiency and sustainability with future Generation IV reactors...

Although this closed fuel cycle significantly increases the sustainability of nuclear energy, major improvements can still be made.

Natural uranium consists largely of two isotopes: 0.7% of uranium-235 and 99.3% of uranium-238. Energy produced in current nuclear reactors results from the splitting of the uranium-235 atoms, a process which releases energy in the form of heat. The remaining 99.3% uranium-238 does not contribute directly to this process.

The fourth generation of reactors (GEN IV), which are expected to enter operation by 2030, could allow a breakthrough in the use of uranium by increasing its efficiency up to 100% in theory, as they can also split uranium-238 atoms and allow multiple recycling of plutonium.

Recycling actinides to reduce volume and radiotoxicity of waste...

While GEN IV reactors provide a solution for using the world's uranium resources much more efficiently, waste is still generated and its high radiotoxicity is not reduced. Indeed, MOX fuel contains the minor actinides neptunium, americium and curium which are highly radioactive elements produced in reactors.

This issue can only be addressed through the recycling of these elements. At this stage, Partitioning and Transmutation (P&T) operations can reduce the life expectancy of these minor actinides, dividing them into other elements (fission) with a shorter life cycle. Several recycling options are proposed today which bring the nuclear waste life to a human scale and reduce the volume of the waste by 90%.

The GENIORS project will tackle these challenges by looking into innovative solutions and chemical processes that improve the multiple recycling of spent fuels, use less natural uranium and produce less and shorter-lived radioactive waste.

LEARN MORE ON GENIORS

<p>CONTACT</p> <p>Stephane Boze Coordinator CEA, France contact@geniors.eu</p>	<p>Resources</p> <p>Coming soon...</p>	<p>LATEST NEWS</p> <p>Call for abstracts 9th International Symposium on Reactor and Plutonium 28 August 2017</p> <p>GENIORS project kick-off 17 August 2017</p>	<p>EU HORIZON 2020 PROJECT</p> <p>The GENIORS project received funding from the H2020 European Research and Innovation Programme under grant agreement n° 730227.</p>
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GENIORS PROJECT © 2017 | designed by L&L sustainable innovation

Figure 2: Screenshot of the Context of the project page

ABOUT GENIORS

The “About GENIORS” page describes the project in general, and presents the GENIORS partners and the team present at the kick-off meeting.

GENIORS THE PROJECT NEWS & EVENTS RESULTS RESOURCES PARTNER AREA

About GENIORS Home > About GENIORS

Turning spent nuclear fuel into a resource

Through sound research and an innovative approach, GENIORS is expected to provide the EU with science-based strategies for nuclear fuel management and contribute significantly to its energy independence. In the longer term, the project's results will facilitate radioactive waste management by reducing its volume and radiotoxicity, and support a more efficient utilisation of natural resources.

Launched in June 2017, the European Horizon 2020 GENIORS project will last 48 months with a total budget of €7.52 million. It gathers 24 partners from across Europe: 10 nuclear research centres, 10 universities, two nuclear operators, one SME and one technical safety organisation.

Coordinated by Stéphane Bourg from the CEA, GENIORS will aim to develop innovative techniques for the recycling of spent nuclear fuel and future multiple recycling strategies to be implemented in a closed nuclear fuel cycle.

The current open nuclear fuel cycle uses less than 1% of the energy contained in uranium. Efficiency can be greatly improved with the recycling of spent nuclear fuel and with the multiple recycling strategies to be implemented with the fourth generation (GEN IV) of nuclear reactors that are expected to enter operation by 2030.

In this context, GENIORS will carry out research and innovation activities in fuel cycle chemistry and physics to optimise fuel design. GENIORS focuses on the reprocessing and fuel manufacturing of Mixed Oxide (MOX) fuel that potentially contains containing minor actinides, which would be the reference fuel for the first European GEN IV prototype and demonstrator (i.e. ASTRID in France and ALFRED, respectively). In order to deliver the full picture of a MOX fuel cycle, GENIORS will collaborate closely with the European Horizon 2020 INSPYRE project on oxide fuels performance.

A European consortium

The GENIORS partners at the kick-off meeting on 14-15 June 2017 in Angers, France.

UNIVERSITY OF TWENTE AREVA CEA GENT

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Resources
Coming soon...

LATEST NEWS
Call for abstracts with International Symposium on Sustainable and Renewable Energy
27 November 2017
GENIORS project kicks off
27 August 2017

EU HORIZON 2020 PROJECT
The GENIORS project received funding from the Horizon 2020 European Research and Innovation Programme under grant agreement n°735171.

Figure 4: Screenshot of the About GENIORS page

EXPECTED IMPACTS

The “*Expected impacts*” page will present the project’s impacts expected by 2020, 2025 and 2050. This section will be populated with a description of the project’s impacts in the short-, mid- and long-term.

THE INTERNATIONAL AND EUROPEAN SETTING

The “*International and European setting*” page presents the different international and European cooperative organisations and initiatives/programmes, as well as European research projects in the field of nuclear fuel cycles.

GENIORS
THE PROJECT - NEWS & EVENTS RESULTS RESOURCES PARTNER AREA

The international and European setting
Home > The international and European setting

For more than 15 years, the GEN IV International Forum (GIF | www.gif4.org) has been supporting the development of advanced reactors and associated fuel cycles to allow a better use of resources. In 2002, the GIF selected 6 GEN IV systems among 100 as reference systems:

- gas-cooled fast reactor (GFR)
- lead-cooled fast reactor (LFR)
- sodium-cooled fast reactor (SFR)
- molten salt reactor (MSR)
- supercritical-water-cooled reactor (SCWR)
- very-high-temperature reactor (VHTR)

In Europe, the Sustainable Nuclear Energy Technology Platform (SNETP | <http://www.snetp.eu/>), through its European Sustainable Nuclear Industrial Initiative (ESNI), aims to advance the development of GEN IV technologies, while supporting research infrastructures, fuel facilities and research & development activities.

SNETP has prioritised the different Gen-IV systems and is proposing to develop the following projects through ESNI:

- The sodium-cooled fast neutron reactor technology (ASTRID project), with the construction of a prototype in France and which is strongly supporting this technology
- As a first alternative technology, the lead-cooled fast reactor (ALFRED) with the construction of an experimental demonstration reactor in another European country willing to host the program, and supported by a lead-bismuth irradiation facility project in Belgium (MYRRHA)
- As a second alternative technology, the gas-cooled fast reactor (ALLEGRO), also requiring the construction of technology demonstrator in a European country

Both ASTRID and ALFRED use MOX fuel (potentially bearing minor actinides as reference fuel although minor fuel is considered for ALFRED), MYRRHA, related to the double strata ADS concept, should also be started with MOX fuel.

It is therefore critical to develop the related fuel cycles allowing the fuel fabrication, the recycling of the spent fuel and potentially the minor actinides, and the associated waste management in a safe and reliable way.

This issue can only be addressed through the recycling of these elements. At this stage, Partitioning and Transmutation (P&T) operations can reduce the life expectancy of these minor actinides, dividing them into other elements (fission) with a shorter life-cycle. Several recycling options are proposed today which bring the nuclear waste life to a human scale and reduce the volume of the waste by 90%.

20 years of European research

For more than 20 years, several European research projects have addressed issues related to the development of these advanced fuel cycles, both on the physics side (reactor and/or the chemistry recycling side) and on the waste side.

Within the European partitioning community (then FP1, FP4, FP6, FP7, FP8, FP9, FP10, FP11, FP12, FP13, FP14, FP15, FP16, FP17, FP18, FP19, FP20, FP21, FP22, FP23, FP24, FP25, FP26, FP27, FP28, FP29, FP30, FP31, FP32, FP33, FP34, FP35, FP36, FP37, FP38, FP39, FP40, FP41, FP42, FP43, FP44, FP45, FP46, FP47, FP48, FP49, FP50, FP51, FP52, FP53, FP54, FP55, FP56, FP57, FP58, FP59, FP60, FP61, FP62, FP63, FP64, FP65, FP66, FP67, FP68, FP69, FP70, FP71, FP72, FP73, FP74, FP75, FP76, FP77, FP78, FP79, FP80, FP81, FP82, FP83, FP84, FP85, FP86, FP87, FP88, FP89, FP90, FP91, FP92, FP93, FP94, FP95, FP96, FP97, FP98, FP99, FP100), reference operations and facilities are now available for both the homogeneous recycling (radioactive waste) and the heterogeneous recycling (actinides) as well as the fuel assemblies, GANEX concept of used nuclear fuel.

Finally, several other studies have been carried out to assess the compatibility of these fuel cycles with other types of fuel cycles, which should have been addressed by FP60-62. They have to be integrated in global scenarios, "from fuel to fuel" to finally achieve the demonstration of their relevance. In addition, JARR-VEL and PLUG-IN have addressed the fuel side by studying the behaviour of these fuels in reactor.

Related European projects

- INP/IRE (2017-2023): investigations on fuel reactor MOX fuel to support the European Sustainable Nuclear Industrial Initiative (ESNI) reactor prototypes.
- BIFROST: studies on oxide fuel and cladding interactions.
- BIFROST: studies on oxide fuel and cladding interactions.
- MYRTE (2015-2019): research on high-level nuclear waste transmutation at industrial scale, using the MYRRHA installations (the Multi-purpose Hybrid Research Reactor for High-tech Applications is the first prototype in the world of a nuclear reactor driven by a particle accelerator).
- PELORIM (2013-2016): minor actinide fuel developments for the Generation IV fast reactor system to support the Strategic Research Agenda (SRA) of the European Sustainable Nuclear Energy Technology Platform (SNETP).
- Meet-CINCH (2010-2016): teaching and training package in nuclear and radiochemistry for students and young researchers.
- GANEX-VEL (2013-2015): develop cooperative research activities on interim storage of spent fuel and other high level radioactive wastes.

<p>CONTACT</p> <p>Stéphane Bourg Coordinator CEA, France contact@geniors.eu</p>	<p>Resources</p> <p>Coming soon...</p>	<p>LATEST NEWS</p> <p>Call for abstracts 9th International Symposium on Technology and Reactors</p> <p>20 August 2017</p> <p>GENIORS project kicks off</p> <p>29 August 2017</p>	<p>EU HORIZON 2020 PROJECT</p> <p>The GENIORS project received funding from the H2020 European Research and Innovation Programme under grant agreement 1010175517.</p>
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Figure 5: Screenshot of the International and European setting page

NEWS AND EVENTS

The “News and events” section reports on the news and the events relating to GENIORS, as well as related projects, or news and events of interest to the project’s key stakeholders.

GENIORS
THE PROJECT - NEWS & EVENTS RESULTS RESOURCES PARTNER AREA

News & Events
Home - News & Events



Call for abstracts: 9th International Symposium on Technetium and Rhenium

30 24 | By Chris | No comments yet | [Event, Nuclear, Nuclear fuel cycle, Rhenium, Technetium](#)

The 9th International Symposium on Technetium and Rhenium: Science and Utilization will be held from 5 - 10 November 2017 in Sydney, Australia. ISTR 2017 will be carrying forward the tradition established by over 20 years of meetings on Technetium and Rhenium that have occurred every three years. The aim of ISTR 2017 is to cover all aspects of Technetium.

[Read more](#)

Upcoming Events

14 **Plutonium Future 2018**
September 14

24 **Global 2017: International Nuclear Fuel Cycle Conference**
September 24 - September 29
Korea, Republic Of

[View More...](#)

Latest News

30 **Call for abstracts: 9th International Symposium on Technetium and Rhenium**
30 August 2017

29 **GENIORS project kicks off**
29 August 2017



GENIORS project kicks off

29 Aug | By Chris | No comments yet | [Generation 4, Horizon 2020, Recycling, Research](#)

Launched in June 2017, GENIORS is a new project funded by the European Commission to contribute to improving multi-recycling of radioactive waste. GENIORS stands for 'GEN IV integrated oxide fuel recycling strategies', and focuses on the 4th generation of nuclear reactors, expected by 2030 and equipped with more sustainable technologies. From 2017 to 2021, scientific research will be led principally on

[Read more](#)

The project

- [About GENIORS](#)
- [Launched in June 2017, GENIORS aims to advance scientific research and improve the recycling techniques of spent fuels in the nuclear fuel cycle. Learn more...](#)
- [The context of the project](#)
- [Expected impacts](#)
- [Results](#)
- [Resources](#)

CONTACT

Stéphane Bouré,
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Resources

Coming soon...

LATEST NEWS

30 **Call for abstracts: 9th International Symposium on Technetium and Rhenium**
30 August 2017

29 **GENIORS project kicks off**
29 August 2017

EU HORIZON 2020 PROJECT

The GENIORS project received funding from the H2020 Euratom Research and Innovation Programme under grant agreement #7303171.

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Figure 6: Screenshot of the News and Events section

RESULTS

The “Results” section gives access to the results produced in the project and public reports/deliverables.

GENIORS

[THE PROJECT](#) [NEWS & EVENTS](#) [RESULTS](#) [RESOURCES](#) [PARTNER AREA](#)

Results
Home > Results

The public results of the GENIORS project will be available for download in this section.

- + Fission product behaviour
- + Degradation chemistry
- + Solvent extraction chemistry
- + Solid/liquid interface chemistry
- + Process and flowsheet modelling and safety
- + Dissolution, conversion and interface with SX
- + System studies
- + Process safety

<p>CONTACT</p> <p>Stéphane Bourg, Coordinator CEA, France contact@geniors.eu</p>	<p>Resources</p> <p>Coming soon...</p>	<p>LATEST NEWS</p> <div style="margin-bottom: 10px;">  <p>Call for abstracts: 9th International Symposium on Technetium and Rhenium</p> <p><small>30 August 2017</small></p> </div> <div>  <p>GENIORS project kicks off</p> <p><small>29 August 2017</small></p> </div>	<p>EU HORIZON 2020 PROJECT</p> <div style="margin-bottom: 10px;">  <p>The GENIORS project received funding from the H2020 Euratom Research and Innovation Programme under grant agreement n°755171.</p> </div>
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Figure 8: Screenshot of the Results section

RESOURCES

The “Resources” section gives access to to project’s resources that provide additional information on the project, such as press releases, photos galleries and promotional materials (brochures and flyers).

PARTNER AREA

The “Partner area” section is dedicated to the partners. This platform allows partners to share documents and work in a collaborative way. It provides an online repository for information about the management of the project, contacts, results from the meetings, as well as internal work documents related to different WPs that are required to be shared. All documents and files are saved and organised in one place and can be shared at any time, from any location or device.



Figure 9: Screenshot of the Partner area section

OTHER CONSIDERATIONS

BROWSER COMPATIBILITY

The website is compatible with the common web browsers on all common operating systems. These include various versions of Internet Explorer, Firefox, Safari, Opera and Chrome.

The layout of the website is also responsive: it adjusts the design display based on the screen size of the device it's viewed on, regardless of whether it is viewed on a desktop, tablet or mobile.

GOOGLE ANALYTICS

To understand how the website is used by visitors, a Google Analytics account will be registered for GENIORS. The reports will give a clear idea on:

- How many users are visiting the site
- Which pages are the most viewed
- The geographic location of visitors

UPDATE OF THE WEBPAGE

Updates will be made every 4 – 6 months so that it continues to adapt to the important milestones (e.g. the completion of each demonstration). This is to ensure that the website remains a dynamic and useful tool to spread the knowledge acquired during the project.

CONCLUSION

The GENIORS website has been prepared during the first stage of the project, and was launched on August 2017 according to specific needs and aims to maximise the impact of the project. It also aims to boost the awareness on the results and milestones to be accomplished during the project. The GENIORS website will be updated regularly and will remain a flexible tool, content and structure may evolve if necessary.