URENCO has a pivotal role in the nuclear fuel supply chain, providing our customers with the enrichment service they need to produce low carbon electricity through nuclear generation.

As part of a balanced energy mix, low carbon electricity generated from nuclear power can help mitigate the effects of climate change on the world around us, including protecting Earth’s magnificent glaciers from melting.

We are proud to play a role in reducing the global carbon footprint and helping to protect our planet.
Welcome to URENCO

URENCO is a leading provider of uranium enrichment services to the world’s nuclear energy industry. With operations across four countries, we ensure our customers around the world receive safe and reliable supplies of enriched uranium to fuel civil nuclear reactors.

Nuclear power plays a key role in meeting the world’s low carbon energy demands. Using centrifuge technology designed and developed by URENCO, we have provided quality and expertise for more than 40 years, helping our customers to meet global energy consumption with a reduced carbon footprint.

Our robust position in the global nuclear market is due to our healthy business strategy, strong leadership and talented workforce. Nuclear is a long-term business, and we take a long-term view of our operations to ensure we meet the needs of our customers and our commitments to society and the environment.

Sustainability is embedded within our business – with dedicated focus areas covering economic, environmental and social issues monitored by Sustainability Champions across all our sites and with Board-level oversight. The enrichment of uranium is sustainable for generations to come – both in the processes it deploys and the low carbon end product it delivers.

It is what we call ‘enriching the future’.

What we do

URENCO is a global business serving a range of utility customers, who provide low carbon electricity through nuclear generation. Our customers source the feed, uranium hexafluoride (UF6), and we provide a service to enrich the material to meet their specifications, enabling them to continue to the next stage of the nuclear fuel supply chain.

Supplying the world with fuel to generate low carbon energy is just part of what we do – our commitment to sustainability and educating the next generation on the importance of nuclear in our energy mix is a core part of our culture.

Our facilities

We have four uranium enrichment facilities. These are located at Almelo in the Netherlands; Capenhurst in the UK; Gronau in Germany and Eunice, New Mexico in the USA. Our Head Office is located close to London.

We are the only company in the world to operate enrichment facilities in four countries under four different regulatory regimes. This geographical reach and diversity of supply are distinct competitive advantages which allow us to respond flexibly to the needs of our customers. We have a strong forward order book which allows us to plan production volumes many years in advance.

We are firmly committed to leading the way in responsible uranium stewardship and have several subsidiaries dedicated to overseeing our work in this area. These include URENCO ChemPlants Limited, which is responsible for the construction of our Tails Management Facility (TMF) in the UK, and Capenhurst Nuclear Services Limited (CNS).1

Our Stable Isotopes business in the Netherlands draws on our expertise and capabilities in centrifuge technology to produce a variety of products for medical, industrial and research applications.

1 For more information on materials management and uranium stewardship, visit www.capenhursturaniumservices.com.

Our customers

As a global leader in enrichment services, we supply more than 50 customers in 19 countries. We build robust, long-term partnerships supporting customers to deliver on their goals and respond flexibly to their requirements.

We regularly survey our customers to assess the quality of our services, and the strength of our customer relationships were analysed in our Global Customer Survey. In 2014, 81% of URENCO customers said they were ‘very satisfied’ with their enrichment services, and 76% said they were ‘very satisfied’ with their relationship with URENCO.

The Treaty of Almelo

Our leadership position and longevity can be traced back to the Treaty of Almelo. Signed in 1970 by the UK, Dutch and German governments, the Treaty of Almelo laid the foundations for international co-operation. At its core was a commitment to promote the peaceful application of nuclear power and to harness atomic expertise for use in energy, science and medicine. It created a platform for the joint development of centrifuge enrichment technology and put robust safeguards in place to protect this technology from misuse and proliferation.

Under the terms and principles of the Treaty, URENCO has become a market leader of enrichment services globally. As URENCO has grown, it has extended its international co-operation through treaties with the USA and France. By complying with these agreements and living our values (see page 8), we continue to focus on quality, reliability and the highest standards of uranium stewardship and corporate responsibility.
Inside a centrifuge cascade hall at a URENGO enrichment facility.
Our culture

URENCO company culture underpins our business model.

Our purpose
We play a key part in meeting the world’s need for reliable, low carbon energy.

Our vision
We believe the world needs nuclear energy to meet the demands of sustainable global energy. We can help the transition to a low carbon economy through the deployment of our enrichment services and technology.

Our mission
Our mission is to be the supplier of choice within our sector and a key contributor to sustainable energy.

Our five values
Inspired by our culture, five values guide everything we do at URENCO – from our strategic and operational decision-making to our day-to-day activities.

- Safety: We operate to the highest standards of safety, environmental and security requirements.
- Integrity: We conduct all our relationships with honesty, fairness and respect.
- Flexibility: We respond to best meet our customers’ needs by flexibly deploying our skills and capabilities.
- Development: We are committed to the sustainable development of our business by continuously developing our employees, services and products.
- Profitability: We are committed to making profits to secure our future and reward our shareholders and employees.

Our duty to the Treaty of Almelo
The Treaty of Almelo enshrines the enduring purpose and principles of URENCO regardless of ownership.

About URENCO
Our culture and values

Our strategic goals

URENCO’s strategy to deliver its mission is focused on providing excellent customer service. The implementation of our strategy is based on five strategic pillars:

1. Responsiveness
2. International presence and collaboration
3. Highly motivated and committed people
4. Responsible long-term business
5. URENCO’s centrifuge technology

About URENCO
Our five strategic pillars

- Customer-focused relationships: We maintain close, long-term relationships with our customers and we are committed to delivering for them. Our technology enables us to respond flexibly to our customers’ needs and market dynamics. In this respect we carry out long-term planning and preparations while making sure we always meet our commitments.
- Geographic spread and reach: We maximise the advantage of our global presence to provide security of supply for our customers. URENCO always aims to share best practice and improve our processes and efficiencies. Our operations in Europe and the USA give us a unique advantage that supports us in serving more than 50 customers in 19 countries worldwide.
- Talent and retention: To ensure we can build our strength as a global leader in enrichment services, we invest substantially in our people’s skills and development. Our aim is to make URENCO an employer of choice. We are also committed to creating one URENCO: four enrichment facilities around the world with our dedicated, highly-skilled workforce united as one.
- Sustainability: Sustainability goes to the very core of our business. For URENCO, sustainability means health, safety, environment, asset integrity, safeguards, security, ethical conduct and social performance. We are committed to continuous improvement in these areas. Our sustainability agenda has Board-level support and is embedded across every aspect of our business.
- Over 40 years’ operational experience: URENCO has successfully and reliably operated gas centrifuge technology for more than 40 years. Our experience and expertise enables us to operate our technology efficiently and effectively, which means we can provide a flexible and responsive service to our customers worldwide.

Again, in 2014 we met 100% of our customer delivery commitments.
As of June 2015, our order book extends beyond 2030.
During 2014, more than 300 employees took part in leadership development training programmes.
In 2014, URENCO established a network of Sustainability Champions who are responsible for delivering on the initiatives across the Group.

In 2014 we made better use of our resources to deliver uranium feed.

Our five strategic pillars

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In 2014 we made better use of our resources to deliver uranium feed.
A series of hot boxes and cool boxes at our Dutch enrichment facility.
URENCO USA
Eunice, New Mexico
— our American enrichment facility.

URENCO UK
Cramlington, United Kingdom
— our UK enrichment facility.

URENCO Deutschland
Gronau, Germany
— our German enrichment facility.

URENCO Nederland
Almelo, the Netherlands
— our Dutch enrichment facility.

At a glance, global facts

4 Enrichment facilities

50 (more than) Customers

1,500 Employees

19 Customer countries

18,100 Current production capacity (tSW/a)

All data as at 31 December 2014. Visit www.urenco.com for the latest figures.
URENCO plays a key role in the global nuclear fuel supply chain, ensuring countries have a secure source of low carbon energy. We use centrifuge technology to provide uranium enrichment services to customers, who then generate low carbon electricity using nuclear energy.

The nuclear fuel supply chain

1. **Mining**
   Uranium ore is extracted, purified and milled to become uranium oxide, also known as yellow cake.

2. **Conversion**
   Uranium oxide is chemically converted into uranium hexafluoride (UF₆) and transported to one of our enrichment facilities.

3. **Enrichment and feed materials**
   URENCO’s enrichment process starts with the arrival of customers’ UF₆ at our enrichment facilities. We heat UF₆ to turn it into a gas and feed it into our gas centrifuges. The centrifuge separates the two isotopes contained in uranium: U₂₃⁵ and U₂₃⁸. The lighter U₂₃⁵ is generally enriched to up to 5%, which is sufficient to sustain a continuous fission reaction in a nuclear power plant. The flexibility of our centrifuges allows us to conserve feed material and therefore provide Enriched Uranium Product (EUP) and natural uranium in addition to enrichment services.

4. **Fuel fabrication**
   The customers’ enriched uranium is transported to fuel fabricators, where it is converted into pellets before being loaded into fuel rods.

5. **Nuclear power generation**
   The fuel rods are transported to nuclear power stations, where they power the nuclear reactors. Fuel rods are placed into reactors and used to generate steam, which in turn drives turbines which power generators.

6. **Electricity generation**
   At the end of the nuclear fuel supply chain, the nuclear power plants provide a secure source of low carbon energy – generating electricity for homes, schools, hospitals, offices and industries around the world.
Our business
The uranium enrichment process

URENCO’s part in the process starts with the delivery of customers’ uranium hexafluoride (UF₆) to our enrichment facilities. UF₆ is the most suitable form of uranium for enrichment because it is easily turned into a gas when heated.

A closer look at the enrichment process

Heating UF₆ to turn it into a gas
UF₆ is delivered to our enrichment facilities by approved suppliers in internationally standardised transport containers. UF₆ is solid at ambient temperature. At our enrichment facility we connect the transport container holding UF₆ to the plant feed system. It is then heated in order to vaporise the UF₆ and turn it into gas at sub-atmospheric pressure.

Spinning UF₆ in high speed centrifuges to enrich it
We feed the UF₆ gas into a centrifuge casing containing a cylindrical rotor which spins at high speed, separating uranium’s two isotopes. The heavier isotope U₂₃₈ is forced closer to the wall of the rotor than the lighter U₂₃₅. As a result, the UF₆ gas closer to the wall is depleted in U₂₃₅ and the UF₆ gas nearer the rotor axis is slightly enriched in U₂₃₅. We repeat the process over and over again in a series of centrifuges, known as cascades, until we achieve the desired levels of U₂₃₅ enrichment to meet our customers’ specifications.

Compressing and cooling the enriched uranium
The enriched uranium (UF₆ containing up to 5% of the U₂₃₅ isotope) is fed from the centrifuge cascades into a compressor and then into a cooling box containing a cylinder. As it cools, the UF₆ vapour solidifies in cylinders. We homogenise the UF₆ in the cylinders and check the quality of a sample before delivery to customers.

We weigh all cylinders to comply with the accounting and tracking requirements of the European Atomic Energy Community (EURATOM), United States Nuclear Regulatory Commission (USNRC) and the International Atomic Energy Agency (IAEA).

Storing and converting depleted uranium
The UF₆ gas closer to the wall in the centrifuge is partially depleted in U₂₃₅. This by-product is known as ‘tails’. We collect and cool tails in a cooling box containing a cylinder, weighing it to ensure all material can be accounted for. Tails still contain a low concentration of U₂₃₅ and can be re-enriched if economically viable. We store tails at our enrichment facilities in internationally approved containers pending deconversion to a chemically stable form—uranium oxide (U₃O₈)—for long-term storage.

As well as storing tails at our facilities, we currently contract a third party to chemically convert depleted UF₆ into U₃O₈. We are constructing our own Tails Management Facility to convert UF₆ to U₃O₈. This conversion process additionally creates hydrofluoric acid, a valuable chemical used globally by industry.
As a global leader in enrichment services, URENCO supplies more than 50 customers in 19 countries.

Below is a profile of one of our customers, Emirates Nuclear Energy Corporation.

Profile: Emirates Nuclear Energy Corporation

The Emirates Nuclear Energy Corporation (ENEC) is working to deliver safe, clean, efficient nuclear energy to the United Arab Emirates (UAE) – energy that is needed to support the UAE’s social and economic growth.

Energy demand in the UAE is growing at an annual rate of about 9% – three times the global average. Developing a reliable supply of electricity is critical to the future growth of the nation.

ENEC is taking on this challenge, with four APR1400 nuclear energy generating units currently under construction at Barakah in the Western Region of Abu Dhabi and a target of delivering electricity to the UAE grid in 2017. By 2020, it is projected that ENEC’s four units will produce nearly a quarter of the nation’s electricity needs.

In 2012, ENEC and URENCO signed a long-term contract for the supply of enrichment services to the UAE peaceful nuclear energy programme, an important part of ENEC’s comprehensive fuel supply strategy. URENCO looks forward to continuing with a reliable supply of enrichment services to ENEC and supporting the UAE’s long-term nuclear energy plans.
Safety is our number one priority and focus across the Group. We always seek to operate to the highest standards of safety, environmental and security requirements, for the protection of our employees, the communities where we operate, the suppliers we work with and the customers we supply.

Our four enrichment facilities and subsidiaries comply fully with all regulatory requirements to ensure the safe handling of uranium and other chemicals. The safety culture embedded across the Group is maintained through regular training of employees across all business areas.

Radiological safety
All of our centrifuge plants are designed with the fail-safe principle, with no increased safety risks in the event of a loss of power, water, control, air or other inputs.

In the UK, Public Health England has calculated that, on average, people are exposed to about 2.7 millisieverts (mSv) of radiation a year from naturally occurring sources in homes, workplaces and medical exposures, including X-rays. Many people who visit our enrichment facilities for the first time are surprised at how low the levels of radiation involved in uranium enrichment actually are.

The average radiation dose an employee working in a controlled environment at our UK enrichment facility received in 2013 was 0.40 mSv, well below the natural radiation average calculated by Public Health England. To put it into context, having one abdomen X-ray CT once a year exposes you to 20 times the amount of radiation as working in our UK enrichment facility.

Safeguards and regulatory requirements
Nuclear safeguards are fundamental to the secure operations of our enrichment facilities, and help to ensure that civil nuclear power remains a safe, secure and reliable energy source. URENCO operates in accordance with stringent industry and regulatory standards regarding nuclear safeguards. Across the Group, our centrifuge technology and enrichment facilities are verified and protected by international safeguards policies.

URENCO works closely with governments and organisations such as the International Atomic Energy Agency (IAEA), European Atomic Energy Community (EURATOM), European Safeguards Research & Development Association (ESARDA) and US Nuclear Regulatory Commission (NRC) to create and comply with safeguards regimes. Our commitment has assisted the implementation of international safeguards in the area of enrichment in other countries to the high standards set by the URENCO Group.

Security
Each year, URENCO processes thousands of tonnes of uranium and operates sensitive gas centrifuge technology. We ensure the security of uranic material and our own technology and assets, and we have invested in comprehensive measures to ensure both the physical security of our sites as well as cyber security.

3URENCO internal data.

Did you know?
Nuclear energy has the best safety record of any major form of electricity generation.
Case study: Transport

Our safety values extend to everything we do – including transport. UF₆ transports are very tightly regulated by the nuclear industry, which has an excellent safety and security record. The Dutch, British, German and American licensing authorities regularly inspect URENCO’s transports. We adhere to International Atomic Energy Agency (IAEA) guidelines alongside all other national and international regulations regarding the transportation of fissile material, and we go beyond regulatory requirements in aspects of our own logistics procedures.

We place the utmost importance on the safe transportation of UF₆ at all stages of the enrichment process and only work with specialist audited transport suppliers. International certified containers used for the transportation of UF₆ are designed and produced according to strict international regulations, which pose high demands on materials used to guarantee safety in different transport situations.

The transport cylinders are manufactured from 16mm thick steel, and the cylinders are fitted with overpacks during transport to protect them in case of fire. The feed cylinders can hold 12.5 tonnes of UF₆. The product cylinders are smaller in diameter than the feed cylinders and have a licensed protective casing. Both types of cylinder have to comply with the stringent standards required for pressure vessels; they are tested at the time of manufacture and at five-year intervals thereafter.

Did you know?

Around 20 million shipments of radioactive material take place every year. Packages containing radioactive material are designed to withstand severe accident conditions – there has never been a significant environmental release from a nuclear materials transport.

URENCO’s transport suppliers carry internationally certified cylinders of UF₆ from one of our enrichment facilities.
At URENCO, sustainability is at the very heart of who we are and what we do. Nuclear power plays a key role in meeting the world’s low carbon energy demands and its production requires processes that are efficient, safe and cost-effective. Our commitment to sustainability runs through every aspect of our business. We live up to this commitment by focusing on six key areas of sustainability.

Health and safety, safeguards and security
Health and safety, safeguards and security are crucial elements of our culture, which are championed by our employees and contractors across the Group. At all our facilities, our operations are scrutinised and regulated by government authorities. They approve the design and operating principles of our enrichment facilities and verify the systems we deploy to manage safety, security, safeguards and environmental protection.

Key initiatives and achievements:
- Group-wide ZERO HARM safety campaign
- Regular training programmes
- Cross-site safety audits
- Compliance with all industry and regulatory standards
- IAEA representation and membership, ESARDA membership
- European enrichment facilities management systems certified to EN ISO 14001 (environmental) and ISO 9001 (quality)
- Stringent on-site security measures and precautions
- Co-ordinated the Nuclear Industry Security Summit in Amsterdam
- Enrichment facilities in the Netherlands and Germany are certified to ISO 27001 (IT security)

Environmental impact
We are committed to minimising the environmental impact of our business and achieving greater efficiencies across our facilities. Minimising our environmental impact goes hand in hand with our long-term commitment to a low carbon energy future.

Key initiatives and achievements:
- Developing and reviewing environmental objectives
- Minimising waste and use of natural resources
- Engaging employees on environmental issues
- Assessing the environmental credentials of partner suppliers
- Our Head Office building continues to be rated ‘good’ under BREEAM certification – the world’s foremost environmental assessment method and rating system for buildings

Supplier of choice
URENCO has always believed that building long-term relationships with our customers is at the core of our sustainable business. Being a supplier of choice is the mark of this commitment. Our customers choose us for a number of reasons – namely our reliability in meeting their delivery requirements, our diversity of supply and our desire to respond flexibly to their changing needs.

Key initiatives and achievements:
- Strong financial and commercial performances
- Deliveries planned well in advance to maximise efficiency
- 100% customer delivery on time and in full
- Combined pick-ups and deliveries in Europe to limit the number of empty vehicles on roads

Employer of choice
URENCO wants to be recognised as an employer of choice that offers an inspiring and fulfilling working environment for all our employees. We are proud to have an immensely capable and engaged workforce and we strive to inspire and challenge our employees, to manage their performance effectively and fairly and measure and recognise their achievements.

Key initiatives and achievements:
- Employee survey and HR forum
- Initiatives to help minimise workplace stress
- Flexible working
- Initiatives at our enrichment facility in Germany led to a successful audit of berylundifiable (job and family life)
- URENCO Nederland won the Best Employer 2013 award in the category “Organisations with fewer than 1,000 employees” in an annual survey by research companies Effectity and Intermediar

Community engagement
Building strong links with the local communities where we operate is a core aspect of our sustainability programme and one of our principal responsibilities as an industry leader. Across the URENCO Group, we support local communities through both practical and financial investments focused on education, environment, health, living and culture. Through our community and education programmes, we seek to enhance people’s understanding of our business and our industry. We also aim to nurture interest in science among school children and raise awareness of career opportunities within science, technology and engineering.

Key initiatives and achievements:
- Sponsorship of local events
- Regular council and local liaison meetings
- Practical and financial donations to local and regional charities
- Rich science workshops and annual Rich Lecture
- Volunteer activities – each employee can dedicate one day a year to a specific community initiative
- Highly commended at PRCA Awards 2014 for sustainability programme
- Founding member of Duurzaam Network Almelo (DNA) in the Netherlands, a community-wide sustainability network of local businesses from many different sectors

Asset integrity
The smooth ongoing running of our plant components, systems and infrastructure is vital to the success of our business. At URENCO is a long-term business, it is imperative to ensure the multiple elements of our business function efficiently now and in the future. As such, asset integrity lies at the very heart of URENCO’s overall strategy.

Key initiatives and achievements:
- Group-wide asset integrity audit
- Focus on asset integrity, upgrade and improvement across the Group

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Our success is built on the quality, commitment and professionalism of our employees. We are proud to have an immensely talented workforce and we strive to inspire and challenge our colleagues in their chosen roles.

The success of URENCO is underpinned by our people, in whom we continually invest to ensure we have the expertise and leadership to sustain our business long into the future. Our people are one of our core strategic strengths – their skills and expertise are valuable assets.

As a multi-national group with several subsidiaries, the range of skills and experience at URENCO varies considerably. We’d like to introduce you to just a few of our valued employees to learn more about their areas of focus.

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**Edwin**

*Shift Manager*

**URENCO Nederland**

Edwin has worked for URENCO Nederland for 17 years in technical operation roles. As a Shift Manager, he is responsible for all operational issues and for the development of his shift employees.

Edwin’s diverse background in process and environmental, radiation, vacuum and chemical technologies has prepared him well for scenarios he comes across day-to-day.

A typical day sees Edwin gathering information and checking the status of the plant, as well as taking part in technical discussions and meetings. He works closely with URENCO’s Central Technology Group (CTG) in Germany to enhance procedures and processes.

Edwin thinks that URENCO’s success can be attributed to the strength and professionalism of its workforce, and loves being able to provide skill development opportunities for personnel.

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**Clara**

*Analyst, Business Intelligence*

**URENCO Head Office**

Clara began her career at URENCO on a summer placement in 2011 with the Finance team and is now an Analyst in the Business Intelligence unit of the Commercial department. Based at URENCO’s Head Office, just outside of London, UK, she has also worked at Enrichment Technology Company Limited (ETC) in Germany – so has a diverse knowledge of the companies that make up URENCO Group.

Her main responsibility is to report on the Group-wide Separative Work Unit (SWU) which indicates the energy input relative to the amount of uranium processed, and uranium position, on a monthly basis. The team turns this data into budgets and business plans to support and inform internal and external stakeholders, as well as monitor commercial performance. Day-to-day, her role ranges from compiling position reports to answering specific analysis requests from within the company.

A self-described ‘numbers person’, Clara enjoys framing data into a shape and form that can be used by other teams to make well-informed decisions that benefit the business.

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Did you know?

Nuclear energy provides career opportunities across a diverse range of fields. Jobs are often long-term, with internationally transferrable skills.
Nicola
Senior Radiation Protection Adviser
URENCO UK

Nicola has worked on URENCO’s UK site at Capenhurst for over 25 years, specialising in radiation protection.

In addition to managing the Radiation Protection team, her role focuses on setting the radiation protection standards for URENCO UK and confirming that these standards are being met. She advises and challenges the business on how to drive radiation doses to lower levels, and also provides radiological monitoring equipment and radiological training for the site.

In 2013, the URENCO Radiation Protection Managers Working Group was established, which Nicola is a member of. This has helped in the sharing of good practice across the Group as well as understanding of each site’s processes.

Outside of her day-to-day responsibilities, Nicola is a member of URENCO’s UK Women’s Network and acts as a science, technology, engineering and maths (STEM) ambassador, which has enabled her to work with local schoolchildren and encourage them to think about a career in a STEM industry.

Marcel
Deputy Shift Manager
URENCO Deutschland

Marcel has worked for URENCO Deutschland for almost ten years and is trained as a technician, operator, and fire fighter. During his time at URENCO, he has been able to further develop his knowledge and skills by working at other URENCO facilities including URENCO USA and URENCO UK and has contributed to the development of large projects within the organisation.

Prior to his current role, he worked as an Operator and was responsible for plant control and monitoring, co-ordination of work in the plant and feed supply. He also巡查了 the plant to check systems and components for pressure, temperature and odours and was responsible for tasks like troubleshooting, cascade-sampling and recurring tests.

Marcel was appointed Deputy Shift Manager in September 2015 and in this role, he is responsible for the training of shift operators, arranging working parties and ensuring operational tasks and plant controls. Before his new role commenced, he received extensive training to become a Fire Chief and a Radiation Protection Officer and the opportunity to continually train and improve is the part of the job Marcel likes most.

Joe
Facilities Maintenance
URENCO USA

With a background in electricity, Joe has worked at URENCO USA for almost six years.

His role is varied, but each day starts and ends with a Plan of the Day (POD) meeting where the scheduled jobs are discussed, before his team hits the ground running and doesn’t stop until it’s time to go home.

Each employee in the department is trained in many areas and they must always be ready to switch gears to accommodate the job at hand. They may be working on an issue with an electrical outlet one moment and then trying to find the source of a roof leak the next.

Henry
Recycling Craft Technician
URENCO UK

Henry has worked at URENCO for two years, after joining as part of his advanced apprenticeship. He has since achieved a Higher National Certificate (HNC) in mechanical engineering.

In his role as Recycling Craft Technician, he is responsible for building and testing pumps to keep process plants online, which includes keeping up-to-date records and being responsible for his and others’ safety. He has previously worked in URENCO’s Plant Maintenance department.

A childhood spent working on cars, motorbikes and push bikes gave Henry a taste for fixing things, and his favourite part of his current role is working out solutions to problems and implementing them.

For further information on careers at URENCO, please visit our careers portal: www.urenco.com/careers.
The control room at one of our enrichment facilities.
At URENCO, we are keen to increase the public’s understanding of the nuclear industry and the key role it plays in meeting the world’s growing need for reliable low carbon energy. We are committed to engaging transparently with our stakeholders, to explain our enrichment process and provide an education on the industry we supply. We believe that in doing so, we can help educate and inform public opinion on our industry.

Initiatives around education and STEM (science, technology, engineering and maths) are important to URENCO and its employees, and we provide many different opportunities for young people to pursue engineering and other scientific careers through apprenticeships as well as education programmes.

**Education**

We proactively support our nuclear industry peers in the provision of education and information for a wide variety of stakeholder audiences. We also strive to encourage the next generation of talent, to ensure that we and other businesses in the industry can be confident of having enough skilled people to sustain our success.

To encourage young people into our industry, we support science and education initiatives in the local communities in which we operate and are also closely involved with universities and international science education programmes. We want young people to understand that not only is the nuclear sector a reliable and rewarding industry to be a part of – it provides an opportunity for an innovative and exciting career.

Our extensive connections with universities across the Group include research programmes at Oxford University and the University of Manchester Dalton Nuclear Institute. Our enrichment facility in the Netherlands is a key supporter of the UK’s science and engineering education programmes. We want young people to understand that not only is the nuclear sector a reliable and rewarding industry to be a part of – it provides an opportunity for an innovative and exciting career.

Site visits

We also use our experience in our education programmes.

**Case study: The Richie Programme**

Richie is our science ambassador and the face of URENCO’s enrichment outreach, with a mission to inspire schoolchildren to engage in STEM subjects. Richie workshops across the Netherlands, the UK, Germany, and the USA have helped to educate schoolchildren about energy and science, and to build skills in practical investigation. Group-wide, more than 80,000 pupils have participated globally since the programme began.

The Richie programme was highly commended by a leading public relations body in the UK and the success of the initiative has enabled us to share the Richie workshops far and wide. Richie has worked with over 800 schools both in the UK and internationally through the BSA, URENCO and the BSA held the first Richie Lecture in December 2014 at the Royal Society. Pupils heard a lecture on the world’s future energy challenges from Sir David King, the UK Government’s Special Representative for Climate Change, and participated in interactive, fun, science-based activities and games.

The inaugural lecture was a big success, with over 150 schoolchildren attending. It allowed Richie to connect with a new target audience of children – and pupils heard a lecture on the world’s future energy challenges from Sir David King, the UK Government’s Special Representative for Climate Change, and participated in interactive, fun, science-based activities and games.

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Schoolchildren participate in URENCO’s Richie programme – a key component of our educational outreach on STEM subjects.
Our key contribution

Technology development

With our industry-leading centrifuge technology, URENCO is ideally placed to support the nuclear industry.

URENCO centrifuge

The URENCO centrifuge consists of an ultra-light, thin-walled tube made from advanced materials, containing a cylindrical rotor that rotates at high velocity in a vacuum, on an almost frictionless bearing. The gaseous UF\(_6\) is fed into the centrifuge, where it adopts a rotational motion. The centrifugal forces push the heavier U\(_{238}\) closer to the wall of the rotor than the lighter U\(_{235}\). The gas closer to the wall becomes depleted in U\(_{235}\) while the gas nearer the rotor axis is slightly enriched in U\(_{235}\). The centrifuge’s electric motor produces heat at the base of the machine, causing a temperature profile along the length of the centrifuge, assisting the separation process.

The gaseous UF\(_6\) is fed through a pipe from the top of the centrifuge into the centre of the cylinder, where it takes up the rotational motion and also flows along the temperature gradient. The two streams of UF\(_6\), one enriched and one depleted in U\(_{235}\), are removed from the centrifuge by two pipes.

As the enrichment level achieved by a single centrifuge is insufficient to obtain the desired concentration of U\(_{235}\), it is therefore necessary to connect a number of centrifuges together – both in series and in parallel. This arrangement of centrifuges is known as a cascade.

Centrifuge cascade

Passing through the successive centrifuges of the cascade, the U\(_{235}\) is gradually enriched to the required assay, typically between 3% and 5% by weight. In a uranium enrichment plant, several cascades are operated in parallel to form an ‘operational unit’ producing one U\(_{235}\) assay. Several operational units together form one enrichment plant.

This modular design enables centrifuge plants to be expanded in line with market demands. It also permits the most recently developed and qualified centrifuge technology to be introduced rapidly into plant operation, thereby gaining maximum economic benefits from the development programme.

Low energy consumption in the centrifuge process has turned out to be one of today’s most important advantages. Because centrifuge rotors spin in a vacuum on almost friction-free bearings, modern plants with current types of centrifuges need only about 40 kWh of electricity to produce one unit of separative work. Thus, the specific energy consumption of the centrifuge is, by a factor of almost 60, less than the 2,400 kWh/kgSVW that diffusion plants need.

Technology development

Did you know?

One nuclear fuel pellet the size of your fingertip produces as much energy as one tonne of coal.

One of URENCO’s centrifuge cascades.
The nuclear industry is much more than just generating low carbon electricity. Many aspects of our everyday life are made possible by nuclear technology and it is the backbone for many products we take for granted from those in the home to those used for medical treatments. URENCO’s campaign, ‘Enabling our every day’, explores the aspects of everyday life made possible by nuclear technology.

**Medical**
Nuclear technology improves the health of millions of people every day as it enables a variety of medical applications, from identifying conditions such as heart disease and a broad range of cancers, through to the sterilisation of bandages. Using URENCO’s world-leading centrifuge technology, URENCO’s Stable Isotopes business, based in the Netherlands, produces a variety of products including medical radioactive isotopes. You can read more about medical uses of Stable Isotopes on page 41.

**Healthy eating**
Food irradiation is a method of treating food to make it safer to eat and also keeps it fresh for longer. Currently, three different irradiation technologies exist using three different kinds of rays: gamma rays, electron beams, and x-rays. Unlike chemical treatments, irradiation leaves no residue and kills bacteria throughout the food, not just on the surface.

**Space travel**
Over the last fifty years, nuclear technology has been used to power much of our space activity, including satellites. Radiisotope Power Systems (RPS) provide electrical power for space missions supporting travel to some of the most hostile environments in the solar system (source: NASA). Looking ahead, RPS will continue to provide a long-term source of electrical power enabling future space exploration including journeys to Jupiter’s ocean moon and to the moons orbiting other planets.

**Smoke alarms**
Until they beep, we often take the smoke alarms in our homes for granted, forgetting they are keeping us safe. Many household smoke alarms contain a small amount of radioactive material which can detect smoke particles and trigger the alarm. They are the ultimate safety device and emit minimal radiation, much less than from many other consumer products, including colour television sets.

**Clear vision**
If you’re a contact lens wearer, you’ll know that cleansing your lenses with a solution is an important part of your daily routine. To maintain high standards of hygiene, contact lens solutions are sterilised with radiation to remove irritants and allergens. As well as contact lens solutions, radiation is also used to sterilise beauty products including mascara and false eyelashes, which are used by millions every day around the world.
Our key contribution
Innovation

Our commitment to innovation will ensure that URENCO remains an industry-leader in technology and sustainability. Innovation enhances efficiency, security and reliability – all of which are crucial to our business model.

We believe that the nuclear industry will grow in the future and form an increasingly crucial part of a sustainable global energy mix. We seek to adapt our processes to benefit customers in different markets and parts of the world. For example, in the future we hope to provide a range of industrial and medical applications using a variety of enriched materials.

URENCO’s businesses outside of enrichment leverage our expertise and technology to benefit science and stimulate industrial innovation. Subsidiaries such as Stable Isotopes support URENCO’s robust business strategy as well as core principles founded as part of the Treaty of Almelo.

Did you know?
Each year, more than one million patient treatments are performed using radioactive sources made from Stable Isotopes’ enriched materials.

Case study: Stable Isotopes

Nuclear technology allows for the separation of isotopes for medical, research and industrial applications, and URENCO’s Stable Isotopes business harnesses our centrifuge technology and enrichment processes to enable progress in these fields.

Since 1990, Stable Isotopes has used its expertise and capabilities in centrifuge technology to produce a variety of these isotopes and is continuously exploring potential new applications. Our Stable Isotopes business applies the enrichment principle to a range of elements, working in partnership with customers across the USA, Europe and Asia to deliver the high-quality materials they need for research and product development.

Based in Almelo in the Netherlands, Stable Isotopes is testament to our commitment to continual development. The company’s product range includes several dozen isotopes and is continuously exploring and developing new applications. Our Stable Isotopes business harnesses our expertise and capabilities in centrifuge technology and enrichment processes to enable progress in these fields.

Industry
Stable Isotopes generates the majority of its sales from products with an industrial application. The most important products in this field are depleted zinc oxide and depleted zinc acetate (DZO/DZA), for which we supply a significant proportion of the world market. DZO and DZA are used as a corrosion inhibitor in nuclear reactors. They also reduce the already minimal dose rate of maintenance workers in nuclear power plants and are widely deployed across the nuclear energy industry.

Medicine
Stable Isotopes focuses on two specific areas of the medical market – diagnostics and therapy. Approximately 100,000 people in the Europe Middle East and Africa (EMEA) region benefit from radioactive diagnostics produced from Stable isotopes products.

Using isotopes, images can be obtained via a gamma camera in nuclear diagnostics. Gamma cameras can accurately detect disease progression and stigma in vital organs. Stable Isotopes’ products are used for a range of diagnostics applications, including for respiratory, thyroid and pulmonary diseases, as well as infections and inflammation.

Stable Isotopes is also producing materials that assist in the application of brachytherapy, the procedure of using temporary irradiation very close to an area of disease (in particular cancer and stenosis). There are also significant opportunities in the area of palliative care of pain arising from secondary metastasis derived from the spread of breast, prostate and lung cancers.

Looking ahead, Stable Isotopes is exploring ways to increase the flexibility of its production capacity so it can respond to changes in the market and continue to meet customer demand. R&D projects include several products that can be used for the production of radioisotopes for therapeutic and diagnostic purposes.

Research
Stable Isotopes collaborates with research institutes in the fields of nuclear physics, health and nutrition. Several of Stable Isotopes’ products have been used to create super heavy elements or study extremely small particles such as neutrons. The company’s enriched zinc products have been used in nutrition studies focused on optimising the diet of children in developing countries.

Future developments
Looking ahead, Stable Isotopes is exploring ways to increase the flexibility of its production capacity so it can respond to changes in the market and continue to meet customer demand. R&D projects include several products that can be used for the production of radioisotopes for therapeutic and diagnostic purposes.