

***newcleo* powers up, closing USD 118 million founding capital round and acquisition of Hydromine Nuclear Energy**

Existing significant patent portfolio supports *newcleo*'s development of safe, clean, inexhaustible nuclear energy and push for a carbon neutral world

LONDON, UK, 31 August 2021 – *newcleo*, the clean and safe nuclear technology company, today announced its incorporation with the closing of a USD 118 million initial capital raising and the acquisition of Hydromine Nuclear Energy S.à r.l. (HNE).

newcleo's disruptive approach is based on the innovative application of well-developed technologies, including, (1) Lead Fast Reactors (LFRs), which utilise lead as a coolant rather than water or sodium, (2) Accelerator Driven Systems (ADSs), based on coupling a sub-critical reactor with a particle accelerator and (3) the use of natural thorium fuel.

The application of these technologies has the potential to:

1. dramatically decrease the volume of radioactive waste produced, while eliminating the need of a geological repository for transuranic elements;
2. much more effective use of existing uranium fuel, while moving toward the use of natural thorium;
3. avoid nuclear accidents as the reactor core remains at all times, sub-critical, and the nuclear cascade can be interrupted instantly by switching off the accelerator.

Nobel laureate Carlo Rubbia, who invented ADSs while he was Director General at CERN (the European Organization for Nuclear Research), shares *newcleo*'s vision for clean nuclear energy and is personally supportive of *newcleo*'s mission.

newcleo's core leadership team brings a decades-long track record in both scientific and entrepreneurial achievements: Stefano Buono as CEO, the former founder of the NASDAQ-listed Advanced Accelerator Applications (sold to Novartis in 2018); Luciano Cinotti as Chief Scientific Officer; Elisabeth Rizzotti as Chief Operating Officer and CEO of the Italian research operations.

With headquarters in London, an ideal base for global operations requiring connectivity and an international workforce, *newcleo* will initially base its research team in Turin, Italy. There, over 100 'energy innovators' will work under the oversight of a Scientific Committee with extensive nuclear energy experience.

newcleo's first key development will be the LFR 'Re-Act' project; a liquid lead modular micro-reactor with significant commercial applications, for example in shipping. This prototype will be the realisation of a concept known at the International Atomic Energy Agency (IAEA) as the LFR-TL-X project¹. Within the next five years, the company intends to finalise the design and realise a full-scale non-nuclear industrial prototype in collaboration with ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development), that also shares one of *newcleo*'s patents.

As demonstrated by the successful acquisition of HNE, *newcleo*'s strategy is to actively pursue all the necessary M&A transactions and partnerships across the globe among energy sector players, institutions, academia and investors, as well as ad hoc acquisitions to rapidly bring to market its projects and create a new industrial standard.

The capital raising has gathered strong international interest led by several visionary individuals and also supported by some institutional investors, including New York-based Exor Seeds, and Turin-based LIFTT and Club degli Investitori.

¹ Advances in Small Modular Reactor Technology Developments, a supplement to: IAEA Advanced Reactors Information System (ARIS), 2020 Edition

Remarking on this memorable launch day, Stefano Buono, newcleo CEO, commented:

"In 1994, I started to work with Carlo Rubbia at CERN on approaches to producing safe, renewable and clean energy. I realised then that it would be possible to disrupt the energy sector with a scalable industrial application of our scientific findings.

Having created Advanced Accelerator Applications as a ground-breaking company in theragnostic nuclear medicine, I have founded newcleo with the same vision: to bring existing nuclear innovative technologies to market for the benefit of the whole world.

'Futurable Energy' perfectly summarises what we intend to do: to develop a new, sustainable, and completely safe way of extracting energy from nuclei that will offer the planet zero emissions, radical reductions in nuclear waste and a material decrease in global warming.

I feel the scientific ambition and moral obligation to make this technology a reality."

Notes to editors

Additional quotes

Elisabeth Rizzotti, COO and CEO of Italian Research Operations:

"We are very excited to be literally putting under the same roof an amazing number of the very best scientists and experts in this field. Historically, Italy has always had a prominent place in scientific research and findings, particularly in nuclear physics and engineering, but often lacked the business and economic opportunities to keep its best minds within its borders. With the newcleo centre of excellence in Turin, I am proud to finally provide a unique space to develop young capable minds and senior scientists from all over the world, including those who may have previously left Italy in search of opportunities abroad".

Luciano Cinotti, CSO:

"I am grateful to Carlo Rubbia for having introduced to me the idea of using lead as a reactor coolant. It realizes the dream working on Fast Breeder Reactors. These allow a 100 times better utilisation of fuel, and the elimination of the need of a geological repository for the transuranic elements. Additionally, the LFR does not come with the risks associated with the use of sodium, which instead is highly reactive in contact with air and water, thus allowing a more immediate and inexpensive approach to truly passive safety. In the Nineties, along with Stefano Buono's CRS4 research group, I had the opportunity to investigate the potential of a nuclear sub-critical core controlled by a particle accelerator and later during the IP-Eurotrans project I also realized how safely it incinerates even minor actinides.

I am excited to embrace the long-term strategy of newcleo to disrupt the energy sector with a completely new approach that with a combination of LFRs, subcritical reactors and appropriate fuel cycle will be possible not only avoiding generation of plutonium, but also to get rid of the long-lived minor actinides, produced by the present fleet of nuclear reactors, which would otherwise have to be disposed of in a geological repository."

About newcleo

newcleo is the clean and safe nuclear technology company. Privately funded and headquartered in London, UK, newcleo was launched in 2021 to be a disruptor in the field of nuclear energy. Its mission is to generate safe, clean and inexhaustible energy for the world, through a radically innovative combination of existing, accessible technologies.

newcleo is building the next generation system with the goals to: (1) eliminate the need for geological repositories by using a fast neutron flux avoiding production of long life radioactive elements; (2) develop an Accelerator Driven System (ADS), based on the intrinsically safe coupling of a particle accelerator and a sub-critical reactor; (3) accelerate the development of new fuel cycles, including thorium, that provide economic, clean, safe and inexhaustible energy from nuclei and the opportunity to burn the long-lived nuclear waste produced by the old generation of nuclear reactors.

With visionary co-founders, *newcleo* brings together a team of engineers with deep knowledge of nuclear energy with younger recruits with a fresh mindset, working to design an innovative micro Lead Fast Reactor with significant commercial applications, for example in shipping.

newcleo wants to be the first step toward the evolution of its industry to become fully respectful of people and the environment. To develop a new, sustainable, and completely safe way of generating nuclear energy that will lead humanity to zero emissions, and to the mitigation of global warming.

About the acquisition of HNE

HNE has been sold to *newcleo* by Hydromine Global Holdings S.à r.l., a company fully controlled by Hydromine Inc., a US-based sustainable energy company dedicated to developing and investing in power production through patient capital and innovation. With offices in New York and Yaoundé, Hydromine's multinational team has extensive experience in the international power sector, including Africa, for the origination, financing, construction, or operation of utility-scale power projects. HNE team comprises several of the world's leading fast reactor engineers who have originated a lead-cooled design (the LFR-AS-200 and LFR-TL-5) that after decades of simplification can offer safer and competitive new nuclear energy.

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newcleo founders

Leadership team - bios



Stefano Buono
Founder & CEO

Italian physicist, worked for 10 years with physics Nobel laureate Carlo Rubbia at CERN and CRS4 (Center for Advanced Studies, Research and Development in Sardinia), focusing on Accelerator Driven Systems and nuclear waste transmutation. In 2002 he founded the French nuclear medicine biotech Advanced Accelerator Applications, which was listed on NASDAQ in 2015 and subsequently taken over by Novartis for \$3.9 bn. He's an impact investor with its single-family office Elysia Capital (www.elysiacapital.com).



Luciano Cinotti
Founder & Chief Scientific Officer

Italian nuclear engineer, Luciano Cinotti worked at Ansaldo Nuclear for 30 years and is a leading expert in Fast Reactor technologies. A Euratom representative and the Chairman of the LFR Steering Committee of the Generation IV International Forum from its inception until 2010, he is the author of most of world's LFR-related patents.



Elisabeth Rizzotti
Founder & Chief Operating Officer; CEO Newcleo, Italy

French physicist, after a period at CERN, she embraced the world of finance, working for leading international consulting companies and several Italian commercial banks accumulating 30 years of strong managerial expertise.

Glossary

ADS	Accelerator Driven Systems is an innovative machine formed by coupling a substantially subcritical reactor core with a high-energy proton accelerator for the production of Energy and the transmutation of nuclear waste. They are intrinsically safe, when compared to nuclear reactors, because when the accelerator is switched off, the nuclear cascade generating energy disappears in less than a millisecond. The accelerator current also modulates power production with precision. ADSs can be used to eliminate the plutonium and Minor Actinides stockpile produced by present-day reactors and efficiently use thorium as fertile element.
Breeder reactor	A nuclear reactor that produces more fissionable material than it consumes to generate energy. This special type of reactor is designed to extend the nuclear fuel supply for electric power generation. Conventional reactors, in contrast, can extract less than one percent of its energy.
Carbon neutrality	Carbon neutrality refers to achieving net-zero carbon dioxide emissions. This can be done by balancing emissions of carbon dioxide with its removal (often through carbon offsetting) or by eliminating emissions from society.
CERN	The European Organization for Nuclear Research, based in Geneva, Switzerland. A research centre that studies the fundamental structure of particles that make up everything around us, using the world's largest and most complex scientific instruments including a unique range of particle accelerator facilities.
Chain reaction	A sequence of reactions where a reactive product or by-product causes additional reactions to take place in a self-amplifying chain of events.
Core	Is the portion of a nuclear reactor containing the nuclear fuel components where the nuclear reactions take place, and the heat is generated. Typically, the fuel will be low-enriched uranium contained in thousands of individual fuel pins.
CRS4	The Center for Advanced Studies, Research and Development in Sardinia is an interdisciplinary research center.
ENEA	Italian National Agency for New Technologies, Energy and Sustainable Economic Development.
Energy Amplifier	Is an alternative definition of an ADS, which underline the fact that an energetic particle beam is used to stimulate a nuclear cascade into a sub-critical core, which in turn releases enough energy to power the system and leave an energy profit for power generation. According to the design of the core, the Energy Amplifier can generally “amplify” the energy of the particle beam 80 to 120 times.
Euratom	Is an international organization established by the Euratom Treaty on 25 March 1957 with the original purpose of creating a specialist market for nuclear power in Europe.
Fast Reactor	Is a category of nuclear reactors in which the fission chain reaction is sustained by a fast neutron, as opposed to thermal neutrons used in thermal reactors (most of today's commercial reactors).

Fast neutron flux	A flux of neutrons carrying on average energies above 0.5 MeV (Mega Electron Volt, a measure of energy) or greater.
Generation IV International Forum	The Generation IV International Forum (GIF) is a co-operative international endeavor which was set up to carry out the research and development needed to establish the feasibility and performance capabilities of the next generation nuclear energy systems.
Geological repository	A way of storing radioactive waste within a stable geologic environment (typically 200–1000 m deep).
IAEA	International Atomic Energy Agency, an international organization that seeks to promote the peaceful use of nuclear energy.
LFR	Lead Fast Reactor. This technology, with its closed fuel cycle, have the potential to multiply the energy output from a given amount of natural uranium by a factor 100; improve high level radioactive waste management through the transmutation of minor actinides; avoid the loss of coolant possible with water-cooled reactors because lead is kept at atmospheric pressure and contained in a double-wall vessel; validate lead technologies as a necessary step for the development of ADS.
LFRTLX	Is a Lead-cooled Fast Reactor, designed by <i>newcleo</i> where TL stands for Transportable Long-lived core and X its power, ranging from 5 to 20 MWe or more, depending on the application.
Long-Lived Waste	Are radioactive materials with a long half-life (more than 20,000 years). Because of their persistent radiotoxicity it is necessary to isolate them from man and biosphere and to confine them in nuclear waste repositories for geological period of times.
Micro-reactor	Are Small Modular Reactors (SMRs) that have a power less than approximately 50 MW.
Minor Actinides	The actinide elements in used nuclear fuel other than uranium and plutonium. Actinides are the 15 metallic chemical elements with atomic number from 89 (Actinium) to 103 (Lawrencium).
Nuclear cascades	A series of nuclear interactions originated by a single event that come to an end. They are originated, for example in sub-critical reactors. The corresponding term for traditional critical reactors is chain reaction, a sequence of reactions where a reactive product or by-product causes additional reactions to take place in a self-amplifying chain of events.
Nuclear waste transmutation:	The transmutation of nuclear waste is the process to convert transuranic nuclear waste (Plutonium and Minor Actinides) into fission products.
Nuclear Proliferation	The spread of nuclear weapons, nuclear weapons technology, or fissile material to countries that do not already possess them.
Particle accelerator	A particle accelerator is a machine that uses electromagnetic fields to propel charged particles to very high speeds and energies and contain them in well-defined beams. They are used to study the fundamental laws of physics, but in many other applications such as to cure cancer, to produce nuclear medicine drugs and as ion implanters for the manufacture of semiconductors.

Passive Safety	Are safety features that take advantages of natural forces or phenomena such as gravity, pressure differences or natural heat convection to accomplish safety functions without requiring an active power source or human intervention.
Sub-critical reactor	Is a nuclear system that cannot sustain a chain reaction, and any beginning of a chain reaction dies out over time.
Small Modular Reactor (SMR)	SMRs are nuclear fission reactors that are a fraction of the size of conventional reactors. They can be manufactured at a plant and transported to a site to be installed. Modular reactors reduce on-site construction, increase containment efficiency, and enhance safety. The greater safety comes via the use of passive safety features that operate without human intervention. SMRs also reduce staffing versus conventional nuclear reactors.
Thorium	Thorium is a metallic element at least three times more abundant in Earth's crust than uranium and doesn't need isotope enrichment to be used as nuclear fuel. LFR reactors with a thorium blanket can generate power from the plutonium left by uranium thermal reactors. The use of thorium as fertile element eliminates the production of minor actinides. A reliable and economic ADS paves the way to the adoption of a fuel cycle based on the use of thorium as proposed by Carlo Rubbia at CERN.
Transmutation	A nuclear transmutation occurs in any process where the number of protons or neutrons in the nucleus is changed.
Transuranic elements	The chemical elements with atomic numbers greater than 92, which is the atomic number of uranium.