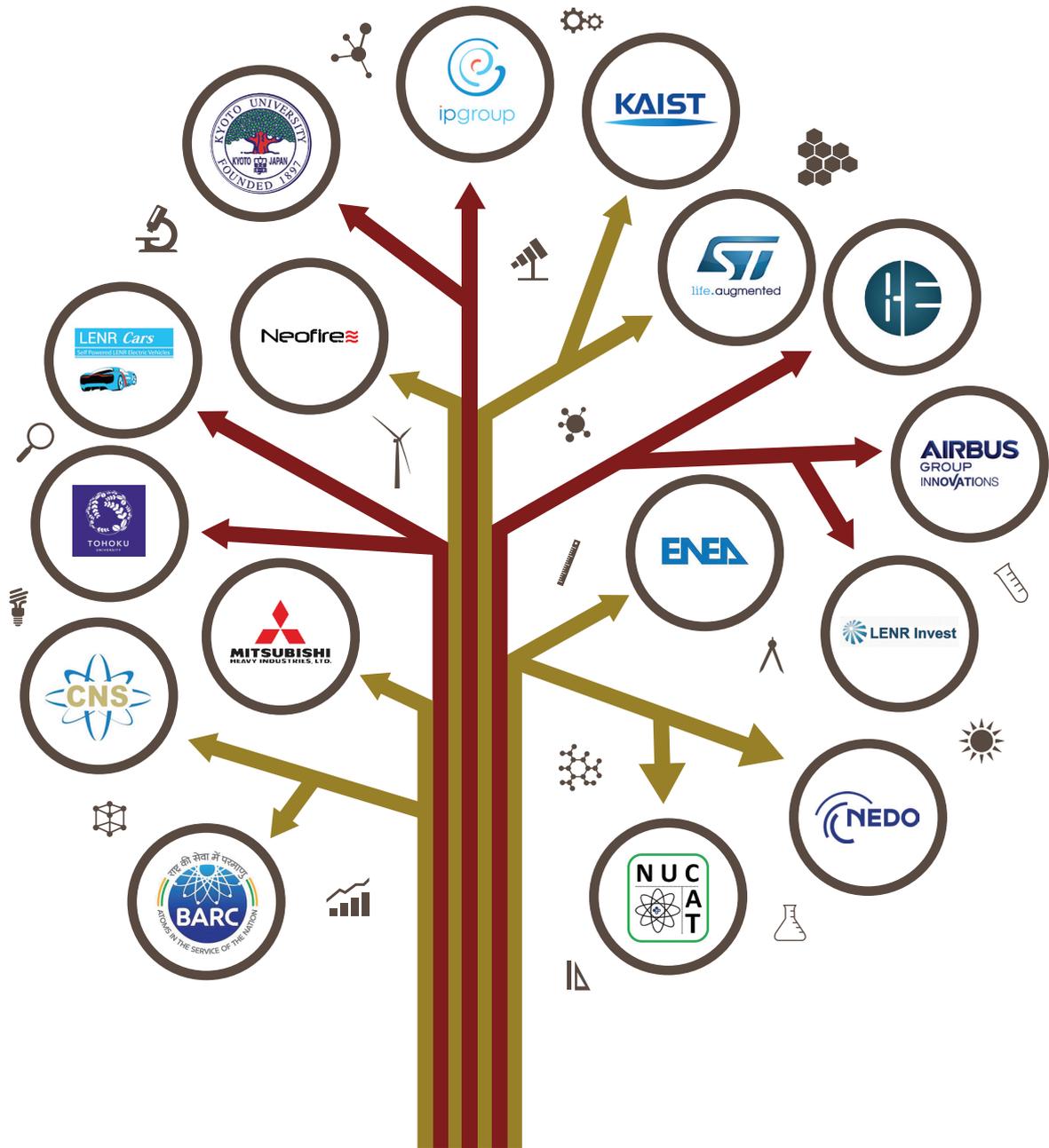


LENRaries

A New Era of Renewable Energy



Anthropocene Institute

About the Anthropocene Institute

In the 2000s, 'Anthropocene' was proposed as a new designation for the current geologic era, in which human culture is recognized as the dominant force shaping Earth's geology. Our use of energy from fossil fuels, which limits today's levels of human development, is not sustainable. The private sector, together with government at all levels and the scientific community, must work together to deploy all appropriate and affordable technologies to avert the most dire impacts from climate change.

The Anthropocene Institute is an incubator for technologies, policies, and market mechanisms that address global environmental challenges: climate change, biological diversity, and sustainability. It strives for a common global culture of innovation to address the interrelated ecological, socioeconomic, developmental, and ethical challenges that humanity faces. Its location in the heart of Silicon Valley, combined with its unique understanding of entrepreneurship, policy-making, and global development priorities provides context in guiding technological, institutional, and financial innovations needed to address the survivability of human civilization. The Anthropocene Institute partners with private companies, universities, NGO's, and government agencies in supporting solutions that these institutions can not provide on their own.

The Anthropocene Institute supports innovations, including advanced nuclear technologies based on low energy nuclear reactions (LENR) and integrated molten salt reactors (IMSR), that promise to enable one cent per kWh renewable energy, unsubsidized.

Visit www.anthropoceneinstitute.com/LENR to learn more and view recommended reading lists of articles in scientific journals and authoritative reference books on LENR.

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Table of Contents

Introduction	1
Why LENR	2
What is LENR	3
LENR Ecosystem	5
• LENR Makers	
• LENR Research & Development Organizations	
• LENR Investment Funds	
• LENR Equipment Suppliers	
• LENR Nonprofit Organizations	
Road Ahead for LENR	16
Endnotes	19
Appendix 1: LENR Maker Survey	20
Appendix 2: LENR Ecosystem Directory	39

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Introduction

LENRaries is a report on the growing global movement of scientists, researchers, entrepreneurs, engineers and academics working to realize the dream of developing and commercializing renewable low energy nuclear reaction (LENR) technologies.

In the nearly three decades of LENR discovery, the field has progressed from simple electrolysis experiments to explorations of processes for transmuting elements and engineering devices capable of powering spacecraft.

Since the early 1990s, LENR has been the focus of a dedicated community of committed scientists and enterprising entrepreneurs working to demonstrate the potential of LENR technologies with their experimental research.

The race to develop verifiable, controllable and reproducible LENR technologies has advanced markedly. In terms of power density and duration, LENR technologies are edging closer to being ready for development into various devices and serving a wide range of applications, including commercial-level power generation. Several LENR Makers have reported reproducing the characteristic LENR excess heat phenomenon reliably.

These developments have led to a global resurgence in the field of LENR discovery. LENRaries identifies 114 entities actively engaged in LENR discovery, including 55 that have raised more than \$250 million to develop low-carbon LENR technologies.

While energy consumption in the US and most developed countries is expected to remain flat over 2017-40¹, global energy demand is forecast to grow by at least 40%. New energy technologies must therefore be capable of competing on cost by displacing existing fossil fuel sources or by providing one cent per kWh energy access in developing countries.

If LENR technologies can be developed to be commercially viable, they have the potential to revolutionize the \$7 trillion global energy industry while lowering the carbon emissions into the atmosphere and the oceans – a win-win for our planet and humanity. With the potential for LENR technologies to provide a new era of one-cent per kWh energy, we could end our addiction to fossil fuels and meet global sustainability goals while achieving unprecedented improvements in standards of living.

Why LENR

The IPCC has predicted a sea level rise of up to one meter by 2100, if emissions are not constrained. Former NASA researcher and father of climate change awareness, James Hansen, and 18 other scientists, have argued that the UN body's assessment is too conservative as it doesn't factor in the potential disintegration of the polar ice sheets which could cause 'several meters' rise in a century, swamping coastal cities.

A new era of one cent per kWh renewable energy would enable a future of sustainable abundance and prosperity. We would enjoy clean air and water, cheap transportation and shipping, efficient agriculture that uses less cropland and fossil-based chemicals while promoting greater biodiversity and a fully cradle-to-cradle upcycling of waste products into new feedstocks.

Interest in low-carbon LENR technologies is driven by their potential to be a disruptive game changing force, offering multiple advantages over existing fossil fuel, solar, wind and nuclear energy sources.

Experimental evidence suggests LENR is very safe. LENR technologies require no expensive or toxic materials or processing steps. With LENR, the fuel inputs are virtually limitless: nickel (Ni), one of the planet's most abundant metals, and hydrogen, the most abundant element. No government-regulated materials are used in the development of LENR reactor systems, and so a quick path to regulatory approval would be feasible.

According to NASA, LENR has 8 million times the energy density of chemical processes.² LENR does not require radioactive materials and does not seem to generate radioactive byproducts or risk dangerous chain reactions. Specifically, experimental results suggest that LENR is capable of safely generating energy at low costs using metallic (Ni, Pd) nickel and/or palladium-platinum nano-powders and hydrogen gas while producing no harmful byproducts. There are no high-energy neutrons or gamma rays, just soft x-rays from the beta decay into helium-4.

LENR technologies have the capacity to scale up for powering existing generation plant turbines at 600 degree C and scale down for distributed generation applications such as water heaters.

LENR technologies embody humanity's goal of generating energy consistently, at a large scale with low input costs and high energy density. Only a small amount of cheap, abundant raw material inputs are required. A number of the LENR Makers profiled have developed prototype LENR systems capable of creating excess energy between 1.5 and 20 times the energy required to catalyze and operate the system.

What Is LENR

The first documented case of LENR discovery was in the 1920s by the American Chemical Society which published a report on helium production from an exploding wire experiment. Popularized at the University of Utah in 1989, LENR is a low energy nuclear reaction that occurs at lower temperatures than traditional nuclear fission or fusion energy reactions. Many researchers in the field of LENR discovery believe the reactions leverage the weak nuclear force, in contrast to the strong force that fission and fusion reactions leverage. Exploration of weak force nuclear reactions fizzled as more reliable and repeatable strong force nuclear reaction research took the lead.

In this respect, LENR reactions can plausibly be characterized as weak force transmutation reactions, which are above the energy levels expected from chemical reactions, and below that of the astronomically high temperature and pressures required for nuclear fusion. It is important to note that the circumstances associated with LENR or “Cold Fusion” are not the same as those of “Hot Fusion”.

Contrary to conventional myth, the “Cold Fusion” experiments announced in 1989 at the University of Utah were confirmed. The anomaly identified as “Cold Fusion” has been replicated a many times over. What we have learned since 1989 is that the anomaly owes much more to the material sciences than “Cold Fusion”.

In many experiments with LENR, observed excess heat drastically exceeds any known or feasible chemical reactions with what LENR scientists and researchers term positive coefficients of performance (COPs). Excess heat at the milliwatt to the kilowatt scale has been observed. Ash products show evidence of metal isotopes gaining mass in the reactor cores as if from neutron accumulation. Enhanced concentration of deuterium and tritium are also observed. Tritium is observed in varying concentrations. Weak x-rays are observed along with tracks from other nuclear particles.

Many observations show that a metal hydride driven far out of equilibrium by some excitation stimulus is capable of transmuting to produce helium-4 and heat energy in a similar ratio to that expected from fusion, but with far less high-energy radiation than fusion. With LENR reactions, it is entirely possible to go from hydrogen to helium by side-stepping the Coulomb barrier and converting hydrogen to helium which releases a lot of energy. In 1995, Dr. Melvin Miles’ experiment at China Lake provided one of the first quantitative characterizations of the outputs from a low energy nuclear reaction. According to Dr. Miles, a low energy nuclear reaction releases helium-4 and excess heat in the same proportion as hot fusion, but neutron emissions and gamma rays were observed to be at least six orders of magnitude lower than expected.³

LENR Makers have discovered that LENR reactions are small enough so a custom designed excitation ignition system can stimulate the reaction to work reliably. Several successful excitation ignition systems have been developed including heat, pressure, dual lasers, high currents and overlapping shock waves. Most materials used in LENR systems are treated to create and manipulate flaws, holes, defects, cracks, and impurities, increase surface area, and provide high flux protons and electron current. Solid transition metals host the reaction, including nickel, palladium and platinum. A chemist might speculate that LENR looks like fusion, by the inputs (hydrogen) and outputs (helium-4 and transmutation products) but LENR looks not-at-all like fusion when judged as a plasma physicist might by telltale radioactive signatures.⁴

Throughout the 1990s, 2000s, and 2010s, researchers using different methods, on four continents, reported having observed net-energy generating low energy nuclear reactions. While empirical evidence of LENR abounds, there is no scientific consensus to explain how it works.

Intellectual honesty demands that we get comfortable with uncertainty when we seek to discover, experiment and work to validate LENR systems. The LENR Ecosystem enjoys a compendium of competing scientific theories that attempt to explain how it works. Four popular theories for LENR that fit within the standard model of physics are:

- Widom-Larsen which involves the weak nuclear force and beta decay;
- Bose-Einstein Condensation Nuclear Fusion which suppresses the Coulomb barrier for fusion;
- Hagelstein Spin-Boson Oscillator, which proposes D-D fusion occurring within the vacancies throughout the surface of a constrained metal lattice in Ni/Pd-D LENR systems; and
- Proton Electron Capture, which says protons in a metal lattice can capture an electron and become an ultra-cold neutron which then get “mopped-up” by moving protons that become deuterium (D), tritium (T), hydrogen-4 that beta decays to helium-4.

Fission experts expect fast moving, hot neutrons to break fissile atoms up. According to the theory of Proton Electron Capture, LENR reactions are driven by slow moving, ultra cold neutrons (which cannot be detected by neutron detectors, but can readily be confirmed by isotope changes) that react with protons. To bring forth LENR reactions that produce over-unity energy, a metal lattice heavily loaded with hydrogen isotopes, driven far out of equilibrium by some excitation system involving proton flux and probably electromigration of atoms in a metal (Pd, Ni) lattice-constrained space is required.

Unlike more reliable fission reactions, controlling LENR reactions has proven to be challenging. The most common reason why many LENR replications produce intermittent COP results is the lack of real-time control of the reactions. This is also why incontrovertible proof of the LENR phenomenon has been elusive.

LENR reactions are challenging to reproduce, much less control, the production of excess heat from the anomalies on-demand. Sometimes it's there, but mostly not. Reproducing, transporting and controlling on-demand the anomaly has eluded many scientists, researchers and enthusiasts working in the field of LENR discovery.

It took mankind eons before understanding the chemical processes involved in fire and decades after the commercialization of x-rays before fully appreciating how they work. The anomalies occurring in LENR are found in nature and have been observed and confirmed many times over, however they have yet to be fully understood, much less controlled for commercial purposes.

LENR Ecosystem

The LENR Ecosystem includes Maker, Investor, Non-Profit, R&D Organization and Equipment Supplier stakeholders.

Critics of LENR cite the need to fully understand the underlying physics before there can be an engineering pathway forward in developing commercial-level LENR technologies or a successful licensing business model. In response, many longtime participants in the LENR Ecosystem point out that earlier technologies such as x-rays were commercialized before being fully understood. The successive developments of the steam engine – separate condenser, expansive working compound cylinder – right down to the steam turbine were essentially successive pathways in engineering and solved in practice before they were solved in theory.⁵

Since the highly publicised announcement of “Cold Fusion” in 1989 at the University of Utah, research and development in LENR discovery has gone largely unnoticed by mainstream media, clean energy technology investors and the scientific community. Indeed, one could easily fall prey to the notion that modern science has largely explained the universe and that only the details need to be filled in.

The global resurgence and expanding universe of LENR stakeholders – deep-pocketed commercial entities, experienced entrepreneurs and investment funds – is an exciting development especially when it comes to shaking-off the reputation of “Cold Fusion” as a placeholder for pathological science.

When we surveyed LENR Makers on what would be most useful in helping them to strengthen their R&D efforts, they ranked more funding the highest.⁶

As we prepare to enter the 2020s, scientists, researchers and engineers in the LENR field are poised to join the new era of renewable energy with state sponsorships for R&D and more than \$250 million in funding from industrial companies, research institutions, private equity billionaires and high-net-worth investors.

In determining the participating entities for inclusion in the LENR EcoSystem, we relied on publicly reported and available information that was compiled from news reports, conference proceedings, publications and websites.⁷ For LENR Makers, we examined over 70 commercial entities that were or at one time had been purporting to be researching and developing LENR-related applications and technologies.

In surveying LENR Makers, it's clear that some participants are guided by hunches, inklings, clues and aha moments. Others it can be argued are still wandering in the jungle of LENR discovery hoping they don't lose sight of the fact that Nature rarely gives up her secrets easily.

At the beginning of 2017, there were 114 entities actively engaged in LENR R&D across four continents – Asia-Australia, Europe and North America. A total of 45 are US-based, 31 are from European nations, 19 from Japan and 6, 5, and 5 are from Russia, China and India respectively. The other 3 entities are from Australia, Canada and Korea.

i. LENR Makers

Growing interest and involvement in R&D for LENR technologies from global industrials, billionaires, governments and international consortia has provided a significant push for commercializing LENR applications by the 2020s. With more than \$250 million raised to support commercial R&D entities in the last five years, investment in LENR Makers is expected to double to \$500 million by 2020.

LENR R&D activities are underway in Asia, Europe and North America. LENRaries profiles 55 commercial LENR Makers engaged in discovery efforts, conducting research experiments, and designing, building and testing prototypes. Most LENR Makers be they early growth-stage or industrial companies, operate their businesses on a start-up scale with less than 20 employees according to respondents to our LENR Makers survey.⁸

The objective for most LENR Makers is to develop and fabricate working LENR technologies that are reproducible, controllable on-demand and can scale with commercial-level potential. In addition to the promise of becoming a new low-cost renewable energy source, LENR technologies represent an alternative source that does not produce greenhouse gases, long-lived radiation or strong prompt radiation.

As the list of LENR Makers illustrates, much of the interest and work in researching and developing LENR technologies is focused on a nickel-hydrogen process, which many believe will prove to be a successful pathway for reliably reproducing commercial-level applications and products.

Organization	Description	Technology	Leadership	Country
Airbus Group Innovations (AGI)	AGI manages Airbus Group's network of research facilities, scientists, engineers and partnerships.	Ni-H	Jean-Francois Geneste	France
Amoterra	A Canadian radioactive waste management company.	Cavitation	Eleonora J. Anderson	Canada
Boeing Phantom Works	Boeing's R&D division involved in prototyping, of advanced military technologies.	n/a	Leanne Caret	US
Brilliant Light Power	Brilliant Light Power (formerly Blacklight) is developing SunCells using water as the source of hydrogen fuel to form Hydrinos.	Hydrogen	Randell Mills	US
Brillouin Energy Corporation	Brillouin is developing LENR technologies capable of producing commercial amounts of thermal energy.	Ni-H	Robert Godes	US
Burst Labs	Burst Labs (formerly Impulse Devices), fuses hydrogen atoms with extreme pressure cavitation to release energy.	Cavitation	Richard Philpott	US
CHAVA Energy LLC	CHAVA Energy is an innovator in the field of energy technology research and development.	Hydrogen, Copper-Ni	Hagen Ruff and Mark Snoswell	US
Chemonuclear Fusion Project	The Chemonuclear Fusion Project is a crowd funding initiative to fund development of chemonuclear fusion R&D projects.	n/a	Phil Lang	US
Clean Nuclear Power LLC	Clean Nuclear Power is a Lugano-based start-up developing clean LENR energy.	Pd, Li	Yogendra Srivastava and Allan Widom	Switzerland
Clean Planet, Inc.	Clean Planet leads a partnership with HEAD and Japanese universities to R&D and prototype a commercial LENR/CMNR device.	Ni-H, Ni alloy nano-particles	Hideki Yoshino and Masanao Hattori	Japan
Coolescence	Coolescence is engaged in Pd-D loading LENR research experiments.	Pd-D	Rick Cantwell and Matt McConnell	US
Etiam Oy	Etiam develops innovative products for affordable clean energy production utilizing alternative energy sources.	Ni-H	Dr. Elers, Chairman	Finland
First Gate Energies	First Gate is a pioneer in using acoustic cavitation to produce an LENR effect.	Cavitation	Roger Stringham	US
First Light Fusion	First Light Fusion is developing a process for achieving practical and affordable fusion energy.	Cavitation	Nick Hawker and Yiannis Ventikos,	UK

Organization	Description	Technology	Leadership	Country
Global Energy Corporation (GEC)	GEC is focused on the development and commercialization of hybrid fusion-fast-fission LENR technology.	n/a	Lawrence Fosley and Jay Khim	US
Guangzhou with co-Energy Technology Company, Ltd.	Guangzhou with co-Energy Technology Company is engaged in the development of LENR technology.	n/a	Lin Xidan	China
Heliorite AB	Heliorite AB is an independent science and technology development company.	Ni-H	Birger Johannson	Sweden
High Mesa Technology	High Mesa Technology provides contract assistance for LENR research experiments.	n/a	Tom Claytor	US
Hope Cell Technologies	Hope Cell Technologies are the producers of the Hope Cell, a scaleable device designed for clean hydrogen generation.	Hydrogen generation	Robert Vancina	Australia
Hydro Fusion Ltd.	North European licensee of Leonardo Corporation's QuarkX E-Cat LENR device.	QuarkX E-Cat	Magnus Holm and Hans-Peter Bermin	Sweden
Industrial Heat, LLC (IH)	LENR technology developer focused on advancing efforts on new, clean and efficient energy sources.	Ni-H-Li, E-Cat	JT Vaughn	US
Is TECH	Is TECH is a group of managers and scientists with experience in working on scientific and industrial research.	Metal-Hydrogen	Paolo Tripodi	Italy
Jet Energy Inc.	JET Energy is a developer of the NANOR® and PHUSOR® LENR/LANR (lattice assisted nuclear reaction) devices.	NANOR, ZrO2-Pd	Mitchell Swartz	US
JWK Technologies Corporation	JWK provides contract engineering services to clients including the US Dept of Defense (DOD).	Nuclear waste treatment	Larry Forsley	US
Kressen Ltd	Kresenn is developing commercial energy production solutions for Francesco Celani's LENR applications.	Pd-D	Angelo Ovidi, Massimo Mongardini	UK
Lattice Energy LLC	Co-promoter of Widom-Larsen-Srivastava theory, Lattice Energy is researching and developing next-generation LENR power devices.	Metal-Hydrides	Lewis Larsen	US
LD-Brane srls	LD-Brane is a R&D focused startup in the field of LENR technologies.	n/a	Luca Gamberale	Italy
LENR Cars SA	Developer of patent-pending power generators based on LENR technology for electric vehicles (aircraft, boats, trains and cars) without CO2 emissions or waste.	n/a	Nicolas Chauvin	Switzerland
LENR Cities Suisse Sàrl	LENR-Cities supports the development of an ecosystem for researchers, scientists and entrepreneurs in the LENR industry.	n/a	Georges Albert de Montmolin	Switzerland
LENGY LLC	LENGY seeks to provide emerging energy solutions based on LENR technologies.	Pd-D	Edmund Storms	US
Lenuco (Dept. of Nuclear, Plasma and Radiological Engineering)	Lenuco develops LENR technology capable of producing energy at room temperature without any heat or electrical input for use by NASA.	Ni-H, Ni alloy nano-particles	George Miley	US
Leonardo Corporation	Leonardo is the developer of the QuarkX e-cat which is related to the E-Cat and the Rossi Effect.	E-Cat, Ni-H	Andrea Rossi	US
Lightstone Technologies	Lightstone is a developer of nuclear fusion prototype systems to produce electricity on demand.		Dr. Sergio Calqueiro	Germany
LockTherm LLC	LockTherm is an innovative R&D team working to successfully replicate LENR experiments.	Ni-H, LiAlH4	Sergei Godin and Andrey Hrischanovich	Russia
LUX Energy Ltd.	An affiliate Industrial Heat, Lux Energy is organized to identify LENR technologies to license, acquire or invest in.	n/a	Alexander Rios and Victoria Stephens	US
Mitsubishi Heavy Industries, Ltd. (MHI)	MHI is a Japanese multinational engineering, electrical equipment, and electronics company headquartered in Tokyo, Japan.	Transmutation	Shigenori Tsuruga, Kenji Muta, Yutaka Tanaka, Tadashi Shimazu, Koji Fujimori and Takehiko Nishida	Japan
Murata Manufacturing Co., Ltd.	Murata manufactures ceramic passive electronic components, including semiconductors, capacitors, antennae and other nanoscale technology.	n/a	Tsuneo Murata	Japan

Organization	Description	Technology	Leadership	Country
NanoSpire Inc	NanoSpire is commercializing cavitation re-entrant jet-based tools and processes.	Cavitation	Mark L. LeClair	US
NeoFire	NeoFire is a Swedish startup working to develop and market a new practical energy source based on LENR.	LiAlH ₄	Peter Björkbom	Sweden
New Inflow	The company aggregates the research efforts of disparate scientific groups and researchers.	Metal Nano-cluster Plasmoid	Anatoly Klimov, N.Magnitskii and Dr. N.Evstigneev	Russia
Nichenergy S.R.L	An R&D company with an innovative proprietary process for producing energy from nickel-hydrogen in a LENR reaction.	Ni-H	Francesco Piantelli	Italy
Nissan Motor Corporation, Ltd. (NMC)	NMC manufactures vehicles in 20 countries and regions and offers innovative products and services in 160 countries.	Metal-Hydrides	Carlos Ghosn	Japan
Nukey Europe Ltd.	Nukey Europe provides guidance for using LENR technologies to remediate nuclear waste.	Transmutation	Angelo Ovidi	UK
Purratio AG	Developer of SolFire LENR technologies for the controlled utilization of fusion energy.	Pa-H	Richard Reichmann	Germany
Quantum Potential Corporation USA (QPC)	Developer of clean alternative energy (LENR, fusion and plasma) technologies.	Cavitation	"Max Fomitchev-Zamilov "	US
Royal Dutch Shell plc	Shell is an Anglo-Dutch multinational oil and gas company headquartered in the Netherlands.	Pd-D	Ben van Beurden	France
Seashore Research, LLC	Seashore Research is the commercial entity set-up and supported by Texas Tech University to conduct R&D in LENR.	Metal Hydrides	Robert Duncan and Michael McKubre	US
STMicronics S.R.L. (ST) (NYSE:STM)	STMicronics is a multinational electronics and semiconductor manufacturer.	Metal Hydrides	Ubaldo Mastromatteo and Federico Giovanni Ziglioli	Switzerland
Swiss OxyHydrogen Energy (SOHO)	Swiss OxyHydrogen Energy is a LENR technology developer.	n/a	Slobodan Stankovic, Gregory Krieger and Richard Anderson	Switzerland
Target Technology Corporation, LLC	Target Technology is a developer of thin film corrosion resistant metal alloys.	n/a	Han H. Nee	US
Technova (Toyota Motor Corporation)	A subsidiary of (TMC), Technova is a LENR R&D leader in providing research grants and advocating for government support.	Pd-D	Akito Takahashi	Japan
TET Laboratory of Experimental Physics	Experimentalists working to develop devices based on plasma electrolysis, LENR and magnets.	Ti-H, Ti-D	Andrew Hrischanovich	Russia
Thermax, Ltd.	India-based Thermax is a global leader in providing integrated sustainable solutions.	LiAlH ₄	M.S.Unnikrishnan	India
TSEM	An Italian company focusing on energy, security and healthcare technologies.	Pd-D, Ni-H	Tony La Gatta	Italy
Unified Gravity Corporation	UGC was established to experimentally prove Hubert and Stephen Lipinski's groundbreaking research.	Li-H	Hubert Lipinski, Mike Palmer and Stephen Lipinski	US

US-based LENR Makers, Brillouin Energy and JET Energy, have demonstrated and tested prototypes of their LENR systems at SRI International and Peter Hagelstein's laboratory at the Massachusetts Institute of Technology, respectively. In January, Brillouin Energy reported that researchers at SRI International successfully replicated "over unity" amounts of thermal energy (heat) for the company's most advanced Isoperibolic ("IPB") Hydrogen Hot Tube™ (HHT™) LENR systems.

Japan's renewed focus on LENR research is an outgrowth of its industrial leadership in the new hydrogen economy and the 3/11 Great East Japan Earthquake and Tsunami. A new research consortium led by Tohoku University and Clean Planet launched in 2015 to develop LENR technologies for power devices and the transmutation of nuclear waste.

Funded by the government's New Energy and Industrial Technology Development Organization (NEDO), Japan's collaborative approach to R&D for LENR technologies includes industry, government, academia, and entrepreneurial start-up companies. This approach was on full display at the ICCF-20 conference in October 2016 with more than 70 Japanese LENR scientists and researchers in attendance.

Official support of LENR from the government through NEDO, together with leadership from Clean Planet, has catalyzed interest in LENR from private and public sectors in Japan. The ICCF-20 conference attracted several new Japanese academics and newcomers from industry. First-time ICCF presenters included researchers from Kyoto University and Waseda University. Several private entities not previously associated with LENR attended to learn more about the latest LENR discoveries and explore new business opportunities.

In Japan, interest in LENR is such that the Nikkei, Japan's largest financial news organization, identified LENR as one of 100 technologies that could disrupt the world. The Nikkei also forecast LENR applications to become a \$100 Billion global market by 2025. Publications like the Nikkei Asian Review and the Asahi Newspaper regularly cover the latest developments at Tohoku University and Clean Planet. Entering their second year of state sponsorship by NEDO, many LENR researchers in Japan are confident LENR will rise to a national level project that will attract an even greater number of researchers into the field of LENR discovery.

Japanese scientists and researchers working on LENR discovery have demonstrated technologies that reproducibly convert elements, and the generation of excess heat. Industrial manufacturing companies, including Mitsubishi Heavy Industries (MHI), Toyota Motor Corporation (TMC), and Nissan Motor Corporation are sponsoring LENR R&D on the nuclide transmutation of elements for the remediation of radioactive waste, as well as energy generation.

In a 2016 news report from Mitsubishi Heavy Industries, the industrial manufacturing company claimed it had developed processes and technologies for the transmutation of elements using nanostructure multi-layer reactional film to transmute elements at low cost.⁹ MHI reported having observed transmutations of cesium (Cs) to praseodymium (Pr), barium (Ba) to samarium (Sm), and strontium (Sr) to molybdenum (Mo). Other Japanese R&D organizations have publicly reported the transmutation of Cs to Pr, including the central research laboratory of TMC.

Research and development into LENR technologies aligns with China's Green Growth policies and the country's latest Five-Year Plan. China's efforts are being conducted at a select number of academic institutions and government labs.

Indian atomic scientist Mahadeva Srinivasan is leading an effort to revive LENR discovery efforts at the Bhabha Atomic Research Center (BARC) that had ceased in the 1990s because of scientific stigmatization. In India, leadership on R&D in LENR technologies is taking a similar path to China. India's aim is utilize LENR technologies to provide their people with access to a low-cost, clean and inexhaustible energy resource.

ii. LENR R&D Organizations

More than 30 highly respected LENR R&D organizations, including SRI International, Tohoku University, and Energiforsk have reported experimental tests on LENR systems. Many of those experimental tests of LENR technologies have produced the characteristic LENR excess heat phenomenon – more heat than could be explained by experimental error, statistical noise, or chemistry. Some of the experiments suffered from serious uncontrolled variables or exhibited nonlinear output, which has led to many reports indicating nothing out of the ordinary. It is challenging to observe nanoscale variation in materials which is widely believed to account for the inconsistent history in the reproducibility of LENR experiments.

Organization	Description	Technology	Leadership	Country
Bhabha Atomic Research Centre (BARC)	Multi-disciplinary research center for advanced R&D in nuclear power production, materials technology, electronics & instrumentation.	Pd-D	Mahadeva Srinivasan	India
Center for Emerging Energy Sciences (CEES) at TTU	Research operation bridging physics and chemistry to determine the origin of the LENR anomalous heat effect.	Ni-H, Ni alloy nano-particles	Robert Duncan	US
Chinese Academy of Sciences (CASS)	CASS is China's premier academic organization and comprehensive scientific research center.	n/a	Zhang Wu-Shou	China
Chinese Nuclear Society (CNS)	CNS is China's multi-disciplinary organization for advanced nuclear power, weapons and materials technology.	n/a	Delin Wang	China
Cold Fusion Power International	Laboratory of high energy physics and international center of fundamental physics.	Pd-D	Edward Tsyganov	Russia
Department of Atomic Energy	DAE is engaged in the development of nuclear power technologies in the fields of agriculture, medicine, industry and basic research.	n/a	Anil Kakodkar and Srikumar Banerjee	India
EarthTech International	A privately funded R&D group exploring novel ideas in physics.	n/a	Harold Puthoff	US
ENEA Research Labs	Italian National Agency for New Technologies, Energy and Sustainable Economic Development.	Pd-D	Vittorio Violante	Italy
Energiforsk (Energy Research Institute)	Energiforsk is the Swedish energy industry's research institute.	Ni-H	Magnus Olofsson	Sweden
Energy Institute Research Affiliate, UT at Austin	The Energy Institute is an organization at the University of Texas at Austin focused on studying energy policy, including LENR.	n/a	Thomas Grimshaw and Fred Beach	US
Hydrobetatron	Italian scientific association promoting the "open source" development of LENR.	n/a	Ugo Abundo	Italy
Hydrogen Engineering Application & Development Company (HEAD)	HEAD is an independent research unit led by Tadahiko Mizuno and supported by Clean Planet.	Ni-H, Ni alloy nano-particles	Tadahiko Mizuno and Hideki Yoshino	Japan
Indira Gandhi Centre for Atomic Research	IGCAR is India's scientific research and advanced engineering program for the development of fast breeder reactor nuclear technology.	n/a	Arun Kumar Bhaduri	India
Iwate University	Department of Electrical Engineering and Computer Science is engaged in LENR discovery.	Pd-Ni, Pd-Ag and Pd-Li	Shinya Narita	Japan
Japan Science and Technology Agency (JST)	JST is a funding agency under the Ministry of Education, Culture, Sports, Science and Technology in Japan.	n/a	Hamaguchi Michinari	Japan
Kobe University	Kobe University's Department of Nuclear Engineering is engaged in LENR discovery.	n/a	Akira Kitamura	Japan
Korea Advanced Institute of Science and Technology (KAIST)	KAIST is Korea's science and technology organization focused on developing world-class scientists capable of applied research.	n/a	Sunwon Park	Korea
Kurchatov Institute, Moscow	The Kurchatov Institute is one of Russia's leading research center with a large interdisciplinary laboratory.	Nuclear waste treatment	Mikhail Kovalchuk	Russia
Kyoto University	Kyoto University has a dedicated LENR research group studying semiconductor nano shells.	n/a	Katsuaki Tanabe	Japan

Organization	Description	Technology	Leadership	Country
Kyushu University	Kyushu University houses the International Research Center of Hydrogen Energy.	n/a	Chiharu Kubo	Japan
NASA Langley Research Center	NASA's Langley Research Center focuses primarily on aeronautical research including high-profile space missions.	n/a	Doug Wells	US
National Institute of Advanced Studies	NIAS is an Indian multi and interdisciplinary research and evidence research organization.	n/a	Baldev Raj	India
National Institute of Technology (Tokyo Kosen)	Tokyo Kosen is an accredited engineering school located 50km west of the city center.	n/a	Kenichi Tsuchiya	Japan
Natural Science Foundation of China (NFSC)	The NSFC is a major source of funding for conducting basic scientific and technical research.	n/a	Yang Wei	China
New Energy and Industrial Technology Development Organization (NEDO)	NEDO is Japan's new energy and applied R&D gov't agency leading a research consortium working on LENR R&D at leading universities.	n/a	Kazuo Furukawa	Japan
Nickel-Hydrogen Research Center	The Nickel-Hydrogen Research Center is located in the Huayan Industrial Park on the southwest side of Tianjin, China.	Ni-H	n/a	China
NUCAT Energy	NUCAT Energy consults, publishes reports and educational materials and conducts courses on LENR.	n/a	David J. Nagel	US
Osaka University	Osaka is Japan's sixth largest university and it is engaged in LENR discovery.	n/a	Norman Cook	Japan
Quantum Gravity Research (QGR)	Quantum Gravity Research is a physics research group working to discover a Theory of Everything.	n/a	Klee Irwin	US
Quantum Rabbit LLC	Quantum Rabbit is dedicated to unlocking the promise of LENR induced transmutation for nuclear waste.	n/a	Edward Esko	US
ReResearch LLC	ReResearch is an institute dedicated to materials research in the renewable energy sector.	n/a	Mason J. Guffey, Yang Tang and P.J. King	US
Russian Academy of Sciences (RAS)	RAS is a network of scientific research institutes from across the Russian Federation.	n/a	Vladimir Fortov	Russia
Science for Humanity Trust	A platform for collaboration among the global scientific community.	n/a	Richard Reichmann	US
Sidney Kimmel Institute for Nuclear Renaissance (SKINR)	SKINR is dedicated to finding the origin of the anomalous heat effect in LENR reactions.	Pd-D	Dennis C. Pease	US
Southern Utah University (SSU)	SSU has a research program to develop methodologies for characterizing nuclear reactions.	n/a	Sangho Bok	US
Space and Naval Warfare Systems Command (SPAWAR)	SPAWAR is the US Navy's warfare systems command focused on R&D and evaluation for military C4ISR systems.	n/a	Rear Adm. Patrick Brady	US
Spazionica	An R&D focused entity working in frontier science both experimentally and theoretically.	Ni-H	Francesco Santandrea	Italy
SRI International	SRI is a nonprofit research center helping clients to take R&D from the laboratory to the marketplace.	n/a	Fran Tanzella	US
Swedish Defence Materiel Administration (FMV)	FMV provides defense logistics to the Swedish Armed Forces.	Ni-H	Abraham Langlet	Sweden
Tohoku University	A national university housing the Condensed Matter Nuclear Reaction Joint Research Division.	n/a	Yasuhiro Iwamura, Takehiko Itoh and Jirohta Kasagi	Japan
Waseda University	Waseda University has an R&D program for rocket propelled engines.	n/a	Ken Naitoh and Hideo Ishii	Japan

The aim of LENR R&D Organizations is to evaluate experimental LENR technologies in order to validate net-energy output and present theoretical and practical explanations of what is occurring in the LENR reactor systems being tested.

Consortia and public-private partnerships in Japan and the European Union led by the Italian national agency for new technologies, energy and sustainable economic development (ENEA) have been organized to provide LENR Makers with support to assist them in validating and reporting on their LENR technologies, including access to financing and highly-respected lab facilities.

In the US, various government agencies have demonstrated a strong interest with growing support for LENR R&D. Scientists and researchers from the Navy's SPAWAR, the Defense Threat Reduction Agency (DTRA) and NASA have published scientific papers on their experiments and investigations into LENR discovery.¹⁰ The release of the SPAWAR DTRA Report attracted senior-level Department of Defense (DOD) and Department of Energy (DOE) attention including officials from NASA and the US Air Force's SBIR Program. Interest from US Defense agencies in LENR technologies has led to the LENR discovery activities of aerospace giants - Airbus and Boeing.

With an expressed willingness to test-drive "new ideas", the 115th US Congress and President Trump are thought to be open to the idea of encouraging a new approach to funding and supporting the LENR discovery process in the US. The Advanced Nuclear Technology Development Act of 2017 removes technology barriers that limit private-sector interest and encourages US national labs to demonstrate potential commercial applications and build a new nuclear research facility.

In Russia, there are regularly scheduled meetings on "Cold Fusion and Ball Lightning". Participants include scientists and researchers from the Russian Physical Society, Nuclear Society of Russia, Russian Mendeleev Chemical Society, M.V. Lomonosov Moscow State University, Russian People's Friendship University and the Russian Academy of Sciences. The coming September will mark the 24th annual Russian Conference on Cold Nuclear Transmutation of Chemical Elements and Ball Lightning in Sochi.

Growing the volume of independent validation reports of LENR technologies from LENR R&D Organizations will be crucial to realizing commercial-level success.

LENR Makers are poised to benefit from third-party validations of their LENR technologies as greater resources and increased access to non-dilutive (i.e. government research grants) sources of financing become more widely available and institutional bias at leading scientific stigmatization continues to diminish.

iii. LENR Investment Funds

Energy technology investors are attracted to LENR's game-changing possibilities. With LENR technologies, there are few regulatory hurdles to overcome and no need for pipelines or exotic and rare earth elements. Unlike many other new energy technologies, LENR has the potential to displace existing fossil fuel and intermittent renewable power sources by providing a low-cost clean energy technology suitable for both centralized and distributed energy environments.

Organization	Description	Leadership	Country
Cherokee Investment Partners	Investment management company with a series of private equity funds specializing in waste remediation and industrial clean-up.	Tom Darden	US
Deep River Ventures	Raleigh-based venture capital firm dedicated to making investments in US businesses.	J. Dewey Weaver	US
IP Group plc	UK-based publicly-traded VC firm investing in world-changing businesses.	Robert Trezona	UK
LENR Invest	US-based operator two investment funds dedicated to investing in LENR commercial and R&D companies.	Michael Halem	US
Medigest SA	Lugano-based financial trust with a portfolio of investments in companies active in life sciences and LENR.	Filippo de Jorio	Switzerland
Transformative Energy Materials (TEM) Capital	Transformative Energy and Materials Capital, LLC (TEM Capital) is a fund manager for the Transformative Energy & Materials Fund I.	John T. Preston	US
Woodford Investment Management Ltd.	Asset manager with £12.5bn under management and £761.4 million (\$950.42 million) set aside in a "patient capital" fund.	Neil Woodford	UK

The aim of LENR Investment Funds is to achieve an outsized return on their investments in LENR technologies.

Access to the commercialization engines of billionaire private equity investors will afford LENR Makers with the resources and capabilities to commercialize their LENR technologies once they have successfully determined the optimal conditions for the reaction to generate a high enough COP for commercial-level applications. The degree of difficulty in determining optimal conditions is significant and arguably presents one of the highest barriers for LENR Makers to overcome.

Cherokee Investment Partners led the funding for Industrial Heat to develop its LENR technologies. The private equity fund stated that LENR discovery represented an area of useful research to fund in its quest to eliminate pollution. Microsoft Co-Founder, Bill Gates has reportedly funded Seashore Research, which is based at Texas Tech University and led by LENR luminaries Drs. Robert Duncan and Michael McKubre.

LENR Makers are eligible for new funding opportunities to gain greater notoriety and financial support from their participation in national and international "Hero-X" and "X-Prize" competitions with the objective to reward the developers of new transformational renewable energy technologies.

Growing activity by LENR Makers in filing patent applications both at the USPTO, which has disbanded its practice of "special secret patent detention" or SAWS, and the USPTO's national counterparts, is likely to help attract more investment dollars for LENR technologies.

iv. LENR Commercial Equipment Suppliers

Many LENR Makers have struggled with their calorimetry for accurately measuring COP, sourcing engineered materials and securing lab equipment for their R&D efforts. With increasing support from LENR Investment Funds, more LENR Makers are likely to gain access to first-class facilities and equipment hastening the timeline for developing commercial-level LENR technologies.

Organization	Description	Leadership	Country
Kyocera	Kyocera is a supplier of components to equipment manufacturers in the energy, electronics semiconductor, information and communications markets.	Tetsuo Kuba, Djuniadi Arifin Sagala	Japan
Leap Forward Labs	Online store offering tools, chemicals and lab equipment to researchers, academics and industry for LENR experiments.	Alan Smith and Sam Hansson	UK
National Instruments (NI) (Nasdaq: NATI)	NI is a global leader in providing test, measurement, and control solutions for R&D companies.	James Truchard	US
Phonon Energy	Nonprofit promoting clean energy solutions, including LENR technologies, to counteract climate change.	David Daggett	US
Thunder Energies Corporation (TEC) (TNRG:OTCQB)	TEC is a R&D company featuring three cutting edge technologies in the fields of optics, nuclear physics and fuel combustion.	Ruggero Santilli and George Gaines	US

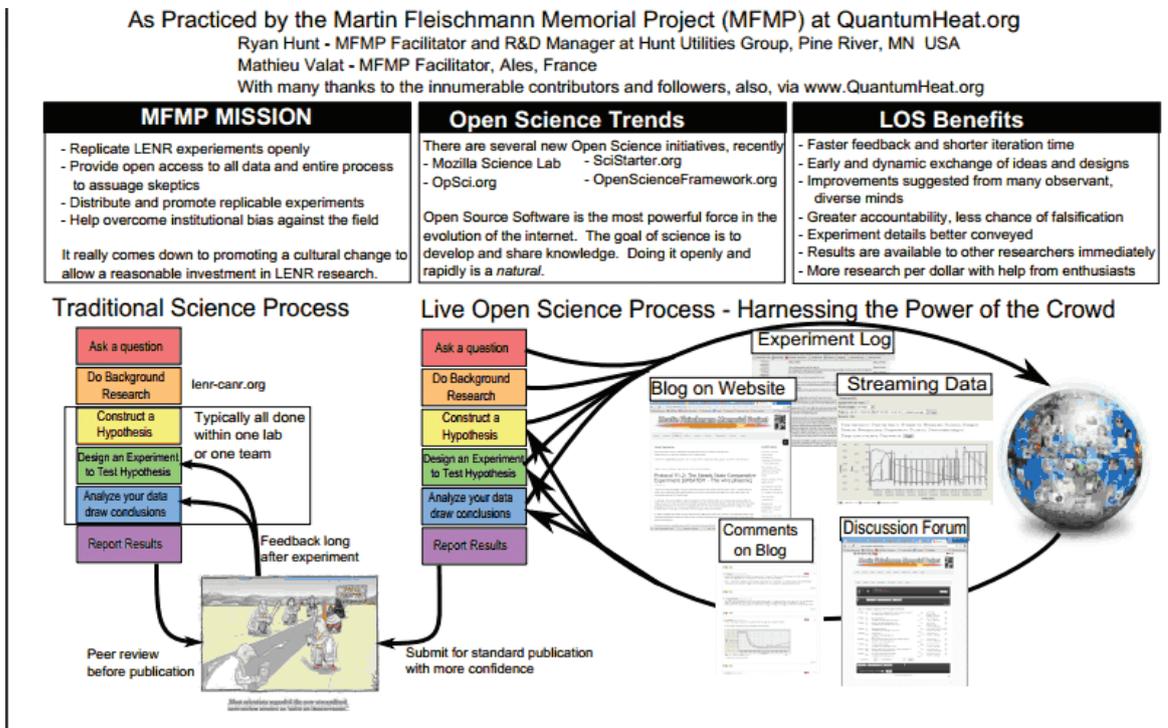
v. LENR Non-Profits

Non-profit organizations in the LENR Ecosystem perform an invaluable role in convening and information sharing among LENR stakeholders. The Ecosystem's most popular and longest standing event is the International Conference on Cold Fusion, which is organized by the International Society for Condensed Matter Nuclear Science. The last ICCF conference was held at Sendai, Japan in October 2016. The next ICCF conference (ICCF-21) is planned for Raleigh, North Carolina in the spring of 2018.

Organization	Description	Leadership	Country
Cold Fusion Research Laboratory	A Japanese multi-disciplinary scientific laboratory engaged in LENR discovery research.	Hideo Kozima	Japan
International Society of Condensed Matter Nuclear Science	Nonprofit organization providing researchers in LENR with a forum to collaborate and share their findings.	Jean Paul Biberian	UK
Japan CF Research Society (JCFR)	JCFR studies "Cold Fusion" phenomena, exchanges research information and convenes meetings between JCF.	Kenichi Tsuchiya	Japan
LENR-CANR	Industry resource organization advocating for cold fusion to lower energy costs.	Jed Rothwell	US
LENRIA	LENR industry group formed to organize and convene the LENR ecosystem.	Steven Katinsky	US
Martin Fleischmann Memorial Project (MFMP)	Nonprofit in the field of LENR following the principle of live open science by sharing all procedures, data and results openly online.	Robert Greenyer, Mathieu Valat, Brian Ahern and Alan Goldwater	UK

The non-profit Martin Fleischmann Memorial Project (MFMP) is dedicated to demonstrating to the world that LENR is real through its widespread replication and validation of LENR experiments. MFMP believes once there is "incontrovertible proof" of LENR, research funds and private capital will flow into the Ecosystem which will lead to some amazing, life saving, and life improving products. ¹¹

Martin Fleischmann Memorial Project - Open Live Science



To make the biggest impact and overcome the hurdle of institutional bias and scientific stigma against the LENR phenomenon, MFMP organizes open-source “live science” experiments using a simple setup to produce excess heat based on Alexander Parkhomov’s LENR recipe. MFMP has been successful in making the whole process, from the apparatus to the procedures, to the whole plan of the project, as transparent and understandable as possible, including live webcasting of its experiments. The open source “live science” initiative for LENR discovery has helped to encourage LENR Makers to lower their firewalls and share their experimental results in order to help speed-up the scientific process.

Industry organizations including the Japan Cold Fusion Research Society (JCFR), LENR-CANR.org and LENRIA have organized resources for LENR stakeholders on their websites including conference proceedings, peer-reviewed articles, experimental test reports and information on the many competing theories to explain LENR.

Road Ahead for LENR

The current timeline for LENR discovery and developing commercial-level LENR technologies is analogous to the period of scientific discovery of radioactivity by Rutherford and advances in quantum theory by his cohorts Niels Bohr, Erwin Schrodinger and Max Planck nearly a century ago. The success of hundreds of esteemed LENR scientists, academics, labs and highly respected research institutions having verified that the phenomenon is real and reproducible, suggests that we still have much to learn about solid state and condensed matter physics. Determining a theory of how LENR works - and, in particular, achieving commercial-level applications and products - is very likely to prove far more than just scientifically interesting.

Commercial success is often achieved by the first company to “get it right” and not by the first one to enter a given market. A survey of leading US companies in terms of market capitalizations illustrates this point. Apple wasn’t the first to introduce the smart phone and Facebook wasn’t the first to unveil a social media platform but they both “got it right”. When Amazon came along, there were already several “e-Commerce” sites. Search engines and web directories were all over the Internet when Google launched. Even cloud-based software platforms were well established before Microsoft launched its popular cloud computing platform & services.

Surveyed LENR Makers reported ambitious commercial deployment timelines with three-quarters of respondents stating they expected to sign licensing deals with OEMs by 2020.¹²

The capabilities of many LENR Makers to scale and control the reaction combined with the use of standard manufacturing processes that are imminently reproducible may be enough for LENR technologies to realize a successful licensing business model which will be an important commercial milestone. However, when asked to assess their confidence-level in taking one of their working prototypes from the lab to market, LENR Makers tempered their enthusiasm.¹³

If developments in LENR discovery track those in other renewable energy technologies then we should expect the pathway to commercialization for LENR Makers to necessitate achieving success in a reasonable time period. Time and resource constraints could reward a consortium or consolidation approach. LENR Makers may be more motivated to focus their efforts on developing the most promising LENR technologies.

80% of LENR Makers agreed there would be greater understanding and interest from the public if they combined efforts to communicate their collective progress on LENR discovery.¹⁴

It is unclear whether or not LENR technologies will face an uphill battle for regulatory approval although most LENR systems use no regulated or toxic materials. Consumer acceptance may prove to be a significant hurdle despite LENR’s promise of providing an abundant, low-cost, renewable energy source. It is also entirely possible that with so many LENR Makers working on different system designs and materials, that more than one approach or one company will be successful.

According to the survey of LENR Makers, the most likely commercial applications for LENR technologies in descending rank order are: ¹⁵

- Hot water (industrial, central utilities, residential)
- Process heat (general industrial, refining, meat treating, pasteurization)
- Steam generation for electricity and other uses (electric power, pulp and paper, food and beverage industry)
- Building heat (commercial and industrial)
- Other (microgrid distributed energy, water desalination/purification).

Respondents to the LENR Maker Survey ranked independent reporting and verification of their operating LENR prototype systems as extremely important for success and as their most significant milestone achievement. ¹⁶

LENR commercialization is a stage-wise process for introducing new technologies and systems into the renewable energy sector. LENR technologies will be well on their way to becoming the game changer envisioned by Fleischmann and Pons once they have cleared the following commercialization milestones.

- Organizing and launching a sizeable multi-million dollar Stephen Hawking or X-Prize challenge for the advancement of LENR technologies
- Ending the US Patent and Trademark Office's foot-dragging in granting LENR patents
- Modernizing how policymakers in the US, EU and Japan support R&D for breakthrough energy technologies such as LENR, especially in government national labs
- Performing and disseminating an incontrovertible test of a commercial-level LENR system analogous to the discovery of radioactivity and the development of fission at the University of Chicago FERME lab
- Persuading one of the scientific and academic establishment (i.e. Oxford, Cambridge, Caltech, MIT or EPFL) on the value and necessity of conducting LENR R&D
- Persuading a major utility to conduct a pilot project with an alpha or beta LENR prototype system

LENR discovery is attracting new attention as a potential alternative and renewable energy source to confront climate change and energy scarcity. With so many recent reports of successful tests of LENR technologies, a growing cohort of researchers and scientists are optimistically declaring that they have an engineering pathway to commercial-level applications and products.

If LENR Makers are successful in their efforts to develop commercial-level technologies, it will be game changing for society. Our challenge then will be to determine how best to harness the inexpensive renewable power derived from LENR technologies.

The challenge of harnessing LENR technologies to empower a future of abundance is analogous to how we are learning to utilize inexpensive processing power in order to enable big data, artificial intelligence and "smart-phones" that can run dozens of applications from a single mobile device.

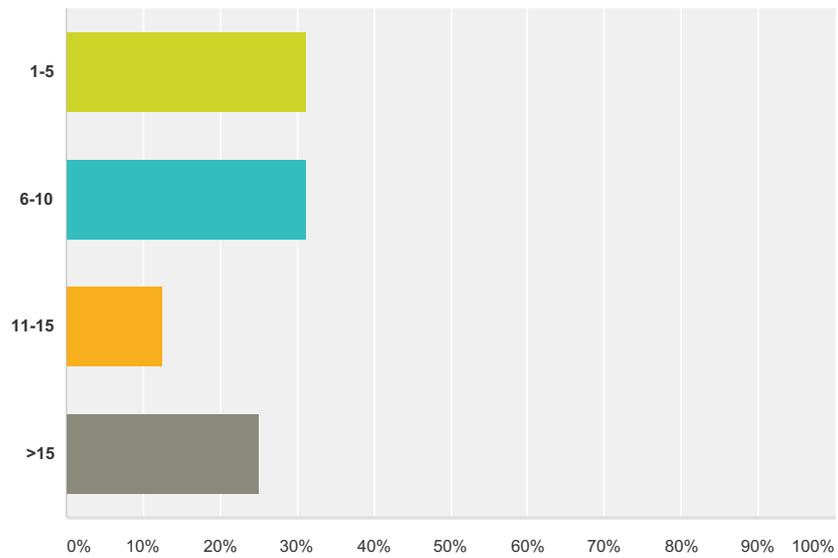
ENDNOTES

1. US Energy Information Administration (EIA) Annual Energy Outlook (AEO) 2017 – Energy consumption in the US is forecast to remain nearly flat over 2016-40 in the current Low Economic Growth Case. <http://www.eia.gov/pressroom/releases/press443.cfm>
2. NASA's assessment of the potential in terms of energy density for LENR technologies was reported in a report titled: The Application of LENR to Synergistic Mission Capabilities; see <https://webcache.googleusercontent.com/search?q=cache:ELqbaOqakiQJ:https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20150000549.pdf+&cd=4&hl=en&ct=clnk&gl=us>
3. LENR-CANR.org has comprehensive introduction to the Cold Fusion experiments of Dr. Melvin Miles at the China Lake Naval Air Weapons Range.
4. Edge.org asked Carl Page what he considered the most interesting recent scientific news and he replied in an article titled: Low Energy Nuclear Reactions Work And Could Supplant Fossil Fuels; see <https://www.edge.org/response-detail/26753>
5. John Desmond Bernal was a scientist and a pioneer in x-ray crystallography in molecular biology that wrote books connecting science and society.
6. Appendix 1: LENR Maker Survey; see Question 17. What additional things would be useful in helping strengthen your LENR efforts?
7. Google Translate and several outstanding LENR industry sources were used to verify the information in this report, including LENR-CANR.org, ISCMNS.org, JCFRS.org, LENRIA.org, LENR-Forum, E-Cat World, Cold Fusion Now, New Energy Times, Pure Energy Systems, Cold Fusion Times, Ego Out, Dr. Bob Blog, Open Source LENR, Sengaku Blog and New Energy Treasure.
8. Appendix 1: LENR Maker Survey; see Question 8. How many employees or contractors work at your organization are dedicated to LENR activities?
9. Mitsubishi Heavy Industries patent filing and press report on their latest LENR nuclear transmutation findings; see <http://patent.newsln.jp/p/2016138807>
10. LENR-CANR.org has US SPAWAR Systems Center Pacific (LENR) researcher Pamela Mosier-Boss's final report investigating nano-nuclear reactions in condensed matter produced for the Defense Threat Reduction Agency; see <http://lenr-canr.org/acrobat/MosierBossinvestigat.pdf>
11. MFMP posted what he termed the Symphony of the New Fire or its 18-step recipe to produce LENR heat with "The Cookbook is the signal in February 2016; see <http://www.quantumheat.org/index.php/en/home/mfmp-blog/519-the-cookbook-is-in-the-signal>
12. Appendix 1: LENR Maker Survey; see Question 7. When do you expect to sell or license your LENR technology to OEMs or release it to the Public?
13. Appendix 1: LENR Maker Survey; see Question 11. On a scale of 1-5, with 1 being not at all and 5 being extremely, how confident are you in your ability to take a working LENR prototype from the lab to market?
14. Appendix 1: LENR Maker Survey; see Question 15. Do you think if scientists and organizations were to combine efforts to communicate progress on the LENR initiatives there would be greater understanding and interest in LENR from the public?
15. Appendix 1: LENR Maker Survey; see Question 6. What are the common applications that you are targeting?
16. Appendix 1: LENR Maker Survey; see Questions 10 & 12. On a scale of 1-5, with 1 being not at all and 5 being extremely, where would you rank the independent reporting and verification of operating prototypes of LENR systems and the following milestones as clear indications that LENR is progressing and gaining momentum?

Appendix 1: LENR Maker Survey

Q1 How many years have you spent on LENR research and development activities?

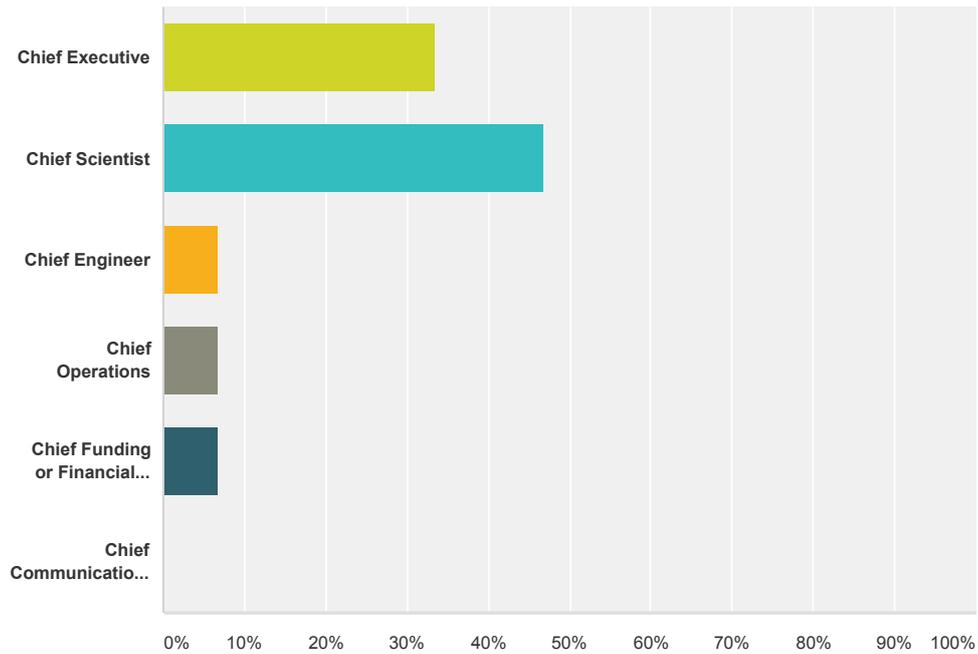
Answered: 16 Skipped: 0



Answer Choices	Responses	Count
1-5	31.25%	5
6-10	31.25%	5
11-15	12.50%	2
>15	25.00%	4
Total		16

Q2 How would you describe your role and responsibilities at your company with respect to its LENR R&D activities?

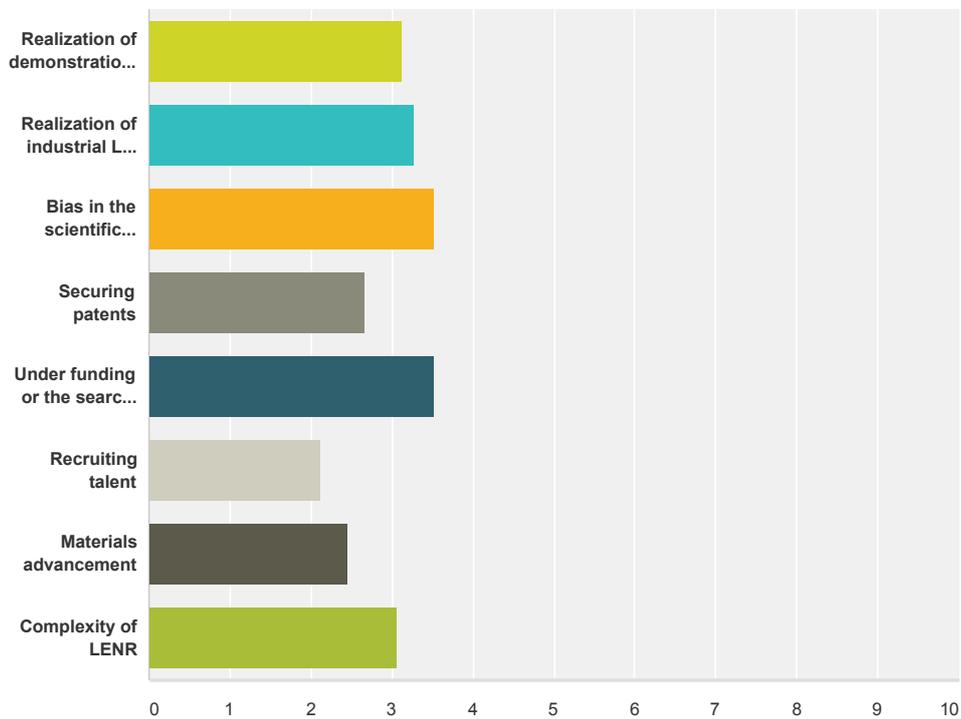
Answered: 15 Skipped: 1



Answer Choices	Responses	Count
Chief Executive	33.33%	5
Chief Scientist	46.67%	7
Chief Engineer	6.67%	1
Chief Operations	6.67%	1
Chief Funding or Financial (Officer)	6.67%	1
Chief Communications (Officer)	0.00%	0
Total		15

Q3 On a scale of 1-5, with 1 being not a barrier at all and 5 being barriers are completely impeding LENR development and implementation, where would you rank the following possible barriers with respect to progress on your company's LENR activities?

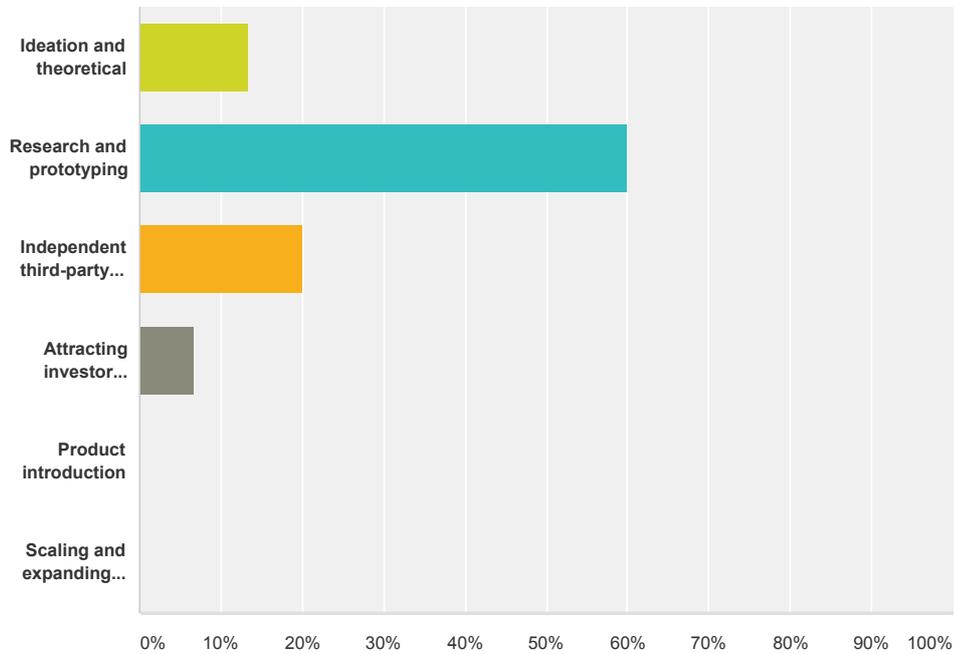
Answered: 15 Skipped: 1



	Not a barrier at all	Somewhat of a barrier	A barrier	Barrier is having a significant impact	Barrier is completely impeding LENR	Total	Weighted Average
Realization of demonstration LENR energy production devices	13.33% 2	26.67% 4	20.00% 3	13.33% 2	26.67% 4	15	3.13
Realization of industrial LENR energy production devices	13.33% 2	6.67% 1	40.00% 6	20.00% 3	20.00% 3	15	3.27
Bias in the scientific community	20.00% 3	6.67% 1	6.67% 1	33.33% 5	33.33% 5	15	3.53
Securing patents	33.33% 5	26.67% 4	0.00% 0	20.00% 3	20.00% 3	15	2.67
Under funding or the search for investors	13.33% 2	20.00% 3	6.67% 1	20.00% 3	40.00% 6	15	3.53
Recruiting talent	40.00% 6	20.00% 3	26.67% 4	13.33% 2	0.00% 0	15	2.13
Materials advancement	33.33% 5	26.67% 4	13.33% 2	13.33% 2	13.33% 2	15	2.47
Complexity of LENR	20.00% 3	26.67% 4	6.67% 1	20.00% 3	26.67% 4	15	3.07

Q4 How would you describe what stage your company at?

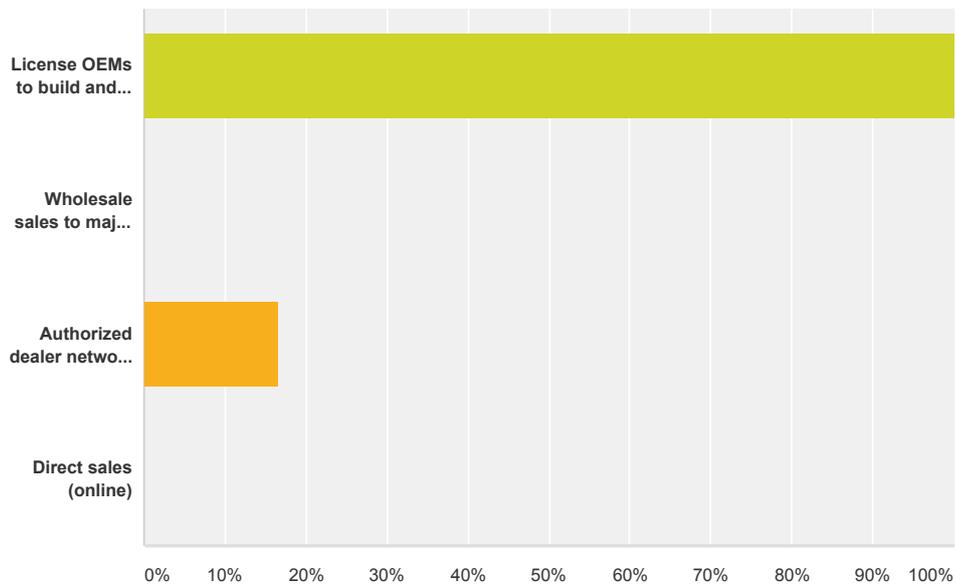
Answered: 15 Skipped: 1



Answer Choices	Responses
Ideation and theoretical	13.33% 2
Research and prototyping	60.00% 9
Independent third-party validation	20.00% 3
Attracting investor resources	6.67% 1
Product introduction	0.00% 0
Scaling and expanding operations	0.00% 0
Total	15

Q5 What business model is your company pursuing or planning to pursue? <check all that apply>

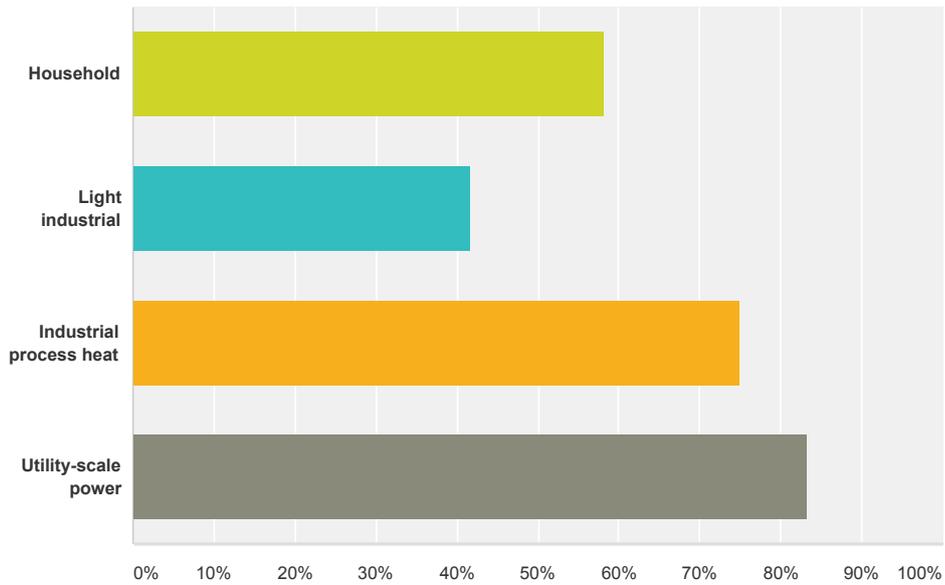
Answered: 12 Skipped: 4



Answer Choices	Responses
License OEMs to build and distribute	100.00% 12
Wholesale sales to major customers and/or retailers	0.00% 0
Authorized dealer network with sales and aftersales support	16.67% 2
Direct sales (online)	0.00% 0
Total Respondents: 12	

Q6 What are the most common applications that you are targeting? <check all that apply>

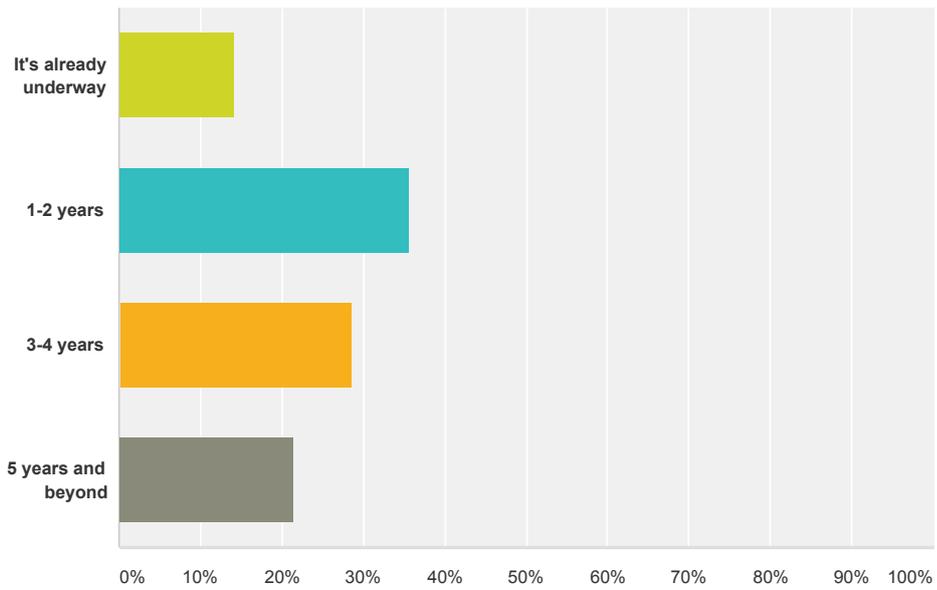
Answered: 12 Skipped: 4



Answer Choices	Responses
Household	58.33% 7
Light industrial	41.67% 5
Industrial process heat	75.00% 9
Utility-scale power	83.33% 10
Total Respondents: 12	

Q7 When do you expect to sell or license your LENR technology to OEMs or release it to the Public?

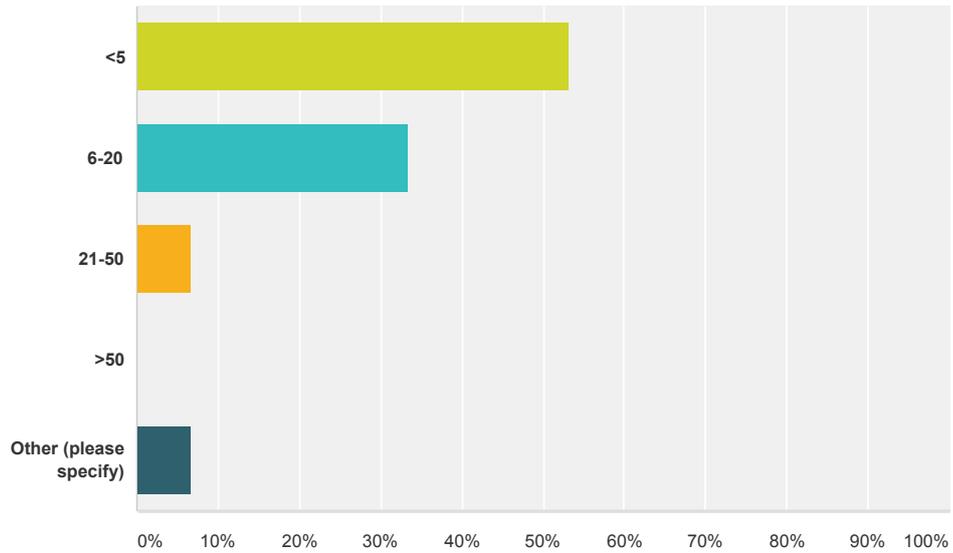
Answered: 14 Skipped: 2



Answer Choices	Responses	Count
It's already underway	14.29%	2
1-2 years	35.71%	5
3-4 years	28.57%	4
5 years and beyond	21.43%	3
Total		14

Q8 How many employees or contractors work your organization that are dedicated to LENR activities ?

Answered: 15 Skipped: 1

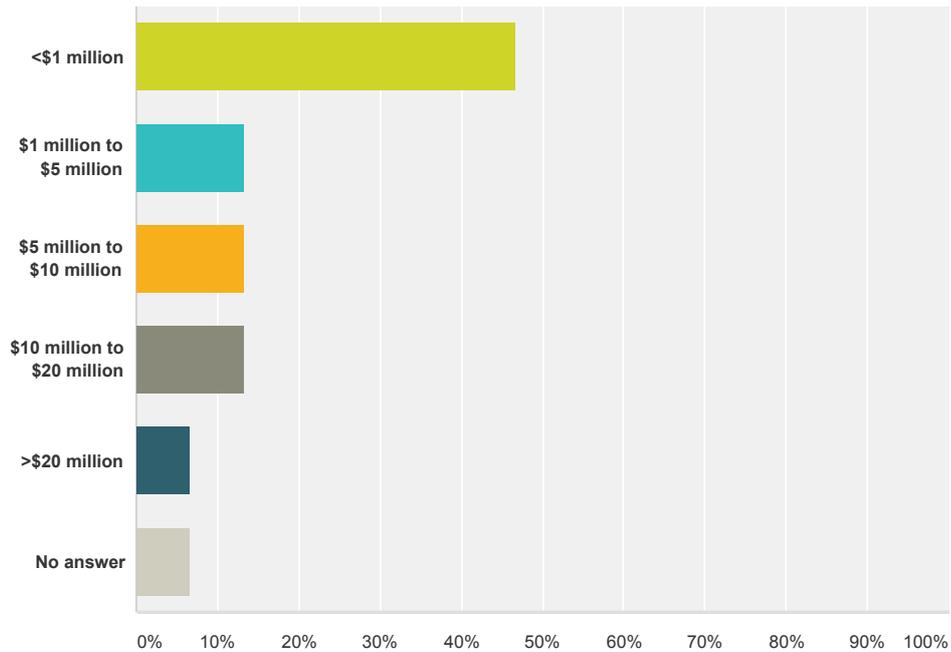


Answer Choices	Responses	
<5	53.33%	8
6-20	33.33%	5
21-50	6.67%	1
>50	0.00%	0
Other (please specify)	6.67%	1
Total		15

#	Other (please specify)	Date
1	All volunteer staffed	5/11/2016 1:46 PM

Q9 Since your organization’s founding, what level of funding or investor resources have you been able to attract?

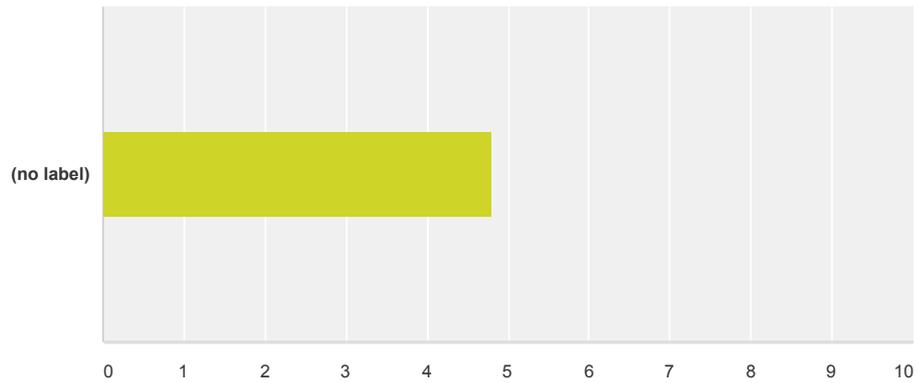
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Answer Choices	Responses	
<\$1 million	46.67%	7
\$1 million to \$5 million	13.33%	2
\$5 million to \$10 million	13.33%	2
\$10 million to \$20 million	13.33%	2
>\$20 million	6.67%	1
No answer	6.67%	1
Total		15

Q10 On a scale of 1-5, with 1 being not important at all and 5 being extremely important, where would you rank the independent reporting and verification of operating prototypes of LENR devices?

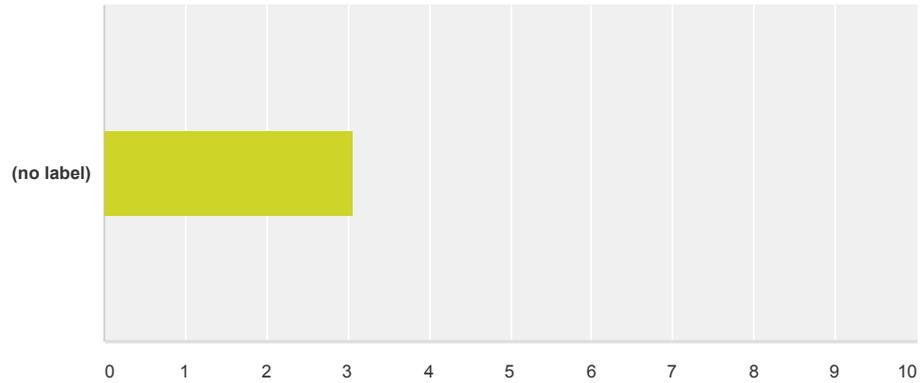
Answered: 15 Skipped: 1



	Not Important	Somewhat Important	Important	Very Important	Extremely Important	Total	Weighted Average
(no label)	0.00% 0	0.00% 0	6.67% 1	6.67% 1	86.67% 13	15	4.80

Q11 On a scale of 1-5, with 1 being not at all and 5 being extremely, how confident are you in your ability to take a working LENR prototype from the lab to market?

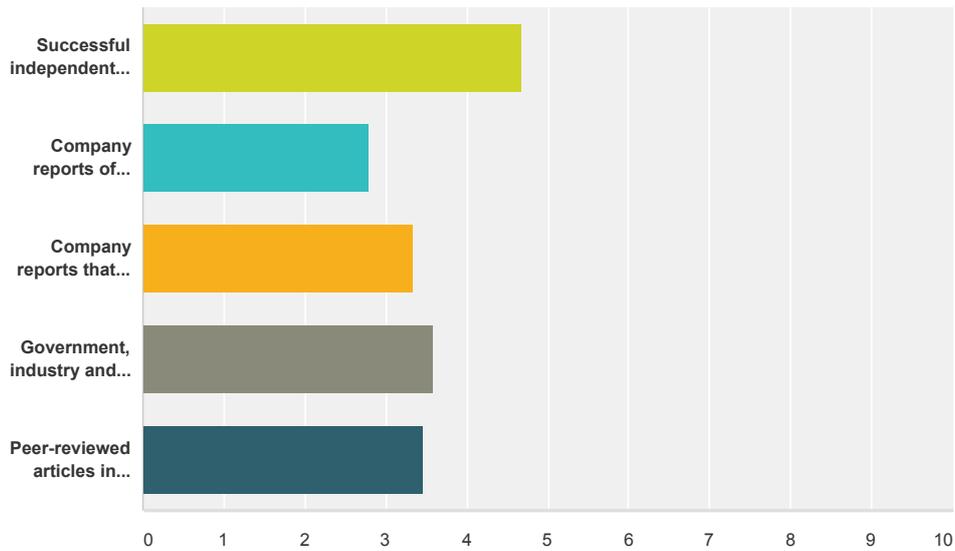
Answered: 14 Skipped: 2



	Not Confident at all	Somewhat Confident	Confident	Very Confident	Extremely Confident	Total	Weighted Average
(no label)	7.14% 1	7.14% 1	64.29% 9	14.29% 2	7.14% 1	14	3.07

Q12 On a scale of 1-5, with 1 being not important at all and 5 being extremely important, where would you rank the following milestones as clear indications that LENR is progressing and gaining momentum?

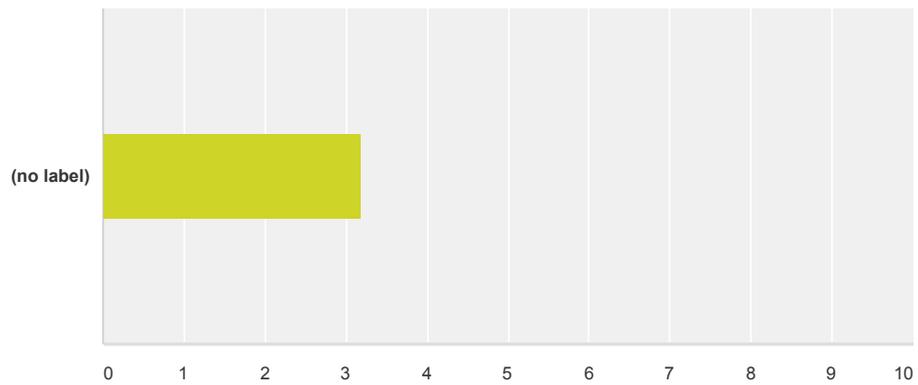
Answered: 15 Skipped: 1



	Not Important	Somewhat Important	Important	Very Important	Extremely Important	Total	Weighted Average
Successful independent tests validating LENR prototypes	0.00% 0	6.67% 1	6.67% 1	0.00% 0	86.67% 13	15	4.67
Company reports of significant excess heat results	26.67% 4	26.67% 4	13.33% 2	6.67% 1	26.67% 4	15	2.80
Company reports that measure the transmutation of hydrogen isotopes	13.33% 2	13.33% 2	20.00% 3	33.33% 5	20.00% 3	15	3.33
Government, industry and private capital funding announcements	13.33% 2	0.00% 0	26.67% 4	33.33% 5	26.67% 4	15	3.60
Peer-reviewed articles in highly respected scientific journals	6.67% 1	26.67% 4	20.00% 3	6.67% 1	40.00% 6	15	3.47

Q13 On a scale of 1-5, with 1 being nowhere near ready and 5 being the in the next twelve months, how far away do you believe LENR technologies are from achieving commercial success and significant sales?

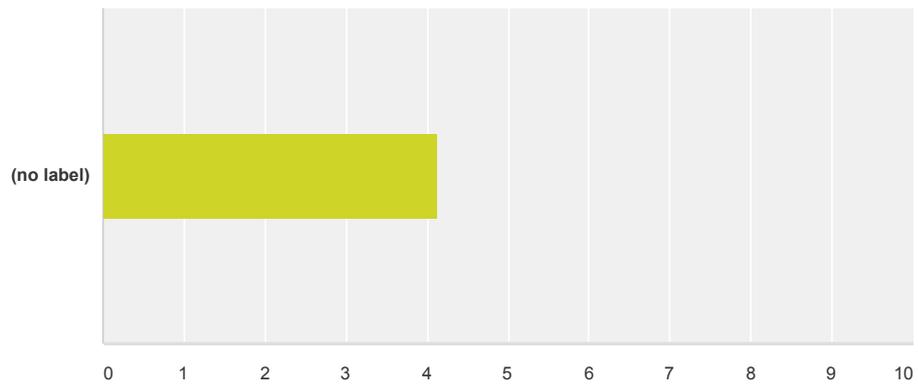
Answered: 15 Skipped: 1



	Nowhere near ready	At least 7-10 years away	After 2020	In the next 2-3 years	In the next 12 months	Total	Weighted Average
(no label)	13.33% 2	13.33% 2	20.00% 3	46.67% 7	6.67% 1	15	3.20

Q14 On a scale of 1-5, with 1 being near the bottom and 5 being the highest point, where would you rank your company versus your competitors in the global LENR marketplace?

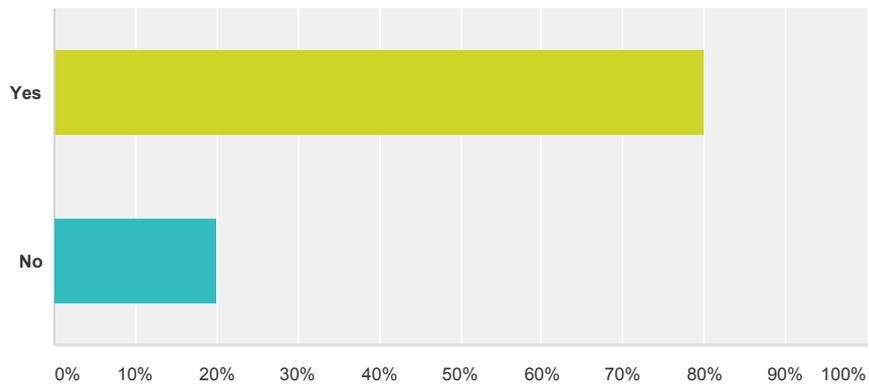
Answered: 14 Skipped: 2



	At the bottom	(no label)	In the middle	(no label)	Leading the field	Total	Weighted Average
(no label)	0.00% 0	0.00% 0	21.43% 3	42.86% 6	35.71% 5	14	4.14

Q15 Do you think if scientists and organizations were to combine efforts to communicate progress on their LENR initiatives there would be greater understanding and interest in LENR from the public?

Answered: 15 Skipped: 1



Answer Choices	Responses	Count
Yes	80.00%	12
No	20.00%	3
Total		15

Q16 With respect to your company's LENR initiative, what are you most enthusiastic about right now?

Answered: 14 Skipped: 2

#	Responses	Date
1	More advances in materials and engineering	1/7/2017 5:59 PM
2	independent third-party testing and publication of the results	1/7/2017 5:52 PM
3	Advances in material science and materials processing	1/7/2017 5:46 PM
4	Understanding basic materials science	6/11/2016 1:22 PM
5	A working prototype. The presence of the explanatory principles of the theory LENR.	5/30/2016 5:50 AM
6	Process variables that affect the generation of heat have been identified.	5/17/2016 10:44 PM
7	Faith in our scientific ability	5/15/2016 11:30 PM
8	excess heat and energy source	5/12/2016 4:25 AM
9	We have achieved 12 repeatable preliminary experiments and results.	5/12/2016 12:49 AM
10	transmutation	5/11/2016 2:13 PM
11	Incremental progress supported by donations and skilled collaborators.	5/11/2016 1:46 PM
12	cold fusion success is approaching	5/11/2016 9:01 AM
13	PdD electrolysis	5/11/2016 8:15 AM
14	finding an effective explanation	5/11/2016 6:51 AM

Q17 What additional things would be useful in helping strengthen your LENR efforts?

Answered: 14 Skipped: 2

#	Responses	Date
1	More collaboration and work with National Labs scientists and researchers	1/7/2017 5:59 PM
2	Publication in peer-reviewed scientific journals	1/7/2017 5:52 PM
3	Funding to expand the number of prototype reactors and cores to accelerate testing	1/7/2017 5:46 PM
4	Actually seeing an effect	6/11/2016 1:22 PM
5	Increasing the number of venture capital firms operating in the field of LENR.	5/30/2016 5:50 AM
6	Sufficient funding of operations.	5/17/2016 10:44 PM
7	Financial resources	5/15/2016 11:30 PM
8	stable funding	5/12/2016 4:25 AM
9	A complete validation with full measurements and adequate working capital.	5/12/2016 12:49 AM
10	sinergy and collaboration	5/11/2016 2:13 PM
11	Modest funding to enable a properly equipped research lab.	5/11/2016 1:46 PM
12	DOE approval of the topic	5/11/2016 9:01 AM
13	cooperation of natioal lab facilities	5/11/2016 8:15 AM
14	money	5/11/2016 6:51 AM

Q18 In your view, where is the greatest level of interest and enthusiasm for LENR coming from right now?

Answered: 14 Skipped: 2

#	Responses	Date
1	Electrochemists and corporate material scientists	1/7/2017 5:59 PM
2	The reality is most people don't even know LENR research is going on and people under haven't clue what we're talking about	1/7/2017 5:52 PM
3	Not from academics as they are still terrified of being associated with it	1/7/2017 5:46 PM
4	Confused fanboys and girls who have no idea how far (if it even exists at all) from commercialisation LENR is	6/11/2016 1:22 PM
5	Scientists - mathematics.	5/30/2016 5:50 AM
6	Research on Rydberg matter by Leif Holmlid and Sveinn Olafsson.	5/17/2016 10:44 PM
7	From the public and from intelligent investors	5/15/2016 11:30 PM
8	excess heat and energy source	5/12/2016 4:25 AM
9	There is a growing global interest in LENR from various sectors.	5/12/2016 12:49 AM
10	none from investors	5/11/2016 2:13 PM
11	Well-informed, scientifically literate crowd reviewers and contributors.	5/11/2016 1:46 PM
12	Italy, China, Russia	5/11/2016 9:01 AM
13	VC's	5/11/2016 8:15 AM
14	industry	5/11/2016 6:51 AM

Appendix 2: LENR Ecosystem Directory



Airbus Group Innovations (AGI)

www.airbusgroup.com

COUNTRY
France

LEADERSHIP
Jean-Francois Geneste

TYPE
LENR Makers

DESCRIPTION
AGI manages Airbus Group's network of research facilities, scientists, engineers and partnerships.

ACTIVITIES
Aerospace giant Airbus Group is pursuing research in the LENR field through its Airbus Group Innovations (AGI) division. Airbus has acknowledged that hydrogen gas loading is a promising technology to reliably create thermal and nuclear anomalies. AGI's patents on LENR and ultra-dense hydrogen note that they have developed a method for generating and for fusing ultra-dense hydrogen in which molecular hydrogen is fed into at least one cavity and catalyzed, where the splitting and subsequent condensation of the molecular hydrogen is initiated on a catalyst of the cavity to form an ultra-dense hydrogen.

TECHNOLOGY
Ni-H



Amoterra

www.amoterra.ca

COUNTRY
Canada

LEADERSHIP
Eleonora J. Anderson-Ahl

TYPE
LENR Makers

DESCRIPTION
A Canadian radioactive waste management company.

ACTIVITIES
Amoterra provides companies with revolutionary solutions for hazardous waste inactivation and disposal. Amoterra's developers market a pyrolytic device for the industrial application of a cold fusion transmutation process to manage and dispose of radioactive waste on an industrial scale.

TECHNOLOGY
Cavitation



Bhabha Atomic Research Centre (BARC)

www.barc.gov.in

COUNTRY
India

LEADERSHIP
Mahadeva Srinivasan

TYPE
LENR R&D Organizations

DESCRIPTION
Multi-disciplinary research center for advanced R&D in nuclear power production, materials technology, electronics & instrumentation.

ACTIVITIES
The BARC team under the leadership of late P. K. Iyengar, found excess heat, neutron bursts and large amounts of tritium in reactions from multiple types of electrolytic cells in what was claimed to be a clear evidence of the nuclear origin of the LENR phenomenon.

TECHNOLOGY
Pd-D



Boeing Phantom Works

www.boeing.com/company/about-bds/

COUNTRY	LEADERSHIP	TYPE
US	Leanne Caret	LENR Makers

DESCRIPTION
Boeing's R&D division involved in prototyping, of advanced military technologies

ACTIVITIES
Boeing Phantom Works (BPW) creates and advances new products and capabilities by drawing on its expertise in innovation, advanced experimentation, and prototyping. BPW was contracted by NASA in 2013 to work on the SUG-AR project which discussed design requirements for a LENR-powered airplane.

TECHNOLOGY
n/a



Brilliant Light Power

www.brilliantlightpower.com

COUNTRY	LEADERSHIP	TYPE
US	Randell Mills	LENR Makers

DESCRIPTION
Brilliant Light Power (formerly Blacklight) is developing SunCells using water as the source of hydrogen fuel to form Hydrinos.

ACTIVITIES
Brilliant Light Power claims their Hydrino energy product utilizes the pervasive dark matter of the universe to produce a high-energy black body light which can be used to power photovoltaic cells. Founder, Dr. Randell Mills expects to release the company's SunCell energy product for commercial use in 2017.

TECHNOLOGY
Hydrogen



Brillouin Energy Corporation

www.brillouinenergy.com

COUNTRY	LEADERSHIP	TYPE
US	Robert Godes, Robert W. George II, David Firshein, David Niebauer and David Correia	LENR Makers

DESCRIPTION
Brillouin is developing LENR technologies capable of producing commercial amounts of thermal energy.

ACTIVITIES
Brillouin Energy is engaged with leading scientists and national labs, including SRI International. The theory behind Brillouin Energy's LENR technologies is its Quantum Reaction Hypothesis. The company is led by an experienced team with scientific, engineering, and business development skills. Brillouin Energy's LENR technologies utilize a proprietary Q-Pulse™ controller method of electrical stimulation for its nickel metal conductors in its Hydrogen Hot Tube and Wet Boiler System LENR devices.

TECHNOLOGY
Ni-H



Burst Labs

www.burstlabs.com

COUNTRY
US

LEADERSHIP
Richard Philpott

TYPE
LENR Makers

DESCRIPTION
Burst Labs (formerly Impulse Devices), fuses hydrogen atoms with extreme pressure cavitation to release energy.

ACTIVITIES
The experienced team at Burst Labs are pioneers in extreme pressure acoustic cavitation technology. The company uses a cavitation process under high static pressure to enable a variety of chemical and physical processes that cannot be achieved with conventional cavitation systems.

TECHNOLOGY
Cavitation



Center for Emerging Energy Sciences (CEES) at Texas Tech University (TTU)

www.ttu.edu

COUNTRY
US

LEADERSHIP
Robert Duncan

TYPE
LENR R&D Organizations

DESCRIPTION
Research operation bridging physics and chemistry to determine the origin of the LENR anomalous heat effect.

ACTIVITIES
TTU's CEES Laboratory functions as an independent institute conducting research into various fields of high energy physics collaborating with Italy's National Energy and Environment Lab (ENEA).

TECHNOLOGY
Ni-H, Ni alloy nano-particles



CHAVA Energy LLC

www.chivaenergy.com

COUNTRY
US

LEADERSHIP
Hagen Ruff and Mark Snoswell

TYPE
LENR Makers

DESCRIPTION
CHAVA Energy is an innovator in the field of energy technology R&D.

ACTIVITIES
CHAVA's global team of innovators are developing breakthrough energy solutions with the goal to dramatically reduce the need for fossil fuels and the associated economic, environmental, health, and geopolitical issues. The scope of the company covers the full R&D life-cycle beginning with basic scientific research through applied development with proof of concept and prototypes to low-rate initial production and eventual full-scale production. CHAVA's global team seeks to balance today's centralized, monopolized, and cartel-influenced energy industry with consumer-oriented market solutions.

TECHNOLOGY
Hydrogen, Copper-Ni



Chemonuclear Fusion Project

www.facebook.com/chemonuclearfusionproject

COUNTRY
US

LEADERSHIP
Phil Lang

TYPE
LENR Makers

DESCRIPTION

The Chemonuclear Fusion Project is a crowd funding initiative to fund development of chemonuclear fusion R&D projects.

ACTIVITIES

Chemonuclear Fusion is a type of low energy nuclear fusion that has been shown to produce energy in experiments with potential for unlimited electric power without polluting the environment with radioactive waste and greenhouse gas emissions. Chemonuclear processes in small dense white dwarf stars accelerate the rate of nuclear fusion and cause them to explode in spectacular supernova explosions. Aneutronic nuclear fusion can provide unlimited electric power without polluting the environment with radioactive waste and greenhouse gas emissions.

TECHNOLOGY

n/a



Cherokee Investment Partners

www.cherokeefund.com

COUNTRY
US

LEADERSHIP
Tom Darden

TYPE
LENR Makers

DESCRIPTION

Cherokee Investment Partners is an investment management company with a series of private equity funds specializing in waste remediation and industrial clean-up.

ACTIVITIES

In 2013, Cherokee Investment Partners formed a subsidiary to purchase and commercialize E-Cat LENR intellectual property from Leonardo Corporation. It was reported in the Chinese press that Cherokee had secured a \$121 million commitment from Chinese authorities to engineer and build commercial LENR devices following the successful demonstration of E-Cat LENR technology.

TECHNOLOGY

n/a



Chinese Academy of Sciences (CASS)

www.casseng.cssn.cn

COUNTRY
China

LEADERSHIP
Zhang Wu-Shou

TYPE
LENR R&D Organizations

DESCRIPTION

CASS is China's premier academic organization and comprehensive scientific research center.

ACTIVITIES

CASS is made up of 31 research institutes and 45 research centers, which carry out research activities covering nearly 300 sub-disciplines. CASS has more than 4,200 staff members in total, of which more than 3,200 are professional researchers.

TECHNOLOGY

n/a



Chinese Nuclear Society (CNS)

www.ns.org.cn

COUNTRY
China

LEADERSHIP
Delin Wang

TYPE
LENR R&D Organizations

DESCRIPTION
CNS is China's multi-disciplinary organization for advanced nuclear power, weapons and materials technology.

ACTIVITIES
CNS has about 9,500 individual and 133 organization members from government, enterprise and universities. CNS employs 280,000 people and oversees 246 organizations focused on design, manufacture, construction, and operation of nuclear power plants, and fuel cycle nuclear technology.

TECHNOLOGY
n/a



Clean Nuclear Power LLC

www.cnptechnologies.net

COUNTRY
Switzerland

LEADERSHIP
Yogendra Srivastava and Allan Widom

TYPE
LENR Makers

DESCRIPTION
Clean Nuclear Power is a Lugano-based start-up developing clean LENR energy technologies.

ACTIVITIES
CNP Technologies has registered patents for its LENR or LENT (Low Energy Nuclear Transmutations) power source technologies. At the heart of the company's prototype is a lithium cylinder wrapped around a palladium hybrid current carrying rod.

TECHNOLOGY
Pd, Li



Clean Planet, Inc.

www.cleanplanet.co.jp

COUNTRY
Japan

LEADERSHIP
Hideki Yoshino and Masanao Hattori

TYPE
LENR Makers

DESCRIPTION
Clean Planet leads a partnership with HEAD and a NEDO-funded consortium led by Tohoku University to R&D and prototype a commercial device.

ACTIVITIES
Clean Planet's public-private partnership with Hydrogen Engineering Application & Development Company (HEAD) and with Tohoku University has the ambitious goal of developing and commercializing LENR which it calls "Condensed Matter Nuclear Reactions" (CMNR) by the 2020 Olympics. The partnership is working with manufacturers to facilitate rapid global distribution of LENR driven commercial products once conclusive proof the effect is shown.

TECHNOLOGY
Ni-H, Ni alloy nano-particles

Cold Fusion Power International

www.coldfusion-power.com

COUNTRY Russia	LEADERSHIP Edward Tsyganov	TYPE LENR R&D Organizations
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DESCRIPTION
Laboratory of high energy physics and international center of fundamental physics.

ACTIVITIES
Cold Fusion Power International's laboratory functions as an independent institute conducting research into various fields of high energy physics in close contact with the Joint Institute for Nuclear Research (JINR) experimental laboratories.

TECHNOLOGY
Pd-D

Cold Fusion Research Laboratory

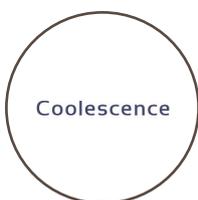
www.geocities.jp/hjrfq930/index.html

COUNTRY Japan	LEADERSHIP Hideo Kozima	TYPE LENR R&D Organizations
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DESCRIPTION
Japanese multi-disciplinary scientific laboratory to research the cold fusion phenomenon.

ACTIVITIES
Established by Dr. Hideo Kozima, Professor Emeritus at Shizuoka University, in April 1999 with collaborators from Shizuoka University to research the cold fusion phenomenon. Current activity is focused on analyzing the physics of low energy neutrons in solids with high-density hydrogen isotopes.

TECHNOLOGY
n/a



Coolescence

www.coolescence.com/

COUNTRY US	LEADERSHIP Rick Cantwell and Matt McConnell	TYPE LENR Makers
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DESCRIPTION
Coolescence is engaged in Pd-D loading LENR research experiments.

ACTIVITIES
Coolescence's strategy is to replicate published LENR experiments in efforts to find a repeatable experiment and work to develop marketable prototypes to raise commercial and venture funding for manufacturing. Coolescence collaborated with the Martin Fleischmann Memorial Project (MFMP) in its Celani Cell replication efforts.

TECHNOLOGY
Pd-D



Deep River Ventures

www.deepriverventures.com

COUNTRY
US

LEADERSHIP
J. Dewey Weaver

TYPE
LENR Investment Funds

DESCRIPTION
Raleigh-based venture capital firm dedicated to making investments in US businesses.

ACTIVITIES
Deep River Ventures works to support entrepreneurs developing technologies with ready-use and patent-pending innovations to help develop new and revitalize existing products and services, create new markets and build IP portfolios.

TECHNOLOGY
n/a



Department of Atomic Energy

www.dae.nic.in

COUNTRY
India

LEADERSHIP
Anil Kakodkar and Srikumar Banerjee

TYPE
LENR R&D Organizations

DESCRIPTION
DAE is engaged in the development of nuclear power technologies in the fields of agriculture, medicine, industry and basic research.

ACTIVITIES
In 2015, the Indian Department of Atomic Energy leadership recommended India restart LENR experiments sponsored by the Ministry of New and Renewable Energy (MNRE).

TECHNOLOGY
n/a



EarthTech International

www.earthtech.org

COUNTRY
US

LEADERSHIP
Harold Puthoff

TYPE
LENR R&D Organizations

DESCRIPTION
A privately funded R&D group exploring novel ideas in physics.

ACTIVITIES
EarthTech International's current interests include gravity, cosmology, and modifications of standard theories of electrodynamics, particularly as they may apply to space propulsion and new sources of energy, such as LENR.

TECHNOLOGY
n/a



ENEA Research Labs

www.enea.it

COUNTRY
Italy

LEADERSHIP
Vittorio Violante

TYPE
LENR R&D Organizations

DESCRIPTION
Italian National Agency for New Technologies, Energy and Sustainable Economic Development.

ACTIVITIES
ENEA's activities are mainly focused on energy efficiency, renewable energy sources, nuclear energy, climate and the environment, safety and health, new technologies, electric system research. The Agency has a staff of 2,700 across 9 research centers and working relationships on LENR research with Texas Tech University (TTU), SRI International and the Sidney Kimmel Institute for Nuclear Renaissance (SKINR).

TECHNOLOGY
Pd-D



Energiforsk (Energy Research Institute)

www.energiforsk.se

COUNTRY
Sweden

LEADERSHIP
Magnus Olofsson

TYPE
LENR R&D Organizations

DESCRIPTION
Energiforsk is the Swedish energy industry's research institute.

ACTIVITIES
Energiforsk is a cooperative owned by the Swedish Energy, Swedish District Heating Association, Swedish power grid, Energigas Sweden, Swedegas, Forest Industries and the Swedish Wind Energy. The Cooperative has issued a call for a LENR research initiative and published a report on LENR describing excess heat that cannot be explained with chemical reactions by researchers from Uppsala University, KTH and the University of Bologna.

TECHNOLOGY
Ni-H



Energy Institute Research Affiliate, UT at Austin

www.energy.utexas.edu

COUNTRY
US

LEADERSHIP
Thomas Grimshaw and Fred Beach

TYPE
LENR R&D Organizations

DESCRIPTION
The Energy Institute is an organization at the University of Texas at Austin focused on studying energy policy, including LENR.

ACTIVITIES
Led by Thomas Grimshaw, the Energy Institute conducts policy research aimed at attracting support for LENR and its public benefit as a new energy source that may yet be realized. Grimshaw has been working on LENR policy and related areas for the past 10 years to help promote the energy benefits and deal with any potential secondary impacts from LENR technologies.

TECHNOLOGY
n/a



Etiam Oy

etiam.fi

COUNTRY
Finland

LEADERSHIP
Dr. Elers, Chairman

TYPE
LENR Makers

DESCRIPTION
Etiam develops innovative products for affordable clean energy production utilizing alternative energy sources.

ACTIVITIES
Etiam consists of three researchers conducting LENR experiments having achieved COPs >1. Early results inspired a crowd-funding share issue campaign presenting Etiam's theory and latest findings including mentioning using sono-fusion ignition (ultra sound) to start the reaction. Etiam is raising additional financial support to fund planned tests. The company has applied for a patent on creating Rydberg matter (EP2783369).

TECHNOLOGY
Ni-H



First Gate Energies

www.sonofusionjets.com

COUNTRY
US

LEADERSHIP
Roger Stringham

TYPE
LENR Makers

DESCRIPTION
First Gate is a pioneer in using acoustic cavitation to produce an LENR effect.

ACTIVITIES
First Gate Energies' M3S sonofusion reactor uses ultrasonic waves to create gas bubbles within heavy water to produce acoustic cavitation.

TECHNOLOGY
Cavitation



First Light Fusion

www.firstlightfusion.com

COUNTRY
UK

LEADERSHIP
Nick Hawker and Yiannis Ventikos

TYPE
LENR Makers

DESCRIPTION
First Light Fusion is developing a process for achieving practical and affordable fusion energy.

ACTIVITIES
First Light Fusion was spun out from the University of Oxford with seed capital from the IP Group plc, Parkwalk Advisors Ltd and a number of Angel investors to develop process for achieving practical and affordable fusion energy. First Light Fusion have submitted USPTO patent applications for a type of sonofusion. Investors in its recently announced \$35 million round include IP Group, a fund managed by Invesco Asset Management Limited, clients advised or managed by Sandaire Investment Office and the University of Oxford.

TECHNOLOGY
Cavitation



Global Energy Corporation (GEC)

www.gec.solutions

COUNTRY
US

LEADERSHIP
Lawrence Fosley and Jay Khim

TYPE
LENR Makers

DESCRIPTION
GEC is focused on the development and commercialization of hybrid fusion-fast-fission LENR technology.

ACTIVITIES
The company's LENR technology builds off of its work with the US Navy SP-AWAR program. GEC's LENR technologies are safe, clean and secure. There is no possibility of a chain reaction or meltdown. They use nuclear waste products or unenriched U as fuel and they are secure because there is no possibility of fuel enrichment or reprocessing. In 2012, the company announced one of the first commercial LENR devices - their hybrid "Genie Reactor" which they said they were planning to build on Guam.

TECHNOLOGY
n/a

Guangzhou with co-Energy Technology Company, Ltd.

www.lenr.com.cn/

COUNTRY
China

LEADERSHIP
Lin Xidan

TYPE
LENR Makers

DESCRIPTION
Guangzhou with co-Energy Technology Company is engaged in the development of LENR technology.

ACTIVITIES
Based in Guangzhou, the company is being led by Professor Lin Xidan with registered capital of 5 million yuan. It has two Chinese "Cold Fusion" patents pending for a reaction tube and a reactor core.

TECHNOLOGY
n/a



Heliorite AB

www.heliorite.com

COUNTRY
Sweden

LEADERSHIP
Birger Johannson

TYPE
LENR Makers

DESCRIPTION
Heliorite AB is an independent science and technology development company.

ACTIVITIES
Heliorite AB's business activities range from designing hardware for environmentally-friendly energy plants to software and simulation projects.

TECHNOLOGY
Ni-H

High Mesa Technology

n/a

COUNTRY
US

LEADERSHIP
Tom Claytor

TYPE
LENR Makers

DESCRIPTION
High Mesa Technology provides contract assistance for LENR research experiments.

ACTIVITIES
Led by former LANL scientist Tom Claytor, High Mesa Technology has conducted several experimental tests of LENR systems, contributing significant data on tritium measurements. The company has supported to First Gate Energies' Sonofusion Jets by providing electron microscopy of the target foils after runs and by analyzing for tritium and helium in samples of the argon atmosphere in their LENR system.

TECHNOLOGY
n/a



Hope Cell Technologies

www.hopecell.wordpress.com

COUNTRY
Australia

LEADERSHIP
Robert Vancina

TYPE
LENR Makers

DESCRIPTION
Hope Cell Technologies are the producers of the Hope Cell a scaleable device designed for clean hydrogen generation.

ACTIVITIES
The Hope Cell is a scaleable device designed for clean hydrogen generation through hydrogen embrittlement in metal hydride lattice and self-induced exothermal low energy nuclear reactions (LENR). The Hope Cell device employs plasma discharge in hydrogen medium to produce hydrogen gas and induce heat under highest energy efficiency helping to bridge the gap of technology in transition from the 20th to the 21st century.

TECHNOLOGY
Hydrogen generation



Hydro Fusion Ltd.

www.hydrofusion.com

COUNTRY
Sweden

LEADERSHIP
Magnus Holm and Hans-Peter Bermin

TYPE
LENR Makers

DESCRIPTION
North European licensee of Leonardo Corporation's QuarkX E-Cat LENR device.

ACTIVITIES
Hydro Fusion is reported to be playing an important role in R&D and prototyping of the QuarkX E-Cat LENR device. The company engages on business collaborations, ventures, with interested parties in the areas of reselling, online affiliates, technology licensing, third party applications for the QuarkX E-Cat LENR device.

TECHNOLOGY
QuarkX E-Cat



Hydrobetatron

www.hydrobetatron.org

COUNTRY
Italy

LEADERSHIP
Ugo Abundo

TYPE
LENR R&D Organizations

DESCRIPTION
Italian scientific association promoting the “open source” development of LENR.

ACTIVITIES
Hydrobetatron believes LENR represents an inexhaustible energy source, clean and economical, which could counteract the material poverty of humanity and allow our beautiful planet Earth to regenerate. The organization has filed for an Italian Patent concerning its LENR apparatus for the direct conversion of nuclear energy into electricity and heat cogeneration. Hydrobetatron has collaborated with the MFMP in replicating Parkhomov experiments.

TECHNOLOGY
n/a

Hydrogen Engineering Application & Development Company (HEAD)

n/a

COUNTRY
Japan

LEADERSHIP
Tadahiko Mizuno and Hideki Yoshino

TYPE
LENR R&D Organizations

DESCRIPTION
HEAD is an independent research unit led by Tadahiko Mizuno and supported by Clean Planet.

ACTIVITIES
Dr. Mizuno’s LENR R&D focuses on excess heat generation. HEAD is reported to have developed a proof of concept prototype reactor that operates at a COP of 1.9 at the 1kw and 10kw power level using normal nickel mesh. The HEAD prototype creates a brilliant plasma to sputter the surface of the metal, cleaning it and creating surface nanostructures which catalyze the LENR effect.

TECHNOLOGY
Ni-H, Ni alloy nano-particles



Indira Gandhi Centre for Atomic Research

www.igcar.ernet.in

COUNTRY
India

LEADERSHIP
Arun Kumar Bhaduri

TYPE
LENR R&D Organizations

DESCRIPTION
IGCAR is India’s scientific research and advanced engineering program for the development of fast breeder reactor nuclear technology.

ACTIVITIES
The IGCAR is engaged in broad based multidisciplinary programme of scientific research and advanced engineering of Fast Breeder Reactor (FBR) technology based on unique mixed Plutonium Uranium Carbide fuel. First of its kind in the world, IGCAR’s KAMINI Reactor is the only operating FBR successfully using U233 fuel.

TECHNOLOGY
n/a

Industrial Heat, LLC (IH)

n/a

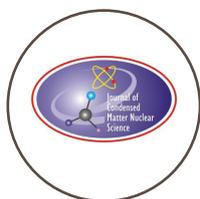
COUNTRY
US

LEADERSHIP **TYPE**
JT Vaughn LENR Makers

DESCRIPTION
LENR technology developer focused on advancing efforts on new, clean and efficient energy sources.

ACTIVITIES
Industrial Heat (IH) has partnerships with LENR industry participants, universities and NGO's to develop and disseminate LENR technologies especially in developing countries. IH believes LENR technologies have the potential to raise living standards and reduce the environmental impact of producing energy. In 2014, IH acquired the intellectual property and licensing rights to Leonardo Corporation's E-Cat LENR device after an independent committee of European scientists conducted two multi-day tests at Rossi's facility in Italy.

TECHNOLOGY
Ni-H-Li, E-Cat



International Society of Condensed Matter Nuclear Science

www.iscmns.org

COUNTRY
UK

LEADERSHIP **TYPE**
Jean Paul Biberian LENR Non-Profits

DESCRIPTION
Nonprofit organization providing researchers in LENR with a forum to collaborate and share their findings.

ACTIVITIES
The International Society of Condensed Matter Nuclear Science publishes the Journal of Condensed Matter Nuclear Science and organizes the International Conference on Cold Fusion. It is the only Scientific Journal dedicated exclusively to covering LENR research and it is available online at www.iscmns.org/CMNS/publications.htm.

TECHNOLOGY
n/a



IP Group plc

www.ipgroupplc.com

COUNTRY
UK

LEADERSHIP **TYPE**
Robert Trezona LENR Investment Funds

DESCRIPTION
UK-based publicly-traded VC firm investing in world-changing businesses.

ACTIVITIES
IP Group is an investor in First Light Fusion, the LENR spinoff based on LENR IP developed at Oxford University.

TECHNOLOGY
n/a

Is TECH

www.istechpot.com

COUNTRY
Italy

LEADERSHIP
Paolo Tripodi

TYPE
LENR Makers

DESCRIPTION
Is TECH is a group of managers and scientists with experience in working on scientific and industrial research.

ACTIVITIES
Is TECH integrates its technology experience into projects and multidisciplinary research and development programs for advanced product and technology solutions.

TECHNOLOGY
Metal-Hydrogen



Iwate University

<http://www.iwate-u.ac.jp/english/>

COUNTRY
Japan

LEADERSHIP
Shinya Narita

TYPE
LENR R&D Organizations

DESCRIPTION
Department of Electrical Engineering and Computer Science.

ACTIVITIES
Narita's group has shown anomalous heat evolution in deuterium desorption experiments with Pd-Ni binary nano-particles. In the experiments, the phenomenon could be attributed to the fine-structure of the sample as well as a specific property of Ni in deuterium diffusion.

TECHNOLOGY
Pd-Ni, Pd-Ag, and Pd-Ti



Japan CF Research Society (JCFRS)

www.jcfrs.org

COUNTRY
Japan

LEADERSHIP
Kenichi Tsuchiya

TYPE
LENR Non-Profits

DESCRIPTION
JCFRS studies "Cold Fusion" phenomena by exchanging research information and convening meetings.

ACTIVITIES
JCFRS believes "cold fusion", like any other area of science, needs an organization to collect and disseminate data and promote general interest in the field. JCFRS works to broaden awareness of cold fusion with an interdisciplinary and multidisciplinary approach involving scientists for many different fields, who would not normally meet together or form a society.

TECHNOLOGY
n/a



Japan Science and Technology Agency (JST)

<http://www.jst.go.jp>

COUNTRY
Japan

LEADERSHIP
Hamaguchi Michinari

TYPE
LENR R&D Organizations

DESCRIPTION
Japan Science and Technology Agency (JST) is a government funding agency under the Ministry of Education, Culture, Sports, Science and Technology in Japan.

ACTIVITIES
JST is one of the core institutions responsible for the implementation of the government's Science and Technology Basic Plan. Through JST's Impulsing Paradigm Change through Disruptive Technologies (ImPACT) program, the agency has previously funded work on elemental transmutation.

TECHNOLOGY
n/a



JET Energy Inc.

<http://www.world.std.com/~mica/jetenergy.htm>

COUNTRY
US

LEADERSHIP
Mitchell Swartz

TYPE
LENR Makers

DESCRIPTION
JET Energy is a developer of the NANOR® and PHUSOR® LENR/LANR (lattice assisted nuclear reaction) devices.

ACTIVITIES
Active since the early 1990s, JET Energy through its operating subsidiary, Nanortech is developing its NANOR® and PHUSOR® LENR devices. JET Energy's NANOR device has been successfully demonstrated and tested with an energy gain of >10 in Peter Hagelstein's laboratory at MIT.

TECHNOLOGY
NANOR, ZrO₂-Pd



JWK Technologies Corporation (JWK)

www.jwk.com

COUNTRY
US

LEADERSHIP
Larry Forsley

TYPE
LENR Makers

DESCRIPTION
JWK provides contract engineering services to clients including the US Dept of Defense (DOD).

ACTIVITIES
JWK's chief scientist, Larry Forsley, holds a LENR patent (US Patent 8,419,919) together with Pamela A. Boss, Frank E. Gordon and Stanislaw Szpak which they developed during their scientific works on behalf of the US Navy's SP-AWAR.

TECHNOLOGY
Nuclear waste treatment



Kobe University

<http://www.kobe-u.ac.jp/en/>

COUNTRY Japan	LEADERSHIP Akira Kitamura	TYPE LENR R&D Organizations
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DESCRIPTION
Kobe University has a Department of Nuclear Engineering.

ACTIVITIES
Akira Kitamura has replicated Akito Takahashi's LENR experiments. His group has reported the phenomena of anomalous heat evolution from hydrogen-isotope-loaded nano-composite metal-oxide samples at room temperature using a twin absorption system.

TECHNOLOGY
n/a



Korea Advanced Institute of Science and Technology (KAIST)

www.kaist.ac.kr

COUNTRY Korea	LEADERSHIP Sunwon Park	TYPE LENR R&D Organizations
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DESCRIPTION
KAIST is Korea's science and technology organization focused on developing world-class scientists capable of applied research.

ACTIVITIES
KAIST's focus is on educating and developing world-class scientists capable of long and short term basic and applied research to enable the nation's strategic technological advancements. KAIST collaborates with a diverse pool of national and international research institutions and industries. KAIST members are reported to be following developments in LENR R&D.

TECHNOLOGY
n/a



Kresenn Ltd

www.kresenn.com

COUNTRY UK	LEADERSHIP Angelo Ovidi, Massimo Mongardini	TYPE LENR Makers
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DESCRIPTION
Kresenn is developing commercial energy production solutions for Francesco Celani's LENR applications.

ACTIVITIES
Kresenn specializes in the research and development of energy production solutions for the data center industry with a strong focus on R&D for hydrogen (LENR) powered portable, zero emission reactors, called Power Modules.

TECHNOLOGY
Pd-D



Kurchatov Institute, Moscow

www.eng.nrcki.ru

COUNTRY
Russia

LEADERSHIP
Mikhail Kovalchuk

TYPE
LENR R&D Organizations

DESCRIPTION
The Kurchatov Institute is one of Russia's leading research centers with a large interdisciplinary laboratory.

ACTIVITIES
The Kurchatov Institute has the research capacities, technological potential and human resources essential for the advancement in new branches of science and technology. The development and implementation of leading-edge and ready-to-use technologies based on unique research and mega-facilities and complexes are priorities. The Kurchatov Institute has 10,000 employees, with nearly 2,000 PhDs and 34 members of the Russian Academy of Sciences.

TECHNOLOGY
Nuclear waste treatment



Kyocera

www.global.kyocera.com

COUNTRY
Japan

LEADERSHIP
Tetsuo Kuba, Djuniadi
Arifin Sagala

TYPE
LENR Commercial Equipment
Suppliers

DESCRIPTION
Kyocera is a supplier of components to equipment manufacturers in the energy, electronics semiconductor, information and communications markets.

ACTIVITIES
Kyocera is a supplier of fine ceramic components to solid oxide fuel cell (SOFC) co-generation system manufacturers.

TECHNOLOGY
n/a



Kyoto University

www.kyoto-u.ac.jp/en

COUNTRY
Japan

LEADERSHIP
Katsuaki Tanabe

TYPE
LENR R&D Organizations

DESCRIPTION
Kyoto University has a dedicated LENR research group studying semiconductor nano shells.

ACTIVITIES
Led by Professor Kiyotake Tanabe, Kyoto University's work on LENR is in the field of semiconductor nano shells.

TECHNOLOGY
n/a



Kyushu University

h2.kyushu-u.ac.jp

COUNTRY
Japan

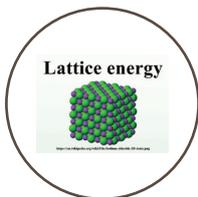
LEADERSHIP
Chiharu Kubo

TYPE
LENR R&D Organizations

DESCRIPTION
Kyushu University houses the International Research Center of Hydrogen Energy.

ACTIVITIES
Through its industry-government-academia collaborations, Kyushu University strives for open innovation on challenging issues related to energy and climate change. Kyushu University manages a hydrogen and fuel cell R&D project in conjunction with the International Center of Hydrogen Research.

TECHNOLOGY
Nuclear waste treatment



Lattice Energy LLC

www.slideshare.net/lewisglarsen

COUNTRY
US

LEADERSHIP
Lewis Larsen

TYPE
LENR Makers

DESCRIPTION
Lattice Energy is researching and developing next-generation LENR power devices.

ACTIVITIES
Lattice Energy is a co-promoter of Widom-Larsen-Srivastava theory. Its products in development include, modular LENR heat sources based upon Lattice's patent-pending, high-temperature electrode designs. The company is preparing to manufacture integrated thin-film proprietary LENR power devices in high-unit volumes by adapting existing third-party generation components.

TECHNOLOGY
Metal-Hydrides



LD-Brane srls

www.Ld-brane.com

COUNTRY
Italy

LEADERSHIP
Luca Gamberale

TYPE
LENR Makers

DESCRIPTION
LD-Brane is a R&D focused startup in the field of LENR technologies.

ACTIVITIES
LD-Brane has a scientific programme for the experimental and theoretical study of LENR and for the realization of prototypes for the production of energy using LENR. LD-Brane participates in LENR research at some of the most prominent public and private esearch centers in Italy and Europe.

TECHNOLOGY
n/a



Leap Forward Labs

www.lookingforheat.com

COUNTRY
UK

LEADERSHIP
Alan Smith and Sam Hansson

TYPE
LENR Commercial Equipment Suppliers

DESCRIPTION
Online store offering tools, chemicals and lab equipment to researchers, academics and industry for LENR experiments.

ACTIVITIES
Leap Forward Labs operates as Looking For Heat (LFH) meeting the needs of hundreds of dedicated small-scale experimenters with its focus on LENR and clean cheap hydrogen. LFH sells parts, tools, instruments, chemicals, kits and books for LENR experiments. LFH provides “LENR” equipment and chemicals in affordable amounts in a “LENR Test Kit”. It is a high-temperature heater with swappable cores intended for running tests with various fuel powder compositions. LFH is continuously improving its “LENR Test Kit” based on the ideas of the online community.

TECHNOLOGY
n/a



LENR Cars SA

www.lenr-cars.com

COUNTRY
Switzerland

LEADERSHIP
Nicolas Chauvin

TYPE
LENR Makers

DESCRIPTION
Developer of patent-pending power generators based on LENR technology for electric vehicles (aircraft, boats, trains and cars) without CO2 emissions or waste.

ACTIVITIES
LENR Cars’ generators can produce heat and electricity, on demand, at a much lower cost than fossil fuel (under \$0.01 / kWh). One gram of fuel – a mix of nickel hydride powders, which store hydrogen – is enough to produce 2.0 MWh of heat based on electron capture and neutron capture reactions. LENR Cars are currently developing small-scale systems, with a focus on hybrid EVs and is collaborating with Nissan. LENR Cars is sharing its technology with larger corporations in exchange for licenses on their own technologies, in order to accelerate its development while managing costs.

TECHNOLOGY
Ni-H



LENR Cities Suisse Sàrl

www.lenr-cities.com

COUNTRY
Switzerland

LEADERSHIP
Georges Albert de Montmollin

TYPE
LENR Makers

DESCRIPTION
LENR-Cities supports the development of an ecosystem for researchers, scientists and entrepreneurs in the LENR industry.

ACTIVITIES
Neuchatel business leader, Georges de Montmollin is supporting the new company in its efforts to encourage and engage in basic LENR research.

TECHNOLOGY
Ni-H



LENR Invest

www.lenr-invest.com

COUNTRY
US

LEADERSHIP
Michael Halem

TYPE
LENR Investment Funds

DESCRIPTION
US-based operator of two investment funds dedicated to investing in LENR commercial and R&D companies.

ACTIVITIES
LENR-Invest finances LENR technologies through targeted investments in commercial ventures including Brillouin Energy, LENR Cars, Lenuco and Nichenergy. The firm is helping to foster a LENR ecosystem by bridging the gap between a lab demonstration and a prototype product suitable for industrial applications.

TECHNOLOGY
n/a



LENR-CANR

www.lenr-canr.org

COUNTRY
US

LEADERSHIP
Jed Rothwell

TYPE
LENR Non-Profits

DESCRIPTION
Industry resource organization advocating for cold fusion to lower energy costs.

ACTIVITIES
LENR-CANR.org is an industry trade organization providing LENR scientists, investors and enthusiasts with an extensive LENR resource library that includes more than 1,000 scientific papers on LENR and CANR (Chemically Assisted Nuclear Reactions).

TECHNOLOGY
n/a



LENERGY LLC

n/a

COUNTRY
US

LEADERSHIP
Edmund Storms

TYPE
LENR Makers

DESCRIPTION
LENERGY seeks to provide emerging energy solutions based on LENR technologies.

ACTIVITIES
A former Los Alamos National Laboratory (LANL) research scientist, Storms has been active in LENR research since 1989, producing advances in both experimental results and explanation of the phenomenon. Storms has collaborated with his former LANL colleagues including Drs. Tom Claytor and Malcolm Fowler.

TECHNOLOGY
Pd-D



LENRIA

www.lenria.org

COUNTRY
US

LEADERSHIP
Steven Katinsky

TYPE
LENR Non-Profits

DESCRIPTION
LENR industry group formed to organize and convene the LENR ecosystem.

ACTIVITIES
LENRIA is a LENR industry trade organization working to change attitudes towards LENR in the science and business communities. LENRIA promotes scientific study through early engineering of systems based on LENR to produce heat and electricity.

TECHNOLOGY
n/a



Lenuco (Dept. of Nuclear, Plasma and Radiological Engineering)

www.npre.illinois.edu

COUNTRY
US

LEADERSHIP
George Miley

TYPE
LENR Makers

DESCRIPTION
Lenuco develops LENR technology capable of producing energy at room temperature without any heat or electrical input for use by NASA.

ACTIVITIES
Founded by Prof. Emeritus George Miley, Lenuco operates as a platform for the development and commercialization of LENR technology in the University of Illinois Research Park. The Champaign, Illinois company developed a LENR-Gen Module device and holds several patents related to its LENR technology. Lenuco has reportedly worked with NASA in using its LENR technology to replace Pu-238 radioactive power sources in future space probes and to provide small to medium range distributed power source for home and industrial use. They have also raised funding from the US Defense Advanced Research Projects Agency (DARPA).

TECHNOLOGY
Ni-H, Ni alloy nano-particles



Leonardo Corporation

n/a

COUNTRY
US

LEADERSHIP
Andrea Rossi

TYPE
LENR Makers

DESCRIPTION
Leonardo Corporation is the developer of the QuarkX E-Cat which is related to the E-Cat and the Rossi Effect.

ACTIVITIES
Leonardo Corporation is in process of preparing experimental tests on its QuarkX E-Cat LENR device. It has announced a series of industrial, commercial and manufacturing licensing partners for its LENR devices. The Rossi Effect utilizes nickel powder in a ceramic tube, hydrogen gas, lithium and significant amounts of heat and pressure to produce heat energy.

TECHNOLOGY
E-Cat, Ni-H



Lightstone Technologies

www.lightstone.net

COUNTRY
Germany

LEADERSHIP
Dr. Sergio Calqueiro

TYPE
LENR Makers

DESCRIPTION
Lightstone is a developer of nuclear fusion prototype systems to produce electricity on demand.

ACTIVITIES
Lightstone is developing its prototypes and applications based patented form of nuclear fusion developed at a Soviet research program. The company is a wholly owned subsidiary NRG Technologies Inc (BVI). In addition to devices to produce on-demand electricity, Lightstone is preparing nuclear waste remediation and non-stick paint to which nothing will adhere. The paint will be used for ship bottoms to avoid marine growth on hulls, hospitals to reduce or eliminate adherence of bacteria to walls and other surfaces, and buildings to eliminate graffiti.

TECHNOLOGY
n/a



LockTherm LLC

n/a

COUNTRY
Russia

LEADERSHIP
Sergei Godin and Andrey Hrischanovich

TYPE
LENR Makers

DESCRIPTION
LockTherm is an innovative R&D team working to successfully replicate LENR experiments.

ACTIVITIES
Working with the MFMP, LockTherm’s team of reserachers have demonstrated several innovative approaches including a method of pressing pellets for their reactors to make powder mixes less likely to react with air or moisture in bulk. In their published experiments, an induction heating apparatus was used to heat reactor cores made from ceramic tubes filled with a mixture of Ni + LiAlH4. The reactors had a coil, connected one end to the other, to enable the induction heater to heat the core, probably in the manner of an air core transformer as much as induction. The resistance coil was embedded in ceramic cement and allowed to dry.

TECHNOLOGY
Ni-H, LiAlh4



LUX Energy Ltd.

www.luxenergy.info

COUNTRY
US

LEADERSHIP
Alexander Rios and Victoria Stephens

TYPE
LENR Makers

DESCRIPTION
Lux Energy identifies LENR technologies to invest in, license and acquire.

ACTIVITIES
An affiliate Industrial Heat, Lux Energy’s objective is to make clean, safe and affordable energy available everywhere, and in doing this we want to build a company that demonstrates respect for all.

TECHNOLOGY
n/a



Martin Fleischmann Memorial Project (MFMP)

www.quantumheat.org

COUNTRY
UK

LEADERSHIP
Robert Greenyer, Mathieu Valat,
Brian Ahern and Alan Goldwater

TYPE
LENR Non-Profits

DESCRIPTION
Nonprofit in the field of LENR following the principle of live open science by sharing all procedures, data and results openly online.

ACTIVITIES
MFMP is dedicated to demonstrating to the world the reality of LENR through the wide-spread replication and validation of LENR experiments. MFMP believes that once there is “incontrovertible proof” of LENR, research funds and private capital will flow into the field and result in some amazing, life saving, and life improving products. To make the biggest impact and overcome the hurdle of institutional bias against this type of phenomenon, MFMP aims to make the whole process, from the apparatus to the procedures, to the whole plan of the project, as transparent and understandable as possible, including the live webcasting of its experiments.

TECHNOLOGY
n/a



Medigest SA

www.medigest.net

COUNTRY
Switzerland

LEADERSHIP
Filippo de Jorio

TYPE
LENR Investment Funds

DESCRIPTION
Lugano-based financial trust with a portfolio of investments in companies engaged in developing life sciences and LENR technologies.

ACTIVITIES
Specialized in brokerage on the secondary market for bonds and illiquid products. Medigest is active in asset management, capital markets, corporate finance and structured investment products.

TECHNOLOGY
n/a



Mitsubishi Heavy Industries, Ltd. (MHI)

www.mhi-global.com

COUNTRY
Japan

LEADERSHIP
Shigenori Tsuruga, Kenji Muta, Yutaka Tanaka,
Tadashi Shimazu, Koji Fujimori & Takehiko Nishida

TYPE
LENR Makers

DESCRIPTION
MHI is a Japanese multinational engineering, electrical equipment, and electronics company headquartered in Tokyo, Japan.

ACTIVITIES
MHI is developing a LENR-based nuclear transmutation method that uses nanostructured multi-layer thin films. MHI’s LENR technology uses a gas permeation process pioneered by Dr. Yasuhiro Iwamura, to transmute cesium to praseodymium, essentially producing a valuable material from a radioactive waste. In 2016, the company began R&D for developing its LENR technologies for energy generation. Awarded a Japanese patent for their methods to decontaminate nuclear waste using LENR technologies by transmutating elements, MHI promises to solve the issue of nuclear contamination.

TECHNOLOGY
Transmutation



Murata Manufacturing Co., Ltd.

www.murata.com

COUNTRY
Japan

LEADERSHIP
Tsuneo Murata

TYPE
LENR Makers

DESCRIPTION

Murata manufactures ceramic passive electronic components, including semiconductors, capacitors, antennae and other nanoscale technology.

ACTIVITIES

Murata Manufacturing has 24 subsidiaries in Japan and 52 overseas. The company was an attendee of ICCF20. In 2016, Murata acquired Sony Corp.'s battery business, Sony Energy Devices Corporation. Sony Corp.'s battery subsidiary, which makes lithium-ion polymer batteries used in smartphones, tablets and digital cameras, and lithium-ion rechargeable batteries.

TECHNOLOGY
n/a



NanoSpire Inc

www.nanospireinc.com

COUNTRY
US

LEADERSHIP
Mark L. LeClair

TYPE
LENR Makers

DESCRIPTION

NanoSpire is commercializing cavitation re-entrant jet-based tools and processes.

ACTIVITIES

NanoSpire's LENR device is 1.25" inner diameter by 12" long reactor and produces 2.9 kW of hot water using only 840 watts of input (COP of 3.4).

TECHNOLOGY
Cavitation



NASA Langley Research Center

www.nasa.gov/langley

COUNTRY
US

LEADERSHIP
Doug Wells

TYPE
LENR R&D Organizations

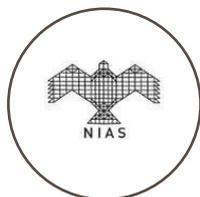
DESCRIPTION

NASA's Langley Research Center focuses primarily on aeronautical research including high-profile space missions.

ACTIVITIES

Experimentalists appearing on NASA's Technology Gateway, a marketplace for commercializing technology developed at NASA, have discussed the commercial potential for LENR applications, including the provision of clean home heating and electricity generation.

TECHNOLOGY
n/a



National Institute of Advanced Studies

www.nias.res.in

COUNTRY
India

LEADERSHIP
Baldev Raj

TYPE
LENR R&D Organizations

DESCRIPTION
NIAS is an Indian multi and interdisciplinary research and evidence research organization.

ACTIVITIES
NIAS encourages and fosters leadership, at all levels, with broad and informed multidisciplinary perspectives. NIAS disseminates its research by publishing books, reports, working papers, conference proceedings, discussion outcomes and documentaries to enrich and enhance India and the world. In 2016, Dr Baldev Raj, Director, NIAS and Research Advisory Council Member (RAC), NETRA and Dr R Krishnan, Former Director, GTRE (DRDO), Bangalore chaired the 3rd LENR-India discussion forum meeting attended by experts from various national institutes, academia and industry.

TECHNOLOGY
n/a



National Institute of Technology, Tokyo College (Tokyo Kosen)

www.tokyo-ct.ac.jp

COUNTRY
Japan

LEADERSHIP
Kenichi Tsuchiya

TYPE
LENR R&D Organizations

DESCRIPTION
Tokyo Kosen is an accredited engineering school located 50km west of Tokyo city center.

ACTIVITIES
Tokyo Kosen conducts joint research with regional companies. Led by Kenichi Tsuchiya, Tokyo Kosen is working in the field of LENR research and development.

TECHNOLOGY
Nuclear waste treatment



National Instruments (NI) (Nasdaq: NATI)

www.ni.com

COUNTRY
US

LEADERSHIP
James Truchard

TYPE
LENR Commercial Equipment Suppliers

DESCRIPTION
NI is a global leader in providing test, measurement, and control solutions for R&D companies.

ACTIVITIES
NI provides powerful, flexible technology solutions that accelerate productivity and drive rapid innovation. From daily tasks to grand challenges, NI helps engineers and scientists overcome complexity to exceed even their own expectations. Customers in nearly every industry—from healthcare and automotive to consumer electronics and particle physics—use NI's integrated hardware and software platform to improve our world. NI has been a sponsor and keynote speaker at ICCF convenings.

TECHNOLOGY
n/a



Natural Science Foundation of China (NSFC)

www.nsf.gov.cn

COUNTRY
China

LEADERSHIP
Yang Wei

TYPE
LENR R&D Organizations

DESCRIPTION
The NSFC is a major source of funding for conducting basic scientific and technical research.

ACTIVITIES
The NSFC encourages international cooperation and exchange in basic scientific and technical research having signed and authored >70 MOUs with partners in 35+ countries. The NSFC funds over 1,500 national institutions conducting basic scientific and technical research in China.

TECHNOLOGY
n/a



NeoFire

www.neofire.com

COUNTRY
Sweden

LEADERSHIP
Peter Björkbom

TYPE
LENR Makers

DESCRIPTION
NeoFire is a Swedish startup working to develop and market a new practical energy source based on LENR.

ACTIVITIES
NeoFire is developing intellectual property and trade secrets while openly championing and cooperating with other persons and organizations involved in the LENR field to push this promising energy source forward. Neofire is involved in conducting Parkhomov-type LENR experiments using lithium-alu-

TECHNOLOGY
LiAlH₄



New Energy & Industrial Technology Development Organization (NEDO)

www.nedo.go.jp

COUNTRY
Japan

LEADERSHIP
Kazuo Furukawa

TYPE
LENR R&D Organizations

DESCRIPTION
NEDO is Japan's new energy and applied R&D gov't agency which funds research consortia working on LENR discovery at leading universities.

ACTIVITIES
NEDO is funding a research consortium headed by Toshihiko Iwamura at the Condensed Matter Nuclear Reaction Division, Research Center for Electron Photon Science, Tohoku University under the title of "nano-metal hydrogen energy project". Their goal is to investigate transmutation as a way to clean the radioactive cesium from Fukushima. The consortium is also examining excess heat from metal hydrides by replicating and confirming the results of Dr. Mizuno. Consortium members include Technova, Nissan Motor Corporation, Kyushu University, and Tohoku University.

TECHNOLOGY
n/a



New Inflow

www.newinflow.ru

COUNTRY
Russia

LEADERSHIP
Anatoly Klimov, N.Magnitskii & Dr. N.Evstigneev

TYPE
LENR Makers

DESCRIPTION
The company aggregates the research efforts of disparate scientific groups and researchers.

ACTIVITIES
New Inflow’s experiments are based on generation of plasmoid formations in swirling gas flow which are created by various impulse-modulated discharges and subsequent utilization of generated heat. Experimental laboratory setups are developed and simulated with the help of new mathematical models and methods. The company’s ongoing projects are executed by reputed scientists, currently employed in departments and laboratories in Russian universities and institutes of Russian Academy of Sciences, such as MSU, MIPT, BMSTU, ME-PhI, ISA RAS, JIHT RAS, ISR RAS etc.

TECHNOLOGY
Metal Nano-cluster
Plasmoid



Nichenergy S.R.L

www.nichenergy.com

COUNTRY
Japan

LEADERSHIP
Francesco Piantelli

TYPE
LENR Makers

DESCRIPTION
An R&D company with an innovative proprietary process for producing energy from nickel-hydrogen in a LENR reaction.

ACTIVITIES
The company is scaling up its propretitary process to produce energy from watts to kilowatts in compact devices suitable for industrial power applications which it envisions licensing for manufacture. Nichenergy has been awarded two European Union-issued patents. Its founder, Francesco Piantelli, once conducted LENR research with Sergio Focardi, whose research was used to develop the original E-Cat technology.

TECHNOLOGY
Ni-H

Nickel-Hydrogen Research Center

n/a

COUNTRY
China

LEADERSHIP
n/a

TYPE
LENR R&D Organizations

DESCRIPTION
The Nickel-Hydrogen Research Center is located in the Huayan Industrial Park on the southwest side of Tianjin, China.

ACTIVITIES
The Nickel-Hydrogen Research Center is part of the larger Tianjin Binhai Hi-tech Industrial Development Area, one of China’s first Hi-tech industrial parks. Tom Darden, Chairman of Industrial Heat, attended the opening ceremony for the Reserach Center, creating speculation about Tianjin becoming a research site for Industrial Heat. The Industrial Park has also attracted a number of multinationals corporations, such as Siemens, Toyota and NEC.

TECHNOLOGY
Ni-H



Nissan Motor Corporation, Ltd. (NMC)

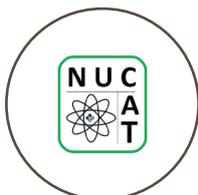
www.nissan-global.com

COUNTRY	LEADERSHIP	TYPE
Japan	Carlos Ghosn	LENR Makers

DESCRIPTION
Nissan Motor Corporation (NMC) manufactures vehicles in 20 countries and regions which are offered for sale in 160 countries.

ACTIVITIES
Nissan Motor Corporation (NMC) has acquired the rights to foreign LENR technologies. It is also a member of the NEDO-funded nano-metal hydrogen energy project. NMC is interested in applying new hydrogen energy and LENR technologies to its fuel cells.

TECHNOLOGY
Metal-Hydrides



NUCAT Energy

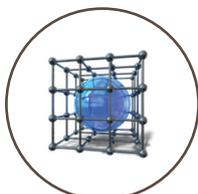
www.nucat-energy.com

COUNTRY	LEADERSHIP	TYPE
US	David J. Nagel	LENR R&D Organizations

DESCRIPTION
NUCAT Energy consults, publishes educational materials and conducts courses on LENR.

ACTIVITIES
LENR energy topics are the main interest of NUCAT Energy whose name derives from the words NUClear and ATomic. The company's principal, David Nagel, presents at LENR events and consults with many organizations focused on R&D in LENR.

TECHNOLOGY
n/a



Nukey Europe Ltd.

www.nukey.eu

COUNTRY	LEADERSHIP	TYPE
UK	Angelo Ovidi	LENR Makers

DESCRIPTION
Nukey Europe provides guidance for using LENR technologies to remediate nuclear waste.

ACTIVITIES
The launch of Nukey Europe follows on the proposed program around nuclear waste remediation introduced during LENR-G events in Milan and Neuchatel. The company was founded by ex-LENR-Cities CTO, Angelo Ovidi to support efforts to develop solution for nuclear waste remediation, leveraging academic and industrial partnerships, in UK and abroad.

TECHNOLOGY
Transmutation



Osaka University

<http://www.res.kutcc.kansai-u.ac.jp/~cook/>

COUNTRY Japan	LEADERSHIP Norman Cook	TYPE LENR R&D Organizations
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DESCRIPTION
Osaka University is a national university located in Osaka, Japan and is the sixth oldest university in the country.

ACTIVITIES
Norman Cook has been collaborating with Andrea Rossi on developing a theoretical understanding of the physics behind the “Rossi Effect” in the E-Cat. Osaka University is known for Professors Yoshiaki Arata and Akito Takahashi’s work in LENR.

TECHNOLOGY
n/a



Phonon Energy

www.phonon-energy.org/

COUNTRY US	LEADERSHIP David Daggett	TYPE LENR Commercial Equipment Suppliers
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DESCRIPTION
Nonprofit promoting clean energy solutions, including LENR technologies, to counteract climate change.

ACTIVITIES
Phonon Energy has partnerships with LENR scientists providing LENR test rigs, data acquisition systems, supporting equipment and expertise. Partners are provided access to Phonon Energy’s variable frequency infra-red lasers, supporting services to operate the laser, measurement equipment, and any labor needed for pointing/alignment of the beam.

TECHNOLOGY
n/a



Purratio AG

www.purratio.ag

COUNTRY Germany	LEADERSHIP Richard Reichmann	TYPE LENR Makers
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DESCRIPTION
Developer of SolFire LENR technologies for the controlled utilization of fusion energy.

ACTIVITIES
Purratio has developed a LENR reactor system using palladium in a hollow tube, a few centimeters long and designed to absorb hydrogen when an electrical charge is passed through it. The reactor system produces proof of a neutron generating nuclear process that can be amplified up to the generation of excess heat.

TECHNOLOGY
Pd-H



Quantum Gravity Research (QGR)

www.quantumgravityresearch.org

COUNTRY	LEADERSHIP	TYPE
US	Klee Irwin	LENR R&D Organizations

DESCRIPTION
Quantum Gravity Research is a physics research group working to discover a Theory of Everything.

ACTIVITIES
Quantum Gravity Research (QGR) believes its “Emergence Theory” suggests a mechanism of action for LENR and makes predictions on how to massively increase the energetic output. QGR promotes the need to open source LENR technologies so we can gain a full understanding of them.

TECHNOLOGY
n/a



Quantum Potential Corporation USA (QPC)

n/a

COUNTRY	LEADERSHIP	TYPE
US	Max Fomitchev-Zamilov	LENR Makers

DESCRIPTION
Developer of clean alternative energy (LENR, fusion and plasma) technologies.

ACTIVITIES
QPC envisions itself as the Bell Labs of the 21st Century in the field of clean energy. The company engages in supporting high-risk/high-payoff research that is within the arm’s length of commercialization and can result in transformational commercial applications with potential to revolutionize entire industries.

TECHNOLOGY
Cavitation

Quantum Rabbit LLC

n/a

COUNTRY	LEADERSHIP	TYPE
US	Edward Esko	LENR R&D Organizations

DESCRIPTION
Quantum Rabbit is dedicated to unlocking the promise of LENR induced transmutation for nuclear waste.

ACTIVITIES
Quantum Rabbit (QR) has published a series articles and books discussing Edward Esko’s experiments in LENR transmutations. Esko describes how he creates liquid metals by arcing between two electrodes and observes significant transmutations by both fusion and fission. QR believes LENR provides possible pathways to reduce (i.e. transmutate) nuclear materials by accelerating the natural decay cycle of U-235, Pu-239, Ra-226 and fission products including Cs-137 and Sr-90.

TECHNOLOGY
n/a

ReResearch LLC

www.reresearch.squarespace.com

COUNTRY
US

LEADERSHIP
Mason J. Guffey, Yang Tang and P.J. King

TYPE
LENR R&D Organizations

DESCRIPTION
ReResearch is an institute dedicated to materials research in the renewable energy sector.

ACTIVITIES
ReResearch engages in high-risk, high reward research that can lead to breakthrough industrial applications. It has laboratories in Hawthorne California as well as European research facilities at the National University of Ireland in Galway and contracted from the CRANN Institute at Trinity College Dublin.

TECHNOLOGY
n/a



Royal Dutch Shell plc

www.shell.com

COUNTRY
France

LEADERSHIP
Ben van Beurden

TYPE
LENR Makers

DESCRIPTION
Shell is an Anglo-Dutch multinational oil and gas company headquartered in the Netherlands.

ACTIVITIES
Royal Dutch Shell has participated in LENR discovery dating back to the early 1990s. In 2011, two Shell scientists, Anitha Sarkar and Gilles Buchs, with the backing of the Company's GameChanger program, investigated opportunities to develop and work with LENR technologies.

TECHNOLOGY
Pd-D



Russian Academy of Sciences

www.ras.ru

COUNTRY
Russia

LEADERSHIP
Vladimir Fortov

TYPE
LENR R&D Organizations

DESCRIPTION
The RAS is a network of scientific research institutes from across the Russian Federation.

ACTIVITIES
Headquartered in Moscow, the Academy (RAS) is considered a civil, self-governed, non-commercial organization chartered by the Government of Russia. It currently includes around 650 institutions and 55,000 scientific researchers. Anatolii Ivanovich Klimov's research is on plasmoidal sources of energy and the transmutations of chemical elements and Igor Goryachev recently presented his work on Technology of Processing and Conditioning Uranium and Plutonium Fission Products and Liquid Radioactive Waste at ICCF20 in Sendai.

TECHNOLOGY
n/a

Science for Humanity Trust, Inc.

n/a

COUNTRY
US

LEADERSHIP
Richard Reichmann

TYPE
LENR R&D Organizations

DESCRIPTION
Science for Humanity is a platform for collaboration among the global scientific community.

ACTIVITIES
Created in 2008 with the aim of letting scientists showcase technologies — in fields such as medicine, agriculture, energy, water supply and sanitation — to NGOs and local people, who could then advise on how best to adapt them, Science for Humanity has been a leader in LENR discovery with a special on understanding the fundamental mechanisms involved in light and matter.

TECHNOLOGY
n/a

Seashore Research, LLC

n/a

COUNTRY
US

LEADERSHIP
Robert Duncan and Michael McKubre

TYPE
LENR Makers

DESCRIPTION
Seashore Research is the commercial entity set-up and supported by Texas Tech University to conduct R&D in LENR

ACTIVITIES
Seashore Research is working to prove a hypothesis that the heat produced in a LENR reaction is the result of the conversion of deuterium to helium. Both Drs. Duncan and McKubre appeared in a 60 Minutes story entitled “Cold Fusion is Hot Again” in April 2009. The company is reportedly funded by Bill Gates, Co-Founder of Microsoft.

TECHNOLOGY
Metal Hydrides



Sidney Kimmel Institute for Nuclear Renaissance (SKINR)

www.research.missouri.edu

COUNTRY
US

LEADERSHIP
Dennis C. Pease

TYPE
LENR R&D Organizations

DESCRIPTION
SKINR is dedicated to finding the origin of the anomalous heat effect in LENR reactions.

ACTIVITIES
An entity within the Dept. of Physics and Astronomy at the University of Missouri, SKINR’s initial funding of \$5.5M was provided by billionaire philanthropist Sidney Kimmel. SKINR is running experiments in collaboration with other groups, recently adding industry giant Aerospace Corp. working with specific waveforms called superwaves. Recent developments include a method of surface analysis which can predict if a material will be active as well as new experiments to detect low energy radiation. SKINR absorbed Israeli-based Energetics which designed their experiments using palladium and single walled carbon nanotubes producing an unstable reaction with a COP >25.

TECHNOLOGY
Pd-D



Southern Utah University (SSU)

www.suu.edu

COUNTRY
US

LEADERSHIP
Sangho Bok

TYPE
LENR R&D Organizations

DESCRIPTION
SSU has a research program to develop methodologies for characterizing nuclear reactions.

ACTIVITIES
Experimental work on neutron detection in LENR devices presented at ICCF20. Sangho Bok has developed a new method of temperature measurement using temperature sensitive fluorescent dyes.

TECHNOLOGY
n/a



Space and Naval Warfare Systems Command (SPAWAR)

www.public.navy.mil/spawar/Pages/default.aspx

COUNTRY
US

LEADERSHIP
Rear Adm. Patrick Brady

TYPE
LENR R&D Organizations

DESCRIPTION
SPAWAR is the US Navy's warfare systems command focused on R&D and evaluation for military C4ISR systems.

ACTIVITIES
SPAWAR has conducted research into LENR discovery. Most recently, it published LENR research report by chemist Pamela Mosier-Boss titled "Investigation of Nano-Nuclear Reactions in Condensed Matter" which it produced on behalf of the US Defense Threat Reduction Agency. Mosier-Ross was assisted in developing the LENR research report by JWK International's Larry Forsley.

TECHNOLOGY
n/a



Spazionica

www.spazionica.org

COUNTRY
Italy

LEADERSHIP
Francesco Santandrea

TYPE
LENR R&D Organizations

DESCRIPTION
An R&D focused entity working in frontier science both experimentally and theoretically.

ACTIVITIES
Spazionica's R&D focuses on a new interpretation and categorization of physical reality for the development of LENR and PNNE (Not Newtownian Electromagnetic Propulsion). The organization conducts experimental tests and prototyping on an ongoing basis.

TECHNOLOGY
Ni-H



SRI International

www.sri.com

COUNTRY
US

LEADERSHIP
Fran Tanzella

TYPE
LENR R&D Organizations

DESCRIPTION
SRI is a nonprofit research center that helps its clients to take R&D from the laboratory to the marketplace.

ACTIVITIES
In addition to private sector clients, SRI partners with US federal agencies, including National Institutes of Health, Department of Energy, National Science Foundation, and the Department of Education. SRI International has been at the forefront of research into cold fusion dating back to 1989. Having made significant advances in the sophistication of calorimeters, SRI International has worked with national government labs (DOE, ENEA, etc.) and a number of commercial entities working on R&D in LENR.

TECHNOLOGY
n/a



STMicroelectronics S.R.L. (ST) (NYSE:STM)

www.st.com

COUNTRY
Switzerland

LEADERSHIP
Ubaldo Mastromatteo and Federico Giovanni Ziglioli

TYPE
LENR Makers

DESCRIPTION
STMicroelectronics is a multinational electronics and semiconductor manufacturer.

ACTIVITIES
ST holds a patent application for a control system for a LENR device but are believed not to have developed any LENR devices other than a Celani Cell replication. According to the patent, their reaction chamber includes an energy port, and the reaction unit is disposed in the reaction chamber which is configured to allow an energy-releasing reaction between first and second materials. And the energy regulator is configured to control a rate at which reaction-released energy exits the reaction chamber via the energy port. The reaction chamber may include a thermally conductive wall that forms a portion of the energy port, and the energy regulator may include a thermally conductive member and a mechanism configured to control a distance between the thermally conductive wall and the thermally conductive member. Furthermore, the reaction unit may include a mechanism configured to facilitate the reaction between the first and second materials, and may also include a mechanism configured to control a rate at which the reaction releases energy.

TECHNOLOGY
Metal Hydrides



Swedish Defence Materiel Administration (FMV)

www.fmv.se

COUNTRY
Sweden

LEADERSHIP
Abraham Langlet

TYPE
LENR R&D Organizations

DESCRIPTION
FMV provides defense logistics to the Swedish Armed Forces.

ACTIVITIES
The Defence Materiel Administration (FMV) is responsible for managing the design and procurement of new defense equipment, where products must be adapted to the future network-based defense. The FMV has financed experiments with nickel and hydrogen, trying to experimentally reproduce the excess heating power claimed by Andrea Rossi and Sergio Focardi and described in Ny Teknik.

TECHNOLOGY
Ni-H



Swiss OxyHydrogen Energy (SOHE)

www.swissoxyhydrogenenergy.com

COUNTRY Switzerland	LEADERSHIP Slobodan Stankovic, Gregory Krieger & Richard Anderson	TYPE LENR Makers
DESCRIPTION Swiss OxyHydrogen Energy is a LENR technology developer.	ACTIVITIES SOHE's LENR energy technology is based on water electrosis. The results of its experiments have produced a commercially viable approach the company believes will be successful in developing a long-term and efficient clean LENR energy technology.	
TECHNOLOGY n/a		



Target Technology Corporation, LLC

www.targettechnology.com

COUNTRY US	LEADERSHIP Han H. Nee	TYPE LENR Makers
DESCRIPTION Target Technology is a developer of thin film corrosion resistant metal alloys.	ACTIVITIES Target Technology coordinates worldwide collaborations in the development of nanomaterials. The company filed a patent application on Nickel alloys for Hydrogen storage and the generation of energy in 2012.	
TECHNOLOGY n/a		



Technova (Toyota Motor Corporation)

www.technova.co.jp

COUNTRY Japan	LEADERSHIP Akito Takahashi	TYPE LENR Makers
DESCRIPTION A subsidiary of (TMC), Technova is a leader in LENR R&D by providing research grants and advocating for government support.	ACTIVITIES Technova has been a leader in the LENR research field going back when they retained Fleischmann and Pons for Toyota's LENR program in the early 1990s. Technova convenes scientific workshops on LENR technologies. It has reported replicating a key experiment of Mitsubishi Heavy Industries, demonstrating the opportunities in LENR energy and transmutation. In April 2015, Technova together with Nissan Motor Corp. have partnered with two universities - Tohoku and Kyushu - on the NEDO-funded nano-metal hydrogen energy research project.	
TECHNOLOGY Pd-D		



TET Laboratory of Experimental Physics

www.tet.in.ua

COUNTRY
Russia

LEADERSHIP
Andrew Hrischanovich

TYPE
LENR Makers

DESCRIPTION
Experimentalists working to develop devices based on plasma electrolysis, LENR and magnets.

ACTIVITIES
Experimentalists working to develop LENR devices which are stable and easy to replicate. Hrischanovich began as a Moscow-based LENR researcher performing Rossi-Celani “mix” related replications before founding TET.

TECHNOLOGY
Ti-H, Ti-D



Thermax, Ltd.

www.thermaxindia.com

COUNTRY
India

LEADERSHIP
M.S.Unnikrishnan

TYPE
LENR Makers

DESCRIPTION
India-based Thermax is a global leader in providing integrated sustainable solutions.

ACTIVITIES
Thermax provides energy efficient and environmentally-friendly heating, cooling, waste recovery, water mgmt, air pollution, solar and more solutions. The company has robust and innovative R&D operations having developed various industrial applications, including hi-grade ion exchange resins for specialized applications. The company is reported to be conducting a series of Parkhomov replication LENR tests.

TECHNOLOGY
LiAlH₄



Thunder Energies Corporation (TEC) (TNRG:OTCQB)

www.thunder-energies.com

COUNTRY
US

LEADERSHIP
Ruggero Santilli & George Gaines

TYPE
LENR Commercial Equipment Suppliers

DESCRIPTION
TEC is a R&D company featuring three cutting edge technologies in the fields of optics, nuclear physics and fuel combustion.

ACTIVITIES
TEC provides optical, combustion and thermal neutron source equipment. The company is building an operational prototype of its Fissionable Material Testing Station (TEC-FMTS) based on the development of an industrial means for the synthesis of neutrons from hydrogen gas.

TECHNOLOGY
n/a



Tohoku University

<http://www.tohoku.ac.jp/japanese/>

COUNTRY
Japan

LEADERSHIP
Yasuhiro Iwamura, Takehiko Itoh and Jirohta Kasagi

TYPE
LENR R&D Organizations

DESCRIPTION
Tohoku is a national university housing the Condensed Matter Nuclear Reaction Joint Research Division.

ACTIVITIES
Tohoku University leads the NEDO-funded nano-metal hydrogen energy project. Their goal is to investigate transmutation as a way to clean the radioactive cesium from Fukushima. The consortium is also examining excess heat from metal hydrides by replicating and confirming the results of Dr. Mizuno. Consortium members also include Technova, Nissan Motor Corporation, and Kyushu University.

TECHNOLOGY
n/a



Transformative Energy Materials (TEM) Capital

www.temcapital.com

COUNTRY
US

LEADERSHIP **TYPE**
John T. Preston LENR Investment Funds

DESCRIPTION
Transformative Energy and Materials Capital, LLC (TEM Capital) is a fund manager for the Transformative Energy & Materials Fund I.

ACTIVITIES
Founded and led by former director of technology development for MIT and energy investor John T. Preston, Transformative Energy & Materials Fund I was launched with a \$100 million raise led by Vanterra Capital Ltd., Cambridge Venture Capital and C Change Investments Mgmt. Strategy is to invest in companies that will play a key role in helping large industrial firms gain enhanced competitiveness through better use of energy and materials.

TECHNOLOGY
n/a



TSEM

www.tsemmed.ch

COUNTRY
Italy

LEADERSHIP **TYPE**
Tony La Gatta LENR Makers

DESCRIPTION
An Italian company focusing on energy, security and healthcare technologies.

ACTIVITIES
TSEM is engaged in the study of high bandwidth calorimetric measurement of palladium excess heat. TSEM has collaborated with SRI, ENEA and NRL.

TECHNOLOGY
Pd-D, Ni-H



Unified Gravity Corporation (UGC)

www.unifiedgravity.com

COUNTRY
US

LEADERSHIP
Hubert Lipinski, Mike Palmer & Stephen Lipinski

TYPE
LENR Makers

DESCRIPTION
UGC was established to experimentally prove Hubert and Stephen Lipinski's groundbreaking research.

ACTIVITIES
UGC has filed a patent for its Hydrogen Lithium Fusion (HLF) device which is a novel technology to obtain high alpha particles resulting from proton-lithium fusion. The HLF device's power output is determined by measuring high-energy alpha particles with calibrated ORTEC ruggedized particle detectors and performing standard solid angle calculations to determine total alpha particle production. No harmful radiation is produced. The company's founders have pioneered research on how kinetic energy storage effects gravity.

TECHNOLOGY
Li-H



Waseda University

www.waseda.jp

COUNTRY
Japan

LEADERSHIP
Ken Naitoh and Hideo Ishii

TYPE
LENR R&D Organizations

DESCRIPTION
Waseda University has an R&D program for rocket propelled engines.

ACTIVITIES
Naitoh presented on Waseda University's R&D on the excess heat generated from their rocket propelled engines at ICCF20.

TECHNOLOGY
n/a



Woodford Investment Management Ltd.

www.woodfordfunds.com

COUNTRY
UK

LEADERSHIP
Neil Woodford

TYPE
LENR Investment Funds

DESCRIPTION
Asset manager with £12.5bn under management and £761.4 million (\$950.42 million) set aside in a "patient capital" fund.

ACTIVITIES
Oxford, UK-based privately owned Woodford focuses on the public equity markets. Woodford makes venture capital investments in startups, early stage, mature and growth stage companies. Formed in April 2014 the firm is an early investor in Industrial Heat LLC. The firm primarily invests in companies incorporated in the United Kingdom or traded on a London Stock Exchange market.

TECHNOLOGY
n/a