Mapping of Nuclear Education Possibilities and Nuclear Stakeholders in the EU-27

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JRC 67016

EUR 25160 EN
ISSN 1831-9424
DOI 10.2790/41101

Luxembourg: Office for Official Publications of the European Communities

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Printed in the Netherlands
EXECUTIVE SUMMARY

According to the common vision of major stakeholders from the nuclear industry and research institutions, safe nuclear energy generation will continue to provide an important contribution to the security and competitiveness of energy supply in the EU, and the abatement of greenhouse gas emissions in line with the Strategic Energy Technology Plan (SET Plan) targets. To translate that vision into concrete steps, the Sustainable Nuclear Energy Technology Platform (SNETP) has been created to develop a Strategic Research Agenda (SRA, 2009) summarising the most urgent research topics to be addressed, and to derive a Deployment Strategy (DS, 2010) identifying key actions for the implementation within a time horizon up to 2050.

Additionally, the European Nuclear Energy Forum (ENEF) was founded in 2007, which is a unique platform for a broad discussion, free of any taboos, on transparency issues as well as the opportunities and risks of nuclear energy.


Both the Council Conclusion from 1-2 December 2008 on the preservation of nuclear skills in the EU and the Council Directive from 23 June 2009 establishing the Community Framework for nuclear safety require adequate competence on nuclear safety and are as well the impetus for the production of this report, which is providing an overview of the current situation in EU education and training opportunities in nuclear energy field.

One of the aims of this report is to help the new generation of students who are considering working in the nuclear industry to see all the higher educational opportunities in the nuclear field available to them in Europe. This report also provides a map of what is happening in the academic field and in the nuclear industry in all the EU countries. This will help academia and industry to know about the different initiatives, to be complementary to each other and to collaborate for a harmonic resurgence of nuclear energy.

In summary, this report makes a contribution to ensuring that the educational institutions that SUPPLY human resources and the stakeholders that DEMAND these human resources are aware of the existence of each other and can make contact so that they can collaborate in making improvements to rectify the shortfalls in this sector.

In addition, this report forms the basis for a systematic monitoring of the SUPPLY and DEMAND situation of Human Resources in the Nuclear Energy Sector in the EU-27. It will be used and updated regularly by the European Human Resource Observatory in the Nuclear Energy Sector (EHRO-N).

The first observation is that there is a lack of harmony in the field of nuclear energy education in Europe, however the European Nuclear Education Network (ENEN) had been established to support the cooperation between the academia. In addition, it is recognised that the existence of institutions like the European Nuclear Society (ENS), the nuclear fora and the Academies of Sciences (or similar educational institutions) are providing a major contribution in the field of nuclear education in ensuring that the general public and future students are aware of the issues relating to nuclear energy.

In those countries where nuclear energy plays an essential role, education in the nuclear field is widely supported both by government and by the different educational institutions.

It is noted that, within the 27 EU countries, there is a clear division between those countries that support nuclear energy and those countries that do not. In the countries that do not have a nuclear power programme, it is usually the case that the higher educational institutions do not offer many courses in the nuclear field. However, in some of these countries, there is ongoing research and
educational activities in the nuclear field that are continuously being maintained and updated.

In general terms, it is noted that increasing SUPPLY possibilities for human resources for the nuclear industry are being created and that this is beginning to repair the deficit that has arisen during the last decades in which the acceptance of nuclear energy has shown a downturn.

Much of the work to produce the report was carried out before the accident at the Fukushima Daiichi nuclear power plant occurred in March 2011. It is clear that there will be a change in public opinion on the future of nuclear power in the EU, which is still difficult to foresee. However, the factual information presented in the report that presents the situation relating to nuclear power in each of the countries, the higher educational opportunities available and the companies involved in the nuclear industry will still be valid. Hence, the report in its current form will still provide a source of information that can be used by young people considering working in the nuclear industry, the higher educational institutions and companies involved in the nuclear industry.
FOREWORD

According to the common vision of the major stakeholders from the nuclear industry and research institutions, safe nuclear energy generation will continue to provide an important contribution to the security and competitiveness of energy supply, and the abatement of greenhouse gas emissions in line with the Europe 20/20/20 Energy targets and the Strategic Energy Technology Plan (SET Plan) targets. To translate that vision into concrete steps, the Sustainable Nuclear Energy Technology Platform (SNETP) has been created to develop a Strategic Research Agenda (SRA, 2009) summarising the most urgent research topics to be addressed, and to derive a Deployment Strategy (DS, 2010) identifying key actions for the implementation within a time horizon up to 2050.

Additionally, the European Nuclear Energy Forum (ENEF) was founded in 2007, which is a unique platform for a broad discussion on transparency issues as well as the opportunities and risks of nuclear energy. Both nuclear stakeholder platforms (SNETP and ENEF) have a working group on Knowledge Management, Education and Training issues, which are pointing to possible risks in that area.

Both the Council Conclusion from 1-2 December 2008 on the preservation of nuclear skills in the EU and the Council Directive from 23 June 2009 establishing the Community Framework for nuclear safety require adequate competence on nuclear safety and are as well the impetus for the production of this report, which is providing an overview of the current situation in EU education and training opportunities in nuclear energy field.

Several initiatives have been implemented in response to these challenges both by the Commission and by the Member States. To address these initiatives a communication from the EC to the Council on education and training in the nuclear energy field is being prepared.

One of the initiatives undertaken by the EC was the establishment in 2010/2011 of the European Human Resource Observatory in the Nuclear Energy Sector (EHRO-N) with the overall objective to provide qualified data and analyses on the short- and long-term trends in supply and demands of human resources in the nuclear field within the European Union.

The particular objectives of EHRO-N are to provide regularly updated and quality-assured data on the short, medium and long-term needs of human resources for the different stakeholders in nuclear energy and nuclear safety, to identify strengths, gaps and deficiencies in the European nuclear E&T infrastructure and elaborate recommendations for remedial actions and optimisations, to play an active role in the development of a European scheme of nuclear qualifications and mutual recognitions as well as to regularly communicate relevant data to the Member States governmental, academic and private organisations involved in nuclear education and training.

EHRO-N will monitor the availability of adequately educated and trained nuclear human resources and will advise on policy decisions to be taken when improvements are necessary to ensure adequate EU capacities.

One of the first tasks EHRO-N was to provide an overview and inventory on the available educational opportunities in the nuclear energy field in the EU-27 countries. The current report is developed to support dissemination of information on European educational opportunities and will be published on the EHRO-N website as complementary information to the EHRO-N EU-27 nuclear educational institutions mapping. The report will form also a basis on which further analyses to assess the adequacy of nuclear human resources supply in Europe will be done.

Much of the work to produce the report was carried out before the accident at the Fukushima Daiichi nuclear power plant occurred in March 2011. It is clear that this event will impact future development of nuclear industry as well as attractiveness for young generations to study nuclear science and engineering. Nevertheless, the factual information presented in the report as concerns the current situation relating to nuclear power in each of the EU countries, the higher educational opportunities available and the companies involved in the nuclear industry will still be valid. Hence, the report
in its current form will still provide a source of information that can be used by young people considering entering the nuclear field, higher educational institutions and companies involved in the nuclear industry and provides a snap shot of the pre Fukushima situation which will be useful for benchmarking with any future post Fukushima EU developments.

The report was developed by members of the JRC team of the European Human Resource Observatory in the Nuclear Energy Sector (EHRO-N) and was reviewed by the EHRO-N Senior Advisory Group (SAG) composed of senior management representatives from different nuclear Stakeholders and EU Member States.
INTRODUCTION

The use of nuclear energy for peaceful purposes became widespread following the Second World War. One of the reasons for this was undoubtedly the need for an effective source of electrical energy for the reconstruction of Europe. From this beginning, it was recognised in many countries that nuclear energy would be a good option for the production of electrical energy in the longer term.

Despite the advantages of nuclear energy, there has always been a vigorous debate between those that are for it and those that are against. The petroleum crisis in 1973 caused public opinion to move in favour of the development of nuclear energy since this did not depend on the import of oil and the costs were becoming more and more economic.

The accidents at Three Mile Island in 1979 and Chernobyl in 1986 caused the support for nuclear energy to be significantly reduced and, as a result of this, the construction of all new nuclear power stations in Europe was stopped. This also led to the nuclear energy option being dropped in several countries.

However, in the beginning of the 21st century, there was a renewed interest in nuclear energy due to the major technical and technological improvements that have been made, especially in the area of safety. Nuclear energy was considered to be a clean source of electrical power that is able to meet world-wide demands without producing emissions of CO₂, and hence not contributing to climatic change.

These fluctuations in the public acceptance of nuclear energy have significantly affected education in this area, especially at the higher level and led to the mismatch that exists at the present time between the SUPPLY of and DEMAND for human resources by the nuclear industry.

One of the aims of this report is to help the new generation of students who are considering working in the nuclear industry to see all the possibilities for them higher educational opportunities in the nuclear field available to them in Europe. This report also provides a mapping what is happening in the academic field and in the nuclear industry in all the EU countries. This will help academia and industry to know about the different initiatives, to be complementary to each other and to collaborate for a harmonic resurgence of nuclear energy.

In summary, this report makes a contribution to ensuring that the educational institutions that SUPPLY human resources and the stakeholders that DEMAND these human resources are aware of the existence of each other and can make contact so that they can collaborate in making improvements to rectify the shortfalls in this sector.

This report has gone through a number of revisions in which its contents have been changed to take account of new developments that have occurred during the period over which the work has been carried out. This has included: the second Strategic Energy Review (SER II) which outlined the progress that has been made in mapping out the future of nuclear energy as a key component of the EU’s future low-carbon energy policy; the Laperrouze Report which endorsed the pivotal role of nuclear energy and called for the European Commission “to draw up a specific roadmap for nuclear investments”; and the publication of the Reflection Group to the European Council which concluded that nuclear energy should be included in the European mix and recommended that the Commission should also promote co-operation in nuclear training programmes.

This report will be published on the EHRO-N website http://ehron.jrc.ec.europa.eu
The first phase of the work was to carry out a review to determine the position regarding nuclear energy in each of the European Union 27 countries and how this was reflected in the scope of the educational opportunities in the nuclear area. This was done before starting to compile the list of universities and the courses available in the nuclear field. In this initial phase it was observed that each of the countries has its own national position regarding nuclear energy and this is reflected in the education available in the nuclear field. It is also the case that the Bologna Process has not yet been implemented in all the countries. Hence, differences were observed in the educational opportunities available to students in the nuclear field in the 27 countries in the EU.

The second phase was to compile information on nuclear stakeholders and universities that provided courses related to the nuclear field in each country. The way that this was done is described below and this is reflected in the way that the report has been presented:

1. For each country, an introduction is given about the situation regarding nuclear energy in the country. This includes information on the national nuclear authorities; nuclear power programmes and where available information on the importance of nuclear energy in the country and public opinion, two factors that influence the national educational policies.

2. The research has been carried out independently for each of the 27 countries of the European Union and the findings have been presented separately in the report for each country. When looking at this information, it needs to be remembered that the European Union has mechanisms of academic mobility which allow the nationals of a country to study in another one without much difficulty.

3. Three categories of courses have been identified: the main one is made up of Bachelor’s, Master’s and Doctorate degrees offered by universities; the second one is made up of the different courses given by the universities (or other higher educational institutions) that are worth at least 10 European Credit Transfer and Accumulation System (ECTS) credits; and the third one refers to specialist courses offered by nuclear research centres.

4. The website link to each of the courses identified and the institutions that offer them has been given and this can be used to obtain more detailed information. Where links to a course is not available, the institution that teaches the course can be contacted through its website.

5. In addition, links to the website of the major stakeholders in nuclear energy in each country are provided. This information is deemed to be useful both to new graduates as well as for any further analyses as concerns the correlations between supply and demands of nuclear human resources in Europe. While every attempt is made to provide the complete information, it is clear that some information might be missing.

BOLOGNA PROCESS

The main objective of the Bologna Process (or Bologna Accords) is to create the European High Education Area by making the standards for academic degrees more comparable and compatible and to guarantee a high quality of the higher education degrees throughout Europe.

This meant that the signatories to the agreement undertook to reform their high educational systems to bring them into line with the basic framework adopted in the Bologna declaration signed in 1999 by the Ministers of education from 29 European countries.

This framework is based in three cycles of higher education qualification which are related to European Credit Transfer and Accumulation System (ECTS) credits as follows:

- 1st cycle (awarding a Bachelor’s degree): 180−240 ECTS credits.
- 2nd cycle (awarding a Master’s degree): 90−120 ECTS credits.
- 3rd cycle (awarding a Doctorate): no ECTS.

There are 47 countries which are members of the European Higher Education Area which includes 27 members from the European Union, and 20 from outside the EU.
Most of the educational information presented in this report has been taken from the websites of the educational and research institutions. Other sources of information have also been used to identify the centres that offer courses in the nuclear area. This includes: the national nuclear fora, the International Atomic Energy Agency (IAEA), the national nuclear associations and the European Nuclear Education Network (ENEN) database. Many of them regularly compile information and publish it in digital or printed form. In addition, continuous contact with experts in the academic and nuclear fields has promoted the constant search for information.

The search for information is the cornerstone of the report and therefore it has been carried out rigorously by constantly verifying the information identified, crosschecking it with different sources of information and updating it regularly. The information was then processed to clarify which course was given by which university and what was the category in which this study was included.

It is important to emphasize that, although the report is in English, many of the educational and research centres are identified by its name in English (the translation of the original name to English) and by its original name in the official language of the country where they are located. Furthermore, although all the names of the courses have been translated into English, this does not mean that they are taught in English. (Full details of these courses are given on the websites of the various educational centres).

In addition, it was sometimes difficult to find the information required for this report due to a number of reasons as follows:

The first reason is due to language differences - the 27 EU countries have 23 official languages. Although English is being used more and more as the common language in the academic world (partly with the aim of attracting foreign students) not all the educational institutions use English and sometimes not all the information is in English so that it is more difficult to find.

A second reason is that the names used for the different courses are sometimes not as clear as they could be which can cause confusion and does not facilitate the information search, and even sometimes obstructs it. This happens especially when terms such as energy or electricity are used as synonymous for nuclear or when incorrect terminology has been used during translation.

Finally, the information provided by an educational institution through its website may sometimes be difficult to understand and needs to be verified by an alternative means.
RESULTS

EU-27

The Nuclear Curricula in the EU-27 are shown in the following two figures, as a summary, where MSc degrees are the majority, and by Member State, where Italy, France and the UK offer most degrees.

Nuclear curricula in the EU

Number of Nuclear Degrees available in the EU-27

Degrees per country

Nuclear Education Degrees by Country
Regarding the Stakeholders it can be concluded, that most are Engineering, Manufacturing or Consultancy companies. But it has to be noted that both figures below consider only the number of stakeholders, not the number of staff that they employ.
AUSTRIA

In 19787, a Federal law was passed that prohibited the operation of nuclear power plants in Austria. This non-nuclear policy was confirmed in 1997 when the Parliament adopted the Federal Constitutional Act for a Nuclear-Free Austria. There is only one nuclear facility in Austria, the 250kW TRIGA Mark II reactor operated by the Atomic Institute/Atominstitut which is used in national and international programmes.

The Federal Alarm Centre/Bundeswarnzentrale8 which is the operational base of the federal government to coordinate relief efforts during major disasters and this includes a permanently manned radiation early warning system for nuclear accidents.

Higher education in the nuclear field is closely related to the non-nuclear policy and is focused on the use of ionising radiation for peaceful purposes.

EDUCATION

To meet the requirements of the Bologna Process, Austria has changed the structure of its higher educational system so that it is divided into three levels: Bachelor’s, Master’s and Doctorate degrees.

Concerning education in the nuclear field, one of the peculiarities of the Austrian educational system is the existence of the Universities of Applied Sciences/Fachhochschulen in which the training is more tailored to practically applicable professional skills.

There are only two institutions that offer a Bachelor’s degree in the nuclear field which are:

- the University of Applied Sciences, FH Campus Vienna/Fachhochschuel FH Campus Wien9 which offers a degree in Radiological Technology10; and
- the University of Applied Sciences Wiener Neustadt/Fachhochschule Wiener Neustadt11 which also offers a degree in Radiological Technology12.

The only university that offers a Master’s degree in the nuclear field is the Upper Austria University of Applied Sciences/FH Oberösterreich13 which is in the same field as the Bachelor’s degrees - Radiological Technology14.

The Atomic Institute of the Austrian Universities/Atominstitut15 offers the possibility to carry out a post-Bachelor specialization in the fields of: Nuclear Technology; Radiochemistry; Radiation Protection; Nuclear and Astrophysics; and X-Ray Physics.

Regarding Doctorate degrees, there are no institutions that offer a specific degree in the nuclear field. However, there is the possibility of working on a Doctorate degree in the nuclear field in any of the Physics Faculties of the Austrian universities and in the applied sciences research centres, especially in the Atominstitut16.

Although there are only a small number of degrees offered in the nuclear field, there is a wide range of courses (that range between 3 and 10 ECTS) offered by the different universities as follows:

- the University of Applied Sciences Technical School Vienna/Fachhochschule Technikum Wien17 offers courses in: Biomedical Engineering18, Nuclear Medicine and Radiation Therapy and Radiation Protection;

7 BGBs No. 676/1978 Bundesgesetz vom 15 Dezember 1978 über das Verbot der Nutzung des Kernspaltung für die Energieversorgung in Österreich
9 University of Applied Sciences, FH Campus Wien/Fachhochshul FH Campus Wien: http://www.fh-campuswien.ac.at/en/home
10 Radiological Technology Bachelor: http://www.fh-campuswien.ac.at/en/studies/health/bachelor/radiological_technology/overview
12 Radiological Technology Bachelor: http://www.fhwn.ac.at/default.aspx?pageid=1003
14 Radiological Technology: http://www.fhcampuswien.ac.at/en/studies/health/master_degree_programmes_for_advanced_professional_training/radiological_technology/overview
15 Atomic Institute of the Austrian Universities/Atominstitut: http://www.ati.ac.at
16 Proposed Diploma and Doctorate Theses: http://www.ati.ac.at/index.php?id=thematen_fuer_d_und_d&L=1
17 University of Applied Sciences Technikum Wien/Fachhochschule Technikum Wien: http://www.technikum-wien.at/en/home
18 Biomedical Engineering: http://www.technikum-wien.at/en/study_programs/bachelor_s/biomedical_engineering
the University of Applied Sciences Vienna Neustadt/Fachhochschule Wiener Neustadt offers several courses in nuclear medicine which includes Bachelor’s degrees in Biomedical Analytics\textsuperscript{19} and Nuclear Medicine in Hospitals (which is a field lecture);

the Vienna University of Technology/Technische Universität Wien\textsuperscript{20} offers nuclear courses at its Institute of Atomic and Subatomic Physics\textsuperscript{41}: Atoms-Light-Matter-Waves, Atomic Nuclear and Particle Physics I and II, Experimental Quantum Optics-Atomic Physics, Nuclear Engineering, Practical course on Reactor Instrumentation, Project Related Work on Reactor Technology, Project Work on Numerical Methods in Nuclear Physics, Project Work Subatomic Physics, Radiochemistry, Radioisotope Techniques, Seminar on Atomic and Subatomic Physics and Seminar on Reactor Safety and Scattering and Reaction Theory;

the Vienna University of Technology offers courses in its Institute of Theoretical Physics\textsuperscript{22}: Advanced Atomic Theory and Project Work in Interaction of Atoms with Strong and Short Laser Fields; and

the Atomic Institute of the Austrian Universities offers a wide range of nuclear courses due to its close relationship with the International Atomic Energy Agency (IAEA)\textsuperscript{23} and with some European universities. This includes the Eugene Wigner Course\textsuperscript{44} which is sponsored by the European Nuclear Engineering Network (ENEN)\textsuperscript{25} and the co-operation with the Dalton Nuclear Institute of the University of Manchester\textsuperscript{26}. Overall, the Atomic Institute offers about 80 theoretical\textsuperscript{27} and 10 practical courses in the nuclear field\textsuperscript{28}. Most of these training courses are in the framework of the ENEN. In addition, the Stefan-Mayer-Institut für Subatomic Physics/Stefan-Meyer-Institut für Subatomare Physik\textsuperscript{29} offers some seminars\textsuperscript{30}.

Research in the nuclear field is focused on safety and radiology. Furthermore, in the Atom Institute of the Austrian Universities, research in the nuclear field is carried out by the Austrian Academy of Sciences/Österreichische Akademie der Wissenschaften\textsuperscript{31} in the Erich Schmid Institute of Materials Science\textsuperscript{32} (in collaboration with the Department of Materials of the Austrian Institute of Technology)\textsuperscript{33} (AIT) and the Stefan-Mayer-Institut für Subatomic Physics/Stefan-Meyer-Institut für Subatomare Physik), by the Research Studios Austria/Forschungsgesellschaft mbH\textsuperscript{34}; by the Seibersdorf Laboratories\textsuperscript{35}; by the Vienna University of Technology; by the University of Innsbruck/Universität Innsbruck\textsuperscript{36} in its Institute for Experimental Physics\textsuperscript{37}; by the Vienna Environmental Research Accelerator\textsuperscript{38} which belongs to the Nuclear Department\textsuperscript{39} of the University of Vienna/Universität Wien\textsuperscript{40}; by the NIMBUS Institute/Institut für Nukleareinrichtungen,

\textsuperscript{19} Biomedical Analytics Bachelor http://www.fhwn.ac.at/desktopdefault.aspx?pageid=112
\textsuperscript{20} Vienna University of Technology/ Technische Universität Wien http://www.tuwien.ac.at/tuwien_home/EN
\textsuperscript{21} Institute of Atomic and Subatomic Physics http://www.ati.ac.at/index.php?id=startseite&L=
\textsuperscript{22} Institute of Theoretical Physics http://www.itp.tuwien.ac.at/
\textsuperscript{23} International Atomic Energy Agency http://www.iaea.org/
\textsuperscript{24} Eugene Wigner Course http://www.reak.bme.hu/WignerCourse/
\textsuperscript{25} European Nuclear Education Network /ENEN http://www.enen-assoc.org
\textsuperscript{26} Dalton Institute/University of Manchester http://www.dalton.manchester.ac.uk
\textsuperscript{27} Seminars http://www.ati.ac.at/index.php?id=lehreventstfungen&L=
\textsuperscript{28} BOCK, H.; VILLA, M. Training in Nuclear Technology in Anti-Nuclear Environment.
\textsuperscript{29} Stefan-Mayer-Institut/Stefan-Meyer-Institut für Subatomare Physik http://www.oeaw.ac.at/sm
\textsuperscript{30} Seminars http://www.oeaw.ac.at/smi/home/seminar/
\textsuperscript{31} Austrian Academy of Sciences/Österreichische Akademie der Wissenschaften http://www.oeaw.ac.at/english/home.htm
\textsuperscript{32} Erich Schmid Institute of Materials Science http://www.oeaw.ac.at/esi/english/index.html
\textsuperscript{33} Austrian Institute of Technology/AIT http://www.arcs.at/home_en.htm
\textsuperscript{34} Research Studios Austria/Forschungsgesellschaft mbH http://www.researchstudio.at/home_en.html
\textsuperscript{35} Seibersdorf Laboratories http://www.seibersdorf-laboratories.at/en/home.htm
\textsuperscript{36} University of Innsbruck/Universität Innsbruck http://wwwuibk.ac.at/
\textsuperscript{37} Institute for Experimental Physics http://www.uibk.ac.at/phys
\textsuperscript{38} Vienna Environmental Research Accelerator http://isotopenforschung.univie.ac.at/
\textsuperscript{39} Nuclear Physics Department http://kernphysik.univie.ac.at/index.php?id=go
\textsuperscript{40} University of Vienna/Universität Wien http://www.univie.ac.at/?L=2
Institutions such as the Institute of High Energy Physics/Institut für Hochenergiephysik (HEPHY) collaborates with European Organization for Nuclear Research (CERN) in some nuclear projects although it is not its specialization.

Finally, the World Institute for Nuclear Security (WINS) based in Vienna is focused on a fast and sustainable improvement of security at nuclear facilities.

**STAKEHOLDERS**

There are some institutions in Austria that participate in the development and improvement of nuclear education which includes the Austrian Physical Society/Österreichische Physikalische Gesellschaft and the Association EUROATOM-OAW.

Regarding the stakeholders in the nuclear field, the most important employers in Austria include the following:

- **ABB AG Österreich**, **Aslom**, **Böhler Edelstahl**, **BT**, **Bureau Veritas Group**, **Camfil Farr**, **Cegelec**, **DLA Piper**, **Enconet Consulting**, **Freshfields Bruckhaus Deringer**

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41 NIMBUS Institute/Institut für Nukleareinrichtungen, Monitoring, Betrieb & Sicherheit [http://www.nimbus-institute.eu/]
42 Association EUROATOM- coordinates projects of the Vienna University of Technology, the Institute of Atomic and Subatomic Physics, the Graz University of Technology, the Erich Schmid Institute of Materials Science, the University of Vienna, the University of Innsbruck and the Research Studios Austria [http://www.oepg.at/euratom/foerschung_e.htm]
43 Institute of High Energy Physics/Institut für Hochenergiephysik (HEPHY) [http://www.hephy.at/en/institute]
GE-Hitachi Nuclear Energy International\textsuperscript{57}, Hyder Consulting\textsuperscript{58}, Johan Nemetz, Lanza\textsuperscript{59}, M+W Group\textsuperscript{60}, Nuclear Engineering Seibersdorf\textsuperscript{61}, Roxtec\textsuperscript{62}, Sandvik\textsuperscript{63}, Siemens Österreich\textsuperscript{64}.

\textsuperscript{57} GE-Hitachi Nuclear Energy International is a Japanese-US company with presence in Austria, France, Germany, Hungary, Italy, the Netherlands, Spain and the UK. \url{http://www.gepower.com/home/index.htm}

\textsuperscript{58} Hyder Consulting \url{http://www.hyderconsulting.com/EN/Pages/default.aspx}

\textsuperscript{59} Lanza \url{http://www.lanza.at/en/company/profile.html}

\textsuperscript{60} M+W Group \url{http://www.mwgroup.net}

\textsuperscript{61} Nuclear Engineering Seibersdorf \url{http://www.nuclear-engineering.at/home_en.htm}

\textsuperscript{62} Roxtec \url{http://www.roxtec.com}

\textsuperscript{63} Sandvik is a Swedish company that operates in Austria \url{http://www.sandvik.com}

\textsuperscript{64} Siemens Österreich is a German Company that operates in Austria \url{http://w1.siemens.com/entry/cee/de}
BELGIUM

The Belgian nuclear power programme started in 1974. Currently, there are seven nuclear reactors operating in Belgium - four at Doel and three at Tihange, all PWRs, and together they produce about half of the country’s domestically-generated electricity. In addition, there are three research reactors still in operation.

However, in 2003, the Belgian Senate approved the Federal Act which prohibits the building of new nuclear power plants and limits the operating lives of the existing ones to 40 years so that by 2025 no nuclear power plants would be in operation in Belgium.

The public authorities in Belgium with responsibilities in the nuclear field are: the Federal Agency for Nuclear Control (FANC) which is the regulatory body for all nuclear activities, its support organisation BEL V; and the Organisation for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS) which is responsible for the management of radioactive waste.

The current dependency on nuclear power is reflected in the higher educational opportunities available in Belgium. The educational institutions in the country are seen to have an important role in the dissemination of knowledge in the nuclear field, especially in the area of research.

EDUCATION

Higher education in Belgium is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). The only Bachelor’s degree available in the nuclear field is the one on Industrial Sciences – Nuclear Engineering at the XIOS University College Limburg/ Xios Hogeschool Limburg, where there is the possibility of combining a Bachelor’s degree in Engineering with some courses in the nuclear field and more specifically with a Master’s degree in Nuclear Engineering which is offered by several universities. The most relevant of these Master courses is the inter-university Master’s degree in Nuclear Engineering offered by the Belgian Nuclear Higher Education Network (BNEN) which is a consortium of the following six universities along with the Belgian Nuclear Research Centre/ Studencentrum Voor Kerkenenergie/Centre d’Etude de l’Energie Nucléaire (SCK CEN):

- the University of Ghent /Universiteit Gent;
- the Catholic University of Leuven/Katholieke Universiteit Leuven;
- the Catholic University of Louvain/Université Catholique de Louvain (UCL);
- the Free University of Brussels/ Université Libre de Bruxelles (ULB);
- the University of Liege/Université de Liège;

The Belgian Nuclear Higher Education Network, BNEN, is a network of six Belgium universities and Belgian Nuclear Research Centre/Studencentrum Voor Kerkenenergie/ Centre d’Etude de l’Energie Nucléaire (SCK CEN). These universities are: Free University of Brussels/ Université Libre de Bruxelles, Free University of Brussels/Vrije Universiteit Brussel, Ghent University/Universiteit Ghent, Katholieke Universiteit Leuven/Katholieke Universiteit Leuven, University of Liege/Université de Liège and University Catholic of Louvain/ Université Catholique de Louvain.

Bibliography

67 Federal Agency for Nuclear Control (FANC) www.fanc.fgov.be
68 BEL V. www.belv.be
71 The Belgian Nuclear Higher Education Network, BNEN, is a network of six Belgium universities and Belgian Nuclear Research Centre/Studencentrum Voor Kerkenenergie/ Centre d’Etude de l’Energie Nucléaire (SCK CEN). These universities are: Free University of Brussels/ Université Libre de Bruxelles, Free University of Brussels/Vrije Universiteit Brussel, Ghent University/Universiteit Ghent, Katholieke Universiteit Leuven/Katholieke Universiteit Leuven, University of Liege/Université de Liège and University Catholic of Louvain/ Université Catholique de Louvain.
73 Master Course is the interuniversity Master of Nuclear Engineering http://www.opleidingen.ugent.be/StudyGuide/2009/EN/STUDY/M/M410/ENNUCL/INDEX.htm
74 Catholic University Leuven/Katholieke Universiteit Leuven http://www.kuleuven.be/english
75 Master of Nuclear Engineering (interuniversity) http://www.kuleuven.be/onderwijs/opleidingen/E/QC_50268907.htm
76 Catholic University of Louvain/ Université Catholique de Louvain http://www.uclouvain.be/en-index.html
78 Free University of Brussels/ Université Libre de Bruxelles http://www.ulb.be/index.html
79 University of Liege/ Université de Liège http://www.ut.ac.be/cms/c_5000/home
and

- the Free University of Brussels/Vrije Universiteit Brussel (VRIJ)\(^\text{77}\).

The BNEN is supported by the major stakeholders in the nuclear industry in Belgium including Tractebel Engineering and Electrabel.

As well as this inter-university degree in Nuclear Engineering, there are a number of other Master’s degrees which includes the following:

- the University of Ghent/ Universiteit Ghent offers a European degree in Nuclear Fusion Science and Engineering Physics\(^\text{78}\) and Postgraduate Studies in Radiation Protection\(^\text{79}\);

- the Free University of Brussels/ Université Libre de Bruxelles (ULB) offers a degree in Nuclear Medicine\(^\text{80}\); and

- the University of Liege/ Université de Liège offers an Advanced Master’s degree in Nuclear Medicine\(^\text{81}\).

As indicated above, the XIOS University College Limburg/ Xios Hogeschool Limburg offer a Master’s degree in Industrial Sciences/ Nuclear Engineering\(^\text{82}\).

The Institut Supérieur Industriel de Bruxelles (ISIB)\(^\text{83}\) offers a Master’s degree in Industrial Engineering with specialisation in Physical and Nuclear Engineering\(^\text{84}\).

Regarding Doctorate degrees, there are two possibilities: the University of Ghent/Universiteit Ghent offers a Doctorate under the supervision of the Nuclear Structure and Correlations in the Nuclear Many Body System Division\(^\text{85}\); and the Belgian Nuclear Research Centre/Studencentrum Voor Kernenergie/Centre d’Etude de l’Energie Nucléaire (SCK/CEN)\(^\text{86}\) offers the Doctorate in the nuclear field\(^\text{87}\).

In addition there are a number of courses in the nuclear field offered by universities which includes: the University of Ghent/Universiteit Ghent offers a Post Academic Course in Nuclear Medicine\(^\text{88}\) with similar characteristics to a Master’s degree; the Catholic University of Louvain/Université Catholique de Louvain (UCL) offers courses on an Introduction to Nuclear Engineering and Reactor Technology\(^\text{89}\) and Nuclear Reactor Theory and Experiments\(^\text{90}\).

The Department of Physics of the University of Antwerp/Universiteit Antwerpen\(^\text{91}\) offers courses on Nuclear Chemistry and Radioprotection/ Nucleaire Chemie en Radioprotectie\(^\text{92}\),

\(^{77}\) Free University of Brussels/ Vrije Universiteit Brussel http://www.vub.ac.be


\(^{80}\) Master Complémentaire en Médecine Nucléaire http://www.ulg.ac.be/catalogue/medecine/ME-MEDN.htm

\(^{81}\) Advanced Master in Nuclear Medicine http://www.progrcoop.ulg.ac.be/cocoon/en/programmes/MHNUCL01.html


\(^{83}\) Institut Supérieur Industriel de Bruxelles http://www.isib.be


\(^{85}\) Nuclear Structure and Correlations in the Nuclear Many Body System Division http://www.nustruc.ugent.be/index.htm

\(^{86}\) Belgian Nuclear Research Centre/Studiecentrum voor Kernenergie/Centre d’etude de l’Energie Nucléaire http://www.sckcen.be


\(^{88}\) Post Academic Course in Nuclear Medicine http://www.uznuclear.ugent.be


Nuclear Physics93 and Subatomic Physics94. The Free University of Brussels offers courses in Nuclear Physics95 and Physics of Thermonuclear Fusion96.

The University of Liege/Univérsité de Liège offers several courses which include: Cold Atoms and Atomic Clocks97, Biospectroscopies and Nuclear Magnetic Resonance Applied to Biology98, Nuclear Chemistry99, Fundamental problems in physics in relation to medical radiodiagnosis, radiotherapy and nuclear medicine100 and Radio Protection101.

The Free University of Brussels/Vrije Universiteit Brussel (VRIJ) offers courses which include: Introduction to Nuclear Physics102; Nuclear Materials I103; Nuclear Materials II104; Nuclear Reactor Theory and Experiments105; Nuclear Thermal Hydraulics106; Physics of Nuclear Technology107; and Radiation Protection and Nuclear Measurements108.

Finally, the Xios Hogeschool Limburg offers the Postgraduate Radiation Expert course in addition to the course on Radiation Protection.

The importance of nuclear knowledge in Belgium is reflected by the fact that the Federal Agency for Nuclear Control/Federal Agentschap Voor Nucleaire Controle/Agence Fédérale de Contrôle Nucléaire (FANC/AFCN)109, which carries out important work in the nuclear safety field, offers training courses in several nuclear fields such as medicine and waste recycling. This includes the following training for drivers transporting nuclear material offered by the FANC Training Agency110: ADR initial course of specialization Class 7111; Refresher Class 7112; and Training and examination of safety advisers for ADR-RID Class 7113.

As well as FANC, another institution involved in nuclear security is the Belgian Agency for Radioactive Waste and Enriched Fissile Materials/Organisme National des Déchets Radioactifs et des Matiéres Fissiles Enrichies/Nationale instelling Voor Radioactief afval en verrijkte Spiljtstoffen (ONDRAF/NIRAS)114.

Regarding training in the nuclear field, the University of Ghent/Universiteit Ghent offers Permanent Training in Nuclear Medicine115 and in Radiation

97 Cold Atoms and Atomic Clocks http://progcours.ulg.ac.be/cocoon/cours/PHYS0932-1.html
100 Fundamental problems in physics in relation to the medical radiodiagnosis, the radiotherapy and the nuclear medicine http://progcours.ulg.ac.be/cocoon/cours/PHYS0932-1.html
110 http://www.fanc.fgov.be/fr/page/formations-de-l-agence-afcn/205.aspx#P_3342
111 http://www.fanc.fgov.be/fr/page/formations-de-l-agence-afcn/205.aspx#P_3206
112 http://www.fanc.fgov.be/fr/page/formations-de-l-agence-afcn/205.aspx#P_4260
113 http://www.fanc.fgov.be/fr/page/formations-de-l-agence-afcn/205.aspx#P_4260
Protection-Diagnostic Use of X-Rays. In the same way, the Association Vinçotte Nuclear (AVN)\(^{116}\) has a permanent training programme.

In the nuclear field there are important institutions involved in the research which include the Belgian Nuclear Research Centre/Studiecentrum Voor Kernenergie/Centre d’Etude de l’Energie Nucleaire (SCK/CEN) and more specifically its Institutes for: Nuclear Materials Science (NMS)\(^{117}\), Advanced Nuclear Systems (ANS)\(^{118}\) and Environment, Health and Safety (EHS)\(^{119}\).

The European Underground Research Infrastructure for Disposal of Nuclear Waste in Clay Environments EURIDICE\(^{120}\) has a very important role in nuclear research. In addition, research is carried out at the University of Ghent/Universiteit Gent which has the following departments/divisions involved in nuclear research: the Department of Applied Physics\(^{121}\), the Department of Subatomic and Radiation Physics\(^{122}\), and the Nuclear Medicine Division\(^{123}\). The Catholic University of Leuven/Katholieke Universiteit Leuven is involved in nuclear research which is done in the Division of Nuclear Medicine\(^{124}\), the Nuclear and Radiation Physics Group\(^{125}\), the Nuclear Solid State Group\(^{126}\) and the Nuclear Spectroscopy Group\(^{127}\).

Further nuclear research is carried out by the Department of Mechanics\(^{128}\) of the Catholic University of Louvain/Université Catholique de Louvain, the Chemistry Department\(^{129}\) of the University of Antwerp /Universiteit Antwerpen and the Nuclear, Atomic Physics and Spectroscopy Institute/Institut de Physique Nucléaire, Atomique et de Spectroscopie\(^{130}\) of the University of Liege/Université de Liège.

The Free University of Brussels/Université Libre de Bruxelles has three research institutions: the Department of Theoretical Nuclear Physics and Mathematical Physics/Physique Nucléaire Teorique et Physique Mathématique Department\(^{131}\), the Nuclear Metrology Service/Service de Métrologie Nucléaire (SMN)\(^{132}\) and the Statistical and Plasma Physics research unit\(^{133}\).

In addition, there are four institutions deeply involved in the development of nuclear knowledge: the Association Vinçoyye Nuclear (AVN)\(^{134}\), The Institut National des Radioéléments (IRE)\(^{135}\), the JRC-Institute for Reference Materials and Measurements\(^{136}\) and the Belgian Nuclear Higher Education Network (BNEN).

**STAKEHOLDERS**

Regarding the importance of the nuclear energy there are a great number of companies involved in the nuclear field in Belgium which includes: Ateliers

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- **EURIDICE** [http://www.euridice.be/eng/00home.shtml](http://www.euridice.be/eng/00home.shtml)
- **UGent** Institutes: [Department of Applied Physics](http://www.ugent.be/ir/appliedphysics/en/research/fusion), [Department of Subatomic and Radiation Physics](http://ssf.ugent.be/en/home), [Nuclear Medicine Division](http://www.uznuclear.ugent.be/)
- **UCLouvain** Institutes: [Department of Theoretical Nuclear Physics and Mathematical Physics](http://pntpm.ulb.ac.be/pntpm/index.htm), [Nuclear Metrology Service](http://mntek3.ulb.ac.be/pub/), [Statistical and Plasma Physics research unit](http://plasma-mac6.ulb.ac.be/~dcf/twiki/bin/view/SPP/WebHome)
Nuclear curricula in BELGIUM

Number of Nuclear Degrees available in Belgium

- de la Meuse
- Belgatom
- Belgonucleaire
- Belgoprocess
- Clifford Change
- Cockerill Maintenance & Ingénierie
- Electrabel
- IBA
- Société Coopérative de Production d’Électricité
- Synatom
- Tractebel Engineering
- Transnubel

The international companies that have subsidiaries in Belgium include: ABB Group, Allen & Overy LLP, Alstom, Ashurst, Assytem, Areva, Böhler Edelstahl, BT, Bureau Veritas Group, DLA Piper, Field Fisher Waterhouse, Fluor Corporation, Freshfields Bruckhaus Deringer, Gardiner & Theobald, Hammonds, Herbert Smith, M+W Group, Morgan Lewis, MWH, Norton Rose, Osborne Clarke International.
INDUSTRY IN BELGIUM

Nuclear Stakeholders per business in Belgium [%]

Finally Belgian Nuclear Research Centre/Studiecentrum Voor Kernenergie/Centre d’Etude de l’Énergie Nucleaire (SCK/CEN) and the Belgian Agency for Radioactive Waste and Enriched Fissile Materials/Organisme National des Déchets Radioactifs et des Matières Fissiles Enrichies/Nationale Instelling voor Radioactief Afval en Verrijkte Splijtstoffen (ONDRAS/NIRAS) are as well nuclear stakeholders.

Outo Kumpu, Parsons Brinckerhoff, Roxtec, Sarens, Serco, Simmons & Simmons, URS, White & Case, and Westinghouse Electric Belgium.

170 Outo Kumpu http://www.outokumpu.com
171 Parsons Brinckerhoff is an US company with subsidiaries in Belgium, Germany, Poland, Spain and United Kingdom http://www.pbworld.com
172 Roxtec http://www.roxtc.com
173 Sarens http://www.sarens.com/default.asp?id=1&mnu=1
174 Serco http://www.serco.com
175 URS is an US international company with presence in Belgium, France, Germany, Ireland, Italy, Netherlands, Spain, Sweden and United Kingdom http://www.urscorp.eu
176 White & Case http://www.whitecase.com
177 Westinghouse is a US company with presence in Belgium, Bulgaria, France, Germany, Spain, Sweden and the UK http://www.westinghousenuclear.com
BULGARIA

Currently, there are two nuclear reactors operating in Bulgaria at Kozloduy. They are both VVERs and together they produce about one third of the country’s electricity. The four older plants at Kozloduy which were all VVERs have been shut down. Two further units, both VVERs, are being constructed at Belene.

In the past few years, Bulgaria has upgraded the Kozloduy nuclear power plant to bring the two units into line with IAEA safety standards and increased the knowledge of its human resources in the nuclear field.

The Bulgarian nuclear regulatory body is the Nuclear Regulatory Agency/Агенция за ядрено регулиране\(^\text{178}\).

Bulgaria launched its national educational programme in nuclear engineering in the 70’s and the proposal to build new nuclear power plants and to continue to operate the existing ones means that this will continue, especially in the research field.

EDUCATION

Higher education in Bulgaria is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). Bulgaria offers courses in the nuclear field at all three levels.

The Bachelor’s degrees available include the following:

- the University of Sofia St. Kliment Ohridski\(^\text{179}\), one of the main technical universities of Bulgaria, offers Bachelor’s degrees in a number of different fields related to nuclear and radiation protection including: Dosimetry and Radiation Protection\(^\text{180}\), Nuclear Chemistry\(^\text{181}\), Nuclear Technology and Nuclear Power Engineering (Nuclear Techniques and Energetics)\(^\text{182}\); and
  - the Technical University of Sofia\(^\text{183}\) offers a Bachelor’s degree in Thermal and Nuclear Power Engineering\(^\text{184}\) which complements its Nuclear Power Engineering Master’s degree\(^\text{185}\).

Regarding Master’s degrees, the University of Sofia St. Kliment Ohridski offers two options in the nuclear field: Nuclear Techniques and Technologies, and Nuclear Physics and Elementary Particles\(^\text{186}\).

Regarding Doctorates, there are two possibilities:

- the University of Sofia St. Kliment Ohridski offers a degree in Nuclear Physics and Elementary Particles\(^\text{187}\); and
  - the Technical University of Sofia offers a degree in Nuclear Power Engineering\(^\text{188}\).

In addition to these degrees, some Bulgarian universities offer courses in the nuclear field which includes: the Plovdiv University Paisii Hilendarski\(^\text{189}\) which offers a Postgraduate course in Nuclear Physics Method\(^\text{190}\); and the Ruse University/Русенски университет “Ангел Кънчев”\(^\text{191}\) which offers courses in Atomic and Nuclear Physics, and General and Applied Physics.

\(^{178}\) Bulgarian Nuclear Regulatory Agency. \url{http://www.bnsa.bas.bg}

\(^{179}\) Sofia University St. Kliment Ohridski/Софийски Университет Св. Климент Охридски \url{http://portal.uni-sofia.bg/index.php/eng}

\(^{180}\) Dosimetry and Radiation protection \url{http://atomic.phys.uni-sofia.bg/for-students-1/bachelors/bachelor-paths/dosimetry-and-radiation-protection/view}

\(^{181}\) Nuclear Physics \url{http://atomic.phys.uni-sofia.bg/for-students-1/bachelors/bachelor-paths/nuclear-physics/view}

\(^{182}\) Nuclear Technology and Nuclear Power Engineering \url{http://portal.uni-sofia.bg/index.php/eng/faculties/faculty_of_physics2/degree_programmes/bachelor_s_degree_programme}

\(^{183}\) Technical University of Sofia/Технически Университет – София \url{http://www.tu-sofia.bg/ENG/index.html}

\(^{184}\) Thermal and Nuclear Power Engineering \url{http://dtnpe.tu-sofia.bg/?section=11&language=us}

\(^{185}\) Nuclear Power Engineering \url{http://dtnpe.tu-sofia.bg/?section=11&language=us}

\(^{186}\) Nuclear Physics and Elementary Particles \url{http://portal.uni-sofia.bg/index.php/eng/faculties/faculty_of_physics2/degree_programmes/master_s_degree_programme}

\(^{187}\) Nuclear Physics and Elementary Particles \url{http://portal.uni-sofia.bg/index.php/eng/faculties/faculty_of_physics2/degree_programmes/master_s_degree_programme}

\(^{188}\) Nuclear Power Engineering \url{http://dtnpe.tu-sofia.bg/?section=11&language=us}

\(^{189}\) Plovdiv University Paisii Hilendarski/Пловдивски университет \url{http://www.uni-plovdiv.bg/?ln=2}

\(^{190}\) Nuclear Physics Methods \url{http://www.uni-plovdiv.bg/site.jsp?ln=2&Id=6}

\(^{191}\) Ruse University/Русенски университет “Ангел Кънчев” \url{http://www.ru.acad.bg/en/ru.php}
The Institute for Nuclear Research and Nuclear Energy (INRNE) offers the following courses: Neutron Physics and Physics of Nuclear Reactors, Nuclear Physics and Physics of Elementary Particles and High Energies; which are all at Doctorate degree level.

The institutions that are involved in nuclear research include: the Institute for Nuclear Research and Nuclear Energy (INRNE), the Atomic Physics Department of the University of Sofia and the Department of Applied Physics and the Research and Development Sector (R&DS) of the Technical University of Sofia.

STAKEHOLDERS

The presence of Bulgarian and International nuclear companies in Bulgaria is important and includes the following: Aegis, Anils, Astro, AtomENERGOPROEKI, Atomenergoremont, Belene NPP, Bon Marine, Chahov, Complex Welding Services Bourgas, Controleengineering, Dics Intertrade, Electroenergoproekt, Elkabel, Elox-Prom, Emco, Enemona, Energo Service, Energoremont Holding, Energostroymontaj-Engineering, EnproConsult.

192 Institute for Nuclear Research and Nuclear Energy (INRNE)/Институтът за ядрени изследвания и ядрена енергетика (ИЯИЯЕ)
193 Bulgarian Academy of Sciences/Българска Академия на Науките
194 Atomic Physics Department http://atomic.phys.uni-sofia.bg/
196 Research and Development Sector (R&DS) http://www.tu-sofia.bg/ENG/r&ds/home.htm
197 Aegis http://aegisgroup.net/_sgg/m4m1_1.html
198 Anils http://www.amec.com
199 Astro http://www.astroeng.bg
201 Atomenergoremont http://kary.hit.bg
203 Chahov http://www.chahov.com
204 Complex Welding Services Bourgas http://www.kzu-ltd.bg/eng.htm
205 Control engineering http://controlbg.com
206 Dics Intertrade http://www.dicsintertrade.com/pages/aboutus.htm
207 Electroenergoproekt http://www.electroenpro.com/eng/company.htm
208 Elkabel http://www.elkabel.bg/en/home
209 Elox-Prom http://www.elox-prom.ru/eng_index.php
210 Emco http://www.emco-bg.com/about_en.htm
211 Enemona http://enemona.bg/english
212 Energo Service http://www.energoservicebg.com/new
215 EnproConsult http://www.enproco.com
Eqe Bulgaria\textsuperscript{216}, Executive Energy Efficiency Agency (EEA)\textsuperscript{217}, Filkab\textsuperscript{218}, Foundation Evgenii Balabanov\textsuperscript{219}, Gardiner & Theobald\textsuperscript{220}, Hydroremont IG\textsuperscript{221}, Item Engineering\textsuperscript{222}, InterAtomEnergo, Interpriborservice\textsuperscript{223}, IPU- Sofia\textsuperscript{224}, Kimtech Bulgaria\textsuperscript{225}, Kozloduy NPP, Plc\textsuperscript{226}, Komos\textsuperscript{227}, M.C. Triton Bulgaria\textsuperscript{228}, Minstroy Holding\textsuperscript{229}, Mistral TSS\textsuperscript{230}, Natsionalna Elektricheska Kompania EAD (NEK EAD)\textsuperscript{231}, Nucleon\textsuperscript{232}, Onet Technologies Bulgaria\textsuperscript{233}, Outo Kumpu\textsuperscript{234}, Partners Maint Company Ltd\textsuperscript{235}, PMU\textsuperscript{236}, PMU . Svishtov\textsuperscript{237}, Proservice NT\textsuperscript{238}, Prostream Group\textsuperscript{239}, Quant Engineering\textsuperscript{240}, Risk Engineering Bulgaria\textsuperscript{241}, Roxtec\textsuperscript{242}, Sakar\textsuperscript{243}, SD Mistrali TSS, SE Radioactive Waste\textsuperscript{244}, Sika Bulgaria\textsuperscript{245}, Simmatron\textsuperscript{246}, Simlogic\textsuperscript{247}, Theta Consult\textsuperscript{248}, Trafoservice\textsuperscript{249}, Yonev Valkov Noven\textsuperscript{250} and Vniiaies\textsuperscript{251}.

Additionally, the international companies ABB Group\textsuperscript{252}, Amec\textsuperscript{253}, Areva\textsuperscript{254}, Atomstroyexport\textsuperscript{255}, Bureau Veritas Group\textsuperscript{256}, Siemens Bulgaria\textsuperscript{257}, WorleyParsons Europe Energy Services\textsuperscript{258} and Westinghouse\textsuperscript{259} are involved in many nuclear projects in Bulgaria.
INDUSTRY IN BULGARIA

Nuclear Stakeholders per business in Bulgaria [%]

Nuclear Stakeholders per business in Bulgaria
CYPRUS

Cyprus does not produce nuclear power and it does not have any involvement in the nuclear industry.

EDUCATION

Higher education in Cyprus is divided into three stages: Bachelor's, Master's and Doctorate degrees (as required by the Bologna Process). However, no degrees are offered that specialize in the nuclear field.

Only the University of Cyprus offers courses in the nuclear field which include: Advanced Topics in Nuclear Physics (special graduate course); Advanced Topics in Particle Physics; and Measurement and Detection Techniques of Nuclear Radiation Physics of Hot and Compressed Nuclear Matter (special graduate course).

In addition, there are few opportunities to carry out research in the nuclear field. The University of Cyprus is the only one that carries out any research work in its Nuclear Physics Department.

STAKEHOLDERS

The companies in Cyprus that are involved in the nuclear field include: Aker Solutions, Böhler Edelstahl, Bureau Veritas Group and Nuclear Diagnostics Company.

260 University of Cyprus http://www.new.ucy.ac.cy/goto/mainportal/en-US/HOME.asp
261 Advanced Topics in Nuclear Physics (special graduate course) http://www.new.ucy.ac.cy/goto/physics/en-US PHY659Advancedtopicsinnuclearphysics.asp
264 Nuclear Physics Department http://www-np.ucy.ac.cy
265 Aker Solutions http://www.akersolutions.com/internet/default.htm
266 Böhler Edelstahl http://www.bohler-edelstahl.com
267 Bureau Veritas Group http://www.bureauveritas.com/wps/wcm/connect/bv_com/Group
268 Nuclear Diagnostics http://www.nucleardiagnostics.com.cy
INDUSTRY IN CYPRUS

Nuclear Stakeholders per business in Cyprus [%]

Nuclear Stakeholders per business in Cyprus
CZECH REPUBLIC

Currently there are six nuclear reactors operating in the Czech Republic – four at Dukovany and two at Temelin. All six units are VVERs and together they supply about one third of the countries electricity needs. Consideration is being given to the further development of nuclear power and in August 2009 the Government started a public tender for contractors to build two new reactors at Temelin. The country also has three research reactors and facilities for the storage of radioactive waste.

The Czech Republic has two national authorities that play an important role in the nuclear field: the State Office for Nuclear Safety (SUJB)269 which is the regulatory body and the Radioactive Waste Repository Authority/Správy úložiště radioaktivních odpadů270.

The higher educational opportunities available in the Czech Republic reflect the relatively high significance of nuclear power in the country.

EDUCATION

Higher education in the Czech Republic is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). Some of the universities offer Bachelor’s degrees in the nuclear field. The most important one is the Charles University in Prague/Univerzita Karlova v Praze271, which in its Faculty of Mathematics and Physics272 offers a degree in Plasma Physics and Ionized Environments.

Also the Czech Technical University in Prague/Ceské Vysoké Uceni Technicke273 offers some specializations274 within this scope which includes: Dosimetry and Application of Ionizing Radiation; Theory and Technology of Nuclear Reactors; Nuclear Facilities; Physics and Technology of Thermonuclear Fusion; Experimental Nuclear Physics; Radiation Safety and Environment; and Physics and Technology of Thermonuclear Fusion.

At the Master’s degree level, the Czech Technical University in Prague/Ceské Vysoké Uceni Technicke offers a number of specializations which include: Dosimetry and Application of Ionizing Radiation; Theory and Technology of Nuclear Reactors; Radiological Physics in Medicine; Experimental Nuclear Physics; Nuclear Energy and Environment; Physics and Technology of Thermonuclear Fusion; and Radiological Physics.

The Brno University of Technology/Vysoké Uceni Technicke v Brne275 within its Master’s degree in Power Engineering has the possibility of a Nuclear Power Engineering Specialization276.

There are more possibilities at Doctorate level in the nuclear field. The Institute of Physics277 of the Academy of Sciences of the Czech Republic/Akademia věd ČR278 offers two nuclear specialisations: Plasma Physics and Ionized Environments; and Sub-nuclear Physics.

The Institute of Physics279 of the Academy of Sciences of the Czech Republic offers the possibility of Doctorate students studying within the framework of the sub-nuclear physics program.

In addition, the Nuclear Physics Institute of the ASCR/Ústav Jaderné Fyziky AV CR v.v.i.280 collaborates with the Faculty of Mathematics and Physics of the Charles University in Prague and with the Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University in Prague/Ceské Vysoké Uceni Technicke in several Doctorate degrees in the nuclear field: Nuclear Chemistry; Nuclear Engineering; Nuclear Physics; and Sub-nuclear Physics.

The Charles University in Prague/Univerzita Karlova v Praze offers a wide range of courses in the nuclear field which includes: Applied Nuclear Physics281;

269 State Office for Nuclear Safety (SUJB) http://www.sujb.cz/?r_id=26
270 Radioactive Waste Repository Authority/Správy úložiště radioaktivních odpadů (RAWRA) http://www.rawra.cz
272 Faculty of Mathematics and Physics http://www.mff.cuni.cz/
275 Brno University of Technology/Vysoké Uceni Technicke v Brne http://www.vutbr.cz/?set_lang=cz
277 Institute of Physics http://www.fzu.cz/en
278 Academy of Sciences of the Czech Republic/ Akademia věd ČR http://www.cas.cz/en
279 Institute of Physics http://www.fzu.cz
Charged Particle Accelerators\textsuperscript{282}; Electronics for Nuclear Physicists\textsuperscript{283}; Experimental Methods in Nuclear and Subnuclear Physics\textsuperscript{285}; Introductory Seminar on Nuclear and Sub-nuclear Seminar\textsuperscript{286}; Many Body Problem in Nuclear Structure\textsuperscript{287}; Nuclear Physics\textsuperscript{288}; Nuclear Reactions with Heavy Ions\textsuperscript{289}; Optional Practical Course in Nuclear Physics\textsuperscript{290}; Radioanalytical Methods\textsuperscript{291}; Relativistic Description of Nuclear Systems\textsuperscript{292}; Selected Topics on Nuclear Physics\textsuperscript{293}; Semiconductor Detectors in Nuclear and Subnuclear Physics\textsuperscript{294}; Seminar on Particle and Nuclear Physics I\textsuperscript{295}; Seminar on Particle and Nuclear Physics\textsuperscript{296}; Special Practical Course in Nuclear Physics\textsuperscript{297}; Statistical Aspects of Nuclear Physics\textsuperscript{298}; Statistical Nuclear Physics I\textsuperscript{299}; Statistical Nuclear Physics II\textsuperscript{300}; Theory of Nuclei and Nuclear Reactions I\textsuperscript{301}; and Theory of Nuclei and Nuclear Reactions II\textsuperscript{302}.

The University of Ostrava/Ostravská Univerzita v Ostravě\textsuperscript{303} offers several courses which includes Nuclear Power and Nuclear Power Equipment (by the Department of Power Engineering\textsuperscript{304}).

The Institute of Experimental and Applied Physics Czech Technical University in Prague offers several courses which includes: 3D Radiation Imaging Detectors\textsuperscript{305}; Hypernuclei at Dubna and Darmstadt\textsuperscript{306}; Neutron Beams, Neutron Filters and Time-of-flight Techniques in Capture Gamma-ray Spectroscopy\textsuperscript{307}; Pathways to Energy from Inertial Fusion: an Approach\textsuperscript{308}; Research program for the Dubna Nuclotron\textsuperscript{309}; Study of Hypernuclei with Nuclotron Beams, Status of project, test runs, nuclotron upgrade\textsuperscript{310}; the progress in vertex detector construction for hypernuclear experiment at Nuclotron\textsuperscript{311}; and Use of new accelerator runs, Nuclotron upgrade\textsuperscript{310}; the progress in vertex detector construction for hypernuclear experiment at Nuclotron\textsuperscript{311}; and Use of new accelerator
There are a number of institutions involved in the nuclear research field. The main one is the Czech Nuclear Research Institute Rez/Ústav Jaderného Výzkumu Rez a.s. (UJV) which takes part in the European Nuclear Safety Training Institute (ENSTTI) and offers several training courses. Others include:

- the Nuclear Physics Institute of the Academy of Sciences of the Czech Republic (ASCR);
- the Institute of Particle and Nuclear Physics of the Charles University in Prague;
- the Institute of Nuclear Fuel of the UJP Prague;
- the Faculty of Nuclear Sciences and Physical Engineering, Faculty of Mechanical Engineering and the Faculty Electrical Engineering of the Czech Technical University in Prague/Ceské Vysoké Učení Technické;
- the Faculty of Mechanical Engineering of the University of West Bohemia/Západoceska Univerzita v Plzni; and
- the Institute of Chemical Technology Prague/Vysoká Škola Chemicko-Technologická v Praze.

Tandetron for material research, development of new structures and ion physics

Number of Nuclear Degrees available in the Czech Republic

![Bar chart showing the number of nuclear degrees available in the Czech Republic, with BSC, MSC, and PHD degrees represented.]

- the Institute of Nuclear Fuel of the UJP Prague;
- the Faculty of Nuclear Sciences and Physical Engineering, Faculty of Mechanical Engineering and the Faculty Electrical Engineering of the Czech Technical University in Prague/Ceské Vysoké Učení Technické;
- the Faculty of Mechanical Engineering of the University of West Bohemia/Západoceska Univerzita v Plzni; and
- the Institute of Chemical Technology Prague/Vysoká Škola Chemicko-Technologická v Praze.
The Faculty of Nuclear Sciences and Physical Engineering (CTU) also operates the training school for the experimental reactor Vrabec VR-1\textsuperscript{333}.

The Czech Nuclear Education Network (CENEN)\textsuperscript{334}, which is the academic association of Czech educational institutions, offers teaching and training within the field of Nuclear Engineering and is involved in the development of Czech nuclear education to a high standard. The Nuclear Information Centre/Ústav Jaderných Informací Zbraslav a.s. collaborated through its task of nuclear knowledge dissemination.

\section*{STAKEHOLDERS}

The companies from the Czech Republic that are involved in the nuclear field include: Cez Energoservis\textsuperscript{335}, Czech Power Enterprise (CEZ Group)\textsuperscript{336}, Diamo\textsuperscript{337}, EGP Invest\textsuperscript{338}, I & C Energo\textsuperscript{339}, Královopolska\textsuperscript{340}, Modrandská Potrubní\textsuperscript{334}, Orgrez SC\textsuperscript{341}, PBS První Brněnská Strojírna\textsuperscript{342}, Pro Engineering\textsuperscript{343}, Skoda JS\textsuperscript{344}, Skoda Praha\textsuperscript{345}, Va Tech EZ, VF\textsuperscript{346}, Vitkovice\textsuperscript{347}, Zam Services\textsuperscript{348} and ZVVZ Emen Engineering\textsuperscript{349}.

The international companies that are represented in the Czech Republic include: ABB Group\textsuperscript{340}, AF Consult\textsuperscript{341}, Allen & Overy LLP\textsuperscript{342}, Amec\textsuperscript{343}, Asltom\textsuperscript{344}, Areva\textsuperscript{345}, Atostromyexport\textsuperscript{346}, Böhler Edelstahl, BT\textsuperscript{347}, Bureau Veritas Group, Camfil Farr\textsuperscript{348}, Clifford Change\textsuperscript{349}, DLA Piper\textsuperscript{350}, Gardiner & Theobald\textsuperscript{351}, GERB\textsuperscript{352}, Gleeds Worldwide\textsuperscript{353}, M+W Group\textsuperscript{354}, Mott MacDonald\textsuperscript{355}, Norton Rose\textsuperscript{356}, Outo Kumpu\textsuperscript{357} and Roxtec\textsuperscript{358}.

\begin{footnotesize}
\begin{enumerate}
\item School Experimental Reactor Vrabec VR-1: http://www.fjfi.cvut.cz/Stara_verze/k417/eng_k417.html
\item Czech Nuclear Education Network (CENEN): http://www.cenen.cz/kontakt.html
\item Cez Energoservis: http://www.cezenergoservis.cz/
\item Diamo: http://www.diamo.cz/en
\item EGP Invest: http://www.egpi.cz/index.php
\item I & C Energo: http://www.ic-energo.cz/aj/page.php
\item Královopolska: http://www.kralovopolska.cz/
\item Modrandská Potrubní: http://www.modrany.cz/index.php?xSET=lang&xLANG=2&xLANGNAME=Eng
\item Orgrez SC: http://www.osc.cz/eng/firma/historie_eng.asp
\item PBS První Brněnská Strojírna: http://wwwpbs.cz/eng
\item Pro Engineering: http://www.pro-eng.com
\item TF: http://www.tf.eu
\item Vitkovice: http://www.vitkovice.cz/Inactive/index/index.html?locale=cs
\item Zam Services: http://www.zam.cz/ENGLISH/index.htm
\item ABB Group: http://www.abb.com
\item AF Consult: http://www.afconsult.com/en
\item Allen & Overy LLP: http://www.allenovery.com/AOWeb/home/AllenOveryHome.aspx?prefLangID=410
\item Amec: http://www.amec.com
\item Alstom: http://www.alstom.com/home
\item Areva: http://www.areva.com
\item Atostromyexport: http://www.ostromyexport.com
\item BT: http://www.globalservices.bt.com/HomeAction.do
\item Camfil Farr: http://www.camfilfarr.com/COU_Camfil
\item Clifford Change: http://www.cliffordcharge.com/home
\item DLA Piper: http://www.dlapiper.com
\item Gardiner & Theobald: http://www.gardiner.com
\item GERB: http://www.gerb.com/index_en.php
\item Gleeds Worldwide: http://www.gleeds.com/worldwide/index.cfm
\item M+W Group: http://www.mwgroup.net
\item Mott MacDonald: http://www.mottmac.cz
\item Norton Rose: http://www.nortonrose.com
\item Outo Kumpu: http://www.outokumpu.com
\item Roxtec: http://www.roxtec.com
\end{enumerate}
\end{footnotesize}
INDUSTRY IN CZECH REPUBLIC

Nuclear Stakeholders per business in the Czech Republic [%]

Nuclear Stakeholders per business in the Czech Republic
DENMARK

Denmark does not have a nuclear power programme. In 1985, the Parliament passed a resolution that nuclear power would not be generated in the country and that no nuclear power plants would be built. Denmark had three research reactors which have all now been decommissioned and the fuel has been removed.

Denmark does not have a nuclear regulatory body. In the event of a nuclear emergency abroad, the Nuclear Division of the Danish Emergency Management Agency/Beredskabs Styrelsen (DEMA) is the agency that will take action to protect Danish population and the environment.

This non-nuclear policy in Denmark is reflected in the higher educational opportunities available in the country. None of the institutions offers a degree that specialises in the nuclear field and there very few research activities carried out.

Higher education in the Denmark is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). However, very few courses are offered in the nuclear field due to the country’s policy on nuclear energy.

The University of Aarhus/Aarhus Universitet is the only higher level educational institution that offers a degree that specialises in the nuclear field and specifically offers a Doctorate degree in this field.

The University of Aarhus/Aarhus Universitet offers a course in Nuclear Particle Physics and it has two research departments involved in the nuclear field: the Institute for Storage Ring Facilities in Aarhus/ISA; and the Department of Physics and Astronomy which performs research in the field of Subatomic Physics.

There are other institutions involved in the research area which include: the Institute for Energy Technology; the Niels Bohr Institute of the University of Copenhagen/Kobenhavns Universitet; the Center for Atomic-scale Materials Design; the Department of Physics of the Technical University of Denmark/Danmarks Tekniske Universitet; and the National Laboratory for Sustainable Energy.

Finally, Denmark participates in the Nordic Nuclear Safety Research/Nordisk kernesikkerhedsforskning, a platform for Nordic cooperation and competence for nuclear issues.

360 Danish Emergency Management Agency/Beredskabs Styrelsen (DEMA) http://www.beredskabsstyrelsen.dk
361 Aarhus University/Aarhus Universitet http://www.au.dk
363 Institute for Storage Ring Facilities in Aarhus/ISA http://www.isa.au.dk
364 Subatomic Physics http://phys.au.dk/forskning/subatomic-physics
365 Institute for Energy Technology http://www.ife.no/index.html
366 Niels Bohr Institute http://www.nbi.ku.dk/english
367 University of Copenhagen/Kobenhavns Universitet http://www.ku.dk/english
368 Center for Atomic-scale Materials Design http://www.camd.dtu.dk/English.asp
369 Department of Physics http://www.fys.dtu.dk/English.asp
370 Technical University of Denmark/Danmarks Tekniske Universitet http://www.dtu.dk/english.asp
371 National Laboratory for Sustainable Energy http://www.2soc.dk
372 Odense University Hospital/Odense Universitetshospital http://www.ouh.dk/wm122110
373 Department of Nuclear Medicine http://www.sygehusfyn.dk/wm263278
STAKEHOLDERS

Although there is no nuclear energy production in Denmark, there are a number of Danish companies that are involved in radiology or nuclear medicine which include: Danfysik [375] (a Danish Technological Institute subsidiary [376]), GE Healthcare [377] (a GE Healthcare International subsidiary [378]).

The international companies that are represented in the Denmark include: ABB Group [379], Aker Solutions [380], ARUP [381], Alstom [382], Atkins [383], BT [384], Böhler Edelstahl [385], Bureau Veritas Group [386], Camfil Farr [387], Gammadata Instruments [388], Golder Associates [389], Outo Kumpu [390] and Roxtec [391].

[376] Danish Technological Institute: http://www.dti.dk
[381] ARUP: http://www.arup.com
[389] Golder Associates is a Canadian international company with presence in Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Portugal, Spain, Sweden and United Kingdom http://www.golderassociates.dk/location_map.php
INDUSTRY IN DENMARK

Nuclear Stakeholders per business in Denmark [%]

Nuclear Stakeholders per business in Denmark
ESTONIA

Estonia does not have a nuclear power programme but there are a number of nuclear facilities that date back to when Estonia was part of the Soviet Union which include a uranium extraction facility and two submarine training reactors. To reduce the country’s CO2 emissions, the government has approved plans to build a nuclear power plant of up to 1,000 MW(e) to be in operation by 2023.

Estonia does not have a nuclear regulatory body. The nuclear safety and waste issues at the existing facilities are being addressed by the state-owned Estonian Radioactive Waste Management Agency (AS ALARA Ltd.).

The current position is reflected in the lack of higher educational opportunities available in the nuclear field.

EDUCATION

Higher education in Estonia is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). There are no higher educational institutions that offer specialized courses in the nuclear field. However, there are some that are involved in nuclear research which include: the Estonian Academy of Sciences/Eesti Teaduste Akadeemia\(^{392}\); Tallinn University of Technology/Tallinna Tehnikaülikool\(^{393}\); and the Physics Institute\(^{394}\) of the University of Tartu/Tartu Ülikool\(^{395}\).

STAKEHOLDERS

Due to the revival of the nuclear energy in Estonia, there are a number of Estonian companies that are involved in the nuclear field which includes: Alara\(^{396}\), Eesti Energia\(^{397}\), Roxtec\(^{398}\) and Silmet\(^{399}\).

The international companies that are represented in the Estonia include: the Russian company Dvigatel\(^{400}\) which has an important presence in the Estonian nuclear market, ABB Group\(^{401}\), Aslom\(^{402}\), Böhler Edelstahl\(^{403}\) and Bureau Veritas Group\(^{404}\).

\(^{393}\) Tallinn University of Technology/Tallinna Tehnikaülikool [http://www.ttu.ee/](http://www.ttu.ee/)
\(^{395}\) University of Tartu/Tartu Ülikool [http://www.ut.ee/en](http://www.ut.ee/en)
\(^{396}\) Alara [http://www.alara.ee](http://www.alara.ee)
\(^{398}\) Roxtec [http://www.roxtec.com](http://www.roxtec.com)
\(^{399}\) Silmet [http://www.silmet.ee](http://www.silmet.ee)
\(^{400}\) Dvigatel [http://www.dvigatel.ru](http://www.dvigatel.ru)
\(^{401}\) ABB Group [http://www.abb.com](http://www.abb.com)
\(^{402}\) Aslom [http://www.alstom.com/home](http://www.alstom.com/home)
\(^{403}\) Böhler Edelstahl [http://www.bohler-edelstahl.com](http://www.bohler-edelstahl.com)
Nuclear Stakeholders per business in Estonia [%]

Nuclear Stakeholders per business in Estonia
FINLAND

In Finland, there are four nuclear reactors currently operating – two VVERs at Loviisa and two BWRs at Olkiluoto and together they generate about a quarter of the country's electrical power requirements. The four operating units have undergone a process of modernisation and power uprating, and their operating lives have been extended. A fifth unit, a PWR, is currently being constructed on the Olkiluoto site and construction permits have been granted for two further units. In addition, the Technical Research Centre of Finland (VTT) operates a small research reactor in Otaniemi, Espoo which is not used for electricity production.

In 2000 Finland made a decision-in-principle for the construction of the final repository for nuclear waste from the Finnish nuclear plants. This facility, referred to as “Onkalo” (the underground cave), is located close to the Olkiluoto site. Construction of the access tunnel for the facility was started by Posiva Oy in 2004.

The main Finnish authorities in the nuclear field are the Ministry of Employment and the Economy/Työ-ja elinkeinoministerii and the Radiation and Nuclear Safety Authority Finland/Säteilyturvakeskus (STUK) which is the nuclear regulatory body.

Despite the high level of activity in the nuclear industry, the higher educational institutions in Finland do not offer very many courses in the nuclear field but Finland is very active in the research field.

EDUCATION

In Finland, the Ministry of Education has called for a system-wide restructuring of higher education and this is going on at the same time as changes are being made to conform to requirements of the Bologna Process. Following this, higher education will be divided into three stages: Bachelor's, Master's and Doctorate degrees.

The main higher education institution in the nuclear field is the Graduate School in Particle and Nuclear Physics (GRASPANP).

There are no higher education institutions that offer a Bachelor’s or a Master’s degree in the nuclear field. The Department of Energy and Process Engineering of the Tampere University of Technology/Tampereen Teknikkisen Yliopiston Korkeakoulu offers the possibility of a Doctorate.

However, a wide range of courses in the nuclear field are offered by universities. The Lappeenranta University of Technology/Lappeenrannan Teknillinen Yliopisto offers a Nuclear Physics course and there are a number of courses in nuclear engineering available as part of the Energy Technology degree (in fact these studies are the most wide ranging in the field in Finland).

The Helsinki University of Technology/Aalto-Yliopiston Teknillinen Korkeakoulu offers a special Advanced Course in Nuclear Engineering, and some other courses which include: Introduction to Nuclear Engineering/Introduction to Nuclear Reactors; Laboratory course in energy

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407 Graduate School in Particle and Nuclear Physics (GRASPANP) is participated by Ministry of Education, the Academy of Finland the University of Helsinki/Helsingin Yliopisto, the University of Jyväskylä/Jyväskylän Yliopisto, the University of Turku/Turun Yliopisto, the University of Oulu/Oulun Yliopisto, the University of Jyväskylä/Jyväskylän Yliopisto, the University of Oulu/Oulun Yliopisto, the University of Turku/Turun Yliopisto, the University of Jyväskylä/Jyväskylän Yliopisto, the University of Oulu/Oulun Yliopisto, the University of Turku/Turun Yliopisto, the University of Jyväskylä/Jyväskylän Yliopisto, the University of Oulu/Oulun Yliopisto, the University of Turku/Turun Yliopisto, the University of Jyväskylä/Jyväskylän Yliopisto, the University of Oulu/Oulun Yliopisto, the University of Turku/Turun Yliopisto.

408 Tampere University of Technology/Tampereen Teknillinen Yliopisto, Lappeenranta University of Technology/Lappeenrannan Teknillinen Yliopisto.

409 Advanced Course in Nuclear Engineering.

410 Introduction to Nuclear Reactors.
technologies; Medical Physics II; and Radiation physics and safety.

The University of Jyväskylä/Jyväskylän Yliopisto offers three more courses in Applied Nuclear Physics and Nuclear Physics I and II and the Tampere University of Technology/Tampereen Teknillinen Yliopisto offers some nuclear course as part of the Bachelor's degree in Environmental and Energy Technology.

STUK has initiated a national training programme in the nuclear field which aims to maintain the knowledge in nuclear technology and train the next generation. The training is carried out as a co-operative venture involving STUK, the Ministry of Employment and Economy, the Lappeenranta University of Technology (LUT), Teknillinen Korkeakoulu (TKK), Technical Research Centre of Finland (VTT), the nuclear licensees Fortum and TVO, and Posiva Oy. The national nuclear training programme, which lasts for five weeks, has been based on the nuclear safety training of the IAEA.

In the field of research there are several universities involved, which include:

- the Helsinki Institute of Physics/Fysiikan Tutkimuslaitos (HIP);
- the Department of Applied Physics of the Helsinki University of Technology/Aalto-Yliopiston Teknillinen Korkeakoulu;
- the Nuclear Engineering Group of the Lappeenranta University of Technology/Lappeenrannan Teknillinen Yliopisto;
- the University of Jyväskylä/Jyväskylän Yliopisto (which is involved in research on nuclear and accelerator based physics);
- the Tampere University of Technology/Tampereen Teknillinen Yliopisto (particularly its Department of Energy and Process Engineering); and

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414 Laboratory course in energy technologies [https://noppa.tkk.fi/noppa/kurssi/tyfy-56.4113/]

415 Medical Physics II [http://peili.hut.fi/tyfy993274/]

416 Radiation physics and safety [https://noppa.tkk.fi/noppa/kurssi/tyfy-56.4232/]

417 Helsinki Institute of Physics/Fysiikan tutkimuslaitos (HIP) [http://www.hip.fi/index.htm]

418 Department of Applied Physics [http://tyfy.tkk.fi/researchgroups/]

419 [https://www.jyu.fi/fysiikka/en/research/accelerator/index.html]
the University of Turku/Turun Yliopisto\textsuperscript{420} which has a Department of Medicine that specialises in nuclear medicine.

As well as the universities, there are other institutions that are involved in nuclear research which include: the Academy of Finland/Suomen Akatemia\textsuperscript{421}; the Radiation and Nuclear Safety Authority of Finland/S"at"eilyturvakeskuksen (STUK); the Technical Research Centre of Finland (VTT)\textsuperscript{422}; and companies which include Posiva\textsuperscript{423} and Teollisuuden Voima Oyj (TVO)\textsuperscript{424}.

**STAKEHOLDERS**

The Finnish Nuclear Society/Suomen Atomiknillinen Seura (ATS)\textsuperscript{425} has an important role in developing business in the nuclear field.

The companies that are involved in the nuclear field include: ABB Group\textsuperscript{426}, Aker Solutions\textsuperscript{427}, Areva\textsuperscript{428}, Ashtom\textsuperscript{429}, Assystem\textsuperscript{430}, B"ohler Edelstahl\textsuperscript{431}, BT\textsuperscript{432}, Camfil Farr\textsuperscript{433}, Energiatollisuus\textsuperscript{434}, Fennovoima\textsuperscript{435}, Fortum\textsuperscript{436}, Gammadata Instruments\textsuperscript{437}, Golder Associates\textsuperscript{438}, Outo Kumpu\textsuperscript{439}, P"o"yry\textsuperscript{440}, Posiva\textsuperscript{441}, Roxtec\textsuperscript{442}, Teollisuuden Voima Oyj (TVO)\textsuperscript{443} and VTT Research Institute\textsuperscript{444}.

\textsuperscript{420} University of Turku/Turun Yliopisto http://www.utu.fi/en
\textsuperscript{421} Academy of Finland/Suomen Akatemia http://www.aka.fi/en-gb/A
\textsuperscript{422} Technical Research Centre of Finland (VTT) http://www.vtt.fi/index.jsp?lang=en
\textsuperscript{423} Posiva http://www.posiva.fi/en
\textsuperscript{424} Teollisuuden Voima Oyj (TVO) http://www.tvo.fi/www/page/etusivu_en
\textsuperscript{425} Finnish Nuclear Society/Suomen Atomiknillinen Seura (ATS) http://www.ats-fns.fi/eng/eng_index.html
\textsuperscript{426} ABB Group http://www.abb.com
\textsuperscript{427} Aker solutions http://www.akersolutions.com/internet/default.html
\textsuperscript{428} Areva http://www.areva.com
\textsuperscript{429} Ashtom http://www.ashtom.com
\textsuperscript{430} Assystem http://www.assystem.com/en/index.htm
\textsuperscript{431} B"ohler Edelstahl http://www.boehler-edelstahl.com
\textsuperscript{432} BT http://www.globalservices.bt.com/HomeAction.do
\textsuperscript{433} Camfil Farr http://www.camfilfarr.com/cou_camfil
\textsuperscript{434} Energiatollisuus http://www.energia.fi/EN
\textsuperscript{435} Fennovoima http://www.fennovoima.com
\textsuperscript{436} Fortum http://www.fortum.com/corporation.jsp?path=14022;14024;14026
\textsuperscript{437} Gammadata Instruments http://www.gammadatainstrument.se
\textsuperscript{438} Golder Associates http://www.golder.fi/en/modules.php/name=Pages&sp_id=1083
\textsuperscript{439} Outo Kumpu is a Finnish company with presence in Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom http://www.outokumpu.com
\textsuperscript{440} P"o"yry is a Finnish company with presence in Finland, France, Germany and the UK http://www.poyry.com
\textsuperscript{441} Posiva http://www.posiva.fi/en
\textsuperscript{442} Roxtec http://www.roxtec.com
\textsuperscript{443} Teollisuuden Voima Oyj -TVO- is present as well in Belgium http://www.tvo.fi/www/page/etusivu_en
\textsuperscript{444} VTT Research Institute http://www.vtt.fi/?lang=en
INDUSTRY IN FINLAND

Nuclear Stakeholders per business in Finland [%]

Nuclear Stakeholders per business in Finland
FRANCE

In 1974, the French government made the decision to launch a large nuclear power program and within 15 years sufficient nuclear power plants had been installed to satisfy its electrical power requirements. Since then, France has rapidly expanded its nuclear power capacity and now there are 58 nuclear reactors, all PWRs, operating at 19 different sites as follows: Gravelines has 6 PWRs; Blayais, Bugey, Cattenom, Chinon, Cruas, Dampierre, Paluel and Tricastin each have 4 PWRs; and Belleville, Chooz, Civaux, Fessenheim, Flamanville, Golfech, Nogent, Penly, Saint-Alban and Saint-Laurent each have 2 PWRs. France now derives about three quarters of its electricity from nuclear power.\(^445\)

The European Pressurised-water Reactor (EPR) is being built on the Flamanville site and a further one is being planned at Penly. The Phénix fast breeder reactor was still in operation mainly as an experimental facility, but is closed since 2010. 12 plants are being decommissioned as follows: the gas cooled reactors at Chinon (3), Marcoule (3), Saint Laurent des Eaux (2) Bugey; the PWR at Chooz; the heavy water reactor at Brennilis; and the Superphénix fast breeder reactor.

France also has an active nuclear reprocessing program carried out at the (former COGEMA) AREVA La Hague site and Uranium enrichment and Mixed Oxide (MOX) fuel fabrication at the AREVA Melox plant Marcoule, close to the Tricastin Nuclear Power Centre.

The French Nuclear Safety Authority/Autorité de Sûreté Nucléaire (ASN)\(^446\) regulates nuclear safety and radiation protection, and its support organisation is the Institute for Radioprotection and Nuclear Safety/ Institut de Radioprotection et de Sûreté Nucléaire (IRSN)\(^447\).

The high significance of nuclear power in the country means that France has been very active in the development of nuclear technology and has made constant efforts to maintain and consolidate nuclear knowledge. This is reflected in the higher educational opportunities in the nuclear field available in France.

EDUCATION

Higher education in France is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). A Bachelor’s degree in Engineering usually consists of two years of common study plus and a third year of specialization (option).

At the Bachelor’s degree level there are a wide range of courses offered in the nuclear field which include:

- the National Institute for Nuclear Science and Technology/Institut National des Sciences & Techniques Nucléaires (INSTN)\(^448\) offers an Atomic Engineering degree\(^449\);
- the Mines Paris Graduate School/École des Mines Paris (ENSM)\(^450\) offers a Bachelor’s degree Specialization in Nuclear Engineering\(^451\);
- the Engineering National High School of Caen/École Nationale Supérieure d’Ingénieurs de Caen (ENSICAEN)\(^452\) offers a specialization in Nuclear and Instruments Engineering\(^453\);
- the Grenoble Institute of Technology/Institute Polytechnique de Grenoble\(^454\) offers an option in Energy and Nuclear Engineering\(^455\);
- the Mines School of Nantes/École des Mines de Nantes\(^456\) offers a Bachelor’s degree in Nu-
clear: Technology, Environmental and Safety (NTSE)\textsuperscript{457};

- the Chemistry Paris Tech/Chimie Paris Tech\textsuperscript{458} offers a specialization in Nuclear Chemistry\textsuperscript{459};

- the Mines School of Alés/École des Mines d’Alés\textsuperscript{460} offers a Nuclear Specialization\textsuperscript{461}; and

- the National Mines High School of Saint-Étienne/École Nationale Supérieure des Mines de Saint-Étienne\textsuperscript{462} (in collaboration with the INSTN) offers a Bachelor’s degree in Nuclear Installations Engineering\textsuperscript{463}.

In addition, Bachelor’s degrees are offered by: the Central School Paris/École Centrale Paris\textsuperscript{464} and Supelec in collaboration which offers the option of a course on Energy\textsuperscript{465}; the High School of Arts and Crafts/École National Supérieure d’Arts et Métiers\textsuperscript{466} offers a specialization in Future Energy; and the National Chemistry High School of Montpellier/École Nationale Supérieure de Chimie de Montpellier\textsuperscript{467} offers the third year specialization in Environmental and Nuclear Chemistry\textsuperscript{468}. All these degrees have a strong relationship with nuclear energy.

There is a wide range of opportunities for Master’s degrees which includes: the Grenoble Institute of Technology/Institute Polytechnique de Grenoble (in collaboration with EDF and the National Institute for Nuclear Science and Technology/Institut National des Sciences & Techniques Nucléaires - INSTN) offers a degree in International Materials for Nuclear Energy (MaNuEn)\textsuperscript{469}; and the University Pierre and Marie Curie-Paris VI/Université Pierre et Marie Curie-Paris VI\textsuperscript{470} offers a degree in Nuclear Engineering\textsuperscript{471}.

In addition, an International Master’s degree in Nuclear Energy\textsuperscript{472} is offered by the Consortium established by:

- the Paris Tech\textsuperscript{473};

- the University Paris-Sud 11/Université Paris-Sud\textsuperscript{474};

- the École Central Paris (ECP)\textsuperscript{475};

- the National Institute for Nuclear Science and Technology/Institut National des Sciences & Techniques Nucléaires (INSTN)\textsuperscript{476}; and

- EDF\textsuperscript{477};

and this is supported by Areva and GDF Suez.

The National Institute for Nuclear Science and Technology/Institut National des Sciences & Techniques Nucléaires offers the European


\textsuperscript{459} Nuclear Chemistry http://www.cge.asso.fr/ecoles/ECOLE63.phtml

\textsuperscript{460} Mines School of Alés/École des Mines d’Alés http://www.mines-ales.fr/pages/?all=accueil&idi=21

\textsuperscript{461} Nuclear Specialization http://www.mines-ales.fr/UserFiles/File/PDF%20enseignement/nucleaire-bd.pdf

\textsuperscript{462} National Mines High School of Saint-Étienne/École Nationale Supérieure des Mines de Saint-Étienne http://www.emse.fr/en/

\textsuperscript{463} Nuclear Installations Engineering Bachelor Degree http://www.emse.fr/spip/-Ingenieur-par-alternance-.html

\textsuperscript{464} Central School Paris/École Centrale Paris http://www.ecp.fr/index.html

\textsuperscript{465} Option Energy http://www.supelec.fr/222_p_10912/programs-of-the-engineer-degree-course.html

\textsuperscript{466} High School of Arts and Crafts/École National Supérieure d’Arts et Métiers http://www.ensam.fr/en

\textsuperscript{467} National Chemistry High School of Montpellier/École Nationale Supérieure de Chimie de Montpellier http://www.enscm.fr/en

\textsuperscript{468} Environmental and Nuclear Chemistry http://www.enscm.fr/Formation/diplome-ingenieur.html

\textsuperscript{469} Master International Materials for Nuclear Energy (MaNuEn) http://phelma.grenoble-inp.fr/1204729656655/0/fiche_article

\textsuperscript{470} University Pierre and Marie Curie-Paris VI/Université Pierre et Marie Curie-Paris VI http://www.upmc.fr/en/index.html

\textsuperscript{471} Nuclear Engineering Master http://www.master.sdi.upmc.fr/fr/ing_nucleaire.html


\textsuperscript{474} University Paris-Sud 11/Université Paris-Sud11 http://www.u-psud.fr/en/index.html

\textsuperscript{475} École Central Paris (ECP) http://www.ecp.fr/fr/A_ecp/A3_intergroupe/A3c_alliance_supelec.html


\textsuperscript{477} EDF http://www.edf.fr/edf-fr-accueil-1.html#Accueil
Master's degree in Molecular Imaging (EMMI) and the University of Nancy I Henri Poincare/Université Henri Poincaré (Nancy I) collaborates in the European Master's degree in Nuclear Fusion Science and Engineering Physics.

The University Joseph Fourier/Université Joseph Fourier offers a Professional Master ITDD with four specializations and in collaboration with INP offers a Master's degree in Research in Energy Physics. The INSTN coordinates the ENEN European Master of Science in Nuclear Engineering (EMSNE).

Several other institutions offer a Master's degree within the nuclear field including:

- the University Montpellier/Université Montpellier in collaboration with the INSTN and the National High School of Chemistry of Paris/École National Supérieure de Chimie de Paris (ENSCP) which offers a degree in Chemistry;
- the Blaise Pascal University Clermont Ferrand/Université Blaise Pascal Clermont-Ferrand teaches a Physics Master with several courses within the nuclear field. INSTN offers a Modelling and Simulation Master degree; and
- the ENSTA Paris Tech/École Nationale Supérieure de Techniques Avancées offers a Nuclear Engineering specialization within the Engineering curricula.

Regarding Doctorate degrees, there are several institutions that offer possibilities which includes:

- the National Academy of Arts and Crafts/Conservatoire National des Arts et Métiers (CNAM) offers a degree in Sciences Nuclear/Sciences et Techniques Nucléaires; and
- the National Academy of Arts and Crafts/Conservatoire National des Arts et Métiers (CNAM) offers a degree in Sciences Nuclear/Sciences et Techniques Nucléaires; and
the National Institute for Nuclear Science and Technology/Institut National des Sciences & Techniques Nucléaires in collaboration with Paris XI University, offers a degree in Nuclear Energy. A number of other courses of several weeks duration are offered by the National Institute for Nuclear Science and Technology/Institut National des Sciences & Techniques Nucléaires which includes:

- Dismantling experience of nuclear facilities in France;
- Generation IV: nuclear reactor systems for the future;
- International School in Nuclear Engineering;
- Measurement uncertainties;
- Metallurgy and properties of Zr alloys for nuclear applications;
- Nuclear fuel cycle;
- Nuclear waste management;
- Principals and operation of nuclear reactors; and
- Research and medical applications of radio-pharmaceuticals.

Training courses are offered by the National Institute for Nuclear Science and Technology/Institut National des Sciences & Techniques Nucléaires and by four European Technical Safety Organisations (TSO) which includes the French Institut de Radioprotection et de Sûreté Nucléaire which has founded the European Nuclear Safety Training and Tutoring Institute (ENSTTI), which offers several short applied training sessions.

Other main activities on education and training in the nuclear field are carried out by the French Atomic Energy Commission/Commissariat à l’énergie atomique (CEA) and Institute of Radioprotection and Nuclear Safety/Institut de Radioprotection et de Sûreté Nucléaire (IRSN) who provide apprenticeships for master students at several levels. The companies Areva, EDF and GDF Suez offer initial training for the operating personnel of several nuclear power plants (many of them in collaboration with the French Council for Education and Training in Nuclear Energy (CFEN)). The French Nuclear Energy Society/Société Française d’Énergie Nucléaire (SFEN) promotes a high-level exchange on scientific and technical issues and organises professional and technical seminars.
In the nuclear research field, there are several institutions involved: the Armines (which is a joint initiative of Grandes Écoles); the Nuclear Magnetic Resonance Center of the ESPCI Paris Tech; the French Atomic Energy Commission/Commissariat à l'énergie atomique (specially the Cadarache Research Institute; the Energy Department of the Grenoble Institute of Technology; and the Institute of Radioprotection and Nuclear Safety/Institut de Radioprotection et de Sûreté Nucléaire (IRSN).

Finally, the European Foundation for Tomorrow’s Energies/Fondation Européenne pour les Energies de Demain promotes the development of nuclear energy in the higher educational field.

STAKEHOLDERS

Due to the high nuclear potential, France has a large number of companies that are involved in the nuclear industry which includes: ABB Group, Aker Solutions, Allen & Overy LLP, Andra, Areva, Areva TA Technicatome, Ashurst, Alstom, Assystem, Bechtel Power Corporation, etc.

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516 Armines (joint of Grandes Écoles) http://www.armines.net/?SetLang=uk
517 Nuclear Magnetic Resonance Center http://www.espci.fr/recherche/labos/rmn/eng.htm
519 Cadarache Research Institute http://www-cadarache.cea.fr/index_gb.php
520 Energy Department http://www.grenoble-inp.fr/1121066288765/1/fiche_article/&RH=INPG_EN
522 ABB Group http://www.abb.com
525 Andra http://www.andra.fr
526 Areva is a French company with presence in Belgium, Bulgaria, France, Finland, Germany, Hungary, Italy, Lithuania, the Netherlands, Slovakia, Slovenia, Spain and Sweden http://www.areva.com/EN/home-57/solutions-for-nuclear-energy-and-renewable-energies.html
528 Ashurst http://www.ashurst.com/home.aspx?id_Content=1
529 Alstom is a French company with presence in seventy countries among them the European Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Poland, Portugal, Romania, Spain, Sweden and United Kingdom. http://www.alstom.com/home
530 Assystem is a French company with presence in Belgium, Finland, France, Germany, Italy, Portugal, Romania, Spain and United Kingdom http://www.assystem.com/en/index.html
531 Bechtel Power Corporation http://www.bechtel.com
BNFL\textsuperscript{532}, Biogas Nord\textsuperscript{533}, BT\textsuperscript{534}, Bureau Veritas Group\textsuperscript{535}, Camfil Farr\textsuperscript{536}, Canberra France\textsuperscript{537}, Clifford Change\textsuperscript{538}, Comurhex\textsuperscript{539}, Clyde & Co\textsuperscript{540}, Cyril Swett\textsuperscript{541}, Denton Wilde Sapte\textsuperscript{542}, DLA Piper\textsuperscript{543}, EDF\textsuperscript{544}, Field Fisher Waterhouse\textsuperscript{545}, Fives Nordon\textsuperscript{546}, Freshfields Bruckhaus Deringer\textsuperscript{47}, Gardiner & Theobald\textsuperscript{548}, GE-Hitachi Nuclear Energy International\textsuperscript{549}, GERB\textsuperscript{550}, Gleeds Worldwide\textsuperscript{551}, Golder Associates\textsuperscript{552}, Herbert Smith\textsuperscript{553}, HSB Global Standards\textsuperscript{554}, Inéo Activité Nucléaire et Centrales\textsuperscript{555}, Intercontrole\textsuperscript{556}, Iter\textsuperscript{557}, Lavera Energies, LGI Consulting\textsuperscript{558}, Lisega\textsuperscript{559}, M+W Group\textsuperscript{560}, Milieu Ionisant\textsuperscript{601}, Mirion Technologies\textsuperscript{562}, Morgan Lewis\textsuperscript{563}, Oakridge, Omexon\textsuperscript{564}, Onet Technologies\textsuperscript{565}, Osborne Clarke International\textsuperscript{566}, Outo Kumpu\textsuperscript{607}, Oxand\textsuperscript{608}, QSA Global\textsuperscript{569}, Reel\textsuperscript{570}, Robatel\textsuperscript{571}, Roxtec\textsuperscript{572}, Salvarem\textsuperscript{573}, Simmons & Simmons\textsuperscript{574}, SGN\textsuperscript{575}, SOM Groupe Ortec\textsuperscript{576}, STMI/Société des Techniques, System et Solutions\textsuperscript{577}, URS\textsuperscript{578}, Weir Power & Industrial\textsuperscript{579} and Westinghouse France\textsuperscript{580}.

INDUSTRY IN FRANCE

Nuclear Stakeholders per business in France [%]

Nuclear Stakeholders per business in France
GERMANY

The first commercial nuclear power plant started operating in Germany in 1969 and currently there are 17 nuclear reactors made up of 11 PWRs and 6 BWRs operating on 12 sites as follows: there are PWRs at Biblis-A, Neckarwestheim-1, Biblis-B, Unterweser, Grafenrheinfeld, Gröhnde, Phillipsburg-2, Brokdorf, Isar-2, Emsland and Neckarwestheim-2; and there are BWRs at Brunsbüttel, Isar-1, Phillipsburg-1, Krummel, Gundremmingen-B and Gundremmingen-C. Together they supply about a quarter of the country’s electricity requirements.

The following reactors have been shut down: Gundremmingen-A, Greifswald, Großwalzheim, Hamm-Uentrop, Kahl, Kalkar (SNR-300), Lingen, Mülheim-Kärlich, Obrigheim, Niederaichbach, Rheinsberg, Stade, Stendal and Würgassen. There are also five research reactors. Germany also has facilities for nuclear fuel fabrication and for the storage of radioactive waste.

In 1998 the new coalition government decided to phase out nuclear power. In the energy concept presented by the German Federal Government at the end of September 2010 it was proposed that the operating period of the 17 nuclear power plants in Germany would be extended by an average of 12 years. The individual extra periods would depend on the start of commercial operation of the plants so that plants that had been taken into commercial operation before 1980 would be operated for another eight years and for younger plants the periods would be extended by another 14 years. On June 6, 2011 Germany, however, decided to step out of nuclear energy production gradually by 2022.

The responsibility for licensing the construction and operation of all nuclear facilities is shared between the federal and “Länder” governments (both with the power of veto). The main authority within the nuclear field is the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety/ Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. The Federal Office for Radiation Protection/Bundesamt für Strahlenschutz has as well an important role in the safety and protection against harm due to radiation.

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The federal and state authorities are supported by consulting companies/organizations which includes: Plant and Reactor Safety Company/Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, technical inspection companies TÜV Nord and TÜV Süd (fields of nuclear engineering are situated in Hamburg/TÜV Nord SysTec GmbH & Co KG, Hannover/TÜV Nord EnSys Hannover GmbH & Co KG, Mannheim/TÜV Süd Energetechnik GmbH Baden Württemberg, München/TÜV SÜD Industry Service GmbH, Kerntechnik-Gutachterarbeitsgemeinschaft Baden-Württemberg (KeTAG); and ESN EnergieSyteme Nord GmbH/Sicherheitstechnik.

The dependence on nuclear power in Germany is reflected in the higher educational opportunities available in the country.

EDUCATION

Traditionally, most of the nuclear education at the higher level has been provided at the University of Applied Sciences (UAS)/Fachhochschule (FH) sometimes abbreviated as Hochschule or Hochschule für angewandte Wissenschaften (HAW) which often specialize in particular topicals.

Following the Bologna Process, these institutions, which formerly awarded Diplom degrees, now award Bachelor’s and Master’s degrees which are the same as those awarded by the University/Universitäten and the Diplom degree has been phased out. Hence, in the German higher educational system, there are now three levels: Bachelor’s, Master’s and Doctorate degrees.

Regarding Bachelor’s degrees, the Technical University of Munich/Technische Universität München offers a course in Nuclear Technology.

582 Federal Office for Radiation Protection/Bundesamt für Strahlenschutz http://www.bfs.de/en/bfs
583 TÜV Nord SysTec GmbH & Co KG http://www.tuev-nord.de/en/company/1TUEV_NORD_SysTec_5537.html
586 TÜV Süd Industrie Service GmbH http://www.tuev-sued.de/company/about_tuev_sued/about_us/our_companies/industry/tuev_sued_industrie_service_gmbh
588 Technical University of Munich/Technische Universität München http://portal.mytum.de/welcome
589 Bachelor’s Course of study in Nuclear Technology http://www.mw.tum.de/index.php?id=1036
Regarding Master's degrees, there are the following possibilities: the Aachen University of Applied Sciences/Hochschule Aachen590 teaches the European Master's degree in Nuclear Applications (EMINA)591; the Technical University of Munich/Technische Universität München offers a degree in Nuclear Technology592; and the RWTH Aachen University/Rheinisch-Westfälische Technische Hochschule Aachen593 offers a degree in Engineering594.

There are several universities offering courses in the nuclear field which includes: the Aachen University of Applied Sciences/Hochschule Aachen which offers a Spectroscopy course; the Institute for Reactor Safety and Reactor Technology/Lehrstuhl für Reaktorsicherheit und Technik595 of the RWTH Aachen University/Rheinisch-Westfälische Technische Hochschule Aachen offers the Consolidated Reactor Safety and Reactor Technology596 course; and the University of Stuttgart/Universität Stuttgart597 offers three courses – Applied Plasmaphysics/Angewandte Plasmaphysik, Advanced Atomic Physics/Fortgeschrittene Atomphysik and Nuclear and Particle Physics/Physik der Kerne und Teilchen.

Regarding nuclear training, there are three institutions that provide this. The first of them, the Aachen University of Applied Sciences offers an ERASMUS Intensive Program organized jointly by the universities of the CHERNE Network598 called Jülich Nuclear Summer School JUNCS599.

The courses offered by the Karlsruhe Institute of Technology600 include several in the nuclear field. The Simulator Centre/Simulator Zentrum601 has over 2000 trainees per year from the 17 nuclear power plants. The the Plant and Reactor Safety Company/Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) GmbH602 offers a training course for Experts in the Field of Nuclear Safety603.

Recently, following an agreement between the companies Areva, Axpo AG, EnBW, E.ON Kernkraft GmbH, URENCO Limited and Vattenfall AB, the European Nuclear Energy Leadership Academy (ENELA)604 was founded. This institution, located in Garching, offers a Nuclear Energy Management Program (NEMP) and a Nuclear Energy Leadership Cycle (NELC) which are both one-year courses in technical and non technical skills in the nuclear field.

Germany’s Plants and Reactor Safety Company / Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) takes part in the European Nuclear Safety Training and Tutoring Institute (ENSTTI)605 which offers a number of training courses.

590 Aachen University of Applied Sciences/Hochschule Aachen http://www.fh-aachen.de/homepage.html?&no_cache=1&L=1
592 Master's Course of Study in Nuclear Technology http://www.muw.tum.de/index.php?id=1040
593 RWTH Aachen University/Rheinisch-Westfälische Technische Hochschule Aachen http://www.rwth-aachen.de/go/id/562
597 University of Stuttgart/Universität Stuttgart http://www.uni-stuttgart.de/index.en.html
598 The CHERNE Network is integrated by the FH Aachen, Alma Mater Studiorum – Università di Bologna, ISIB Bruxelles, Universidade de Coimbra, Universitat Politecnica de Valencia, XIOS Hogeschool Limburg
599 Juelich Nuclear Summer School JUNCS http://www.fh-aachen.de/16712.html
601 Simulator Centre/Simulator Zentrum http://www.simulatorzentrum.de/
604 European Nuclear Energy Leadership Academy (ENELA) info@enela.eu
605 The European Nuclear Safety Training and Tutoring Institute (ENSTTI) is a joint initiative of French Institute for Radiological Protection and Nuclear Safety/Institut de Radioprotection et de Sûreté Nucléaire (IRSN), Germany’s Company for Plants and Reactor Safety/Gesellschaft für Anlagen- und Reaktorsicherheit (GRS), Lithuanian Energy Institute (LEI) and Czech Nuclear Research Institute Rez/Ústav Jaderného Výzkumu Rez a.s. (UJV) http://www.enstti.eu/Pages/Home.aspx
In Germany, research has a high priority in the nuclear field and there are several institutions involved which include: the Federal Institute for Geosciences and Natural Resources/Bundesanstalt für Geowissenschaften und Rohstoffe\textsuperscript{606}; the Federal Office for Radiation Protection/Bundesamt für Strahlenschutz\textsuperscript{607}; the Institutes of the Dresden-Rossendorf Research Center/Institute des Forschungszentrums Dresden-Rossendorf\textsuperscript{608}; the Jülich Research Centre/ Forschungszentrum Jülich\textsuperscript{609} (specially the Institute of Energy Research/ Institut für Energieforschung (IEF)\textsuperscript{610} and the Institute for Nuclear Physics/Institut für Kernphysik (IKP)\textsuperscript{611}); the German Research Foundation/Deutsche Forschungsgemeinschaft\textsuperscript{612}; the Karlsruhe Institute of Technology; and the Plant and Reactor Safety Company /Gesellschaft für Anlagen-und Reaktorsicherheit (GRS) mbH.

Additionally, there are several universities involved in nuclear research field which includes: the Heidelberg University/Universität Heidelberg\textsuperscript{613}; the RWTH Aachen University/RWTH Rheinisch-Westfälische Technische Hochschule Aachen\textsuperscript{614} particularly its Institute for Reactor Safety and Reactor Technology\textsuperscript{615}; the Institute of Nuclear and Particle Physics\textsuperscript{616} of the Technical University of Dresden/Technische Universität Dresden\textsuperscript{617}; the Institute for Technology/Lehrstuhl für Nukleartechnik\textsuperscript{618} of the Technical University of Munich/Technische Universität München; the Stuttgart University/Universität Stuttgart\textsuperscript{619} with its Institute for Plasma Research/Institut für Plasmaforschung\textsuperscript{620} and its Materialprüfungsanstalt Universität Stuttgart\textsuperscript{621}; and the Karlsruhe University/Universität Karlsruhe\textsuperscript{622} which has two research groups in the nuclear field, the European Approach to Nuclear and Radiological Emergency Management and Rehabilitation Strategies (EU-Projekt)\textsuperscript{623} and the Nuclear Magnetic Resonance Investigations on Structure and Functions of Complex Systems (NMR)\textsuperscript{624}.

In Karlsruhe, there is the Institute for Transuranium Elements\textsuperscript{625} one of the seven institutes of the Joint Research Centre, which is a Directorate-General of the European Commission.

Finally the Alliance for Nuclear Competence/Kompetenzverbund Kerntechnik\textsuperscript{626} under the umbrella of the Federal Ministry of Economics and Technology/Bundesministerium für Wirtschaft und Technologie (BMWi)\textsuperscript{627} works for the improvement of German nuclear higher education and the German

\textsuperscript{606} Federal Institute for Geosciences and Natural Resources/Bundesanstalt für Geowissenschaften und Rohstoffe http://www.bgr.bund.de/EN/Home/homepage_node.html
\textsuperscript{607} Federal Office for Radiation Protection/Bundesamt für Strahlenschutz http://www.bfs.de/en/bfs
\textsuperscript{608} Institutes of the Dresden-Rossendorf Research Center/Institute des Forschungszentrums Dresden-Rossendorf http://www.fzd.de/db/Cms/PrNId=124
\textsuperscript{609} Jülich Research Centre/ Forschungszentrum Jülich http://www.fz-juelich.de/portal/about_us
\textsuperscript{610} Institute of Energy Research/ Institut für Energieforschung -IEF- http://www.fz-juelich.de/ief/en/Index.shtml
\textsuperscript{611} Institute for Nuclear Physics/Institut für Kernphysik (IKP) http://www.fz-juelich.de/ikp/en/index.shtml
\textsuperscript{612} German Research Foundation/Deutsche Forschungsgemeinschaft http://www.dfg.de/en
\textsuperscript{613} Heidelberg University/Universität Heidelberg http://www.uni-heidelberg.de/research http://www.uni-heidelberg.de
\textsuperscript{614} RWTH Aachen University/RWTH Rheinisch-Westfälische Aachen Universität http://www.rwth-aachen.de/go/id3d2
\textsuperscript{616} Institute of Nuclear and Particle Physics http://iktp.tu-dresden.de/IKTP/english/index.htm
\textsuperscript{617} Technical University of Dresden/Technische Universität Dresden http://tu-dresden.de
\textsuperscript{619} Stuttgart University/Universität Stuttgart http://www.uni-stuttgart.de/index.en.html
\textsuperscript{620} Institut for Plasma Research/Institut für Plasmaforschung http://www.ifp.uni-stuttgart.de/index_e.htm
\textsuperscript{621} Materialprüfungsanstalt Universität Stuttgart http://www.mpa.uni-stuttgart.de/mpa_en_home.htm
\textsuperscript{622} Karlsruhe University/Universität Karlsruhe http://www.uni-karlsruhe.de/index_en.php
\textsuperscript{623} European Approach to Nuclear and Radiological Emergency Management and Rehabilitation Strategies (EU-Projekt) http://www.ft.uni-karlsruhe.de/FORDAT/PROJEKTE/ka8890.htm
\textsuperscript{624} Nuclear Magnetic Resonance Investigations on Structure and Functions of Complex Systems (NMR) http://www.wasserchemie.uni-karlsruhe.de/english/791.php
\textsuperscript{625} JRC Institute for Transuranium Elements http://itu.jrc.ec.europa.eu/index.php?id=72
\textsuperscript{626} Alliance for Nuclear Competence/Kompetenzverbund Kerntechnik http://nuklear-server.ka.fzk.de/kompetenzverbund/start.htm
\textsuperscript{627} Federal Ministry of Economics and Technology/Bundesministerium für Wirtschaft und Technologie (BMWi) http://www.bmw.de/English/Navigation/root.html
nuclear society/Kerntechnische Gesellschaft e.V. promotes the development of nuclear energy.

In Germany, all four nuclear utilities have been engaged in supporting universities in creating new professorships and academic programmes in nuclear technology. Moreover, they created a common utility-led international program for graduates in nuclear technology and management which has operated since 2008 at the Technical University Munich.

**STAKEHOLDERS**

There are many companies in Germany that are involved in the nuclear business which includes:

- Arens Rohrleitungsbau GmbH & Co. KG
- AVA Econ Industries GmbH u. Co. KG
- Babcock Noell GmbH
- Balcke-Dürr GmbH
- Barlage GmbH
- Camfil Farr
- Chemotrade Leipzig
- Cronitec Edelstahl GmbH
- DBE & DBE Tec
- Doosan Heaven Industries & Construction Co Ltd
- Evonik Steag GmbH
- E.ON
- Energiewerke Nord GmbH
- Gamma-Service Produktbestrahlung GmbH
- GNS
- GERB
- GEA Group AG
- Hans Wälischmiller
- Internexco GmbH
- Keller & Kalmbach Fördertechnik GmbH
- Kernkraftwerk Gundremmingen GmbH
- Kerntechnische Hilfsdienst GmbH
- Kraftanlagen München/Heidelberg GmbH
- KSB AG

Number of Nuclear Degrees available in Germany

<table>
<thead>
<tr>
<th>BSC</th>
<th>MSC</th>
<th>PHD</th>
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<td>2</td>
<td>7</td>
<td>1</td>
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Dampfkesselbau GmbH⁶⁵⁴, the MTH Metall-Technik Halbrücke GmbH & Co. KG⁶⁵⁵, NSD-Fusion GmbH, Nuclitec (Eckhert & Ziegler)⁶⁵⁶, Nukem⁶⁵⁷, Peri⁶⁵⁸, Röhr + Stolberg GmbH⁶⁵⁹, RWE⁶⁶⁰, Siemenskamp⁶⁶¹, Simulator Centre⁶⁶², Stahl-und Apparatebau Hans Leefer GmbH & Co. KG⁶⁶³, Verein für Kernverfahrenstechnik und Analytik Rossendorf⁶⁶⁴, and VGB Power Tech e.V.⁶⁶⁵

There is also a large number of international companies that have a presence in Germany which includes: ABB Group⁶⁶⁶, Aker Solutions⁶⁶⁷, Allen & Overy LLP⁶⁶⁸, Areva (its subsidiary Advanced Nuclear Fuels GmbH -ANF-)⁶⁷⁰, ARUP⁶⁷¹, Ashurst⁶⁷², Aslom⁶⁷³, Atkins⁶⁷⁴, BT⁶⁷⁵, Camfil Farr⁶⁷⁶, Pöyry⁶⁷⁷, Clifford Change⁶⁷⁸, DLA Piper⁶⁷⁹, Field Fisher Waterhouse⁶⁸⁰, Freshfields Bruckhaus Deringer⁶⁸¹, Gardiner & Theobald⁶⁸², Gleeds Worldwide⁶⁸³, Golder Associates⁶⁸⁴, Hammonds⁶⁸⁵, HSB Global Standards⁶⁸⁶, Hyder Consulting⁶⁸⁷, M+W Group⁶⁸⁸, Morgan Lewis⁶⁸⁹, Morson Projects⁶⁹⁰, Osborne Clarke International⁶⁹¹, Outo Kumpu⁶⁹², Roxtec⁶⁹³, SA Global⁶⁹⁴, Simmons & Simmons⁶⁹⁵, Studsvik⁶⁹⁶, Urenco⁶⁹⁷, URS⁶⁹⁸, Vattenfall Europe Nuclear Energy (VENE)⁶⁹⁹ and Westinghouse Electric Germany GmbH⁷⁰⁰.

⁶⁵⁴ Meeraner Dampfkesselbau GmbH http://www.mdkb.de
⁶⁵⁵ MTH Metall-Technik Halbrücke GmbH & Co. KG http://www.jlgoslar-batterieprodukte.de/index_e.htm
⁶⁵⁶ Nuclitec (Eckhert & Ziegler) http://www.nuclitec.de/en/company
⁶⁵⁷ Nukem http://www.nukem.de
⁶⁵⁸ Peri http://www.peri.de/ww/en/company/addresses/europe/germany crim
⁶⁶⁰ RWE http://www.rwe.com/web/cms/en/b/energy2/energy1
⁶⁶² www.simulatorzentrum.de
⁶⁶⁴ Verein für Kernverfahrenstechnik und Analytik Rossendorf www.vkta.de
⁶⁶⁵ VGB Power Tech e.V. http://www.vgb.org
⁶⁶⁶ ABB Group http://www.abb.com
⁶⁶⁷ Aker solutions http://www.akersolutions.com/internet/default.html
⁶⁶⁸ Allen & Overy LLP http://www.allenandover.com/AOWeb/home/AllenOveryHome.aspx?id=14
⁶⁶⁹ Areva http://www.areva.com
⁶⁷¹ ARUP http://www.arup.com
⁶⁷³ Aslom http://www.aslom.com/home
⁶⁷⁴ Atkins http://www.atkinsglobal.com
⁶⁷⁵ BT http://www.globalservices.bt.com/HomeAction.do
⁶⁷⁶ Camfil Farr http://www.camfilfarr.com/cou_camfil
⁶⁷⁷ Pöyry http://www.poyry.com
⁶⁷⁸ Clifford Change http://www.cliffordchange.com/home
⁶⁷⁹ DLA Piper http://www.dlapiper.com
⁶⁸⁰ Field Fisher Waterhouse http://www.ffw.com
⁶⁸¹ Freshfields Bruckhaus Deringer http://www.freshfields.com
⁶⁸² Gardiner & Theobald http://www.gardiner.com
⁶⁸⁵ Hammonds http://www.hammonds.com
⁶⁸⁶ HSB Global Standards http://www.hsbglobalstandards.com
⁶⁸⁷ Hyder Consulting
⁶⁸⁸ M+W Group is a German company with presence in Austria, Czech Republic, France, Germany, Ireland, Italy, Netherlands, Poland and United Kingdom http://www.mwgroup.net
⁶⁸⁹ Morgan Lewis http://www.morganlewis.com
⁶⁹⁰ Morson Projects http://www.morson-projects.co.uk
⁶⁹¹ Osborne Clarke International http://www.osborneclarke.com
⁶⁹² Outo Kumpu http://www.ooutokumpu.com
⁶⁹³ Roxtec http://www.roxtec.com
⁶⁹⁴ QSA Global http://www.qsa-global.com
⁶⁹⁷ Urenco http://www.urenco.com/content/45/URENCO Deutschland-(Gronau).aspx
⁶⁹⁸ URS http://www.urscorp.eu
⁶⁹⁹ VENE http://www.vattenfall.de
⁷⁰⁰ Westinghouse Electric Germany GmbH http://www.westinghousenuclear.com/Businesses/nuclear_services/germany_english.shtml
INDUSTRY IN GERMANY

Nuclear Stakeholders per business in Germany [%]

Nuclear Stakeholders per business in Germany
GREECE

Although Greece does not have a nuclear power programme, some work is carried out in nuclear research. This is reflected in the higher educational opportunities available in the country.

The national authority that has the responsibility for nuclear safety and radiation protection issues is the Greek Atomic Energy Commission/ Ελληνική Επιτροπή Ατομικής Ενέργειας (GAEC).

EDUCATION

Higher education in Greece is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). The higher education offered in the nuclear field is limited and is concentrated in two major institutions: the Greek Atomic Energy Commission (GAEC) which offers an Inter-University Postgraduate Course in Medical and Radiation Physics ( Universities of Athens, Ioannina and Thrace); and the Institute of Nuclear Physics of the National Centre of Scientific Research “Demokritos”/ Εθνικό Κέντρο Ερευνών Φυσικών Επιστημών «Δημοκρίτος» which offers, in collaboration with its sister Institute of Materials Science and with the School of Applied Mathematics and Natural Science (ΣΕΜΦΕ) of the National Technical University of Athens/Εθνικό Μετσόβιο Πολυτεχνείο (NTUA/ΕΜΠ) a Master’s degree and a Doctorate in Nuclear and Particle Physics.

In addition, the University of Ioannina/Πανεπιστήμιο Ιωαννίνων offers a wide range of courses which includes: Applications in Nuclear Physics; Atomic Physics; Molecular Physics; Nuclear Physics I and II; and Plasma Physics. Finally, GAEC also offers a post-graduate educational course on Radiation Protection and the Safety of Radiation Sources.

In the field of nuclear technology, the NTUA/ΕΜΠ offers several courses which include: Nuclear Engineering I and II; Advanced Nuclear Engineering I and II; Experimental Nuclear Engineering; Biomedical Engineering; Mechanical Measurements; and Laboratory and Principles of Physics and Engineering Applications. The only institution involved in training for radiation protection is GAEC.

Nuclear research is carried out at: the Institute of Nuclear Technology - Radiation Protection; the Institute of Nuclear Physics; and the Institute of Radioisotopes & Radiodiagnostics Products of “Demokritos”. Furthermore, nuclear research is one of the objectives of several departments of the Aristotle University of Thessaloniki/Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης, the Institute of Geology & Mineral Exploration, the Department of Nuclear and Elementary Particle Physics of the National & Kapodistrian University of Athens/Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθήνων and the Nuclear Engineering Section of NTUA.

277 Institute of Nuclear Physics http://www.inp.demokritos.gr/
278 National Centre of Scientific Research Demokritos/Εθνικό Κέντρο Ερευνών Φυσικών Επιστημών Δημοκρίτος http://www.demokritos.gr/index_muk.asp
279 National Technical University of Athens (NTUA)/Εθνικό Μετσόβιο Πολυτεχνείο (ΕΜΠ) http://www.ntua.gr/ntua_en.html

Department of Electrical & Computer Engineering http://nestoras.ee.auth.gr/
Institute of Nuclear Technology - Radiation Protection http://ipta.demokritos.gr/
Institute of Nuclear Physics http://www.inp.demokritos.gr/
Institute of Radioisotopes & Radiodiagnostics Products http://www.rrp.demokritos.gr/
Aristotle University of Thessaloniki/Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης http://www.auth.gr/home/index_en.html
Dep. Of Nuclear and Elementary Particle Physics http://www2.phys.uoa.gr/html/TOMEAS_B/PirinikiIframesetAll.htm
National & Kapodistrian University of Athens/ Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθήνων http://en.uoa.gr
Finally, several departments of the University of Ioannina, such as, the High Energy Physics Laboratory\textsuperscript{718}, the Nuclear Physics Laboratory\textsuperscript{719}, the School of Medicine\textsuperscript{720} and the Section of Atomic and Molecular Physics, Nuclear Physics and High Energy Physics\textsuperscript{721} are involved in nuclear research.

The companies involved in the nuclear industry in Greece include: ABB Group\textsuperscript{722}, Allen & Overy LLP\textsuperscript{723}, Alstom\textsuperscript{724}, Atkins\textsuperscript{725}, Böhler Edelstahl\textsuperscript{726}, Bureau Veritas\textsuperscript{727}, Clyde & Co\textsuperscript{728}, Outo Kumpu\textsuperscript{729} and Roxtec\textsuperscript{730}.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{nuclear_degrees.png}
\caption{Number of Nuclear Degrees available in Greece}
\end{figure}

\textsuperscript{718} High Energy Physics Laboratory: https://alpha.physics.uoi.gr/
\textsuperscript{719} Nuclear Physics Laboratory: http://www.uoi.gr/physics.npl/research.html
\textsuperscript{720} School of Medicine: http://www.uoi.gr/en/medicine1.php
\textsuperscript{721} Section of Atomic and Molecular Physics, Nuclear Physics and High Energy Physics: https://alpha.physics.uoi.gr/SectionIII.html
\textsuperscript{722} ABB Group: http://www.abb.com/
\textsuperscript{724} Alstom: http://www.alstom.com/home
\textsuperscript{725} Atkins: http://www.atkinsglobal.com
\textsuperscript{726} Böhler Edelstahl: http://www.bohler-edelstahl.com
\textsuperscript{727} Bureau Veritas: http://www.bureauveritas.com/wps/wcm/connect/by_com/group
\textsuperscript{728} Clyde & Co: http://www.clydeco.com
\textsuperscript{729} Outo Kumpu: http://www.outokumpu.com
\textsuperscript{730} Roxtec: http://www.roxtec.com
INDUSTRY IN GREECE

Nuclear Stakeholders per business in Greece [%]

Nuclear Stakeholders per business in Greece
HUNGARY

Hungary has one nuclear power plant, Paks, with four VVER reactors which together produce about one third of the country's electrical power requirements.

In addition, a decision has been made to construct a facility for the storage of high level radioactive waste. The facility for low level waste is already in operation and the one for intermediate level waste is expected to be ready in 2012.

The regulatory body that is responsible for all nuclear facilities and all radioactive and nuclear materials is the Hungarian Atomic Energy Authority (HAEA)731.

Despite having a nuclear power programme, there are very few opportunities in Hungary at the higher educational level in the nuclear field.

EDUCATION

Higher education in Hungary is divided into three stages: Bachelor's, Master's and Doctorate degrees (as required by the Bologna Process). The only university in Hungary that offers a Bachelor's degree in the field of the nuclear energy is the Budapest University of Technology and Economics/Budapesti Műszaki és Gazdaságtudományi Egyetem (BUTE)732. Its Institute of Nuclear Techniques733 offers a Nuclear Specialization in the 5 years Engineering Physics Program734.

There is no university which offers a Master's degree in the nuclear field. However, the University of Debrecen/Debreceni Egyetem735 offers a Doctorate in its Nuclear Physics Programme736 (Atomic and molecular physics, Nuclear Physics, Solid State Physics, Interdisciplinary applications, Particle Physics). This university offers several courses which include: Quantum, Atomic and Nuclear Physics; Nuclear and Particle Physics; Health Protection and Radioecology; Nuclear Techniques; Atomic Energy; Experimental Nuclear Physics; and Measurement Methods in Nuclear and Particle Physics and Laboratory Practices.

Further, the Eötvös Loránd University/Eötvös Loránd Tudományegyetem737 has an Atomic and Molecular Physics Module and a Particle Physics Module within the Master's degree in Physics738.

The University of Pannonia Veszprém/Pannon Egyetem739 offers several courses: Basics of Radiation; Dosimetry; Decontamination; Laboratory practices; Lessons from the Nuclear and Radiation Accidents; Measuring Ambient Radiation; Nuclear Chemistry and Applications of Radioisotopes; Nuclear Metrology; Nuclear Energetic and its Environmental Impacts; Nuclear Emergency, Radiation Accident Management; Radiation Chemistry and Technology, Radioactive Tracer Methods; Radioactive Waste Disposal; Radioactive Waste Management; Radiochemical Calculations; Radioecology; Radiations and Radio-nuclides in Nature; and Uses of Radioisotopes.

The Institute of Nuclear Techniques offers a large number of courses which includes: Application of Nuclear Techniques; Electronics Laboratory; Environmental Radiation Protection; Environmental Protection; Experimental Nuclear Physics; Fundamentals of Nuclear Energy; Introduction to Data Evaluation; Introduction to Environmental Protection; Introduction to Geophysics; Materials of Nuclear Power Plants; Measurements and Diagnostics during Operation; Medical Imaging Systems; Monte Carlo Methods; Nuclear Disarmament - Physical, Technical and Political Aspects; Nuclear Energy Systems; Nuclear Electronics; Nuclear Measuring Methods; Nuclear Measuring Techniques; Nuclear and Neutron physics; Nuclear Power Plants; Nuclear Power Plant Operation; Nuclear Safety Radio-analytics; Radiation protection and legal control; Radioactive Waste; Radioactive Waste Management; Radiochemistry and Nuclear Chemistry; Reactor Physics; Reactor Technology; Reactor Physics for

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731 Hungarian Atomic Energy Authority http://www.hAEA.gov.hu/web/v2/portal.nsf/index_en
733 Institute of Nuclear Techniques/BME Nucleáris Technikai Intézet http://www.reak.bme.hu/en/home.html
734 Nuclear specialization in the 5 years Engineering Physics Program http://www.reak.bme.hu/en/education/academic_programs/nuclear_specialisation_in_the_5_years_engineering_physics_program.html
735 University of Debrecen/Debreceni Egyetem http://www.unideb.hu/portal/en
736 PhD Nuclear Physics Programme http://dragon.unideb.hu/~physphd
737 Eötvös Loránd University/Eötvos Loránd Tudományegyetem http://www.elte.hu/en
738 Master Degree in Physics http://phys.elte.hu/engedu/MSc_Programs_in_English.html
engineers; Special Laboratory for Atomic Energy; Sustainable Development and Nuclear Energy; and Thermo-hydraulics for Nuclear Power Plants.

Finally, the Budapest University of Technology and Economics/Budapesti Műszaki és Gazdaságtudományi Egyetem (BUTE) offers several nuclear related subjects within the Bachelor’s and Master’s degrees in both Physics and Energy Engineering. Regarding training, the possibilities include: the Institute of Nuclear Techniques (BUTE) offers a training course Continuing Education Program in Reactor Physics and Reactor Technology\(^\text{740}\); the Institute of Isotopes/Üdővédőkülj az MTA Izotópkutató Intézet Honlapján offers some lab practices for undergraduate students in chemistry and physics; and several departments of the KFKI Atomic Energy Research Institute/ KFKI Atomenergia Kutatóintézet and the Budapest University of Technology and Economics/Budapesti Műszaki és Gazdaságtudományi Egyetem have organized training courses.

Continuing with its work in the nuclear field, the Institute of Nuclear Techniques (BUTE) also specializes in research. The Hungarian Academy of Sciences/Magyar Tudományos Akadémia\(^\text{741}\) has several centers/institutes which carry out research in the nuclear field which includes: the Chemical Research Center/Kémiai Kutatóközpont\(^\text{742}\); the KFKI Atomic Energy Research Institute/KFKI Atomenergia Kutatóintézet\(^\text{743}\); the Institute of Isotopes/MTA Izotópkutató Intézet\(^\text{744}\); and the Institute of Nuclear Research/Atommagkutató Intézete\(^\text{745}\).

There are a number of other institutions that are involved in research which includes: the Frédéric Joliot Curie National Research Institute for Radiobiology and Radiohygiene/Országos Frédéric Joliot-Curie Sugáregészségügyi Kutató Intézet\(^\text{746}\); the Institute for Electric Power Research\(^\text{747}\); the Institute of Isotopes/Izotóp Intézet\(^\text{748}\); Bay Zoltan Foundation for Applied Research/Bay Zoltan Alkalmazott Kutatasi Közalapitvany (BZAKA)\(^\text{749}\);\n

\(^{741}\) Hungarian Academy of Sciences [http://www.mta.hu/index.php?id=406&type=0](http://www.mta.hu/index.php?id=406&type=0)

\(^{742}\) Chemical Research Center/Kémiai Kutatóközpont [http://www.chemres.hu/index.htm](http://www.chemres.hu/index.htm)

\(^{743}\) KFKI Atomic Energy Research Institute/KFKI Atomenergia Kutatóintézet [http://www.kfki.hu/~aekihp](http://www.kfki.hu/~aekihp)


\(^{745}\) Institute of Nuclear Research/Atommagkutató Intézete [http://www.atomki.hu/index_en.html](http://www.atomki.hu/index_en.html)


\(^{747}\) Institute for Electric Power Research [http://www.veiki.hu/index.htm](http://www.veiki.hu/index.htm)

\(^{748}\) Institute of Isotopes/Izotóp Intézet [http://www.izotop.hu/?page_id=4](http://www.izotop.hu/?page_id=4)

\(^{749}\) Bay Zoltan Foundation for Applied Research/Bay Zoltan Alkalmazott Kutatasi Közalapitany (BZAKA) [http://www.bzlogi.hu/bzaka/bzaka_angol.main.page](http://www.bzlogi.hu/bzaka/bzaka_angol.main.page)
and Power Engineering and Contractor Co./ETV-ERÓTERV Energetikai Tervező és Vállalkozó Zrt.750.

**STAKEHOLDERS**

The companies involved in the nuclear industry in Hungary include: ETV-ERÓTERV Co, the EVIG Engineering751, the Institute of Isotopes (in its market economy field), the KBF UNIO Bányászati Technológiai Fejlesztési Kft.752, Magyar Villamos Művek Zrt753 and Paks NPP have an important presence in the sector.

There are a number of international companies that have a presence in Hungary which includes: ABB Group754, Allen & Overy LLP755, Alstom756, Areva757, Atomstroyexport758, Böhler Edelstahl759, BT760, Bureau Veritas Group761, Clifford Change762, DLA Piper763, Gardiner & Theobald764, GE-Hitachi Nuclear Energy International765, Golder Associates766, Mott MacDonald768, Outo Kumpu762 and Roxtec770. Finally the Magyar Nukleáris Társaság/Hungarian Nuclear Society (MNT)771 is interested in the development of nuclear culture as part of the European Nuclear Society.

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751 EVIG Engineering http://www.evig-engineering.hu/index.us.html
752 KBF UNIO Bányászati Technológiai Fejlesztési Kft. http://www.kbfunio.hu
754 ABB Group http://www.abb.com
756 Alstom http://www.alstom.com/home
757 Areva http://www.areva.com
758 Atomstroyexport http://www.atomstroyexport.com
759 Böhler Edelstahl http://www.bohler-edelstahl.com
760 BT http://www.globalservices.bt.com/HomeAction.do
761 Bureau Veritas Group http://www.bureauveritas.com/wps/wcm/connect/bv_com/Group
762 Clifford Change http://www.cliffordchance.com/home.html
763 DLA Piper http://www.dlapiper.com/
764 Gardiner & Theobald http://www.gardiner.com
767 Mott MacDonald http://www.mottmac.hu
768 Outo Kumpu http://www.outokumpu.com
770 Roxtec http://www.roxtec.com
INDUSTRY IN HUNGARY

Nuclear Stakeholders per business in Hungary [%]

Nuclear Stakeholders per business in Hungary
IRELAND

Ireland does not have a nuclear power programme or any nuclear facilities.

The main nuclear authorities are the Radiological Protection Institute \(^{772}\) which is in charge of the nuclear and radiological matters and the National Emergency Plan for Nuclear Accidents (NEPNA) \(^{773}\) which coordinates the emergency response to a radioactive contamination in Ireland.

This lack of interest in nuclear power is reflected in higher level education where none of the institutions offer a degree or carries out research in the nuclear field.

Higher education in Ireland is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). There are a small number of courses offered in the nuclear field by the School of Physical Sciences \(^{774}\) of the Dublin City University \(^{775}\) (which includes Applied Spectroscopy, Laser Physics and Medical Applications and Medical Imaging Radiation Physics) and by the National University of Ireland (Maynooth) \(^{776}\) (which includes Radiation, Nuclear and Particle Physics).

Regarding nuclear research, four institutions are involved: the Centre for Laser Plasma Research \(^{777}\) of the School of Physical Sciences \(^{778}\) (Dublin City University); the Dublin Institute for Advanced Studies \(^{779}\); the National Centre for Plasma Science and Technology (NCPST) \(^{800}\) and the School of Physics \(^{801}\) of the University of Dublin/Trinity College Dublin \(^{802}\).

STAKEHOLDERS

There are a number of international companies that have a presence in Ireland which includes: ABB Group \(^{783}\), ARUP \(^{784}\), Alstom \(^{785}\), Assystem \(^{786}\), Atkins \(^{787}\), BT \(^{788}\), Camfil Farr \(^{789}\), Cyril Swett \(^{790}\), Davis Langdon \(^{791}\), Fluor Corporation \(^{792}\), Gardiner & Theobald \(^{793}\), Golder Associates \(^{794}\), Hyder Consulting \(^{795}\), M+W Group \(^{796}\), Mott MacDonald \(^{797}\), Outo Kumpu \(^{798}\), Roxtec \(^{799}\), RPS \(^{800}\) and URS \(^{801}\).

\(^{772}\) Radiological Protection Institute [http://www.rpi.ie](http://www.rpi.ie)
\(^{774}\) School of Physical Sciences [http://www.dcu.ie/physics/index.shtml](http://www.dcu.ie/physics/index.shtml)
\(^{775}\) Dublin City University [http://www.dcu.ie/index.shtml](http://www.dcu.ie/index.shtml)
\(^{776}\) National University of Ireland (Maynooth) [http://www.uwm.ie](http://www.uwm.ie)
\(^{778}\) School of Physical Sciences [http://www.dcu.ie/physics/index.shtml](http://www.dcu.ie/physics/index.shtml)
\(^{800}\) National Centre for Plasma Science and Technology (NCPST) [http://www.ncpst.ie](http://www.ncpst.ie)
\(^{801}\) School of Physics [http://www.tcd.ie/Physics](http://www.tcd.ie/Physics)
\(^{802}\) University of Dublin/Trinity College Dublin [http://www.tcd.ie](http://www.tcd.ie)

\(^{783}\) ABB Group [http://www.abb.com](http://www.abb.com)
\(^{784}\) ARUP [http://www.arup.com](http://www.arup.com)
\(^{785}\) Alstom [http://www.alstom.com/home](http://www.alstom.com/home)
\(^{787}\) Atkins [http://www.atkinsglobal.com](http://www.atkinsglobal.com)
\(^{789}\) Camfil Farr [http://www.camfilfarr.com/cou_camfil](http://www.camfilfarr.com/cou_camfil)
\(^{790}\) Cyril Swett [http://www.cyrilsweett.com/home](http://www.cyrilsweett.com/home)
\(^{791}\) Davis Langdon [http://www.davislangdon.com/Global](http://www.davislangdon.com/Global)
\(^{793}\) Gardiner & Theobald [http://www.gardiner.com](http://www.gardiner.com)
\(^{795}\) Hyder Consulting [http://www.hyderconsulting.com/EN/Pages/default.asp](http://www.hyderconsulting.com/EN/Pages/default.asp)
\(^{796}\) M+W Group [http://www.mwgroup.net](http://www.mwgroup.net)
\(^{797}\) Mott MacDonald [http://www.mottmac.ie](http://www.mottmac.ie)
\(^{798}\) Outo Kumpu [http://www.outokumpu.com](http://www.outokumpu.com)
\(^{799}\) Roxtec [http://www.roxtec.com](http://www.roxtec.com)
\(^{800}\) RPS [http://www.rpsgroup.com/getdoc/183bbe87-cd3a-5d79-a778-dacc0d4d676f/Ireland.aspx](http://www.rpsgroup.com/getdoc/183bbe87-cd3a-5d79-a778-dacc0d4d676f/Ireland.aspx)
\(^{801}\) URS [http://www.urscorp.eu](http://www.urscorp.eu)
INDUSTRY IN IRELAND

Nuclear Stakeholders per business in Ireland [%]

Nuclear Stakeholders per business in Ireland
ITALY

Following the Chernobyl accident, nuclear power was phased-out in Italy and the last nuclear power plant was closed in 1990. Following moves by the Italian government to relaunch a nuclear programme including the establishment of a joint venture development company between EDF and ENEL, a referendum was held this summer whose outcome means that there shall be no nuclear developments in Italy for the medium term.

The regulatory body is the Nuclear Safety Agency/Agenzia per la Sicurezza Nucleare. The responsibility for decommissions of old facilities and waste management is with Management Company for Nuclear Installations/Societé Gestione Impianti Nucleari (SOGIN)802 which has the responsibility for the development of a final surface repository.

Although Italy has not produced nuclear power for almost two decades, the higher educational institutions have continued to offer opportunities in the nuclear field so that nuclear education is still important and indeed Italy ranks among the top three providers of nuclear engineering graduates in Europe.

Higher education in Italy is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). At the Bachelor’s degree level there are a number of courses offered in the nuclear field which include:

- the University of Pisa/Università di Pisa803 offers a degree in Nuclear and Safety Engineering804;
- the Technical University of Turin/Politecnico di Torino805 offers a degree in Energy Engineering with a special interest in the Nuclear and Safety Engineering806;
- the University of Palermo/Università degli Studi di Palermo807 offers a degree in Energy Engineering808 and the Specialist degree in Engineering and Safety of Nuclear Technologies809;
- the University of Roma/Sapienza Università di Roma810 offers a degree in Energy Engineering811; and
- the University of Bologna/Università di Bologna812 has the possibility of a nuclear specialization as part of the degree in Energy Engineering813.

Additionally, there is the possibility of specialization in the last year of a degree. In this way, the Milan Polytechnic/Politecnico di Milano offers a third year specialisation in Nuclear Engineering814 within the Energy Engineering degree.

At the Master’s degree level there is a wider range of possibilities as follows:

- the Milan Polytechnic/Politecnico di Milano815 offers a degree in Nuclear Engineering816;

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802 Management Nuclear Systems Society/Societé Gestione Impianti Nucleari (SOGIN) [http://www.sogin.it/Pagine/default.aspx]
803 University of Pisa/Università di Pisa [http://www.unipi.it/english/index.htm]
804 Nuclear and Safety Engineering Bachelor/Ingegneria Nucleare e della Sicurezza [http://www.unipi.it/corsilaurea/corsi/dett_corso_165.html][http://coordinamento.ing.unipi.it/]
805 Torino Polytechnic/Politecnico di Torino [http://www.polito.it/index.en.php]
806 Nuclear and Safety Engineering Bachelor/Ingegneria Nucleare e della Sicurezza [http://www.unipi.it/corsilaurea/corsi/dett_corso_165.html][https://coordinamento.ing.unipi.it/]
807 University of Palermo/Università degli Studi di Palermo [http://portale.unipa.it/]
808 Bachelor's Degree in Energy Engineering [http://portale.unipa.it/amministrazione/areaserviziarete/secreteriastudenti/home/corsi/laucrea_triennali.htm]
809 Specialist Bachelor Degree in Engineering and Safety of Nuclear Technologies/Laurea Specialistica in Ingegneria della Sicurezza e delle Tecnologie Nucleari [http://din.din.unipa.it/Didattica/Didattica.htm]
810 University of Roma/Sapienza Università di Roma [http://www.uniroma1.it/default_e.php]
811 Energy Engineering Bachelor Degree [http://servizi.uniroma1.it/corsilaurea/schedaCorso.do?event=setqCurrentRowWithKeyVal&rowKeyStr=14476&event=Apri]
812 University of Bologna/Università di Bologna [http://www.eng.unibo.it/PortaleEn/Academic+programmes/Courses/Engineering/1stDegree/2010/CoursePage20100924.htm]
813 Energy Engineering Bachelor [http://www.eng.unibo.it/PortaleEn/Academic+programmes/Courses/Engineering/1stDegree/2005/CoursePage20050057.htm]
815 Milan Polytechnic/Politecnico di Milano [http://www.english.polimi.it/english/frame/main.php?id_nav=8]
816 Master of Science in Nuclear Engineering [http://www. cesnef.polimi.it/master_science.php]
the University of Bologna/Università di Bologna offers degrees in Nuclear and Sub-nuclear Physics\(^8\) and Energy and Nuclear Engineering\(^8\); 

the University of Palermo/Università degli Studi di Palermo offers a degree in Nuclear and Energy Engineering\(^8\) and participates in the European Master’s degree in Nuclear Engineering\(^8\); and

the University of Pisa/Università di Pisa offers degrees in Technology of Nuclear Installations/ Tecnologie degli impianti nucleari\(^8\) and Nuclear Safety and Security\(^8\), and a Master’s diploma or degree in Nuclear Engineering and Safety\(^8\).

There is also the possibility of a final year specialization for a Master’s degree. The University of Turin/Università di Torino\(^8\) offers a degree in Nuclear and Sub-nuclear Physics /Laurea Magistrale in Fisica, Percorso Fisica nucleare e subnucleare. The University of Rome/Sapienza Università di Roma offers a degree in Energy Engineering\(^8\).

At the Doctorate level, there are the following possibilities: the University of Rome/Sapienza Università di Roma offers a PhD in the nuclear field\(^8\); the University of Palermo/Università degli Studi di Palermo offers a degree in Engineering of Innovative Nuclear Reactors and Fusion\(^8\); Milan Polytechnic offers a degree in Energy and Nuclear Science and Technology\(^8\) which is sponsored by the Department of Energy\(^8\); the University of Bologna/Università di Bologna offers a degree in Nuclear and Sub-nuclear Physics\(^8\); the University of Pisa offers the Nuclear and Industrial Safety/ Sicurezza nucleare ed industriale\(^8\); and Technical University of Turin/Politecnico di Torino offers the possibility of doing a thesis in the nuclear field as part of the PhD in Energy.

The courses in the nuclear field offered by universities include the following: the University of Bologna/Università di Bologna\(^8\) offers a course on Experimental Nuclear and Sub-nuclear Physic; the University of Rome/Sapienza Università di Roma offers courses on Nuclear Physics/Fisica Nucleare\(^8\) and Nuclear and Sub-nuclear Physics/Fisica nucleare e sub-nucleare; the University of Turin/Università di Torino\(^8\) offers courses in Physics of Fundamental Interactions/ Fisica delle Interazioni Fondamentali\(^8\); Plasma Physics and Introduction to nuclear and sub-nuclear physics.
The Management Company for Nuclear Installations/ Società Gestione Impianti Nucleari (SOGIN) offers a training course in Radioprotection in the Radioprotection School/Scuola di Radioprotezione.

Research in the nuclear field is carried out at a number of institutions which includes: the Italian National Agency for New Technologies, Energy and Sustainable Economic Development/Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA) which carries out a large number of activities; the Nuclear Engineering Division of the Milan Polytechnic; the Physics Department of the University of Bologna/Università di Bologna; the Nuclear Engineering Department of the University of Palermo/Università degli Studi di Palermo; the Department of Mechanical, Nuclear and Production Engineering of the University of Pisa/Università di Pisa; the National Institute of Nuclear Physics; the Energy Department and the Physics Department of the University of Roma/Università di Roma; and the Experimental Physics Department of the University of Torino.

In addition, the National Institute of Nuclear Physics/Istituto Nazionale di Fisica Nucleare (INFN) and the National Research Council/Consiglio Nazionale delle Ricerche (CNR) are improving research activities in the nuclear sector.

Finally the Interuniversity National Nuclear Technology Research Association/Consorzio Interuniversitario Nazionale per la Ricerca Tecnologica Nucleare (CIR TEN) represents the Italian network institution for education and research in the nuclear field. Another association involved in the nuclear field is the Italian Nuclear Association/Associazione Italiana Nucleare (AIN).

STAKEHOLDERS

The main Italian companies involved in the nuclear field include: Ansaldo Nucleare, Camozzi Group, Comecer, Edison, ENEL (SOGIN subsidiary of ENEL for the nuclear activities), BM Hudson Italia, I ter, Mesit, MITSafetrans,
Nuclear curricula in ITALY

Nucleco¹⁶², SRS Group¹⁶³, STF¹⁶⁴ and Tecnoplan¹⁶⁴. The international companies that have presence in Italy include: EDF as EDF-Italy¹⁶⁶, ABB Group (Int)¹⁶⁶, Allen & Overy LLP¹⁶⁸, Areva¹⁷⁰, ARUP¹⁷¹, Ashurst¹⁷², Asltom¹⁷³, Böhler Edelstahl¹⁷⁴, BT¹⁷⁵, Bureau Veritas¹⁷⁶, Camfil Farr¹⁷⁷, Clifford Change¹⁷⁸, DLA Piper¹⁷⁹, Freshfields Bruckhaus Deringer¹⁸⁰, Gardiner & Theobald¹⁸¹, GE-Hitachi Nuclear Energy International¹⁸², GERB¹⁸³, Golder Associates¹⁸⁴, Hammonds¹⁸⁵, M+W Group¹⁸⁶, Morson Projects¹⁸⁷, Osborne Clarke International¹⁸⁸, Pöyry¹⁸⁹, Roxtec¹⁹⁰ and URS¹⁹¹.

¹⁶² Nucleco http://www.nucleco.it/Pagine/default.asp
¹⁶³ SRS Group http://www.srs.it
¹⁶⁴ STF http://www.stf.it/index.htm
¹⁶⁵ Tecnoplan http://www.tecnoplan.it
¹⁶⁶ EDF-Italy http://italy.edf.com/edf-italy-47426.htm
¹⁶⁷ ABB Group (Int) http://www.abb.com
¹⁶⁹ Amec http://www.amec.com
¹⁷⁰ Areva http://www.areva.com
¹⁷¹ ARUP http://www.arup.com
¹⁷³ Asltom http://www.alstom.com/home
¹⁷⁴ Böhler Edelstahl http://www.bohler-edelstahl.com
¹⁷⁵ BT http://www.globalservices.bt.com/HomeAction.do
¹⁷⁶ Bureau Veritas Group http://www.bureauveritas.com/wps/wcm/connect/bv_com/Group
¹⁷⁷ Camfil Farr http://www.camfilfarr.com/cou_camfil
¹⁷⁸ Clifford Change http://www.cliffordchange.com/home.htm
¹⁷⁹ DLA Piper http://www.dlapiper.com
¹⁸⁰ Freshfields Bruckhaus Deringer http://www.freshfields.com
¹⁸¹ Gardiner & Theobald http://www.gardiner.com
¹⁸³ GERB http://www.gerb.com/index_en.php
¹⁸⁵ Hammonds http://www.hammonds.com
¹⁸⁶ M+W Group http://www.mwgroup.net
¹⁸⁷ Morson Projects http://www.morson-projects.co.uk
¹⁸⁸ Osborne Clarke International http://www.osborneclarke.com
¹⁸⁹ Pöyry http://www.poyry.com
¹⁹⁰ Roxtec http://www.roxtc.com
¹⁹¹ URS http://www.urscorp.eu
INDUSTRY IN ITALY

Nuclear Stakeholders per business in Italy [%]

Nuclear Stakeholders per business in Italy
LATVIA

Latvia does not have a nuclear power programme of its own but was dependent on electricity imports from Lithuania so that it has been affected by Lithuania’s decision to close the Ignalina nuclear power plant in December 2009. As a result of this, the national energy company Latvenergo has received a mandate from the Government to work on preparations for a new Ignalina nuclear power plant together with other energy companies from the Baltic countries.

Latvia does not have a nuclear regulatory body. The responsibility for nuclear matters is with the Latvian Environment, Geology and Meteorology Agency (EGMA)892.

The lack of a nuclear power programme is reflected in the higher educational opportunities available in the nuclear field.

EDUCATION

Higher education in Latvia is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). Despite the recent interest in nuclear power, none of the Latvian universities offers a degree in the nuclear field. However, the Riga Technical University/Rigas Tehniska Universitāte893 offers two courses: Molecular Spectroscopy894 and Nuclear Magnetic Resonance Spectroscopy.

Although there is a lack of possibilities in higher education in the nuclear field, there are a number institutions involved in research which includes: the Latvian Academy of Sciences/Latvijas Zinatnu Akadēmija895; the Laboratory of Theoretical Physics/Fizikas Institūts899; the Institute of Atomic Physics and Spectroscopy/Atomfizikas un Spektroskopijas Institūts999; the Institute of Solid State Physics/Cietvielu Fizikas Institūts901 (particularly the Laboratory of Nuclear Reactions and the Laboratory of Applied Nuclear Physics).

Finally, the Latvian Academy of Sciences/Latvijas Zinatu Akadēmija is the most important organisation involved in the improvement of activities in the nuclear field.

STAKEHOLDERS

The companies involved in the nuclear industry in Latvia include the following three: ABB Group902, Outo Kumpu903 and Bureau Veritas Group904.

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892 Latvian Environment, Geology and Meteorology Agency (EGMA) http://www.meteo.lv/public/26902.html
893 Riga Technical University/ Rigas Tehniska Universitāte http://www.rtu.lv/component/option_com_newsboxTask_view/id_1074/lang_en
894 Molecular Spectroscopy http://www.ktf.rtu.lv/mzlkfzn/index.htm
896 Laboratory of Theoretical Physics http://ipul.lv/main
897 University of Latvia/Latvijas Universitāte http://www.lu.lv/eng
898 Laser Centre http://www.lasercentre.lv
900 Institute of Solid State Physics/Cietvielu Fizikas Institūts http://www.cfi.lv/
902 Institute of Physics/Fizikas Institūts http://ipul.lv/main
903 Institute of Solid State Physics/Cietvielu Fizikas Institūts http://www.cfi.lv/
904 ABB Group http://www.abb.com
905 Outo Kumpu http://www.outokumpu.com
906 Bureau Veritas Group http://www.bureauveritas.com
INDUSTRY IN LATVIA

Nuclear Stakeholders per business in Latvia [%]

Nuclear Stakeholders per business in Latvia
LITHUANIA

Lithuania had one nuclear power plant, Ignalina, with two RBMK reactors which generated about two thirds of the country’s electricity requirements. This started commercial operation in 1983 but the first unit on the site was closed down in December 2004 and the second one in December 2009. Currently, the government has decided to build a new nuclear power plant on this site in collaboration with other Baltic countries - referred to as the Visaginas project.

The main Lithuanian nuclear authority is the State Nuclear Power Safety Inspectorate/Valstybine Atomines Energetikos Saugos Inspekcija (VATESI) which has the remit to ensure nuclear safety. Other nuclear institutions are the Radiation Protection Center/Radiacines Saugos Centras and the Radioactive Waste Management Agency/Vl Radioaktyviuju Atlieku Tvarkymo Agentura which was established in 2001 for the management and final disposal of all radioactive waste.

The higher educational institutions in the country offer a small number of possibilities for degrees in the nuclear field.

EDUCATION

Higher education in Lithuania is divided into three stages (as required by the Bologna Process) as follows: the Bachelor’s degree (to gain a theoretical basis in a particular subject), the Master’s degree or special vocational training programmes (to prepare a student for independent scientific work) and the Doctorate degree (for scientists who will specialise in a particular field).

Regarding the first stage, there are two institutions that offer Bachelor’s degrees: Kaunas University of Technology/Kauno Technologijos Universitetas which offers a degree in Nuclear Energy (Bachelor of Power Engineering); and the University of Vilnius /Vilniaus Universitetas which offers a degree in Physics of Nuclear Energetics.

The only university offering a Master’s degree in the nuclear field is Kaunas University of Technology/ Kauno Technologijos Universitetas which offers a degree in Power Engineering. This university also offers the possibility to do a Doctorate degree in the Thermal Engineering Department.

Recently, the Lithuanian Energy Institute (LEI) along with other Technical Support Organisations (TSOs) has created the European Nuclear Safety Training and Tutoring Institute (ENSTTI) which offers several training courses.

Although there is not a wide choice of courses in the nuclear field, there are research activities being carried out at the following institutions: the Lithuanian Energy Institute/Lietuvos Energetikos Institutas with its nuclear departments (Laboratory of Nuclear Engineering, Laboratory of Nuclear Installation Safety and the Lithuanian International Nuclear Safety Center); the Radiation Protection Center/Radiacines Saugos Centras; and the universities, Kaunas University of Technology/ Kauno Technologijos Universitetas in particularly its Department of Thermal and Nuclear Energy, the Institute of Physics of the Lithuanian Academy of Sciences/Lietuvos Mokslu Akademija and the Vilnius University/Vilniaus Universitetas.

906 Radiation Protection Center/Radiacines Saugos Centras http://www.rsc.lt/index.php?pageid=96
908 Kaunas University of Technology/Kauno Technologijos Universitetas http://en.ktu.lt
909 Vilnius University/Vilniaus Universitetas http://www.vu.lt/en/
911 The European Nuclear Safety Training and Tutoring institute (ENSTTI) is a joint initiative of French Institute for Radiological Protection and Nuclear Safety/Institut de Radioprotection et de Sûreté Nucléaire (IRSN), Germany’s Company for Plants and Reactor Safety/Gesellschaft für Anlagen-und Reaktorsicherheit (GRS), Lithuanian Energy Institute (LEI) and Czech Nuclear Research Institute Rez/Ústav Jaderného Výzkumu Rez a.s. (UJV) http://www.enstti.eu/Pages/Home.aspx
913 Laboratory of Nuclear Engineering http://www.lei.lt/main.php?m=261&k=9
914 Laboratory of Nuclear Installation Safety http://www.lei.lt/main.php?m=265&k=9
916 Department of Thermal and Nuclear Energy http://en.ktu.lt/content/department/thermal-and-nuclear-energy
918 Research http://www.vu.lt/en/research
Finally, the Lithuanian Nuclear Energetics Association/Lietuvos Branduolines Energetikos Asociacija has a special interest in the consolidation of nuclear knowledge919.

**STAKEHOLDERS**

The companies in Lithuania involved in the nuclear industry include: Ignalina NPP920 and Visaginas NPP921, under the umbrella of the Lietuvos Energija AB922. The Rytu skirstomieji tinklai923, the UAB Kauno Energetikos Remontas924 and the UAB Visagino Atominė Elektrine925 is as well involved in the nuclear business.

The international companies that have a presence in Lithuania include: ABB Group926, Areva927 and Bureau Veritas Group928, Outo Kumpu929 and Roxtec930.

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920 Ignalina NPP [http://www.iae.lt/default_m.asp?lang=1&subsub=1000](http://www.iae.lt/default_m.asp?lang=1&subsub=1000)


922 Lietuvos Energija AB [http://www.le.lt/en](http://www.le.lt/en)

923 Rytu skirstomieji tinklai [http://www.rst.lt/](http://www.rst.lt/)

924 UAB Kauno Energetikos Remontas [http://www.ker.lt/](http://www.ker.lt/)

925 UAB Visagino Atominė Elektrine [http://www.vae.lt](http://www.vae.lt)

926 ABB Group [http://www.abb.com](http://www.abb.com)

927 Areva [http://www.areva.com](http://www.areva.com)

928 Bureau Veritas Group [http://www.bureauveritas.com](http://www.bureauveritas.com)

929 Outo Kumpu [http://www.outokumpu.com](http://www.outokumpu.com)

930 Roxtec [http://www.roxtec.com](http://www.roxtec.com)
INDUSTRY IN LITHUANIA

Nuclear Stakeholders per business in Lithuania [%]

Nuclear Stakeholders per business in Lithuania
LUXEMBOURG

Traditionally Luxembourg has had a non-nuclear policy and does not have a nuclear power programme. However, it does have a public body in charge of nuclear matters, the Division de Radioprotection/Radionprotection Department of the Ministry of Health/Ministère de la Santé which assumes the major responsibility for nuclear matters in collaboration with other government departments such as the Work and Mines Inspection Department/Inspection du Travail et des Mines.

The non-nuclear policy in Luxembourg means that none of the higher educational institutions in the country offer degrees in the nuclear field.

EDUCATION

Higher education in Luxembourg is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). There is no degree in the nuclear field and only the University of Luxembourg/Université de Luxembourg offers one course, Atomic and Nuclear Physics.

The Radiation Physics Laboratory and the Research Unit in Engineering Science of the University of Luxembourg/Université de Luxembourg are involved in the nuclear research field.

Finally Luxembourg belongs to the Belgium Netherlands Luxembourg Nuclear Receptor society (BNL-NR) an association which tries to coordinate all Nuclear Receptor researches within the Benelux countries.

STAKEHOLDERS

There are a number of companies involved in the nuclear industry in Luxembourg include: ABB Group, Allen & Overy LLP, BT, Bureau Veritas Group, Clifford Change, Equip Fluides, Finauxa, Gradel and Luxenergie.

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934 Radiation Physics Laboratory [http://wwwen.uni.lu/research/fstc/physics_and_material_research_unit/radiation_physics]
935 Research Unit in Engineering Science [http://wwwen.uni.lu/research/fstc/research_unit_in_engineering_science]
936 Belgium Netherlands Luxembourg Nuclear Receptor society (BNL-NR) [http://nrbenelux.n3t.nl]
937 ABB Group [http://www.abb.com]
941 Clifford Change [http://www.cliffordchance.com/home.htm]
942 Equip Fluides [http://www.equip-fluides.com/?wpid=3942]
INDUSTRY IN LUXEMBOURG

Nuclear Stakeholders per business in Luxembourg [%]

Nuclear Stakeholders per business in Luxembourg
MALTA

Malta does not have a nuclear power programme and has no plans to develop nuclear power in the future. This is reflected in the lack of opportunities in the nuclear field at the higher educational level.

EDUCATION

Higher education in Malta is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). There are no degrees available in the nuclear field. Only the University of Malta/L-Universitàta’ ta’ Malta offers Bachelor’s and Master’s degrees in Radiography.

Regarding courses, the Malta Institute for Medical Education (M.I.M.E.) offers a Nuclear Medicine course and the University of Malta/L-Universitàta’ ta’ Malta offers an Atomic Physics course.

Additionally, the University of Malta/L-Universitàta’ ta’ Malta is the only institution involved in nuclear research, particularly the Institute for Energy Technology.

Number of Nuclear Degrees available in Malta

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945 University of Malta/L-Universitàta’ ta’ Malta [http://www.um.edu.mt/](http://www.um.edu.mt/)

946 University of Malta/L-Universitàta’ ta’ Malta [http://www.um.edu.mt/](http://www.um.edu.mt/)


948 Research [http://www.um.edu.mt/about/research/faculties/science](http://www.um.edu.mt/about/research/faculties/science)
THE NETHERLANDS

The Netherlands has one operating nuclear power plant, the PWR at Borssele which will be allowed to operate until 2034. There is also an older plant, the BWR at Dodewaard, which was a test reactor that was closed down in 1997. The government is currently giving consideration to building a second unit on the Borssele site. There is also the High Flux Reactor (HFR) at Petten which is operated by the Netherlands Energy Research Foundation Nuclear Research and consultancy Group (NRG)\textsuperscript{949}.

The regulatory body is the Ministry of Housing, Spatial Planning and the Environment/Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (VROM)\textsuperscript{950}.

Despite having a relatively long involvement with nuclear power, there are few opportunities available in the nuclear field at the higher educational level.

Higher education in the Netherlands is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). Currently there is no high educational institution offering a Bachelor’s degree in the nuclear field. However, the Delft University of Technology/Technische Universiteit Delft\textsuperscript{951} offers two Master’s degrees: Chemical Engineering\textsuperscript{952} or Applied Physics\textsuperscript{953} with Specialisation in Nuclear Science and Engineering.

The Eindhoven University of Technology/Technische Universiteit Eindhoven\textsuperscript{954} offers the following possibilities of a specialization: Science and Technology of Nuclear Fusion\textsuperscript{955}; and Science in Applied Physics/Specialization Plasma Physics & Radiation Technology\textsuperscript{956}.

Regarding Doctorate degrees, the Radiation Radionuclides Reactors Department\textsuperscript{957} of the Delft University of Technology/Technische Universiteit Delft offers the possibility of choosing the nuclear field as a research area\textsuperscript{958}. The University of Groningen/Rijksuniversiteit Groningen especially through its Kernfysisch Versneller Instituut (KVI)\textsuperscript{959} is involved in the nuclear field.

The offer of courses in the nuclear field is quite broad and involves several universities which includes:

- the Delft University of Technology/Technische Universiteit Delft which offers courses in: Nuclear Reactor Physics, Nuclear Reactor Physics Special Topics\textsuperscript{961}, Nuclear Science, Nuclear Chemistry\textsuperscript{962} and Chemistry of the Nuclear Fuel Cycle\textsuperscript{963};

- the Eindhoven University of Technology/Technische Universiteit Eindhoven which offers courses in Advanced Control for Fusion Plasmas, Control and operations of Tokamaks, Fusion on the back of a envelope, Heating and Diagnosing fusion reactors, Magnetic confinement in fusion reactors, Plasma Wall Interaction in fusion reactors, Qualified Expert Level 5A/B, Radiation Safety and Dosimetry for Medical Physicists and Routes to fusion power;

949 Nuclear Research and Consultancy Group/NRG http://www.nrg.eu/indexen.html
950 VROM, Department of Nuclear Safety, Security and Safeguards (Kernfysische Dienst) http://international.vrom.nl
951 Delft University of Technology/Technische Universiteit Delft http://www.tudelft.nl/live/pagina.jsp?id=cd320c39-3af7-4c7e-816e-1119831fa80d
952 MSc Programme in Chemical Engineering: Specialisation Nuclear Science and Engineering http://www.msc.tudelft.nl/live/pagina.jsp?id=60f64af8-bf22-4f6f-96e9-c16c7e8d8024&lang=en
954 Eindhoven University of Technology/Technische Universiteit Eindhoven http://w3.tue.nl/en
955 Science and Technology of Nuclear Fusion Department http://www.fys.tue.nl/fusion
957 Radiation Radionuclides Reactors Department http://www.tudelft.nl/live/pagina.jsp?id=7d9889c0f9b69709-b5e1-c5b04dbf54a6&lang=en
958 PhD Research http://www.tudelft.nl/live/pagina.jsp?id=47e19a84f587a-4a66-aa0f-8436d8073679&lang=en
959 Kernfysisch Versneller Instituut (KVI) http://www.rug.nl/kvi/index
960 Nuclear Reactor Physics Special Topics http://www.msc.tudelft.nl/live/pagina.jsp?id=21a302ca-306f-49e5-8a77-b8aa8a78a86&lang=en
961 Nuclear Chemistry http://www.tnw.tudelft.nl/live/pagina.jsp?id=6248b6843f69f-4550-a80b-6c0a1b1dd75f&lang=en
962 Chemistry of the Nuclear Fuel Cycle http://www.fys.tue.nl/live/pagina.jsp?id=b9e6f6a484-f325-4558-a816-d304326d8c14&lang=en
Nuclear curricula in NETHERLANDS

![Number of Nuclear Degrees available in the Netherlands](chart)

The University of Groningen/Rijksuniversiteit Groningen\textsuperscript{963} with a course in Kern van procestechnologie\textsuperscript{964}; and

- the Nuclear Research and Consultancy Group\textsuperscript{965} which has courses in Advanced and Innovative Reactor Systems, Current LWR Technology, Introduction to Nuclear Power, Nuclear Fuel Cycle and Nuclear Technology.

An important training activity in the nuclear field is performed by the Eindhoven University of Technology/Technische Universiteit Eindhoven, especially in Radiation protection and dosimetry\textsuperscript{966}, by the Nuclear Nederland\textsuperscript{967} and by the Nuclear Research and Consultancy Group (NRG) (see training\textsuperscript{968} activities).

In the research field work is carried out at the following institutions:

- the Delft University of Technology/Technische Universiteit Delft particularly in Radiation Radionuclides Reactors\textsuperscript{969};
- the Eindhoven University of Technology/Technische Universiteit Eindhoven in Coherence and Quantum Technology, Plasma and Materials Processing and Science and Technology of Nuclear Fusion\textsuperscript{970};
- the EC’s JRC-Institute for Energy\textsuperscript{971};
- the Nuclear Research and Consultancy Group (NRG);
- the Foundation for Fundamental Research on Matter (FOM)\textsuperscript{972}; and
- the University of Groningen/Rijksuniversiteit Groningen especially by its Kernfysisch Versneller Instituut (KVI)\textsuperscript{973}.

Finally the Fantom\textsuperscript{974} international Research School for Fundamental and Applied Nuclear and Atomic Physics, with participants from institutions from the

\textsuperscript{963} University of Groningen/Rijksuniversiteit Groningen \url{http://www.rug.nl/corporate/index}
\textsuperscript{964} Kern van procestechnologie \url{http://www.rug.nl/ec/onderwijs/collegeRoosters/vakken/TBPT05E}
\textsuperscript{965} Nuclear Research and Consultancy Group \url{http://www.nrg.eu/indexnl.html}
\textsuperscript{966} Radiation Protection and Dosimetry \url{http://w3.tue.nl/en/services/daz/amvs/sbd/training_instruction_and_education/#c12508}
\textsuperscript{967} Nuclear Nederland \url{http://www.nucleairnederland.nl/}
\textsuperscript{968} Training \url{http://www.nrg.eu/product/edu/index.htm}
\textsuperscript{969} Radiation Radionuclides Reactors \url{http://www.tudelft.nl/live/pagina.jsp?id=70f28057-de88-4790-83dc55b04db54a46&lang=en}
\textsuperscript{970} Science and Technology of Nuclear Fusion \url{http://www.phys.tue.nl/fusion/}
\textsuperscript{971} JRC-Institute for Energy \url{http://ie.jrc.ec.europa.eu/}
\textsuperscript{972} Foundation for Fundamental Research on Matter (FOM) \url{http://www.fom.nl/live/english/home.psd}
\textsuperscript{973} Kernfysisch Versneller Instituut (KVI) \url{http://www.rug.nl/kvi/index}
\textsuperscript{974} Fantom \url{http://www.rug.nl/kvi/research/fantomresearchschool/index}
Netherlands (Groningen), Belgium (Gent, Leuven), Germany (Münster) and France (Orsay/Paris) has the University of Groningen as its principal co-ordinator.

The Netherlands Nuclear Society (NNS)\textsuperscript{975} has a big interest in improving the nuclear high education as well as Kivi Niria\textsuperscript{976} and the Dutch Knowledge Infrastructure on Nuclear Technology (KINT)\textsuperscript{977}.

**STAKEHOLDERS**

The main companies involved in the nuclear business in The Netherlands include: Centrale Organisatie Voor Radioactief Afval (COVRA)\textsuperscript{978}, Energy Research Centre of the Netherlands (ECN), Essent\textsuperscript{979}, EPZ\textsuperscript{980}, KEMA\textsuperscript{981}, NRG and RTD\textsuperscript{982}.

The international companies that have a presence in The Netherlands include: ABB Group\textsuperscript{983}, Aker Solutions\textsuperscript{984}, Allen & Overy LLP\textsuperscript{985}, Alstom\textsuperscript{986}, Areva\textsuperscript{987}, ARUP\textsuperscript{988}, Atkins\textsuperscript{989}, Böhler Edelstahl\textsuperscript{990}, BT\textsuperscript{991}, Bureau Veritas Group\textsuperscript{992}, Camfil Farr\textsuperscript{993}, Clifford Change\textsuperscript{994}, DLA Piper\textsuperscript{995}, Fluor Corporation\textsuperscript{996}, Freshfields Bruckhaus Deringer\textsuperscript{997}, Gardiner & Theobald\textsuperscript{998}, M+W Group\textsuperscript{999}, MWH\textsuperscript{1000}, Mott MacDonald\textsuperscript{1001}, Osborne Clarke International\textsuperscript{1002}, Oxand\textsuperscript{1003}, Roxtec\textsuperscript{1004}, RPS\textsuperscript{1005}, Tesella\textsuperscript{1006}, Urenco\textsuperscript{1007} and URS\textsuperscript{1008}.

\textsuperscript{975} Netherlands Nuclear Society (NNS) http://www. kerntechniek.nl/index.en.html

\textsuperscript{976} Kivi Niria http://www.kiviniria.net/CM/PAG000002092/ english.html

\textsuperscript{977} Dutch Knowledge Infrastructure on Nuclear Technology (KINT) http://www.kint.nl

\textsuperscript{978} Centrale Organisatie Voor Radioactief Afval (COVRA) http://www.covra.nl/to24xj68/index.html

\textsuperscript{979} Essent http://www.essent.eu/content/about_essent/index.html

\textsuperscript{980} EPZ http://www.epz.nl/content.asp

\textsuperscript{981} KEMA http://www.kema.com/about/profile.asp

\textsuperscript{982} RTD Roentgen Technische Dienst http://www.rtd-group.com

\textsuperscript{983} ABB Group http://www.abb.com

\textsuperscript{984} Aker Solutions http://www.akersolutions.com/internet/default.htm

\textsuperscript{985} Allen & Overy LLP http://www.allenovery.com/AOWeb Home/AllenOveryHome.aspx?refIangID=41

\textsuperscript{986} Alstom http://www.alstom.com/home

\textsuperscript{987} Areva http://www.areva.com

\textsuperscript{988} ARUP http://www.arup.com

\textsuperscript{989} Atkins http://www.atkinsglobal.com

\textsuperscript{990} Böhler Edelstahl http://www.bohier-edelstahl.com

\textsuperscript{991} BT http://www.globalservices.bt.com/HomeAction.do

\textsuperscript{992} Bureau Veritas Group http://www.bureauveritas.com rps/wcm/connect/bv_com/Group

\textsuperscript{993} Camfil Farr http://www.camfilfarr.com/cou_camfil

\textsuperscript{994} Clifford Change http://www.cliffordchange.com/home.htm

\textsuperscript{995} DLA Piper http://www.dlapiper.com

\textsuperscript{996} Fluor Corporation http://www.fluor.com/netherlands Pages/default.aspx

\textsuperscript{997} Freshfields Bruckhaus Deringer http://www.freshfields.com

\textsuperscript{998} Gardiner & Theobald http://www.gardiner.com

\textsuperscript{999} M+W Group http://www.mwgroup.net

\textsuperscript{1000} MWH http://www.mwhglobal.com

\textsuperscript{1001} Mott MacDonald http://www.mottmac.nl

\textsuperscript{1002} Osborne Clarke International http://www.osborneclarke.com

\textsuperscript{1003} Outo Kumpu http://www.outokumpu.com

\textsuperscript{1004} Oxand http://www.oxand.com

\textsuperscript{1005} Roxtec http://www.roxtec.com

\textsuperscript{1006} RPS http://www.rps.nl/index.aspx?ID=

\textsuperscript{1007} Tesella http://www.tessella.com

\textsuperscript{1008} URENCO is an independent international energy and technology group operating in UK, D and NL. http://www.urenco.com

\textsuperscript{1009} URS http://www.urscorp.eu
INDUSTRY IN THE NETHERLANDS

Nuclear Stakeholders per business in the Netherlands [%]

Nuclear Stakeholders per business in the Netherlands
There were four nuclear reactors under construction in Poland in the 1980s but this project was cancelled in 1990 so that Poland currently does not have any nuclear power plants in operation. However, Poland is currently considering starting a nuclear power programme and is collaborating with the other Baltic states to build a new nuclear reactor on the Ignalina site.

The main nuclear authority is the National Atomic Energy Agency/Państwowa Agencji Atomistyki[^1010] which will have the responsibility for regulating the new facilities. In addition there is the Central Laboratory for Radiological Protection/Centralne Laboratorium Ochrony Radiologicznej[^1011] which is responsible for radiological protection.

Despite not having a nuclear power programme, there are a number of opportunities in the nuclear field at the higher educational level.

**EDUCATION**

Higher education in Poland is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). The Bachelor’s degrees available include: the AGH University of Science and Technology/Akademia Górniczo-Hutnicza Im. Stanisława Staszica w Krakowie[^1012] offers a degree in Technical Physics Specialization Nuclear Physics[^1013]; and the Warsaw University of Technology/Politechnika Warszawska[^1014] offers a degree in Nuclear Power Engineering[^1015] in its Faculty of Power and Aeronautical Engineering[^1016].

The Consortium Personnel for the Nuclear Energy Industry and Technology in Industry and Medicine/Kadry dla Energetyki Jadrowej i Technologi Jadrowej w Przemysle i Medycynie[^1017] (Maria Curie-Skłodowska University/Uniwersytet Marii Curie Skłodowskiej[^1018], Wrocław University of Technology/Politechnika Wrocławska[^1019] and University of Warsaw/Uniwersytet Warszawski[^1020]) offers a range of degrees which includes:

- the Wrocław University of Technology, Faculty of Mechanical and Power Engineering[^1021] offers a specialization in Design and Utilization of Energy Systems[^1022] within its Energetics;
- the Maria Curie-Skłodowska University, Faculty of Mathematics, Physics and Computer Science[^1023] offers a specialization in Nuclear Safety and Radiological Protection within its Physics studies; and
- the University of Warsaw, Faculty of Chemistry and Faculty of Physics[^1024] offers a Bachelor’s degree in Nuclear Energetics and Chemistry starting 2011/2012.

Besides this consortium, several universities offer a nuclear specialisation in its Energy Engineering which includes:

- the Poznan University of Technology/Politechnika Poznanska[^1025] (Faculty of...
Chemical Technology\textsuperscript{1026}, Faculty of Civil and Environmental Engineering\textsuperscript{1027} and Faculty of Technical Physics\textsuperscript{1028}) offers a Nuclear Energy Engineering Specialization\textsuperscript{1029} in its Energy Engineering degree; the Silesian University of Technology/Politechnika Śląska\textsuperscript{1030} offers a Nuclear Engineering specialization within its Mechanics and Machinery Design department and a Nuclear Energetics Specialization\textsuperscript{1031} in its Energy Engineering degree (Faculty of Energy and Environmental Engineering\textsuperscript{1032}); and the Warsaw University of Technology/Politechnika Wroclawska offers a specialization in Nuclear and Thermal Engineering in its Faculty of Mechanical and Power Engineering\textsuperscript{1033} in its Energy Engineering degree.

Regarding Master's degrees, the AGH University of Science and Technology/Akademia Górniczo-Hutnicza w Krakowie offers two degrees: Technical Physics with a specialisation in Nuclear Physics\textsuperscript{1034}; and Energy Engineering with a specialisation in Nuclear Energy Engineering. In addition, the University of Warsaw/Uniwersytet Warszawski will offer a Nuclear Energetics and Chemistry degree starting in 2012/13.

At the Doctorate level, the AGH University of Science and Technology/Akademia Górniczo-Hutnicza w Krakowie offers Doctorates in: Technical Nuclear Physics\textsuperscript{1035} (Faculty of Physics and Applied Computer Science), and Energy Engineering (in the Faculty of Energy and Fuels starting in 2011/2012).

The Polish Academy of Sciences/Polska Akademia Nauk is the main educational institution and offers the possibility of a Doctorate degree in the nuclear field in several of its institutions which includes\textsuperscript{1036}: the Andrzej Soltan Institute for Nuclear Studies/Instytut Problemów Jadrowych im. Andrzeja Soltana\textsuperscript{1037},\textsuperscript{1038}; the Henryk Niewodniczanski Institute of Nuclear Physics/Instytut Fizyki Jadrowej im. Henryka Niewodniczanskiego\textsuperscript{1039} (specifically the International PhD Studies at the Institute of Nuclear Physics); the Institute of Molecular Physics/Instytut Fizyki Molekularnej\textsuperscript{1040},\textsuperscript{1041}; and the Institute of Physics/Instytut Fizyki\textsuperscript{1042}.

The University of Gdańsk/Uniwersytet Gdański\textsuperscript{1043} offers a Doctorate degree in Experimental Physics - Atomic and Molecular Spectroscopy\textsuperscript{1044} and in Theoretical Physics - Atomic and Molecular Physics.
The following courses are available:

- the Faculty of Mathematics, Physics and Computer Science\textsuperscript{1045} of the Maria Curie-Sklodowska University/Uniwersytet Marii Curie Skłodowskiej offers courses on an Introduction to Nuclear Physics;

- the Henryk Niewodniczanski Institute of Nuclear Physics/Instytut Fizyki Jądrowej im. Henryka Niewodniczanskiego offers several seminars\textsuperscript{1046} in the nuclear field;

- the University of Gdańsk/Uniwersytet Gdański\textsuperscript{1047} offers some courses within the interdisciplinary studies in Energy Engineering (in its Faculty of Ocean Engineering and Ship Technology, Faculty of Electrical and Control Engineering, and Faculty of Mechanical Engineering);

- the Cracow University of Technology/Politechnika Krakowska im. Tadeusza Kościuszki\textsuperscript{1048} offers courses in the Bachelor’s degree in Energy Engineering in its Faculty of Electrical and Computer Engineering;

- the Faculty of Mechanical Engineering of the Technical University of Łódź/Politechnika Łódzka offers some courses in its Bachelor’s degree in Energy Engineering; and

- the Faculty of Electrical Engineering of the Silesian University of Technology/Politechnika Ślask offers some courses in the nuclear field in the Power Engineering Specialization of its degree in Industrial Electrical Engineering.

There is a high level of activity in the nuclear research field and the institutions involved in this include the following:

- the AGH University of Science and Technology/Akademia Górniczo-Hutnicza im. Stanisława Staszica w Krakowie, particularly the Faculty of Energy and Fuels\textsuperscript{1049} (Department of Nuclear Energy) and the Faculty of Physics and Applied Computer Science\textsuperscript{1050};

- the Central Laboratory for Radiological Protection/Centralne Laboratorium Ochrony Radiologicznej\textsuperscript{1051};

- the Institute of Atomic Energy POLATOM/Instytut Energii Atomowej POLATOM\textsuperscript{1052}; and

- the Institute of Plasma Physics and Laser Microfusion/Instytut Fizyki Plazmy i Laserowej Mikrosyntezy\textsuperscript{1053}.

The universities involved in the nuclear research field include the following:

- the Jagiellonian University/Univwersytet Jagiellonski w Krakowie\textsuperscript{1054} in its Department of Nuclear Physics\textsuperscript{1055} and Marian Smoluchowski Institute of Physics\textsuperscript{1056};

- the Institute of Physics\textsuperscript{1057} of the Jan Kochanowski University/Uniwersytet Humanistyczno-Przyrodniczego Jana Kochanowskiego w Kielcach\textsuperscript{1058};

- the Faculty of Mathematics, Physics and Computer Science\textsuperscript{1059} of the Maria Curie-Sklodowska University/Uniwersytet Marii Curie Skłodowskiej;

\textsuperscript{1045} Faculty of Mathematics, Physics and Computer Science \url{http://mfi.umcs.lublin.pl/?lang=en&id=5}

\textsuperscript{1046} Seminars \url{http://www.ifj.edu.pl/sem/?lang=en}

\textsuperscript{1047} University of Gdańsk/Uniwersytet Gdański \url{http://www.ug.gda.pl/en}

\textsuperscript{1048} Cracow University of Technology/Politechnika Krakowska im. Tadeusza Kościuszki \url{http://www.en.pk.edu.pl}

\textsuperscript{1049} Faculty of Energy and Fuels \url{http://galaxy.ucl.agh.edu.pl/~wpik}
Finally, the Polish Academy of Sciences/Polska Akademia Nauk\textsuperscript{1065} has done much work in the nuclear research field and several of its institutions have been involved which includes:

- the Andrzej Soltan Institute for Nuclear Studies/Instytut Problemów Jądrowych im. Andrzeja Soltana\textsuperscript{1066};
- the Henryk Niewodniczanski Institute of Nuclear Physics/Instytut Fizyki Jadrowej im. Henry Niewodniczanski\textsuperscript{1067};
- the Institute of Molecular Physics/Instytut Fizyki Molekularnej\textsuperscript{1068};
- the Institute of Physics/Instytut Fizyki\textsuperscript{1069} (especially its Division of Radiation Physics and Spectroscopy\textsuperscript{1070}); and

\textsuperscript{1065} Polish Academy of Sciences/Polska Akademia Nauk http://www.english.pan.pl/index.php?option=com_content&view=frontpage&Itemid=1
\textsuperscript{1067} Henryk Niewodniczanski Institute of Nuclear Physics/Instytut Fizyki Jadrowej im. Henry Niewodniczanski http://www.ifj.edu.pl/?lang=en
\textsuperscript{1068} Institute of Molecular Physics/Instytut Fizyki Molekularnej http://www.ifmpan.poznan.pl/index.php
\textsuperscript{1069} Institute of Physics/Instytut Fizyki http://www.ifp.edu.pl/index_en.php
\textsuperscript{1070} Division of Radiation Physics and Spectroscopy http://www.ifpan.edu.pl/index_en.php
• the Research Institute of Nuclear Chemistry and Technology/Instytut Chemii I Techniki Jadrowej (ICHTJ)\textsuperscript{1071}.

Work in the nuclear field is overseen by the Polish Nuclear Physics Network/Siec Polskiej Fiztki Jadrowej\textsuperscript{1072} which has been formed by thirteen Polish research and educational institutions\textsuperscript{1073}.

**STAKEHOLDERS**

The main companies in Poland that are involved in the nuclear industry includes: Ape\textsuperscript{1074}, Chemoremont\textsuperscript{1075}, Elektrobudowa\textsuperscript{1076}, EMAG\textsuperscript{1077}, Energomontaz-Polnoc SA\textsuperscript{1078}, Energy Management and Conservation Agency\textsuperscript{1079}, Finow Polska\textsuperscript{1080}, Foster Wheelers\textsuperscript{1081}, Introl\textsuperscript{1082}, Modern Technologies & Filtration Sp. Z oo\textsuperscript{1083}, Polon Alfa\textsuperscript{1084}, Polska Grupa Energetyczna (PGE)\textsuperscript{1085}, Savepol Poliuretan\textsuperscript{1086}, TAURON\textsuperscript{1087}, Wroclaw Technology Park\textsuperscript{1088} and Zec Services\textsuperscript{1089}.

The international companies that have a presence in Poland include: ABB Group\textsuperscript{1090}, ARUP\textsuperscript{1091}, Alstom\textsuperscript{1092}, Atkins\textsuperscript{1093}, Böhler Edelstahl\textsuperscript{1094}, BT\textsuperscript{1095}, Bureau Veritas Group\textsuperscript{1096}, Camfil Group\textsuperscript{1097}, Clifford Change\textsuperscript{1098}, DLA Piper\textsuperscript{1099}, Gardiner & Theobald\textsuperscript{1100}, Gleeds Worldwide\textsuperscript{1101}, M+W Group\textsuperscript{1102}, Mott MacDonald\textsuperscript{1103}, Outo Kumpu\textsuperscript{1104}, Parsons Brinckerhoff\textsuperscript{1105} and Roxtec\textsuperscript{1106}.

Finally the Polish Federation of Engineering Associations\textsuperscript{1107} and Polish Nuclear Society\textsuperscript{1108} are interested in the development of nuclear culture.
INDUSTRY IN POLAND

Nuclear Stakeholders per business in Poland [%]

Nuclear Stakeholders per business in Poland
PORTUGAL

Portugal had a plan to build nuclear power plants but it was decided not to proceed with this so that the country does not have a nuclear power programme. However, there is a research reactor at the Technological and Nuclear Institute/Instituto Tecnológico e Nuclear (ITN).

Despite having no nuclear power plants, Portugal has a wide legislation on nuclear matters, especially in the radiological field, and there are a large number of bodies in different ministries that have responsibilities in this area, the main one being the Ministry for Economic, Innovation and Development Affairs/Ministério da Economia, da Inovação e do Desenvolvimento. In addition, there is an advisory body on nuclear matters - the Independent Commission for Radiological Protection and Nuclear Security/Comissão Independente para a Protecção Radiológica e Segurança Nuclear.

This is reflected in the higher educational systems where no degrees are offered in the nuclear field. However, some universities offer a variety of courses and several institutions are involved in nuclear research.

EDUCATION

Higher education in Portugal is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). There are no possibilities for studying for a Bachelor’s degree in the nuclear field in Portugal. The only university that offers a Master’s degree is the University of Coimbra/Universidade de Coimbra which is in Physics with a specialization in Nuclear and Particles Physics. The University of Lisbon/Universidade de Lisboa offers a Doctorate in Nuclear Physics.

This lack of opportunities for degrees in the nuclear field is offset by the wide range of courses available which includes the following: the Porto University/Universidade de Porto offers courses in Nuclear and Particle Physics, Radiochemistry, Risco Químico, Biológico, Radiológico e Nuclear CBRN; the Technical University of Lisbon/Universidade Técnica de Lisboa offers courses in Advanced Experimental Methods in Particle Physics, Advanced Measurements in Radiofrequency, Advanced Topics in Nuclear Fusion, Advanced Topics in Nuclear Physics, Atomic and Molecular Processes in Plasmas, Computational Methods in Radiation Technology, Design and Simulation of Radiation Detectors, Nuclear Fusion,

\[\text{http://sigarra.up.pt/up_web_page.inicia 1109}\]

\[\text{http://sigarra.up.pt/fcup.jsp/DISCIPLINAS_GERAL.FORMVIEW?p_modo=1&p_cad_c 1110}\]

\[\text{http://sigarra.up.pt/ifup/disciplinas/geral.formview?c_rad_c_digo=MI0732 1111}\]

\[\text{http://sigarra.up.pt/icbas_uk/DISCIPLINAS_GERAL.FORMVIEW?p_cad_codigo=CA124&p_modo=-1} 1112\]

\[\text{http://www.utl.pt/index.php?ling=-} 1113\]


\[\text{http://sigarra.up.pt/fcup.jsp/DISCIPLINAS_GERAL.FORMVIEW?p_cad_c_digo=M 1109}\]

\[\text{http://www.min-economia.pt} 1110\]

\[\text{http://www.uc.pt/en} 1111\]


Nuclear Instrumentation Techniques\textsuperscript{1128}, Nuclear Energy\textsuperscript{1129}, Nuclear Physics\textsuperscript{1130}, Nuclear Physics Methods in Science and Technology\textsuperscript{1131}, Nuclear Reactions\textsuperscript{1132}, Particle Physics\textsuperscript{1133}, Particle Physics Techniques\textsuperscript{1134}, Physics of Laser-Plasma Interactions\textsuperscript{1135}, Plasma Physics and Technology\textsuperscript{1136}, Plasma Technology for Materials Processing\textsuperscript{1137} and Radiation Physics and Technology\textsuperscript{1138}, the University of Coimbra/Universidade de Coimbra offers a course in Atomic and Molecular Physics\textsuperscript{1139} and another in Nuclear and Particles Physics\textsuperscript{1140}; and the University of Lisbon/Universidade de Lisboa offers two courses, one in Nuclear Energy\textsuperscript{1141} and the other in Nuclear and Particles Physics.

The Technological and Nuclear Institute/Instituto Tecnológico é Nuclear\textsuperscript{1142} offers special training courses which include: Nuclear Instrumentation; Reactors Operators; Specialized Laboratory Technicians; and Security and Radiological Protection. This is complemented by the Technical University of Lisbon/Universidade Técnica de Lisboa which offers an Advanced Training Diploma in Radiation Safety\textsuperscript{1143}.

Regarding research in the nuclear field, the main centres are the National Institute of Technological Engineering and Innovation/Instituto Nacional de Engenharia Tecnologia e Inovação\textsuperscript{1144} and the Technological and Nuclear Institute\textsuperscript{1145}. In addition, research is carried out at other institutions which include: the High Technical Institute/Instituto Superior Técnico\textsuperscript{1146} of the Technical University of Lisbon/Universidade Técnica de Lisboa (specially the Plasma Physics Center/Centro de Física de Plasmas\textsuperscript{1147}); the Nuclear Fusion Center/Centro de Fusão Nuclear (CFN)\textsuperscript{1148}; and at other universities such as the University of Coimbra/Universidade de Coimbra (Laboratory of Instrumentation and Experimental Particle Physics/Laboratório de Instrumentação e Física Experimental de Partículas (LIP)\textsuperscript{1149}), the University of Lisbon/Universidade de Lisboa (specially the Atomic Physics Centre\textsuperscript{1150} and the Nuclear Physics Centre\textsuperscript{1151} belonging to the Sciences Faculty Research Centre\textsuperscript{1152}). Regarding the research in the nuclear field, the National Institute of Technological Engineering

\textsuperscript{1128} Nuclear Instrumentation Techniques http://www.utl.pt/paginaescolas.php?area=19&escola=2&curso=2008052058&disciplina=2008052498
\textsuperscript{1129} Nuclear Energy http://www.utl.pt/pagina.php?area=456&anolect=20092010&ref=20092058&disciplina=2008052498
\textsuperscript{1130} Nuclear Physics http://www.utl.pt/paginaescolas.php?area=19&escola=2&curso=2008052058&disciplina=2008052488
\textsuperscript{1132} Nuclear Reactions http://www.utl.pt/paginaescolas.php?area=19&escola=2&curso=2008052058&disciplina=2008052479
\textsuperscript{1133} Particle Physics http://www.utl.pt/paginaescolas.php?area=19&escola=2&curso=2008052058&disciplina=2008052479
\textsuperscript{1134} Particle Physics Techniques http://www.utl.pt/paginaescolas.php?area=19&escola=2&curso=2008052058&disciplina=2008052479
\textsuperscript{1138} Radiation Physics and Technology http://www.utl.pt/paginaescolas.php?area=19&escola=2&curso=2008052058&disciplina=2008052479
\textsuperscript{1139} Atomic and Molecular Physics http://www.fis.uc.pt/df/200092010/df_id_disc.php?formshown=y&disc=e22.2&anoelec=20092010
\textsuperscript{1140} Nuclear and Particles Physics http://www.fis.uc.pt/df/200092010/df_id_disc.php?formshown=y&disc=e30&anoelec=20092010
\textsuperscript{1141} Nuclear Energy http://www.utl.pt/pls/portals/docs/1/250616.PDF
\textsuperscript{1142} Technological and Nuclear Institute/Instituto Tecnológico é Nuclear http://www.itn.pt/uk/uk_main.htm
\textsuperscript{1144} National Institute of Technological Engineering and Innovation/Instituto Nacional de Engenharia Tecnologia e Inovação http://www.ineti.pt/default.asp
\textsuperscript{1145} Technological and Nuclear Institute http://www.itn.pt/uk/uk_main.htm. Research http://www.itn.pt/uk/uk_areasid.htm
\textsuperscript{1146} High Technical Institute/Instituto Superior Técnico http://www.ist.utl.pt/en
\textsuperscript{1147} Plasma Physics Center/Centro de Física de Plasmas http://tlp.ist.utl.pt/
\textsuperscript{1148} Nuclear Fusion Center/Centro de Fusão Nuclear (CFN) http://www.cfn.ist.utl.pt/eng/introd.htm
\textsuperscript{1149} Laboratory of Instrumentation and Experimental Particle Physics/Laboratório de Instrumentação e Física Experimental de Partículas (LIP) http://www-lip.fis.uc.pt/index.php?lang=en
\textsuperscript{1150} Atomic Physics Centre http://cfa.cii.fc.ul.pt/
\textsuperscript{1151} Nuclear Physics Centre http://cfnul.cii.fc.ul.pt/
\textsuperscript{1152} Sciences Faculty Research Centre http://www.fc.ul.pt/fcul_eng
and Innovation/Instituto Nacional de Engenharia Tecnologia e Inovação\textsuperscript{1153} and the Technological and Nuclear Institute\textsuperscript{1154} are involved in it as well as the High Technical Institute/Instituto Superior Técnico\textsuperscript{1155} of the Technical University of Lisbon/Universidade Tecnica de Lisboa (specially the Plasma Physics Center/Centro de Física de Plasmas\textsuperscript{1156} and the Nuclear Fusion Center/Centro de Fusao Nuclear (CFN)\textsuperscript{1157}) and other universities such as the University of Coimbra/Universidade de Coimbra (Laboratory of Instrumentation and Experimental Particle Physics/Laboratório de Instrumentação e Física Experimental de Partículas (LIP)\textsuperscript{1158}) and the University of Lisbon/Universidade de Lisboa (specially the Atomic Physics Centre\textsuperscript{1159} and the Nuclear Physics Centre\textsuperscript{1160} belonging to the Sciences Faculty Research Centre\textsuperscript{1161}.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|}
\hline
\textbf{Degree} & \textbf{BSC} & \textbf{MSC} & \textbf{PHD} \\
\hline
\hline
\end{tabular}
\caption{Number of Nuclear Degrees available in Portugal}
\end{table}

\textbf{STAKEHOLDERS}

Due to the non-nuclear policy, there are only a small number of companies that are involved in the nuclear field in Portugal which includes: Arsopi\textsuperscript{1162}, BTL\textsuperscript{1163} and Efacec\textsuperscript{1164}.

The international companies that have a presence in Portugal includes: ABB Group\textsuperscript{1165}, Asltom\textsuperscript{1166}, Böhler Edelstahl\textsuperscript{1167}, BT\textsuperscript{1168}, Bureau Veritas Group\textsuperscript{1169}, Golder Associates\textsuperscript{1170}, Outo Kumpu\textsuperscript{1171}, Roxtec\textsuperscript{1172} and Simmons & Simmons\textsuperscript{1173}.

\textsuperscript{1153} National Institute of Technological Engineering and Innovation/Instituto Nacional de Engenharia Tecnologia e Inovação http://www.ineti.pt/default.aspx
\textsuperscript{1154} Technological and Nuclear Institute http://www.itn.pt/uk/uk_main.htm - Research http://www.itn.pt/uk/uk_areasid.htm
\textsuperscript{1155} High Technical Institute/Instituto Superior Técnico http://www.ist.utl.pt/pt/
\textsuperscript{1156} Plasma Physics Center/Centro de Física de Plasmas http://cfp.ist.utl.pt/
\textsuperscript{1157} Nuclear Fusion Center/Centro de Fusao Nuclear (CFN) http://www.cfn.ist.utl.pt/eng/introd.htm
\textsuperscript{1158} Laboratory of Instrumentation and Experimental Particle Physics /Laboratório de Instrumentação e Física Experimental de Partículas (LIP) http://www-lip.fis.uc.pt/index.php?lang=en
\textsuperscript{1159} Atomic Physics Centre http://cfa.cii.fc.ul.pt
\textsuperscript{1160} Nuclear Physics Centre http://cfnul.cii.fc.ul.pt
\textsuperscript{1161} Sciences Faculty Research Centre http://www.fc.ul.pt/fcul_eng
\textsuperscript{1162} Arsopi http://www.arsopi.pt/en/
\textsuperscript{1163} BTL http://www.btl.pt/negocio.htm
\textsuperscript{1164} Efacec http://www.efacec.pt/PresentationLayer/efacec_empresa_oo.aspx?idioma=1&area=8&local=303&empresaa=49
\textsuperscript{1165} ABB Group http://www.abb.com
\textsuperscript{1166} Asltom http://www.alstom.com/home
\textsuperscript{1167} Böhler Edelstahl http://www.bohler-edelstahl.com
\textsuperscript{1168} BT http://www.globalservices.bt.com/HomeAction.do
\textsuperscript{1169} Bureau Veritas Group http://www.bureauveritas.com/wps/wcm/connect/bv_com/Group
\textsuperscript{1171} Outo Kumpu http://www.outokumpu.com
\textsuperscript{1172} Roxtec http://www.roxtec.com/Hyder Consulting http://www.hyderconsulting.com/EN/Pages/default.aspx
\textsuperscript{1173} Simmons & Simmons http://www.simmons-simmons.com/index.cfm?FuseAction=simmons_simmons_com.main
INDUSTRY IN PORTUGAL

Nuclear Stakeholders per business in Portugal [%]

Nuclear Stakeholders per business in Portugal
There are two nuclear reactors operating in Romania at Cernavoda, both of which are CANDU reactors and together generate about one fifth of the country's electricity requirements. However, the current Romanian government is now planning to build two further units on the site and the project is well advanced involving a number of international companies.

Romania has a number of official bodies with responsibilities in the nuclear field which includes: the National Commission for Nuclear Activities Control/Comisia Nationala pentru Controlul Activitatilor Nucleare (CNCAN)\[1174\], the Romanian Authority for Nuclear Activities/Regia Autonoma pentru Activitati Nucleare (RAAN)\[1175\], the National Agency for Radioactive Waste/Agenzia Nucleara si Pentru Deseuri Radioactive (ANDRAD)\[1176\], and the Romanian Energy Regulatory Authority/Autoritatea Nationala de Realetamente in domeniul Energiei (ANRE)\[1177\].

This is reflected in the higher educational opportunities available in the country where specialised degrees are offered in the nuclear field.

**EDUCATION**

Higher education in Romania is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). The possibilities for a Bachelor’s degree includes: the Polytechnical University of Bucharest/Universitatea Politehnica din Bucuresti offers a degree in Nuclear Power Engineering and Nuclear Technologies\[1178\] and the Ovidius University of Constanza/Universitatea Ovidius Constanta\[1179\] offers a specialization in Energy Industry within the Energy Engineering degree oriented towards the nuclear field\[1180\].

The possibilities for a Master’s degree includes: the Polytechnical University of Bucharest/Universitatea Politehnica din Bucuresti offers degrees in Radiation Protection and Nuclear Security\[1181\] and Nuclear Engineering; and the University of Bucharest/Universitatea din Bucuresti\[1182\] offers a degree in Physics specialising in Photons, Spectroscopy, Plasma and Laser\[1183\].

The possibilities for a Doctorate degree includes: the Horia Hulubei National Institute of Physics and Nuclear Engineering\[1184\] offers degrees in the nuclear fields\[1185\]; the University of Bucharest/Universitatea din Bucuresti offers several options in different nuclear fields such as the Atomic Physics\[1186\], Nuclear Physics and Elementary Particle Physics; and the University Babes-Bolyai Cluj/Universitatea Babe - Bolyai\[1187\] offers a degree in the nuclear field.

The courses that are offered in the nuclear field include: the Horia Hulubei National Institute of Physics and Nuclear Engineering offers several Seminars\[1188\]; and the University of Bucharest/Universitatea din Bucuresti offers some courses such as Applied Nuclear Physics, Atomic and Molecular Interactions, Nuclear Interactions, Nuclear Physics, Nuclear Physics and Elementary Particles, Laboratory Atomic and Molecular Interactions, Laboratory Nuclear and Elementary Particle Interactions, Physics of the Atom and of the Molecule and two Specialization in Nuclear Physics Engineering and in Specialization in Nuclear and Elementary Interactions seminars.


\[1177\] Romanian Energy Regulatory Authority/Autoritatea Nationala de Realetamente in domeniul Energiei (ANRE) http://www.anre.ro/


\[1179\] Ovidius University of Constanza/Universitatea Ovidius Constanta http://www.univ-ovidiu.ro

\[1180\] Energy Engineering Bachelor oriented to the nuclear scope http://www.imim.ro/ro/articol/43


\[1182\] University of Bucharest/Universitatea din Bucuresti http://www.unibuc.ro/en/home


\[1184\] Horia Hulubei National Institute of Physics and Nuclear Engineering http://www.nipne.ro/


\[1187\] University Babes-Bolyai Cluj/Universitatea Baba - Bolyai http://www.ubbcluj.ro/en

\[1188\] Seminars http://www.nipne.ro/events/seminar/
The Romanian National Consortium (RNC) for Training and Education in Nuclear Sciences Platform (TENSP) offers different possibilities in the nuclear training field.

Regarding nuclear research, there are a number of institutions involved which includes: the Institute for Nuclear Research – Pitesti/Sucursal Cercetari Nucleare - Pitesti and the Horia Hulubei National Institute of Physics and Nuclear Engineering.

In addition, there are two universities working in the nuclear field: the Polytechnic University of Bucharest/Universitatea Politehnica din Bucuresti particularly its Power Engineering Faculty and the University of Bucharest/Universitatea din Bucuresti, especially the Center of Research and Development Nuclear Matter in Extreme Conditions and the Center of Research Photonics, Spectroscopy, Plasma and Laser Research Centre of the Department of Atomic and Nuclear Physics.

The Romanian Nuclear Higher Education Network (RONEN) is a joint initiative of the Romanian Universities, Nuclear Research Institutes, SMEs, NGOs and the Regulatory Body. The foundation members are: IFIN-HH-National Institute for R&D in Physics and Nuclear Engineering-Horia HULUBEI – Coordinator; University Politehnica Bucharest (UPB); University of Bucharest – Faculty of Physics; BABES–BOLYAI University Cluj (UJB); UPIT-University of Pitesti, ICN-Institute for Nuclear Research Pitesti; S.C. DOZIMED S.R.L, S.C. ASCENDIA DESIGN S.R.L; AREN-Romanian “NUCLEAR ENERGY” Association; CNCAN-National Commission for Nuclear Activities Control; and BNEN-Represented by SCK-CEN (Belgium). The Romanian Nuclear Energy Association/Asociatia Romana Energia Nucleara (AREN) is involved in the development of nuclear energy in Romania.

### Nuclear curricula in ROMANIA

<table>
<thead>
<tr>
<th>Number of Nuclear Degrees available in Romania</th>
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<tbody>
<tr>
<td>BSC</td>
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<tr>
<td>MSC</td>
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<tr>
<td>PHD</td>
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</tbody>
</table>

**Romanian National Consortium (RNC) for Training and Education in Nuclear Sciences Platform (TENSP)**

http://tensp.academic.ro/

**Institute for Nuclear Research - Pitesti/Sucursal Cercetari Nucleare - Pitesti**

http://www.nuclear.ro/

**Horia Hulubei National Institute of Physics and Nuclear Engineering**

http://www.npne.ro

**Polytechnic University of Bucharest/Universitatea Politehnica din Bucuresti**

http://www.upb.ro/index.php

http://www.energ.pub.ro/eng/research/index.html

**University of Bucharest/Universitatea din Bucuresti**

http://www.unibuc.ro/en/home

**Center of Research and Development Nuclear Matter in Extreme Conditions**


**Center of Research Photonics, Spectroscopy, Plasma and Laser**

http://www.fizica.unibuc.ro/fotonica/index.html

**Romanian Nuclear Energy Association/Asociatia Romana Energia Nucleara (AREN)**

http://www.aren.ro/en_index.htm
STAKEHOLDERS

The companies involved in the nuclear field in Romania include: Allen & Overy LLP\textsuperscript{1199}, Alstom\textsuperscript{1200}, Amec\textsuperscript{1201}, Analytik Jena Romania\textsuperscript{1202}, ARUP\textsuperscript{1203}, Atkins\textsuperscript{1204}, Böhler Edelstahl\textsuperscript{1205}, Bureau Veritas Group\textsuperscript{1206}, Centru de Inginerie Technologica pentru Obiective Nucleare (CITON)\textsuperscript{1207}, Clifford Chance\textsuperscript{1208}, Doosan IMGB\textsuperscript{1209}, Enel\textsuperscript{1210}, Gardiner & Theobald\textsuperscript{1211}, Gleeds Worldwide\textsuperscript{1212}, Hyder Consulting\textsuperscript{1213}, Microplasma\textsuperscript{1214}, Mining National Company\textsuperscript{1215}, Nuclearaelectrica S.A.\textsuperscript{1216}, Outo Kumpu\textsuperscript{1217}, Romag-Prod\textsuperscript{1218}, Roxtec\textsuperscript{1219}, Titan Echipamente Nucleare\textsuperscript{1220}, Uranium National Company S.A.\textsuperscript{1221}, the Center of Engineering and Technology for Nuclear Objectives\textsuperscript{1222} and Vulcan Vest\textsuperscript{1223}.

\begin{itemize}
\item Allen & Overy LLP: http://www.allenovery.com/AOWeb/term/AllenOveryHome.aspx?prefLangID=410
\item Alstom: http://www.alstom.com/home
\item Amec: http://www.amec.com
\item Analytik Jena Romania: http://www.analytikjenaromania.ro/
\item ARUP: http://www.arup.com
\item Atkins: http://www.atkinsglobal.com
\item Böhler Edelstahl: http://www.bohler-edelstahl.com
\item Bureau Veritas Group: http://www.bureauveritas.com
\item Centru de Inginerie Technologica pentru Obiective Nucleare (CITON): http://www.citon.ro/english_index.html
\item Clifford Chance: http://www.cliffordchance.com/home
\item Doosan IMGB: http://www.doosan.com/en/main.do
\item Enel: http://www.enel.it/it-IT/
\item Gardiner & Theobald: http://www.gardiner.com
\item Gleeds Worldwide: http://www.gleeds.com/worldwide/index.cfm
\item Hyder Consulting: http://www.hyderconsulting.com/EN/Pages/default.aspx
\item Microplasma: http://www.microplasma.ro/en/contact.htm
\item Mining National Company: http://www.cnu.ro/en/about.htm
\item Nuclearaelectrica S.A: http://www.nuclearaelectrica.ro/en
\item Outo Kumpu: http://www.outokumpu.com
\item Romag-Prod: http://www.romag.ro
\item Roxtec: http://www.roxtec.com
\item Uranium National Company S.A: http://www.cnu.ro/en/about.html
\item Center of Engineering and Technology for Nuclear Objectives: http://www.citon.ro/english_index_siamo.htm
\item Vulcan Vest: http://www.vulcanvest.ro/index_en.htm
\end{itemize}
INDUSTRY IN ROMANIA

Nuclear Stakeholders per business in Romania [%]

Nuclear Stakeholders per business in Romania
SLOVAKIA

A nuclear power programme was started in Slovakia in the 1950s and currently there are four nuclear reactors operating – two at Bohunice and two at Mochovce. All the units are VVER-440s and together they produce more than half of the country’s energy needs. The two units on the Bohunice site have had their operational lives extended until 2025 (40 years) and there are two older nuclear units on this site that were shut down in 2006 and 2008. Two units Mochovce 1 and 2 were put in operation in 1998 and 2000 and two more units are currently being constructed on the Mochovce site and are planned to be completed in the near future (2013).

The main Slovakian authority is the Nuclear Regulatory Authority of the Slovak Republic/Úrad Jadrového Dozoru Slovenskej Republiky. However, the high level of acceptance of nuclear energy in Slovakia is not reflected in the opportunities in the higher educational institutions in the nuclear field.

EDUCATION

Higher education in Slovakia is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). However, no Bachelor’s or Master’s degrees are offered in the nuclear field. At university level the complex specialised nuclear engineering education can be achieved via the Institute of Nuclear and Physical Engineering at the Slovak University of Technology in Bratislava. There is one possibility for a Doctorate in the Faculty of Electrical Engineering and Information Technology (FEI) of the Slovak University of Technology in Bratislava/Slovenska Technicka Univerzita v Bratislave which offers a degree in Nuclear Power Engineering.

The Nuclear Power Plant Research Institute (VUJE) is the authorized contractor for theoretical and simulator training, and organizes other training courses as well as regional and international courses for the IAEA, Nuclear Regulatory Authority of the Slovak Republic, US Nuclear Regulatory Commission (NRC) and US Department of Energy.

Other institutions that are involved in nuclear research include:

- the Department of Nuclear Physics and Biophysics of the Comenius University in Bratislava/Univerzita Komenského v Bratislave;

- the Institute of Thermal Power Engineering of the Slovak University of Technology in Bratislava/Slovenska Technicka Univerzita v Bratislave; and

- the Institute of Experimental Physics/Ústav experimentálnej Fyziky of the Slovak Academy of Sciences/Slovenská Akadémia Vied.

Finally, the Young Generation of the Slovak Nuclear Society/Mladá generácia Slovenskej nukleárnej spoločnosti and the Slovak Nuclear Society/Slovenská nukleárna spoločnosť are highly involved in the preservation of nuclear knowledge and other activities in the nuclear human resources area in Slovakia.

1224 Nuclear Regulatory Authority of the Slovak Republic/Úrad Jadrového Dozoru Slovenskej Republiky
1225 Nuclear Power Engineering PhD
1226 Training

1227 Department of Nuclear Physics and Biophysics
1228 Comenius University in Bratislava/Univerzita Komenského v Bratislave
1229 Institute of Thermal Power Engineering
1230 Slovak University of Technology in Bratislava/Slovenska Technicka Univerzita v Bratislave
1231 Institute of Experimental Physics/Ústav experimentálnej Fyziky
1232 Slovak Academy of Sciences/Slovenská Akadémia Vied
1233 Young Generation of the Slovak Nuclear Society/Mladá generácia Slovenskej nukleárnej spoločnosti
The most important companies involved in the nuclear industry in Slovakia include: Hydrostav, Jadrová a Vyráďovacia Spolocnost, Slovenské Elektrárne, Slovenske Energetike Strojne, Slovenska Nuklearna Spolocnost, VÚEZ, VÚJE and VUKI.

The international companies that have a presence in Slovakia include: Allen & Overy LLP, Areva-NP Control, ABB Group, Atomstroyexport, Böhler Edelstahl, Bureau Veritas Group, Camfil Farr, DLA Piper, Gardiner & Theobald, Gleeds Worldwide, M.C. Triton spol., Outo Kumpu and Roxtec.
INDUSTRY IN SLOVAKIA

Nuclear Stakeholders per business in Slovakia [%]

Nuclear Stakeholders per business in Slovakia
SLOVENIA

Slovenia has one nuclear reactor, the PWR at Krško\textsuperscript{1251}, which went into full commercial operation in 1983. The plant is shared between Slovenia and Croatia with each of them owning half of the plant and getting half of the electrical power that it produces. The output from the plant provides about half of Slovenia’s energy requirements and discussions are ongoing about extending its operating life beyond 2023.

In 2006, a resolution was adopted by the Slovenian Parliament on the National Energy Programme and this included the possibility of a second unit being built on the Krško site. This energy policy also has the objective of increasing the opportunities available for education at the higher level on topics related to nuclear power.

The Slovenian Nuclear Safety Administration (SNSA)/Uprava Republike Slovenije za jedrsko varnost\textsuperscript{1252} is the national regulatory body for nuclear facilities. The Slovenian Radiation Protection Administration (SRPA)/Uprava Republike Slovenije za varstvo pred sevanji\textsuperscript{1253} is responsible for all aspects of radiation protection including the use of radiation sources in medicine and the harmful effects of ionizing radiation on humans. The Agency for Radwaste Management/Agencija za radioaktivne odpadke (ARAO)\textsuperscript{1254} is responsible for the management (and storage) of low and intermediate level radioactive waste.

Despite having a long standing nuclear power programme, there are few opportunities in the nuclear field at the higher educational level.

EDUCATION

Higher education in Slovenia is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). There are no possibilities for studying for a Bachelor’s degree in the nuclear field in Slovenia. At the Master’s degree level, there are two possibilities at the University of Maribor/Univerza v Mariboru\textsuperscript{1255} which has a programme in the area of nuclear energy\textsuperscript{1256} in the Faculty of Energy and the Faculty of Civil Engineering offers a Nuclear Power Engineering postgraduate programme\textsuperscript{1257}.

At the Doctorate level, the University of Ljubljana/Univerza v Ljubljani\textsuperscript{1258} offers a degree in Mathematics and Physics with a specialization in the nuclear field, the Nuclear Physics Module\textsuperscript{1259}.

The University of Ljubljana offers several courses which include: Experimental Methods of Particle and Nuclear Physics\textsuperscript{1260}, Mechanics of Nuclear Structures and Materials, Modelling in Nuclear Thermal Hydraulics, Nuclear Technology and Nuclear Energy, Particle Physics and Physics of the Nucleus, Radiation and Reactor Physics, Selected Chapters of Nuclear Engineering, and Selected Chapters of Nuclear and Reactor Physics.

In 2009, the Technical High School in Krško introduced a course on the basics of nuclear engineering for mechanical and electrical engineers\textsuperscript{1261}.

The most important research institutions are the University of Ljubljana\textsuperscript{1262} and the Institute Josef Stefan/Institut Jožef Stefan\textsuperscript{1263} (IJS), which operates a TRIGA Mark II research reactor with Hot Cells.

Among the centres and support services at the Research Centre is the Nuclear Training Centre\textsuperscript{1264}, which organizes training courses for future Krško nuclear power plant operators.

\textsuperscript{1251} Nuklearna Elektrarna Krško \url{http://www.nek.si/en}
\textsuperscript{1252} Slovenian Nuclear Safety Administration \url{http://www.ursjv.gov.si/en}
\textsuperscript{1253} Slovenian Radiation Protection Administration/Uprava Republike Slovenije za varstvo pred sevanji \url{http://www.uvps.gov.si/en}
\textsuperscript{1254} Agency for Radwaste Management/Agencija za radioaktivne odpadke (ARAO) \url{http://www.arao.si}
\textsuperscript{1255} University of Maribor/Univerza v Mariboru \url{http://www.uni-mb.si}
\textsuperscript{1256} http://www.fe.uni-mb.si/si/studijski-programe.html
\textsuperscript{1257} http://www.fg.uni-mb.si/dokument.aspx?id=141
\textsuperscript{1258} University of Ljubljana/Univerza v Ljubljani \url{http://www.uni-lj.si/en}
\textsuperscript{1259} Doctoral Programme in Mathematics and Physics: Nuclear Physics Module \url{http://www.fmf.uni-lj.si/storage/14082/zbornik%20-%20%20DR%20%20studij%20zam.%20fiz.%232009-%20%20%20AN6.pdf}
\textsuperscript{1260} Experimental Methods of Particle and Nuclear Physics \url{http://www.fmf.uni-lj.si/storage/14477/Ucni%20nacrti%20FIZ-30-9-08-ang.pdf}
\textsuperscript{1261} http://www.sc-krsko.si/default.aspx
\textsuperscript{1262} Research \url{http://www.fmf.uni-lj.si/en/research/physics}
\textsuperscript{1263} Institut Josefa Stefan/Institut Jožefa Stefan \url{http://www.ijs.si}
\textsuperscript{1264} http://www.icjt.org/an/what/tecaji/tecaji.htm
Finally, the Nuclear Society of Slovenia/Drustvo Jedrskih Strolovnakov Slovenije\textsuperscript{1265} is highly involved in the dissemination of knowledge in the nuclear field.

The companies involved in the nuclear industry in Slovenia include: GEN Energija\textsuperscript{1266}, Elektro Hrovat Saso SP, Nuklearna Elektrarna Krško\textsuperscript{1267} and Nukel\textsuperscript{1268}.

The international companies that have a presence in Slovenia include: ABB Group\textsuperscript{1269}, Areva\textsuperscript{1270}, Böhler Edelstahl\textsuperscript{1271}, Bureau Veritas Group\textsuperscript{1272}, Outo Kumpu\textsuperscript{1273} and Roxtec\textsuperscript{1274}.

\textsuperscript{1265} Nuclear Society of Slovenia/Drustvo Jedrskih Strolovnakov Slovenije \url{http://www.djs.si/indexen.htm}

\textsuperscript{1266} GEN Energija \url{http://www.gen-energija.si/index.php?lang=eng}

\textsuperscript{1267} Nuklearna Elektrarna Krško \url{http://www.nek.si/en}

\textsuperscript{1268} Nukel \url{http://www.nukel.si/}

\textsuperscript{1269} ABB Group \url{http://www.abb.com/}

\textsuperscript{1270} Areva \url{http://www.areva.com/}

\textsuperscript{1271} Böhler Edelstahl \url{http://www.bohler-edelstahl.com/}

\textsuperscript{1272} Bureau Veritas \url{http://www.bureauveritas.de}

\textsuperscript{1273} Outo Kumpu \url{http://www.autokumpu.com/}

\textsuperscript{1274} Roxtec \url{http://www.roxtex.com/}
INDUSTRY IN SLOVENIA

Nuclear Stakeholders per business in Slovenia [%]

Nuclear Stakeholders per business in Slovenia
The first Spanish commercial nuclear power plant began operating in 1968. Currently, there are eight reactors consisting of six PWRs and 2 BWRs operating on six sites as follows: Santa Maria de Garona and Cofrentes each have one BWR; Almarez and Asco each have 2 PWRs; and Vandellós and Trillo each have one PWR; and together they generate about one fifth of Spain’s electricity requirements. The gas cooled reactor on the Vandellós site was closed down in 1990 and the PWR on the Jose Cabrera was closed down in 2006. The 2 PWRs on the Lemoniz site and the 2 BWRs on the Valdecaballeros site were not completed. Spain also has a nuclear fuel manufacturing facility and radioactive waste disposal facilities.

Despite the importance of nuclear power, a moratorium was enacted in 1983 and since then no new nuclear power plants have been built and the decommissioning process for the older ones was started.

The responsibility for nuclear power is with the Ministry of Industry, Tourism and Commerce and the regulation of energy systems is with the National Energy Commission/Comisión Nacional de Energía. In the nuclear field, the regulatory body is the Nuclear Safety Council/Consejo Seguridad Nuclear (CSN) which has the responsibility for ensuring the safe operation of nuclear and radioactive facilities and the National Enterprise for Radioactive Waste/Empresa Nacional de Residuos Radioactivos (ENRESA) which has the responsibility for the decommissioning of nuclear plants and the management of radioactive waste.

Despite the long standing nuclear power programme in Spain there are relatively few opportunities available at the higher educational level in the nuclear field.

EDUCATION

Higher education in Spain is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). Currently, there is no higher level educational institution that offers a Bachelor’s degree in the nuclear field. There are a number of institutions that offer a Master’s degree which includes:

- the Independent University of Madrid/Universidad Autónoma de Madrid in collaboration with the Research Center for Energy, Environment and Technology/Centro de Investigaciones Energéticas Medio Ambientales y Tecnológicas (CIEMAT) offers a degree in Nuclear Engineering and Applications;
- the Carlos III University of Madrid/Universidad Carlos III de Madrid, Complutense University of Madrid/Universidad Complutense de Madrid and the Polytechnic University of Madrid/Universidad Politécnica de Madrid are partners in the European Master’s degree in Nuclear Fusion Science and Engineering Physics (Erasmus Mundus);
- the Polytechnic University of Madrid/Universidad Politécnica de Madrid offers a degree in Nuclear Science and Technology and, in collaboration with Tecnotam, a degree


1280 Energetic, Environmental and Technologic Research Center/Centro de Investigaciones Energéticas Medio Ambientales y Tecnológicas (CIEMAT) [http://www.ciemat.es](http://www.ciemat.es)
1282 Carlos III University of Madrid/Universidad Carlos III de Madrid [http://www.uc3m.es/portal/page/portal/home](http://www.uc3m.es/portal/page/portal/home)
1284 Polytechnical University of Madrid [http://www.upm.es/portal/site/internacional](http://www.upm.es/portal/site/internacional)
1286 Regarding the Máster de Erasmus Mundus, there is a consortium of Spanish educational institutions participating: Universidad Carlos III de Madrid, Universidad Complutense de Madrid y Universidad Politécnica de Madrid.
1287 Master in Nuclear Science and Technology [http://www.fin.upm.es/webeng/?q=node/72](http://www.fin.upm.es/webeng/?q=node/72)
in Technologies of Electrical Energy Generation with a Specialization Course in Technologies of Nuclear Generation;1288

- the University of Huelva /Universidad de Huelva1289 offers a degree in Nuclear Technology and Instrumentation1290; and

- the Polytechnic University of Catalonia/Universidad Politécnica de Cataluña1296 offers a degree in Synchrotron Radiation and Particle Accelerators1292 and an Inter-university Master's degree in Energy Engineering with a Nuclear Specialization1293.

Regarding Doctorate degrees, there are a number of possibilities which includes:

- the Carlos III University of Madrid/Universidad Carlos III de Madrid offers a PhD in Plasma Physics and Nuclear Fusion1294;

- the Polytechnical University of Catalunya/Universidad Politécnica de Cataluña1296 offers a PhD in Nuclear and Ionizing Radiations Engineering1296;

- the University of Castilla La Mancha/Universidad de Castilla La Mancha1297 offers a PhD in Lasers and Advanced Spectroscopy in Chemistry1298; and

- the Polytechnic University of Madrid/Universidad Politécnica de Madrid offers a PhD in Science and Nuclear Technology and a PhD in the Fusion Nuclear Institute1299.

There are a large number of courses offered in the nuclear field which includes the following: the Basque Country University/Universidad del País Vasco1300 has several courses within this field such as Fundamentals of Nuclear Engineering1301, Nuclear Engineering1302, Nuclear and Particle Physics1303, Nuclear Power Stations1304, Radiological Protection1305 and Radiological Protection and Nuclear Safety1306; the Complutense University of Madrid/Universidad Complutense de Madrid offers two courses - Atomic and Molecular Physics1307 and Nuclear and Particles Physics1308; the University of Granada/Universidad de Granada1309 offers courses in Nuclear Structure, Nuclear and Particles Physics1310, Nuclear Reactions and Nuclear Technology and Plasma Physics; the National Open University/Universidad Nacional de
Educación a Distancia offers courses in Nuclear Instruments, Nuclear Physics I, Nuclear Physics II and Nuclear Technology.

In addition: the Polytechnic University of Catalunya/Universidad Politécnica de Cataluña offers courses in Nuclear Engineering Fundaments (at the School of Engineering of Barcelona/Escuela Técnica Superior de Ingeniería Industrial de Barcelona); the Polytechnic University of Madrid/Universidad Politécnica de Madrid offers courses in Nuclear Physics and Nuclear Technology; the University of Alcalá/Universidad de Alcalá offers course on Atomic, Molecular and Nuclear Physics; and finally the University of Cantabria/Universidad de Cantabria has three courses in the nuclear field - Atomic and Nuclear Physics, Environmental Radioactivity and Nuclear and Particles Physics.

Training for the nuclear industry is provided by Tecnatom at the Training Centres in the Madrid headquarters and at the plants in a number of fields which includes: processing technology, operation and maintenance, materials, non destructive testing, human factors and management skills. Tecnatom is owned by the Spanish utilities Endesa, Iberdrola and Gas Natural Fenosa and has over 500 trainees per year from the 6 Spanish nuclear power plants and from abroad. The Nuclear Forum/Foro Nuclear in its Training Department provides training on nuclear issues for teachers and professionals of the media.

There are a large number of institutions and universities involved in research in the nuclear field. Research activities are carried out at the following universities:

- the Basque Country University/Universidad del País Vasco in its Ingeniería Nuclear y Mecánica de Fluidos Department;
- the Carlos III University of Madrid/Universidad Carlos III de Madrid by the Plasma Physics group;
- the Complutense University of Madrid in its Atomic, Molecular and Nuclear Physics Department;

1311 National Open University/Universidad Nacional de Educación a Distancia http://portal.uned.es/portal/page?_pageid=93,1&_dad=portal&_schema=PORTAL
1315 Nuclear Technology http://www.uned.es/ets-inge/tdfs/105376.pdf
1320 Nuclear Physics http://www.minas.upm.es/Departamentos/diaro/varade/PRONUCLEAR.pdf
1321 Nuclear Technology http://www.etsin.upm.es/portal/site/TSINavales/menuitem.a17770976409dd4a90d7ac907466a8不由得Vg?view=exid=http%3A%2F%2Fwww.uc3m.es/portal/page/portal/investigacion/nuestros_investigadores/grupos_investigacion/grupo_fisica_plasmas
1323 University of Alcalá/Universidad de Alcalá http://www.uah.es http://www.uah.es/idomas/ingles/n
1324 Nuclear Physics http://www.uned.es/ets-inge/tdfs/105376.pdf
1327 Tecnatom http://www.tecnatom.es/en
1328 Training Centre (fields: processing technology; operation and maintenance; materials, non destructive testing; human factors; management skills) http://www.tecnatom.es/en/home/activity-areas/training-operation-and-safety http://caat.tecnatom.es/catalogo/index.html
1330 Training http://www.foronuclear.org/en/formacion.jsp
1331 Basque Country University/Universidad del País Vasco http://www.relaciones-internacionales.ehu.es/p274/home.en
1332 Plasma Physics http://www.uc3m.es/portal/page/portal/investigacion/nuestros_investigadores/grupos_investigacion/grupo_fisica_plasmas
the Fusion by magnetic confinement research1334 of the Energetic, Environmental and Technologic Research Centre/Centro de Investigaciones Energéticas, Medio Ambientales y Tecnológicas (CIEMAT);

the Granada University/Universidad de Granada1335 in its Atomic, Molecular and Nuclear Physics Department1336;

the National Open University/Universidad Nacional de Educación a Distancia1337 specially in the Nuclear Engineering Area1338;

the Nuclear Physics and Engineering Department1339 of the Polytechnic University of Catalunya/Universidad Politécnica de Cataluña;

the Fusion Nuclear Institute1340 and the Nuclear Engineering Department1341 of the Polytechnical University of Madrid/Universidad Politécnica de Madrid;

the Polytechnic University of Valencia1342 and its Energy Engineering Institute1343, Institute for Industrial, Radiophysical and Environmental Safety (ISIRYM)1344 and Chemistry and Nuclear Engineering Department1345;

the Physics Department1346 of the University of Alcalá/Universidad de Alcalá;

the Nuclear and High Energy Physics Laboratory1347 of the University of Zaragoza/Universidad de Zaragoza1348; and

the Applied Mathematics and Computer Science Department1349 of the University of Cantabria/Universidad de Cantabria;

and nuclear research is carried out at a number of institutions including the following:

the Nuclear Safety Council/Consejo de Seguridad Nacional 1350 (Research1351);

the Components Technology Center of Cantabria/Centro Tecnológico de Componentes Cantabria1352;

the Energy, Environmental and Technology Research Center/Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas1353 (Areas of Activity1354);

the Madrid Institute for Advanced Studies of Materials/Instituto Madrileño de Estudios Avanzados de Materias (IMDEA)1355;

1334 Fusion by magnetic confinement research http://www.ciemat.es/portal.do?IDM=11&NM=2
1335 Granada University/Universidad de Granada http://www.ugr.es/pages/index
1336 Atomic, Molecular and Nuclear Physics Dept. https://www.ugr.es/~famn/web
1340 Fusion Nuclear Institute http://www.denim.upm.es
1341 Nuclear Engineering Department http://www.din.upm.es/webeng
1342 Polytechnical University of Valencia http://www.upv.es/maticidades/DIQN/index-en.html
1343 Energetic Engineering Institute http://www.rie.upv.es/maticidades.html
1344 Institute for Industrial, Radiophysical and Environmental Safety (ISIRYM) http://www.upv.es/isirym/index_en.html
1346 Physics Dept. http://www2.uah.es/fisico
1347 Nuclear and High Energy Physics Laboratory http://www.unizar.es/linae/linae_eng.html
1348 University of Zaragoza/Universidad de Zaragoza http://www.unizar.es/servicios/ingles/prese.htm
1353 Energy, Environmental and Technology Research Center/ Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas http://www.ciemat.es/portal.do
1354 Areas of Activity http://www.ciemat.es/portal.do?IDM=72&NM=2
the Physics Center Miguel A. Catalán\textsuperscript{1356} (and its Fundamentals Physics Institute\textsuperscript{1357} and Institute of the Structure of the Matter\textsuperscript{1358}) which belong to the Spanish National Research Council/Consejo Superior de Investigaciones Científicas\textsuperscript{1359}; and

\begin{itemize}
  \item the Technological Platform of Nuclear Energy of Fission/Plataforma Tecnológica de Energía Nuclear de Fisión (CEIDEN)\textsuperscript{1360} (Programas\textsuperscript{1361}).
\end{itemize}

Several associations are working to improve education in the nuclear field including: the Nuclear Forum\textsuperscript{1364}; Sociedad Nuclear Española\textsuperscript{1365}; Plataforma Tecnológica de Energía Nuclear de Fisión (CEIDEN)\textsuperscript{1366}; the Spanish Society for Nuclear Medicine/Sociedad Española De Medicina Nuclear\textsuperscript{1367}; and Asociación Española de la Industria Eléctrica (UNESA)\textsuperscript{1368} which had been established as a negotiation forum between all the participants in the nuclear activities.

## Stakeholders

There is a large number of companies involved in the nuclear business in Spain which includes: ABB Group\textsuperscript{1369}, Acciona Infraestructuras\textsuperscript{1370}, Acpro\textsuperscript{1371}, ADEMI\textsuperscript{1372}, Agilent Technologies\textsuperscript{1373}, Alfa Laval

\begin{itemize}
  \item ABB Group\textsuperscript{1369} \url{http://www.abb.com} \url{http://www.abb.es}
  \item Acciona Infraestructuras \url{http://www.acciona-infraestructuras.com/}
  \item Acpro\textsuperscript{1371} \url{http://www.acpro.es}
  \item ADEMI \url{http://www.ademi.com/}
  \item Agilent Technologies \url{http://www.agilent.com/chem/es}
\end{itemize}
Iberica\textsuperscript{1374}, Alfa Laval Iberica \textsuperscript{1375}, Allen & Overy\textsuperscript{1376}, Alstom\textsuperscript{1377}, Amec\textsuperscript{1378}, Amphos XXI\textsuperscript{1379}, Analisis DSC\textsuperscript{1380}, Applus\textsuperscript{1381}, Areva NP\textsuperscript{1382} ARUP\textsuperscript{1383}, Ashurst\textsuperscript{1384}, Assystem\textsuperscript{1385}, Barnes Group\textsuperscript{1386}, Böllher Edelstahl\textsuperscript{1387}, Boslan Ingeniería\textsuperscript{1388}, Centro de Dosimetria\textsuperscript{1389}, Cespa Conten\textsuperscript{1390}, Chauvin Arnoux Iberica\textsuperscript{1391}, Chemtal Proyectos y Sistemas (CHEPRO)\textsuperscript{1392}, Cimat\textsuperscript{1393}, Clifford Change\textsuperscript{1394}, Club Español de la Energía (ENERCLUB)\textsuperscript{1395}, Cluster de Energía del País Vasco\textsuperscript{1396}, CMG Consultores\textsuperscript{1397}, COAPSA Control\textsuperscript{1398}, Compañía Internacional de Protección, Ingieniería y Tecnología\textsuperscript{1399}, Construcciones Roentgen Ibéricas (CRISA)\textsuperscript{1400}, Construcciones Técnicas de Radioterapia\textsuperscript{1401}, Control y Montajes Industriales (CYMI)\textsuperscript{1402}, Copcisa\textsuperscript{1403}, Copisa Industrial\textsuperscript{1404}, Cyril Swett\textsuperscript{1405}, Davis Langdon\textsuperscript{1406}, Deloitte Spain\textsuperscript{1407}, Enusa Industrias Avanzadas\textsuperscript{1408}, Enwesa Operaciones\textsuperscript{1409}, Euro Plom\textsuperscript{1410}, Equipos Nucleares (ENSA)\textsuperscript{1411}, Ferguera Montajes y Mantenimiento\textsuperscript{1412}, Filtros Ceta\textsuperscript{1413}, Flour Corporation\textsuperscript{1414}, Freshfields Bruckhaus Deringer\textsuperscript{1415}, Gamesa, Gardiner & Theobald\textsuperscript{1416}, Garlock Sealing Technologies\textsuperscript{1417}, Gas Natural-Unión Fenosa\textsuperscript{1418}, GE-Hitachi Nuclear Energy International\textsuperscript{1419}, Geocisa\textsuperscript{1420}, Giles Worldwide\textsuperscript{1421}, Global Energy Service Siemsa\textsuperscript{1422}, Golder Associates\textsuperscript{1423}, Grupo Domingui\textsuperscript{1424},
Hammonds\textsuperscript{1428}, Hidroeléctrica del Cantábrico\textsuperscript{1429}, Iberdrola\textsuperscript{1430}, Iberdrola Ingeniería y Construcción\textsuperscript{1431}, Iberinsa\textsuperscript{1432}, Inabensa\textsuperscript{1433}, Inasmet Tecnalia\textsuperscript{1434}, Indra\textsuperscript{1435}, Industrias Leblan\textsuperscript{1436}, Ingeniería y Diseño Europeo\textsuperscript{1437}, Initec Nuclear\textsuperscript{1438}, Ingeniería IDOM Internacional\textsuperscript{1439}, Inypsa, Informes y Proyectos\textsuperscript{1440}, Laínsa Logistics Industrial Conditioning\textsuperscript{1441}, Leading Enterprises\textsuperscript{1442}, Medidas Ambientales\textsuperscript{1443}, Moncasa (Moncobra)\textsuperscript{1444}, Obeki Electric Machines\textsuperscript{1445}, Osborne Clarke International\textsuperscript{1446}, Outo Kumpu\textsuperscript{1447}, Parsons Brinckerhoff\textsuperscript{1448}, Pöyry Energy/Heymo Ingeniería\textsuperscript{1449}, Ringo Válvulas\textsuperscript{1450}, Roxtec\textsuperscript{1451}, Sener Ingeniería y Sistemas\textsuperscript{1452}, Simmons & Simmons\textsuperscript{1453}, Socoin Ingeniería y Construcción Industrial\textsuperscript{1454}, Suministros y Planificación Industriales\textsuperscript{1455}, Tamoin\textsuperscript{1456}, Tecnatom\textsuperscript{1457}, Tecnicas Reunidas\textsuperscript{1458}, URS\textsuperscript{1459}, Vector & Wellheads Engineering SL\textsuperscript{1460}, Westinghouse Electric Spain\textsuperscript{1461} and Westinghouse Technology Services\textsuperscript{1462}.

\textsuperscript{1428} Hammonds \url{http://www.hammonds.com/}
\textsuperscript{1429} Hidroeléctrica del Cantábrico \url{http://www.hcenergia.com/en/portal.do}
\textsuperscript{1430} Iberdrola \url{http://www.iberdrola.es/webibd/corporativa/iberdrola?IDPAG=ESWEBINICIO}
\textsuperscript{1431} Iberdrola Ingeniería y Construcción \url{http://www.iberdrolaingenieria.com}
\textsuperscript{1432} Iberinsa \url{http://www.iberinsa.es/img_home/noflash.html}
\textsuperscript{1433} Inabensa \url{http://www.inabensa.com/index?idioma=2}
\textsuperscript{1434} Inasmet Tecnalia \url{http://www.inasmet.es/home.aspx?tabid=}
\textsuperscript{1435} Indra \url{http://www.indra.es/servlet/ContentServer?pagename=IndraES/Page&structure=Indra&Language=en_GB}
\textsuperscript{1436} Industrias Leblan \url{http://www.leblan.com/leblan.php}
\textsuperscript{1437} Ingeniería y Diseño Europeo SA \url{http://www.idesa.net/}
\textsuperscript{1438} Initec Nuclear S.A.U. \url{http://www.initec.es/}
\textsuperscript{1439} Ingeniería IDOM Internacional SA \url{http://www.idom.es/?id_sec=&language=1&value=}
\textsuperscript{1440} Inypsa, Informes y Proyectos \url{http://www.inypsa.es/}
\textsuperscript{1441} Laínsa Logistics Industrial Conditioning \url{http://www.lainsa.com/eng/index.php}
\textsuperscript{1442} Leading Enterprises \url{http://www.leadingenterprises.es/eng/main.html}
\textsuperscript{1443} Medidas Ambientales \url{http://www.mroxtcidasambientales.com/}
\textsuperscript{1444} Moncasa (Moncobra) \url{http://www.grupocobra.com}
\textsuperscript{1445} Obeki Electric Machines \url{http://www.obeki.com/index_en.asp}
\textsuperscript{1446} Osborne Clarke International \url{http://www.osborneclarke.com/}
\textsuperscript{1447} Outo Kumpu \url{http://www.uotokumpu.com}
\textsuperscript{1448} Parsons Brinckerhoff \url{http://www.pbworld.com/}
\textsuperscript{1449} Pöyry Energy/Heymo Ingeniería \url{http://www.poyry.com/}
\textsuperscript{1450} Ringo Válvulas \url{http://www.ringospain.com/injtes/index_en.htm}
\textsuperscript{1451} Roxtec \url{http://www.roxtec.com}
\textsuperscript{1452} Sener Ingeniería y Sistemas SA \url{http://www.sener.es/?swlang=en}
\textsuperscript{1453} Simmons & Simmons \url{http://www.simmons-simmons.com/index.cfm?Fuseaction=simmons_simmons_company.main}
\textsuperscript{1454} Socoin Ingeniería y Construcción Industrial \url{http://www.socoin.es/index.jsp}
\textsuperscript{1455} Suministros y Planificación Industriales \url{http://www.spisa-rail2000.com/}
\textsuperscript{1456} Tamoin is a Spanish company with presence in Germany, Poland, Portugal and Spain \url{http://www.tamoin.com/}
\textsuperscript{1457} Tecnatom \url{http://www.tecnatom.es/}
\textsuperscript{1458} Tecnicas Reunidas \url{http://www.tecnicasreunidas.es/english/index.asp}
\textsuperscript{1459} URS \url{http://www.urscorp.eu/}
\textsuperscript{1460} Vector & Wellheads Engineering SL \url{http://www.vectorvalves.com/english/index.php}
\textsuperscript{1461} Westinghouse Electric Spain \url{http://www.westinghousenuclear.com/Our_Company/Driving%20Directions/Spain.shtm}
\textsuperscript{1462} Westinghouse Technology Services \url{http://www.westinghousenuclear.com}
A nuclear power programme was started in Sweden in 1965 and currently there are 10 nuclear reactors operating on three sites as follows: Ringhals has 4 units (3 PWRs and 1 BWR), Forsmark has 3 units (3 BWRs) and Oskarshamn has 3 units (3 BWRs). Together, they provide close to half of the country’s electricity needs. In addition two of the older units on the Barsebäck site have been closed down.

In 1980, the Swedish government held a referendum and it was decided that no further nuclear power plants would be built and that a nuclear power phase-out would be completed by 2010. Following the closure of Barsebäck 1 and 2, the other 10 units were given a reprieve beyond 2010 allowing them to run up to about 40 years.

In February 2009, the Swedish government announced plans to overturn the 30 year old ban on building new nuclear power plants as part of a new plan to increase energy supplies and security and to combat global warming.

The regulatory body is the Swedish Radiation Safety Authority/Strålsäkerhetsmyndigheten (SSM) which has responsibilities for radiation protection and nuclear safety. In 1947, the government established an atomic energy research organization, AB Atomic Energy/AB Atomenergi which has now become Studsvik AB.

The long standing nuclear power programme in Sweden is reflected in the opportunities available at the higher educational level in the nuclear field.

EDUCATION

In 2007, the higher educational system in Sweden was changed to meet the Bologna Process and, since then, it has been divided into three levels: basic level (grundnivå), advanced level (avancerad nivå) and graduate level (forskarnivå) (which are equivalent to Bachelor’s, Master’s and Doctorate degree levels respectively).

No Swedish institutions offer a Bachelor’s degree in the nuclear field. However, Master’s degrees are offered as follows: the Chalmers University offers a degree in Nuclear Engineering and the KTH Royal Institute of Technology/Kungliga Tekniska Högskolan Universitet offers a degree in Nuclear Energy Engineering.

The KTH Royal Institute of Technology has a Doctorate programme managed by the Department of Nuclear Reactor Physics and the Uppsala University/Uppsala Universitet offers a Doctorate degree in Nuclear and Particle Physics. It also manages SELECT which offers a Master’s degree in Energy and Nuclear Engineering.

There are a number of courses available in the nuclear field which includes: the Lund University/Lunds Universitet offers courses on Atomic and Molecular Physics, Atomic and Molecular Spectroscopy, Nuclear Physics and Theoretical Nuclear Physics; and the University of Stockholm/Stockholms Universitet which offers courses on Atomic Physics, Nuclear Physics, Quantum Phenomenology and Radiation Physics, Radiation Dosimetry, Radiation Detectors and Measuring Methods and Radiation Protection and Environmental Radiology.

1463 Swedish Radiation Safety Authority/Strålsäkerhetsmyndigheten http://www.ski.se/In-English/About-the-Swedish-Radiation-Safety-Authority
1464 Chalmers http://www.chalmers.se/en
1466 KTH Royal Institute of Technology/Sveriges Största Tekniska Högskolan Universitet offers a degree in Nuclear Engineering and the KTH
1467 Master in Nuclear Energy Engineering http://www.kth.se/Studies/master/programmes/physics/2.7400
1468 Department of Nuclear Reactor Physics http://reactor.physics.kth.se/study
1469 Uppsala University/Uppsala Universitet http://www.uu.se
1470 PhD Students at Nuclear and Particle Physics http://www.uu.se/graduate/index.en.php
1471 Erasmus Mundus SELECT http://www.kth.se/studies/master/em/select?l=en_UK
1472 Master Degree in Energy and Nuclear Engineering http://international.polito.it/it/supporto_economico/borse-di_studio_internazionali/elenco_generale_dei_progetti/erasmus_mundus_select
1473 Lund University/Lunds Universitet http://www.lu.se/lund-university
1474 Atomic and Molecular Physics http://www.lu.se/o.a.o.s?id=1574&lukas_id=FYSBo
1475 Atomic and Molecular Spectroscopy http://www.lu.se/o.a.o.s?id=1574&lukas_id=FYSTa
1476 Nuclear Physics http://www.lu.se/o.a.o.s?id=1574&lukas_id=FYSBo
1477 Theoretical Nuclear Physics http://www.lu.se/o.a.o.s?id=1574&lukas_id=FYSTa
1478 Stockholm University/Stockholms Universitet http://www.su.se/english
Training in the nuclear field is provided by Nuclear Safety and Training/Kärnkraftsäkerhet och Utbildning (KSU)\(^{1479}\).

There are a number of institutions involved in nuclear research which includes the following:

- the Chemical and Biological Engineering Department\(^{1480}\), the Fundamental Physics Department\(^{1481}\) and the Nuclear Engineering Department\(^{1482}\) of the Chalmers University;

- the Department of Nuclear and Reactor Physics\(^{1483}\) and the Swedish Centre for Nuclear Technology\(^{1484}\) of the KTH Royal Institute of Technology;

- the MAX-lab (National Electron Accelerator Laboratory for Synchrotron Radiation Research, Nuclear Physics and Accelerator Physics)\(^{1485}\) of the Lund University/Lunds Universitet;

- the Swedish Radiation Safety Authority/Strålsäkerhetsmyndigheten\(^{1486}\); and

- the University of Uppsala /Uppsala Universitet in Division of Nuclear and Particle Physics\(^{1487}\) carries out research in Nuclear and Hadron Physics Research\(^{1488}\).

\(^{1479}\) KSU [http://www.ksu.se/]

\(^{1480}\) Chemical and Biological Engineering Dept. [http://www.chalmers.se/chem/EN/]

\(^{1481}\) Fundamental Physics [http://www.chalmers.se/fp/EN]

\(^{1482}\) Nuclear Engineering Department [http://www.nephy.chalmers.se/]

\(^{1483}\) Department of Nuclear and Reactor Physics [http://reactor.physics.kth.se/research]


\(^{1485}\) MAX-lab (National Electron Accelerator Laboratory for Synchrotron Radiation Research, Nuclear Physics and Accelerator Physics) [http://www.maxlab.lu.se/]

\(^{1486}\) Research [http://www.ski.se/In-English/About-the-Swedish-Radiation-Safety-Authority/Research/]

\(^{1487}\) Division of Nuclear and Particle Physics [http://www.isv.uu.se/index.en.html]

\(^{1488}\) Nuclear and Hadron Physics Research [http://www.isv.uu.se/nuclear.en.htm]
STAKEHOLDERS

There are a large number of companies that are involved in the nuclear industry in Sweden which includes: ABB Group\textsuperscript{1489}, AF Consult\textsuperscript{1490}, Ashurst\textsuperscript{1491}, Atkins\textsuperscript{1492}, Alstom\textsuperscript{1493}, BAE Systems Submarines Solutions\textsuperscript{1494}, BGB Power Solutions AB\textsuperscript{1495}, Böhler Edelstahl\textsuperscript{1496}, BT\textsuperscript{1497}, Bureau Veritas Group\textsuperscript{1498}, Bruker AXS\textsuperscript{1499}, CA Mörck\textsuperscript{1500}, Camfil Farr\textsuperscript{1501}, Ekström & Son (Pressure Vessel Expert)\textsuperscript{1502}, Electron Crosslinking AB\textsuperscript{1503}, Fagerström Industriconsult AB\textsuperscript{1504}, Gammadata Instrument\textsuperscript{1505}, Golder Associates\textsuperscript{1506}, IBA Dosimetry\textsuperscript{1507}, Outo Kumpu\textsuperscript{1508}, Roxtec\textsuperscript{1509}, Pöyry\textsuperscript{1510}, Studsvik\textsuperscript{1511}, Svensk Kärnbränslehantering AB (SKB)\textsuperscript{1512}, Unfors Instruments AB\textsuperscript{1513}, Vattenfall\textsuperscript{1514} and Westinghouse\textsuperscript{1515}.

\textsuperscript{1489} ABB is a Swedish company with presence in Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the UK. http://www.abb.com/

\textsuperscript{1490} AF Consult. http://www.afconsult.com/en


\textsuperscript{1492} Atkins. http://www.atkinsglobal.com

\textsuperscript{1493} Alstom. http://www.alstom.com/home


\textsuperscript{1495} BGB Power Solutions AB. http://www.powersolutions.se

\textsuperscript{1496} Böhler Edelstahl. http://www.boehler-edelstahl.com

\textsuperscript{1497} BT. http://www.globalservices.bt.com/HomeAction.do

\textsuperscript{1498} Bureau Veritas Group. http://www.bureauveritas.com/wps/wcm/connect/bv_com/Group

\textsuperscript{1499} Bruker AXS. http://www.bruker-axs.de/home0.html

\textsuperscript{1500} CA Mörck. http://www.ca-morck.se

\textsuperscript{1501} Camfil Farr is a Swedish company with presence in Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Poland, Slovakia, Spain, Sweden and the UK. http://www.camfifarr.com/teo_camfil

\textsuperscript{1502} Ekström & Son (Pressure Vessel Expert). http://www.ekstrom-son.se/default.asp?sprak=sv&huvudmeny=foretags&id=sida

\textsuperscript{1503} Electron Crosslinking AB. http://www.crosslinking.com

\textsuperscript{1504} Fagerström Industriconsult AB. http://www.fagerstrom.se/?s=start&lang=eng

\textsuperscript{1505} Gammadata Instrument. http://www.gammadatainstrument.se/


\textsuperscript{1507} IBA Dosimetry. http://www.iba-dosimetry.com

\textsuperscript{1508} Outo Kumpu. http://www.outokumpu.com

\textsuperscript{1509} Roxtec. is a Swedish company with presence in Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom. http://www.roxtec.com

\textsuperscript{1510} Pöyry. http://www.poyry.com

\textsuperscript{1511} Studsvik. http://www.studsvik.com

\textsuperscript{1512} Svensk Kärnbränslehantering AB (SKB). http://www.skb.se/default_23417.asp

\textsuperscript{1513} Unfors Instruments AB. http://www.unfors.com


INDUSTRY IN SWEDEN

Nuclear Stakeholders per business in Sweden [%]

Nuclear Stakeholders per business in Sweden
UNITED KINGDOM

The first commercial nuclear power plant in the UK came into service in 1956. Currently there are 19 nuclear reactors made up of 2 Magnox reactors, 16 Advanced Gas-cooled Reactors (AGRs) and 1 Pressurised Water Reactor (PWR), operating on 9 different sites as follows: Oldbury and Wylfa each have 2 Magnox reactors; Dungeness, Hinkley Point, Hunterston, Hartlepool and Torness each have 2 AGRs; Heysham has 4 AGRs; and Sizewell has one PWR. Together they generate about one fifth of the country’s electricity requirements. The older steel-vesseled Magnox reactors at Calder Hall, Chapelcross, Berkeley, Bradwell, Hunterston, Hinkley Point, Trawsfynydd, Dungeness and Sizewell have all been closed down as have the two fast reactors at Dounreay.

In addition, the government recently gave the go-ahead for a new generation of nuclear power plants to be built and in November 2009 ten nuclear sites were identified that could accommodate future nuclear power plants. The regulatory authority is carrying out a Generic Design Review of a number of new nuclear reactor designs that might be introduced into the UK. However, the position in the Scottish Parliament is that new nuclear power plants will not be built in Scotland.

The regulatory body in the UK is the Office of Nuclear Regulation (ONR)\textsuperscript{1517,1518} which has the responsibility for safety and security for all operating nuclear facilities. The Nuclear Decommissioning Authority (NDA)\textsuperscript{1519} has the responsibility for the decommissioning and cleanup of the existing civil nuclear sites and the storage of radioactive waste. The United Kingdom Atomic Energy Authority\textsuperscript{1520} carries out research and development on behalf of the nuclear industry. In addition, Cogent\textsuperscript{1521} is the Sector Skills Council (SSC) for the nuclear industry.

Due to the great importance of nuclear power in the UK, the higher educational institutions offer a wide range of possibilities in the nuclear field.

EDUCATION

Higher education in the UK is divided into three stages: Bachelor’s, Master’s and Doctorate degrees (as required by the Bologna Process). At the Bachelor’s degree level, the possibilities include:

- Imperial College London\textsuperscript{1522} offers a BSc in Mechanical with Nuclear Engineering\textsuperscript{1523};
- the University of Leeds\textsuperscript{1524} offers a BSc in Chemical and Nuclear Engineering\textsuperscript{1525};
- the University of Liverpool\textsuperscript{1526} offers a BSc in Physics with Nuclear Science\textsuperscript{1527}; and
- the University of Lancaster\textsuperscript{1528} offers a BSc in Nuclear Engineering\textsuperscript{1529}.

At the Master’s degree level, the possibilities include:

- the University of Birmingham\textsuperscript{1530} offers an MSc in the Physics and Technology of Nuclear Reactors\textsuperscript{1531};
- the University of Leeds\textsuperscript{1532} offers an MSc in Chemical and Nuclear Engineering\textsuperscript{1533};
- the University of Liverpool\textsuperscript{1534} offers an MSc in Nuclear Science and Technology\textsuperscript{1535};

\begin{itemize}
  \item \textsuperscript{1517} Health Safety Executive \url{http://www.hse.gov.uk/nuclear/index.htm}
  \item \textsuperscript{1518} Health and Safety in the Nuclear Industry \url{http://www.hse.gov.uk/nuclear/index.htm}
  \item \textsuperscript{1519} Nuclear Decommissioning Authority (NDA) \url{http://www.nda.gov.uk}
  \item \textsuperscript{1520} United Kingdom Atomic Energy Authority \url{http://www.ukaea.org.uk}
  \item \textsuperscript{1521} Cogent SSC \url{http://www.cogent-ssc.com/index.php}
  \item \textsuperscript{1522} Imperial College London \url{http://www3.imperial.ac.uk}
  \item \textsuperscript{1523} Mechanical with Nuclear Engineering \url{http://www3.imperial.ac.uk/ugprospectus/whatcanyoustudy/#M}
  \item \textsuperscript{1524} University of Leeds \url{http://www.leeds.ac.uk}
  \item \textsuperscript{1525} Chemical and Nuclear Engineering \url{http://www.engineering.leeds.ac.uk/ug/courses/MEBE-CEN_EN.shtml}
  \item \textsuperscript{1526} University of Liverpool \url{http://www.liv.ac.uk}
  \item \textsuperscript{1527} Physics with Nuclear Science \url{http://www.liv.ac.uk/study/undergraduate/courses/F390.htm}
  \item \textsuperscript{1528} Lancaster University \url{http://www.lancs.ac.uk}
  \item \textsuperscript{1529} Nuclear Engineering MEng Honours \url{http://www.lancs.ac.uk/coursesearch/course.php?course_id=009890&entry_session_id=000110}
  \item \textsuperscript{1530} University of Birmingham \url{http://www.bham.ac.uk}
  \item \textsuperscript{1531} Physics and Technology of Nuclear Reactors MSc \url{http://www.postgraduate.bham.ac.uk/programmes/taught/physics/physics-technology-nuclear-reactors_s.htm}
  \item \textsuperscript{1532} University of Leeds \url{http://www.leeds.ac.uk}
  \item \textsuperscript{1533} Chemical and Nuclear Engineering MEng \url{http://www.engineering.leeds.ac.uk/ug/courses/MEBE-CEN_EN.shtml}
  \item \textsuperscript{1534} University of Liverpool \url{http://www.liv.ac.uk}
  \item \textsuperscript{1535} Nuclear Science and Technology MSc \url{http://www.liv.ac.uk/study/postgraduate/taught_courses/nuclear_science_technology.htm}
\end{itemize}
the University of Sheffield\textsuperscript{1536} offers MSc degrees in Nuclear Environmental Science and Technology\textsuperscript{1537} and Nuclear Science and Technology\textsuperscript{1538};

the City University London\textsuperscript{1539} offers a MSc in Nuclear Medicine\textsuperscript{1540}; and

the Nuclear Technology Education Consortium\textsuperscript{1541} offers a MSc in Nuclear Science & Technology (distance learning)\textsuperscript{1542} in which there are courses in: Criticality Safety Management; Decommissioning/Waste/Environmental Management; Decommissioning Technology & Robotics; Management of the Decommissioning Process; Nuclear Fuel Cycle; Nuclear Safety Case Development; Processing, Storage and Disposal of Nuclear Wastes; Radiation & Radiological Protection; Reactor Physics, Criticality & Design; and Reactor Thermal Hydraulics.

The University of Cambridge\textsuperscript{1543} will run a new Master’s degree in Nuclear Energy starting in the autumn of 2011.

Regarding Doctorate degrees, there are a number of possibilities which include:

- the University of Liverpool offers a PhD in Nuclear Physics\textsuperscript{1544};
- the University of Manchester\textsuperscript{1545} offers a PhD in Nuclear Engineering\textsuperscript{1546}; and
- the University of Sheffield offers a PhD in Nuclear Engineering\textsuperscript{1547}.

There are a wide range of courses available which include the following:

- the Defence Academy of the UK\textsuperscript{1548} offers several courses in its Nuclear Department\textsuperscript{1549} which includes: Nuclear Reactor Engineering, Radiation Protection, Nuclear Safety Management, Safety Case Development, Radiation Emergency Planning and Response, Nuclear Fuel Cycle -NTCE Program- and Nuclear Safety Case Development -NTCE Program;
- Imperial College London offers courses in: Water Reactor Performance and Safety -NTCE Program;
- the University of Lancaster\textsuperscript{1550} offers courses in Decommissioning Technology & Robotic -NTCE Program-, Design of Safety Critical Systems -NTCE Program- and Environmental Decision Making Applied to Decommissioning -NTCE Program-;
- the University of Birmingham offers courses in: Management of the Decommissioning Process -NTCE Program-, Reactor Physics, Criticality & Design -NTCE Program- and the Seminars\textsuperscript{1551} of the Nuclear Physics Group\textsuperscript{1552};
- the University of Leeds\textsuperscript{1553} offers a course in Particle & Colloid Engineering in the Nuclear Industry -NTCE Program;
- the University of Manchester\textsuperscript{1545} offers a PhD in Nuclear Engineering\textsuperscript{1546}; and
- the University of Sheffield offers a PhD in Nuclear Engineering\textsuperscript{1547}.

\textsuperscript{1536}University of Sheffield http://www.sheffield.ac.uk
\textsuperscript{1537}Nuclear Environmental Science and Technology http://www.shef.ac.uk/postgraduate/taught/courses/engineering/material/waste.html
\textsuperscript{1538}Nuclear Science and Technology http://www.shef.ac.uk/postgraduate/taught/courses/engineering/material/nuclear.html
\textsuperscript{1539}City University London http://www.city.ac.uk
\textsuperscript{1540}Msc Nuclear Medicine http://www.city.ac.uk/study/courses/communityhealth/nuclear-medicine-technology/msc.html
\textsuperscript{1541}The Nuclear Technology Education Consortium (NTEC) is a network of several United Kingdom universities and research centres: the University of Birmingham, the University of Central Lancashire, the University of Lancaster, the University of Leeds, the University of Liverpool, the University of Manchester and the University of Sheffield, the University of City University (London), the Defence Academy - College of Management and Technology, the Imperial College London and UHI Millennium Institute. http://www.ntec.ac.uk/prog
\textsuperscript{1542}Master in Nuclear Science & Technology -distance learning http://www.ntec.ac.uk/distance.html
\textsuperscript{1543}University of Cambridge http://www.cam.ac.uk
\textsuperscript{1544}PhD Studentships in Nuclear Physics http://www.liv.ac.uk/physics/research/PGResearch/PGR_Nuclear.html
\textsuperscript{1545}University of Manchester http://www.manchester.ac.uk
\textsuperscript{1546}Nuclear Engineering PhD http://www.mace.manchester.ac.uk/postgraduate/research/choosing/by_degree/phd/nuclear/index.htm
\textsuperscript{1547}Nuclear Engineering PhD http://www.shef.ac.uk/nuclear-engineering-idc/index.htm
\textsuperscript{1548}Defence Academy of the U.K. http://defac.ac.uk
\textsuperscript{1549}Nuclear Department http://www.royalnavy.mod.uk/operations-and-support/establishments/training/establishments/hms-sultan/nuclear-department
\textsuperscript{1550}Lancaster University http://www.lancs.ac.uk
\textsuperscript{1551}Seminars http://www.np.ph.bham.ac.uk/seminars.html
\textsuperscript{1552}Nuclear Physics Group http://www.np.ph.bham.ac.uk/research/npt.htm
\textsuperscript{1553}University of Leeds http://www.leeds.ac.uk
the University of Liverpool offers courses in Environmental Impact Assessment, Radiation Shielding and Reactor Materials & Lifetime Behaviour - all within the NTCE Program -, and a Nuclear Engineering Module;

the University of Manchester (Experimental Reactor Physics - NTCE Program -, Policy, Regulation & Licensing - NTCE Program -) specially in the Dalton Nuclear Institute (Courses topics), the School of Chemistry (Radiochemistry and Nuclear Chemistry), the School of Physics (Introduction to Nuclear and Particle Physics, Nuclear Physics, Applied Nuclear Physics, Nuclear Fusion and Astrophysical Plasmas, Physics Applied to Medicine and Biology, Nuclear Structure, Nuclear Reactions and Research Master classes - nuclear topics -);

the University of Lancaster offers courses in Nuclear Safety Environment and Nuclear Engineering Systems; and

the University of Sheffield offers courses in Processing, Storage & Disposal of Nuclear Waste - NTCE Program -;

the City University London offers courses in Risk Management - NTCE Program -, Post Graduate Certificate Nuclear Medicine Technology and Post Graduate Diploma Nuclear Medicine Technology; and


The United Kingdom Atomic Energy Authority has a number of training courses which includes: Peer Review, Successful Nuclear Safety Case Production and Radiological HAZAN Production Course.

In the nuclear research field the following institutions are involved: Imperial College London and its Department of Physics (see High Energy Physics and Plasma Physics), its Department of Mechanical Engineering (see Nuclear Engineering) and its Energy Futures Lab, the University of Lancaster specially the Engineering Department (see Nuclear Energy); the Nuclear Institute; the University of Liverpool offers courses in Environmental Impact Assessment, Radiation Shielding and Reactor Materials & Lifetime Behaviour - all within the NTCE Program -, and a Nuclear Engineering Module;

the University of Manchester (Experimental Reactor Physics - NTCE Program -, Policy, Regulation & Licensing - NTCE Program -) specially in the Dalton Nuclear Institute (Courses topics), the School of Chemistry (Radiochemistry and Nuclear Chemistry), the School of Physics (Introduction to Nuclear and Particle Physics, Nuclear Physics, Applied Nuclear Physics, Nuclear Fusion and Astrophysical Plasmas, Physics Applied to Medicine and Biology, Nuclear Structure, Nuclear Reactions and Research Master classes - nuclear topics -);

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of Birmingham specially its Nuclear Physics Group; the University of Liverpool and its Department of Physics (see Nuclear Physics Group); the University of Manchester particularly the Dalton Nuclear Institute (Nuclear Group) and the Westlakes Scientific Consulting.

The most important associations involved in the nuclear education are the National Skills Academy and the Nuclear Industry Association.

STAKEHOLDERS

There are a large number of companies that are involved in the nuclear industry in the UK which includes: ABB Group, Abbot Risk Consulting, Addleshaw Goddard LLP, Aish Technologies, Aker Solutions, Allen & Overy LLP, Alstom, Altran Praxis, Amec, Arcadis, ASD Metal Services, Ashurst, Association

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1581 Nuclear Physics Group http://www.np.ph.bham.ac.uk/
1582 University of Liverpool http://www.liv.ac.uk/
1583 Department of Physics http://www.liv.ac.uk/physics/index.html
1584 Nuclear Physics Group http://www.liv.ac.uk/physics/research/nuclear_physics.html
1585 University of Manchester http://www.manchester.ac.uk/
1586 Dalton Nuclear Institute http://www.dalton.manchester.ac.uk/
1587 Nuclear Group http://www.mace.manchester.ac.uk/research/groups/nuclear http://www.nuclear.manchester.ac.uk
1588 Westlakes Scientific Consulting http://www.westlakes.org
1589 National Skills Academy http://www.niauk.org/component/option,com_niaidfront/itemid,311
1590 Nuclear Industry Association http://www.niauk.org/component/option,com_niaidfront/itemid,311
1591 ABB Group http://www.abb.com/
1592 Abbot Risk Consulting http://www.consultarc.com/content/home.asp
1594 Aish Technologies http://www.aishtechnologies.com/home/index.html
1595 Aker Solutions is a UK company with presence in Cyprus, Denmark, Finland, France, Germany, Netherlands and United Kingdom http://www.akersolutions.com/internet/default.htm
1596 Allen & Overy LLP is a UK company with presence in Belgium, Czech Republic, France, Germany, Greece, Hungary, Italy, Luxembourg, Netherlands, Poland, Romania, Slovak Republic, Spain and United Kingdom http://www.allenovery.com/AOWeb/Home/AllenOveryHome.aspx?prefLangID=410
1597 Alstom http://www.alstom.com/home
1598 Altran Praxis http://www.altran-praxis.com
1599 Amec is a UK company with presence in Czech Republic, German, Italy, Netherlands, Slovakia, Spain and United Kingdom http://www.amec.com/aboutus.htm
1600 Arcadis http://www.arcadis-uk.com
1601 ARUP is a UK company with presence in Denmark, Germany, Italy, Netherlands, Poland, Romania, Spain and United Kingdom http://www.arup.com
1602 ASD Metal Services http://www.asdmetalservices.co.uk
1603 Ashurst is a UK company with presence in Belgium, France, Germany, Italy, Spain, Sweden and United Kingdom http://www.ashurst.com/home.aspx?id=content=2
of Electricity Producers
Assystem
ATB
ATG
ATK
AWE
Babcock & Wilcox
BAE Systems Submarines Solutions
Balfour Beatty
Bam Nuttall
Barhale Construction
Battelle
Bechtel Power Corporation
Biwater Treatment
BMT Isis
Bouling Group
Böhler Edelstahl
Brachium
Bradtec Decon Technologies
BRC Reinforcement
British Nuclear Fuels Limited (BNFL)
British Energy
Brown and Mason
BT
C&D Group
Calder
Cammell Laird
Carroll
Carpenter & Paterson
Cask
Centrica
Centronic
CH2M HILL
Clifford Change
Clyde
CMP Products
CMS Cameron McKenna
Controlled Group
Converteam
Corporate Risks Associates
Corus Consulting
Costain
Culham Centre Fusion Energy
Daher
Darchem Engineering (Esterline)
Davis Langdon
Day & Zimmermann
Deloitte
Del Fungo Giera Energia
Denton Wilde Sapte
DBD Nuclear
DLA Piper
Dundas & Wilson
Cara Group
Carillon
Carter Consulting
Caski
Centronic
CH2M HILL
Clifford Change
Clyde
CMP Products
CMS Cameron McKenna
Controlled Group
Converteam
Corporate Risks Associates
Corus Consulting
Costain
Culham Centre Fusion Energy
Daher
Darchem Engineering (Esterline)
Davis Langdon
Day & Zimmermann
Deloitte
Del Fungo Giera Energia
Denton Wilde Sapte
DBD Nuclear
DLA Piper
Dundas & Wilson

1215 Morson Projects is a UK company with presence in Germany, Italy and United Kingdom. [http://www.morson-projects.co.uk/]
1216 Mott MacDonald is a UK company with presence in Bulgaria, Czech Republic, France, Hungary, Ireland, Netherlands, Poland, Romania and United Kingdom. [http://www.mottmac.com/]
1217 NG Bailey [http://www.ngbailey.co.uk/]
1218 NIS Group [http://www.nisltd.com/]
1219 Northwest Development Agency [http://www.nwda.co.uk/]
1220 Norton Rose [http://www.nortonrose.com/]
1221 NSG Environmental [http://www.nsgltd.com/]
1222 Nuclear Engineering Services [http://www.nes-limited.co.uk/]
1223 Nuclear Management Partners [http://www.nuclearmanagementpartners.com/]
1224 Nuclear National Laboratory [http://www.nnl.co.uk/]
1225 Nuclear Risk Insurers [http://www.nuclear-risk.com/]
1226 Nuclear Technologies [http://www.nuclear.co.uk/]
1227 Nuvia [http://www.nuvia.co.uk/]
1228 OEE [http://www.oeeuk.com/]
1229 Osborne Clarke International [http://www.osborneclarke.com/]
1230 Outo Kumpu [http://www.outokumpu.com/]
1231 Pac Tec EPS [http://www.pactecep.co.uk/]
1232 Panorama Group [http://www.panoramagroup.co.uk/]
1233 Parsons Brinckerhoff [http://www.pbworld.com/]
1234 Piper Supports [http://www.pipesupports.com/]
1235 Powerplus Systems [http://www.powerplus.co.uk/]
1236 Procon Engineering [http://www.proconeng.com/]
1237 Promanex [http://www.promanex.com/English/PromanexGroup/Home.asp?ID=94]
1238 Qinetiq (int) [http://www.qinetiq.com/global.htm]
1239 Qinshield [http://www.qinshield.com]
1240 Radwise [http://www.radwiselimited.co.uk/index.htm]
1241 Rider Levet Bucknall [http://www.rlb.com]
1242 Rolls Royce [http://www.rolls-royce.com/]
1244 Roxtec [http://www.roxtex.com/]
1245 RPS is a UK consultancy with subsidiaries in Ireland, Netherlands and United Kingdom. [http://www.rpsgroup.com/getdoc/34b815f9-8a26-4a3a-b495-77c556e27e4e/index.asp]
1247 Safety and Ecology Corporation [http://www.sec-tn.com/]
1248 Scottish Enterprise Energy Team [http://www.scottishenterprise.com/]
1249 Scott Wilson [http://www.scottwilson.com/]
1250 SEC [http://www.sec-uk.com/]
1251 Senior Hargreaves [http://www.hargreaves-ductwork.co.uk/]
1252 Serck Services [http://www.serckservices.co.uk/]
1253 Serco [http://www.serco.com/]
1254 Shaw Group [http://www.shawgrp.com/]
1255 Simmons & Simmons is a UK company with presence in Belgium, France, Germany, Italy, Netherlands, Spain and United Kingdom. [http://www.simmons-simmons.com/index.cfm?fuseaction=simmons_simmons_com.main]
1256 Sir Robert McAlpine [http://www.sir-robert-mcalpine.com/]
1257 Stainless Metalcraft (charteris) [http://www.metalcraft.co.uk/index.htm]
1259 Tesella [http://www.tesella.com/]
1260 TRM [http://www.temperature-house.com/]
1261 Trulfo Marine [http://www.trulfomarine.com/]
1262 Turley Associates [http://www.turleyassociates.co.uk]
1264 TWI Technology Engineering [http://www.twi.co.uk/]
1265 Ultra Electronics [http://www.ultra-electronics.com/]
1266 URS is also based in Netherlands. [http://www.urscorp.eu/]
1267 Weir Power & Industrial is a UK company with also presence in France. [http://www.weirpowerindustrial.com/]
1268 White & Case [http://www.whitecase.com/]
1269 Wragge [http://www.wragge.com/]

INDUSTRY IN THE UNITED KINGDOM

Nuclear Stakeholders per business in the UK [%]

Nuclear Stakeholders per business in the UK
CONCLUSIONS

The first observation is that there is still a lack of harmonization in the field of nuclear education in Europe. Although the choice of whether to use nuclear energy or not is at the discretion of the national authorities, harmonization is necessary if mobility and effective use of nuclear human resources through Europe is persuaded. At present, all EU countries are going through a period of transition to make the necessary reforms to implement the Bologna Process. However, these systems have not yet been fully harmonized since not all the countries have made all the necessary changes to their higher level educational systems and there are still some countries where the old higher level educational system coexists with the new one.

There are also differences in the position on nuclear energy since each of the 27 EU countries has different policies on the acceptability and the need to develop nuclear energy. This affects the educational system since the relative strength or weakness of the nuclear industry has a significant influence on the SUPPLY of and the DEMAND for human resources. In those countries where nuclear energy plays an essential role, education in the nuclear field is widely supported both by government and by the different educational institutions.

It is noted that, within the 27 EU countries, there is a clear division between those countries that support nuclear energy and those countries that do not. Amongst the latter, in most cases there is a lack of interest and a lack of educational centres that offer courses in the nuclear area.

In addition, there are some countries where nuclear energy has not been adopted but there is ongoing research and educational activities in the nuclear field that are continuously being maintained and updated.

It was noted that the European Nuclear Education Network (ENEN) plays already a significant role for harmonization of educational systems and encouragement of mobility of students and professors. In addition, the existence of institutions like the European Nuclear Society (ENS), the nuclear fora and the Academies of Sciences (or similar educational institutions) are providing a major contribution in the field of nuclear education in ensuring that the general public and future students are aware of the issues relating to nuclear energy.

In general terms, it is noted that increasing SUPPLY possibilities for human resources for the nuclear industry are being created in last couple of years and that this is beginning to repair the deficit that has arisen during the years in which the acceptance of nuclear energy has shown a downturn. It is clear however, that the accident that has occurred at the Fukushima Daiichi nuclear power plant in Japan will affect public opinion on nuclear power and this most probably will be reflected in the educational field. Because of this, it will be even more important to monitor and forecast the development/maintenance of adequate nuclear human resources in Europe and act in a timely manner to ensure expertise and competence needed to ensure safe operation of the EU nuclear power plants is in place. JRC EHRO-N will regularly update its studies on this issue and will provide relevant information to EC policy makers on this issue.
## ANNEX I: HIGHER LEVEL EDUCATION POSSIBILITIES IN EU-27

<table>
<thead>
<tr>
<th>Country</th>
<th>Institution</th>
<th>Website</th>
<th>Type</th>
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<tr>
<td>AUSTRIA</td>
<td>Atomic Institute of the Austrian Universities/Atominstitut</td>
<td><a href="http://www.ati.ac.at/index">http://www.ati.ac.at/index</a></td>
<td>Research</td>
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<td>AUSTRIA</td>
<td>Vienna University of Technology/Technische Universität Wien</td>
<td><a href="http://www.tuwien.ac.at/tuwien_home/EN">http://www.tuwien.ac.at/tuwien_home/EN</a></td>
<td>Research</td>
</tr>
<tr>
<td>BELGIUM</td>
<td>Free University of Brussels/Université Libre de Bruxelles (ULB)</td>
<td><a href="http://www.ulb.be/index.htm">http://www.ulb.be/index.htm</a></td>
<td>Master/Research</td>
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<td>BELGIUM</td>
<td>Free University of Brussels/Vrije Universiteit Brussel (VRIJ)</td>
<td><a href="http://www.vub.ac.be/">http://www.vub.ac.be/</a></td>
<td>Course</td>
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<tr>
<td>BELGIUM</td>
<td>SCK-CEN</td>
<td><a href="http://www.sckcen.be">http://www.sckcen.be</a></td>
<td>PhD/Research</td>
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<tr>
<td>BELGIUM</td>
<td>University of Liege/Université de Liège</td>
<td><a href="http://www.ulg.ac.be/cms/c_5000/home">http://www.ulg.ac.be/cms/c_5000/home</a></td>
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<tr>
<td>BULGARIA</td>
<td>Institute for Nuclear Research and Nuclear Energy (INRNE)</td>
<td><a href="http://www.inrne.bas.bg/cgi-bin/e-cms/vis.pl?s=001&amp;p=0107&amp;w=">http://www.inrne.bas.bg/cgi-bin/ecms/vis.pl?s=001&amp;p=0107&amp;w=</a></td>
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<tr>
<td>BULGARIA</td>
<td>Plodiv University Paisii Hilendarski</td>
<td><a href="http://www.uni-plovdiv.bg/?ln=">http://www.uni-plovdiv.bg/?ln=</a></td>
<td>Course</td>
</tr>
<tr>
<td>BULGARIA</td>
<td>Sofia University St. Kliment Ohridski</td>
<td><a href="http://portal.uni-sofia.bg/index.php/eng">http://portal.uni-sofia.bg/index.php/eng</a></td>
<td>Bachelor, Master, PhD, Research</td>
</tr>
<tr>
<td>BULGARIA</td>
<td>Technical University of Sofia</td>
<td><a href="http://www.tu-sofia.bg/ENG/index.htm">http://www.tu-sofia.bg/ENG/index.htm</a></td>
<td>Bachelor, Master, PhD, Research</td>
</tr>
<tr>
<td>CZECH REP.</td>
<td>Charles University in Prague/Univerzita Karlova v Praze</td>
<td><a href="http://www.cuni.cz/UKENG-1.htm">http://www.cuni.cz/UKENG-1.htm</a></td>
<td>Bachelor, Course, Research</td>
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<tr>
<td>ESTONIA</td>
<td>Tallinn University of Technology/Tallinna TehnikaÜlikool</td>
<td><a href="http://www.ttu.ee/?lang=en">http://www.ttu.ee/?lang=en</a></td>
<td>Research</td>
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<tr>
<td>Country</td>
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<tr>
<td>FINLAND</td>
<td>Graduate School in Particle and Nuclear Physics (GRASPANP)</td>
<td><a href="https://www.jyu.fi/fysiikka/opiskelu/tutkijakoulut/summary.html">https://www.jyu.fi/fysiikka/opiskelu/tutkijakoulut/summary.html</a></td>
<td>Course, Research</td>
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<tr>
<td>FINLAND</td>
<td>Helsinki Institute of Physics/Fysiikan Tutkimuslaitos (HIP)</td>
<td><a href="http://www.hip.fi/index.html">http://www.hip.fi/index.html</a></td>
<td>Research</td>
</tr>
<tr>
<td>FINLAND</td>
<td>University of Jyväskylä/Jyväskylän Yliopisto</td>
<td><a href="https://www.jyu.fi/en">https://www.jyu.fi/en</a></td>
<td>Course, Research</td>
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<td>FRANCE</td>
<td>Armines (Grandes Écoles)</td>
<td><a href="http://www.armines.net/?SetLang=uk">http://www.armines.net/?SetLang=uk</a></td>
<td>Research</td>
</tr>
<tr>
<td>FRANCE</td>
<td>Engineering National High School of Caen/ École Nationale Supérieure d’Ingénieurs de Caen (ENSICAEN)</td>
<td><a href="http://www.ensicaen.fr/61401893/o/fichesagelibre/&amp;RH=OUTILS">http://www.ensicaen.fr/61401893/o/fichesagelibre/&amp;RH=OUTILS</a></td>
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<tr>
<td>FRANCE</td>
<td>Mines School of Alès/École des Mines d'Alès</td>
<td><a href="http://www.mines-ales.fr/pages/?all=accueil&amp;id=29">http://www.mines-ales.fr/pages/?all=accueil&amp;id=29</a></td>
<td>Bachelor</td>
</tr>
<tr>
<td>FRANCE</td>
<td>National Chemistry High School of Montpellier/École Nationale Supérieure de Chimie de Montpellier</td>
<td><a href="http://www.enscm.fr/en">http://www.enscm.fr/en</a></td>
<td>Bachelor</td>
</tr>
<tr>
<td>FRANCE</td>
<td>National Institute for Nuclear Science and Technology/Institut National des Sciences &amp; Techniques Nucléaires (INSTN)</td>
<td><a href="http://www-instn.cea.fr/Page-Sommaire.html">http://www-instn.cea.fr/Page-Sommaire.html</a></td>
<td>Bachelor, Master (Eur), PhD (coll. Paris XI), Course</td>
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<tr>
<td>FRANCE</td>
<td>Radioprotection and Nuclear Safety Institute/Institut de Radioprotection et de Sûreté Nucléaire</td>
<td><a href="http://www.irsn.fr/EN/Pages/home.aspx">http://www.irsn.fr/EN/Pages/home.aspx</a></td>
<td>Research</td>
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<tr>
<td>GERMANY</td>
<td>Clausthal University of Technology/Technische Universität Clausthal</td>
<td><a href="http://www.tu-clausthal.de/info/Welcome.html">http://www.tu-clausthal.de/info/Welcome.html</a></td>
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<tr>
<td>GERMANY</td>
<td>European Nuclear Energy Leadership Academy (ENELA)</td>
<td><a href="http://www.enela.eu/">http://www.enela.eu/</a></td>
<td>Master</td>
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<tr>
<td>GERMANY</td>
<td>Federal Institute for Geosciences and Natural Resources/Bundesanstalt für Geowissenschaften und Rohstoffe</td>
<td><a href="http://www.bgr.bund.de/EN/Home/homepage_node.html">http://www.bgr.bund.de/EN/Home/homepage_node.html</a></td>
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<td>GERMANY</td>
<td>German Research Foundation/Deutsche Forschungsgemeinschaft</td>
<td><a href="http://www.dfg.de/en/">http://www.dfg.de/en/</a></td>
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<td>GERMANY</td>
<td>Heidelberg University/Universität Heidelberg</td>
<td><a href="http://www.uni-heidelberg.de/">http://www.uni-heidelberg.de/</a></td>
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<td>GERMANY</td>
<td>Institutes of the Dresden-Rossendorf Research Center/Institute des Forschungszentrums Dresden-Rossendorf</td>
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<td>NETHERLAND</td>
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<td>POLAND</td>
<td>Central Laboratory for Radiological Protection/Centralne Laboratorium Ochrony Radiologicznej</td>
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## ANNEX II: NATIONAL ACADEMIES INVOLVED IN THE NUCLEAR FIELD

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<td>Bulgarian Academy of Sciences</td>
<td><a href="http://www.bas.bg/cgi-bin/e-cms/vis/vis.pl?s=001&amp;p=020">http://www.bas.bg/cgi-bin/e-cms/vis/vis.pl?s=001&amp;p=020</a></td>
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<td>Hungary</td>
<td>Hungarian Academy of Sciences/ Magyar Tudományos Akadémia</td>
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<td>National Skills Academy</td>
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### ANNEX III: NUCLEAR EDUCATION NETWORKS

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<th>Country</th>
<th>Network</th>
<th>Website</th>
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<tr>
<td>FINLAND</td>
<td>FINNEN</td>
<td><a href="http://www.tkk.fi/en">http://www.tkk.fi/en</a></td>
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<tr>
<td>FRANCE</td>
<td>INSTN</td>
<td><a href="http://www-instn.cea.fr/Page-Home.htm">http://www-instn.cea.fr/Page-Home.htm</a></td>
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<tr>
<td>GERMANY</td>
<td>Kompetenzverbund Kerntechnik</td>
<td><a href="http://nuklear-server.ka.fzk.de/Kompetenzverbund/start.htm">http://nuklear-server.ka.fzk.de/Kompetenzverbund/start.htm</a></td>
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<td>ITALY</td>
<td>CIRTEN</td>
<td><a href="http://www.cirten.it">http://www.cirten.it</a></td>
</tr>
<tr>
<td>NETHERLAND</td>
<td>KINT</td>
<td><a href="http://www.kint.nl">http://www.kint.nl</a></td>
</tr>
<tr>
<td>ROMANIA</td>
<td>RONEN</td>
<td><a href="http://www.ronen.ro">http://www.ronen.ro</a></td>
</tr>
<tr>
<td>U.K.</td>
<td>NTEC</td>
<td><a href="http://www.ntec.ac.uk">http://www.ntec.ac.uk</a></td>
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<tr>
<td>EU</td>
<td>ENEN</td>
<td><a href="http://www.enen-assoc.org">http://www.enen-assoc.org</a></td>
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</table>

![Bar chart showing the number of members in each network](chart.png)
## ANNEX IV: NUCLEAR NATIONAL SOCIETIES

<table>
<thead>
<tr>
<th>Country</th>
<th>Society</th>
<th>Website</th>
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<td>AUSTRIA</td>
<td>ÖKTG</td>
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<td>BELGIUM</td>
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<td><a href="http://www.bns.org.eu/">http://www.bns.org.eu/</a></td>
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<td>BULGARIA</td>
<td>BGNS</td>
<td><a href="http://www.bgns.bg/page.php?n=103201&amp;SiteID=802">http://www.bgns.bg/page.php?n=103201&amp;SiteID=802</a></td>
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<tr>
<td>CZECH REP.</td>
<td>CNS</td>
<td><a href="http://www.csvts.cz/cns/">http://www.csvts.cz/cns/</a></td>
</tr>
<tr>
<td>EUROPEAN</td>
<td>ENS</td>
<td><a href="http://www.euronuclear.org/">http://www.euronuclear.org/</a></td>
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<tr>
<td>FINLAND</td>
<td>ATS</td>
<td><a href="http://www.ats-fns.fi/eng/eng_index.html">http://www.ats-fns.fi/eng/eng_index.html</a></td>
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<tr>
<td>FRANCE</td>
<td>SFEN</td>
<td><a href="http://www.sfen.org/">http://www.sfen.org/</a></td>
</tr>
<tr>
<td>ITALY</td>
<td>AIN</td>
<td><a href="http://www.assonucleare.it/">http://www.assonucleare.it/</a></td>
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<td>LNEA</td>
<td><a href="http://www.lbea.lt/?lang=en">http://www.lbea.lt/?lang=en</a></td>
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<td>NNS</td>
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<tr>
<td>ROMANIA</td>
<td>AREN</td>
<td><a href="http://www.aren.ro/en_index.htm">http://www.aren.ro/en_index.htm</a></td>
</tr>
<tr>
<td>SLOVAKIA</td>
<td>SNS</td>
<td><a href="http://www.snus.sk/default_en.htm">http://www.snus.sk/default_en.htm</a></td>
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<tr>
<td>SLOVENIA</td>
<td>NSS</td>
<td><a href="http://www.djs.si/indexen.html">http://www.djs.si/indexen.html</a></td>
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<td><a href="http://www.nss.si/">http://www.nss.si/</a></td>
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<tr>
<td>SPAIN</td>
<td>SNE</td>
<td><a href="http://www.sne.es/sne/">http://www.sne.es/sne/</a></td>
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<tr>
<td>SWEDEN</td>
<td>SKS</td>
<td><a href="http://www.karnteknik.se/">http://www.karnteknik.se/</a></td>
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## ANNEX V: NUCLEAR REGULATORY AUTHORITIES

<table>
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<tr>
<th>Country</th>
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<tr>
<td>BELGIUM</td>
<td>BEL V</td>
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<tr>
<td>DENMARK</td>
<td>DEMA</td>
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</tr>
<tr>
<td>ESTONIA</td>
<td>ALARA</td>
<td><a href="http://www.alara.ee">http://www.alara.ee</a></td>
</tr>
<tr>
<td>FRANCE</td>
<td>ASN</td>
<td><a href="http://www.asn.fr">http://www.asn.fr</a></td>
</tr>
<tr>
<td>GERMANY</td>
<td>BMU</td>
<td><a href="http://www.bmu.de/english/aktuell/4152.php">http://www.bmu.de/english/aktuell/4152.php</a></td>
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<tr>
<td>IRELAND</td>
<td>RPII</td>
<td><a href="http://www.rpii.ie">http://www.rpii.ie</a></td>
</tr>
<tr>
<td>ITALY</td>
<td>ISPRRA</td>
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<td>LUXEMBOURG</td>
<td>Radioprotection Department</td>
<td><a href="http://www.ms.public.lu/fr/activites/radioprotection/index.htm">http://www.ms.public.lu/fr/activites/radioprotection/index.htm</a></td>
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<tr>
<td>NETHERLAND</td>
<td>VROM</td>
<td><a href="http://international.vrom.nl">http://international.vrom.nl</a></td>
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<tr>
<td>PORTUGAL</td>
<td>CIPRSN</td>
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<td>SPAIN</td>
<td>CSN</td>
<td><a href="http://www.csn.es">http://www.csn.es</a></td>
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<tr>
<td>SWEDEN</td>
<td>SKI</td>
<td><a href="http://www.ski.se/Allmanhet">http://www.ski.se/Allmanhet</a></td>
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BIBLIOGRAPHY


• Discusión y opinión pública sobre la energía nuclear en España. Pérez-Díaz, Víctor; Rodríguez, Juan Carlos. ASP Research Paper 73(a)/2007.


• Nuclear Energy in Finland. Ministry of Employment and the Economy.


• ENEN Website

• Status and Trends in Nuclear Education. IAEA Nuclear Energy Series Nr. NG-T-6.1, 2011.
ACKNOWLEDGEMENT

This report has been reviewed internally by staff from the JRC’s Institute for Energy and externally by the Senior Advisory Group (SAG) of the European Human Resource Observatory in the Nuclear Energy Sector (EHRO-N). We would like to acknowledge therefore the following persons for their contribution:

Internal


SAG Members of EHRO-N

Ute Blohm-Hieber, David Gilchrist, Georges van Goethem, Andreas Hamann, Luc van Hoenacker, Simonne Henrard, Joachim Knebel, Jürgen Krone, Ludger Mohrbach, Brian Murphy, Eckhard Nithack, Francisco Sanchez, Anselm Schäfer, Vladimir Slugen, Laurent Turpin, Yanko Yanev
ABSTRACT

The petroleum crisis in 1973 caused public opinion to swing in favour of the development of nuclear energy, since this did not depend on the imports of oil and the costs of nuclear energy were becoming more and more economic. However, the accidents of Three Mile Island in 1979 and Chernobyl in 1986 caused a significant reduction in the support for nuclear energy leading to the construction of all new nuclear power stations in Europe being stopped.

This reduction in the support for nuclear energy has had a significant effect on education in the nuclear field, especially at the higher educational level since there was no longer the need for new human resources in the nuclear industry. This has led to a reduction in student numbers in courses related to nuclear energy which in turn has led to the SUPPLY of human resources to the nuclear industry being reduced.

One of the aims of this report is to help young people who might wish to work in the nuclear industry to get an overview of all the courses that are being offered by academic and research institutions in the nuclear field. This report also provides a mapping of what is happening in the educational and research institutions in the nuclear field in the EU-27. This is intended to help academia and industry to know about the different initiatives, to be complementary to each other and to collaborate for a harmonic resurgence of nuclear energy across Europe.

In short, this report makes a contribution that allows both the SUPPLY institutions of human resources to the nuclear industry and the DEMAND stakeholders of these human resources to be aware of the existence of each other, to make contact, and to collaborate in addressing the shortfalls that exist in the nuclear industry.

The report gives factual information for each of the countries of the EU relating to the situation with respect to nuclear power, the higher educational opportunities available and the companies involved in the nuclear industry. Much of the work to produce the report was carried out before the accident at the Fukushima Daiichi nuclear power plant occurred in March 2011. It is clear that this has led to a change in public opinion so that the support for nuclear power has reduced significantly. In addition, the future of the operating nuclear power plants and the need to build additional ones is being reconsidered by the government in some countries. However, the factual information presented in the report that presents the situation relating to nuclear power in each of the countries, the higher educational opportunities available and the companies involved in the nuclear industry will still be valid.

The contents of this report will be published and updated on the website of EHRO-N, which is [http://ehron.jrc.ec.europa.eu](http://ehron.jrc.ec.europa.eu).
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