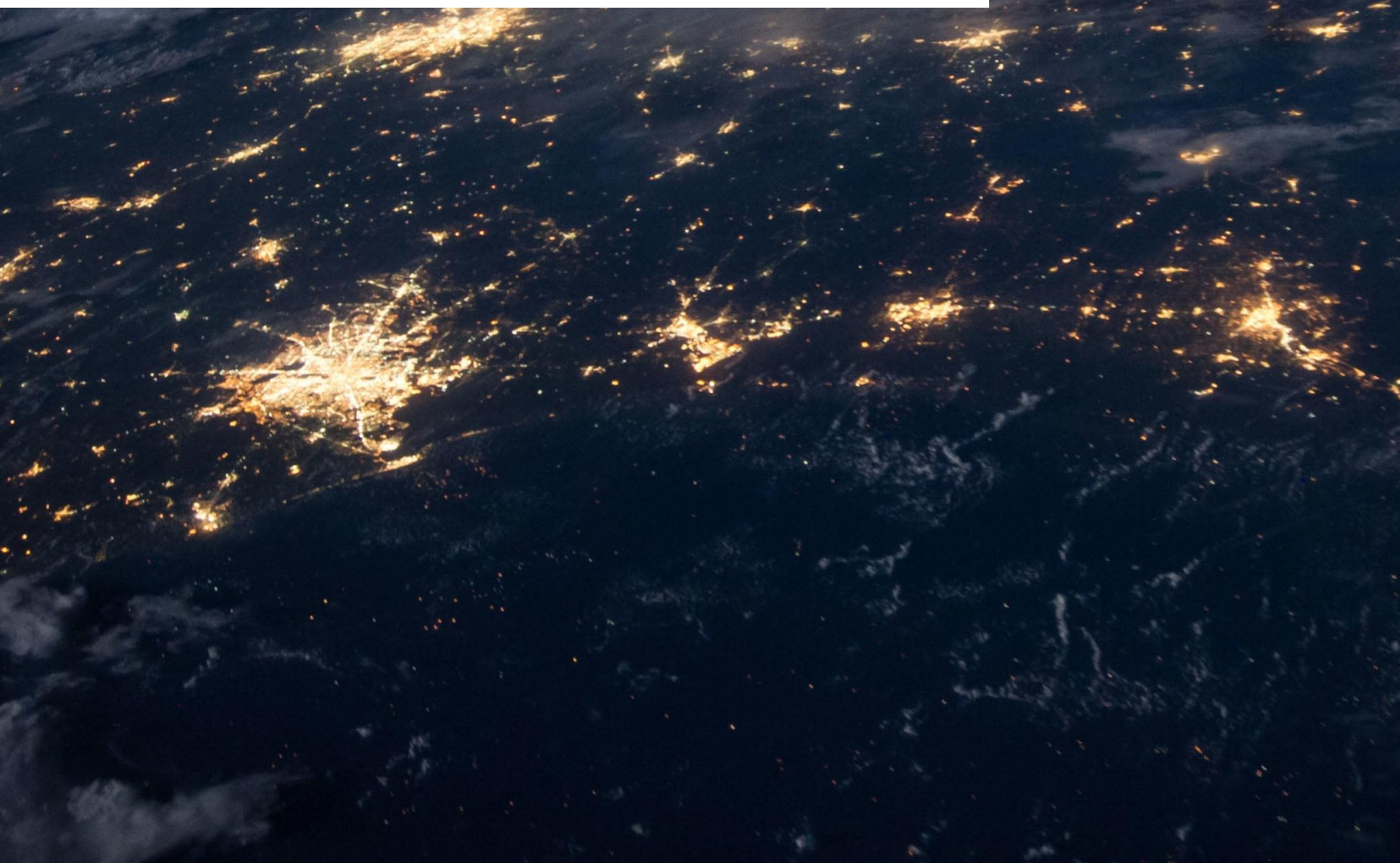
Investing
in a sustainable future

PAP-LENR Technology

Professor Christos D. Papageorgiou,
Electrical Engineer, PhD Imperial College

PAP-LENR Technology White Paper



An Innovative Solution to a Critical Problem

In humanity's struggle against global warming, renewable energy sources are put to the task of substituting conventional energy sources in order to reverse a collapsing global natural system. Despite the radical advancements in associated technologies, evidence shows that the sole power of renewable energy sources by itself is still not enough to achieve the required goal of sustainability. Such are the needs of modern society for energy, that despite the increasing use of renewables, the extensive use of fossil fuels is still required to satisfy energy demand and preserve our modern way of life.

On the other hand, the continuing deterioration of life diversity in a global scale, the steep rise of oceanic temperatures and the destruction of associated habitats, CO2 accumulation in earth's atmosphere and its undisputed effects on weather models, all lead to the conclusion that humanity is running on a seemingly futile race against time. Other fuel sources that were once considered as promising intermediate solutions towards the full transition to sustainable energy, are failing to serve their goal in terms of safety and stability. The most recent example is that of natural gas and the 2021 dramatic surge of its prices. The wild rally of gas prices, led by demand and supply, increased insecurity for the already financially overwhelmed households and governments. It is therefore evident that a more radical solution is required to work along renewables, in order for the problem of sustainability to be safely and efficiently addressed in time.

Throughout the last century, scientists have tried to come up with various potential substitutes for traditional fuels; but finding a safe and efficient solution has proven to be no easy task. Amongst potential solutions, the nuclear fission reactors, are considered dangerous due to the high risk of nuclear accidents like the ones that happened in Chernobyl (1986), Tokaimura (1999), Fukushima (2011).
More on reusing nuclear power plants to tackle climate change can be found in the following article:

https://bostonreview.net/science-nature/samuel-miller-mcdonald-nuclear-power-our-best-bet-against-climate-change

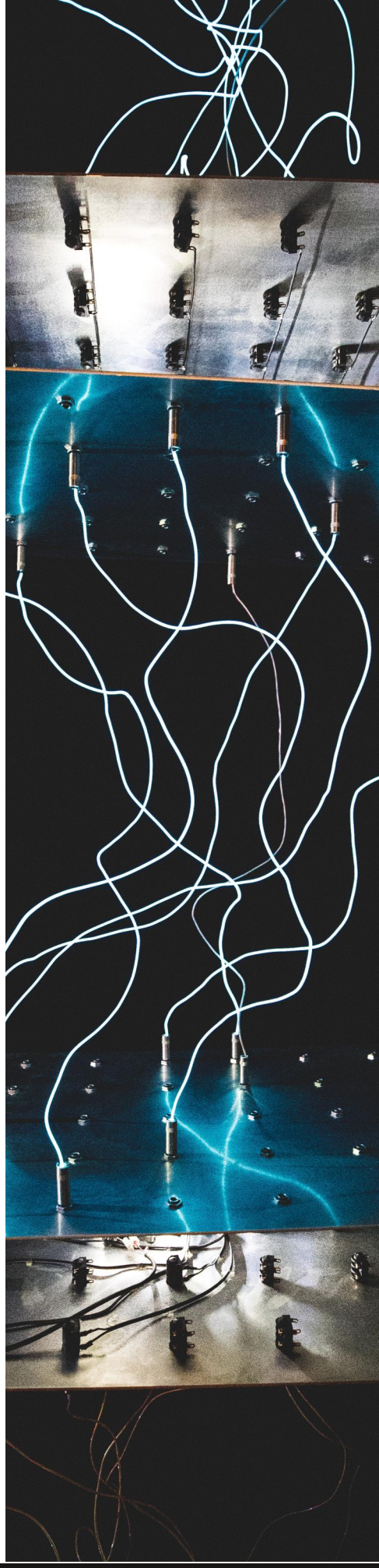
Fusion reactors were also believed to be a promising solution for sustainable energy. But despite many billions of dollars that have been spent already, such reactors are merely experimentally tested and are still considered far from eligible for immediate application. The old cliche joke in newsrooms remains: "Nuclear fusion is 30 years away...and always will be." The cold fusion concept and related devices have not been justified experimentally, but in certain cases low energy nuclear reactions (LENR) have occured.

Consequently, the urgent problem of climate change mitigation still remains unanswered, mainly due to the lack of proper technology. New hope however comes from another field in energy research. Signs of Low Energy Nuclear Reactions phenomena have been observed in various experiments triggering new research and sparking hopes for an alternative approach to tackle the problem.

The **Low Energy Nuclear Reactions (LENR) phenomena** that have been observed **can generally be classified into two major categories:**

1. Transmutations that occur in bacterial or microbial cultures

https://www.researchgate.net/publication/332030670_Microbial_radiation_resistance_biotransmutation_of_elements_and_dawn_of_life_on_Earth_Credible_experimental_data_suggests_some_bacteria_can_shift_isotope_ratios_and_may_be_transmuting_certain_elements



2. Transmutations that occur in several experiments related to the so-called Cold Fusion

Unfortunately, up to this moment, the scientific community has not been able to provide a solid explanation for such phenomena.

Professor Christos Papageorgiou argues that all LENR phenomena share the same -or quite similar- physical source of origin.

A quote from the blog of Scientific American states:

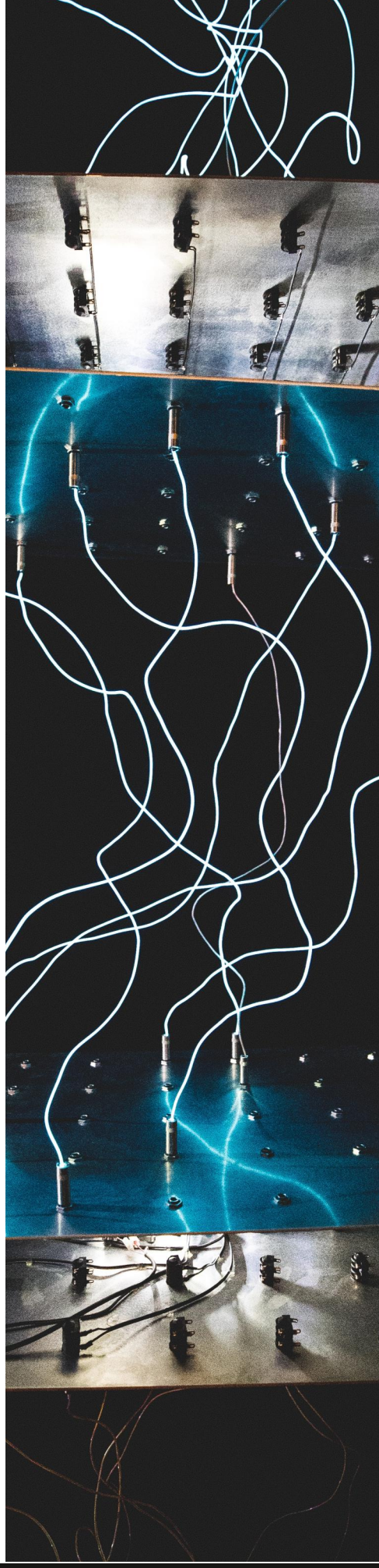
"But among research of the atomic nucleus, and to the surprise of many scientists, a new field of nuclear research has emerged: It offers unexplored opportunities for the scientific community. Data shows that changes in atomic nuclei, including observed shifts in the abundance of isotopes, can occur without high-energy accelerators or nuclear reactors. For a century, this has been considered impossible. "

https://blogs.scientificamerican.com/guest-blog/its-not-cold-fusion-but-its-something/

The case of Cold Fusion or LENR phenomena is recently reopened, as the involved researchers' goal is to find the underlying mechanism behind LENR.

https://spectrum.ieee.org/amp/cold-fusion-or-low-energy-nuclear-reactions-us-navy-researchers-reopen-case-2652903844

“The most important thing is to reveal a mechanism by which the LENR phenomenon works, because if we understand the mechanism, then we can do better experiments and make them reproducible”



PAP-LENR Technology

Our proposal is a completely **novel Low Energy Nuclear Reaction (LENR) technology** named **PAP-LENR technology** that will be incorporated within a fully functional energy producing device. The device will receive electric energy in the form of electric pulses, and will generate as output, kinetic or thermal energy.

The output energy of the device will be higher than input energy as a result of the LENR occurrences.

The proposed device will continue its operation indefinitely without emitting any harmful nuclear radiation in the form of moving neutrons or 'γ' radiation.

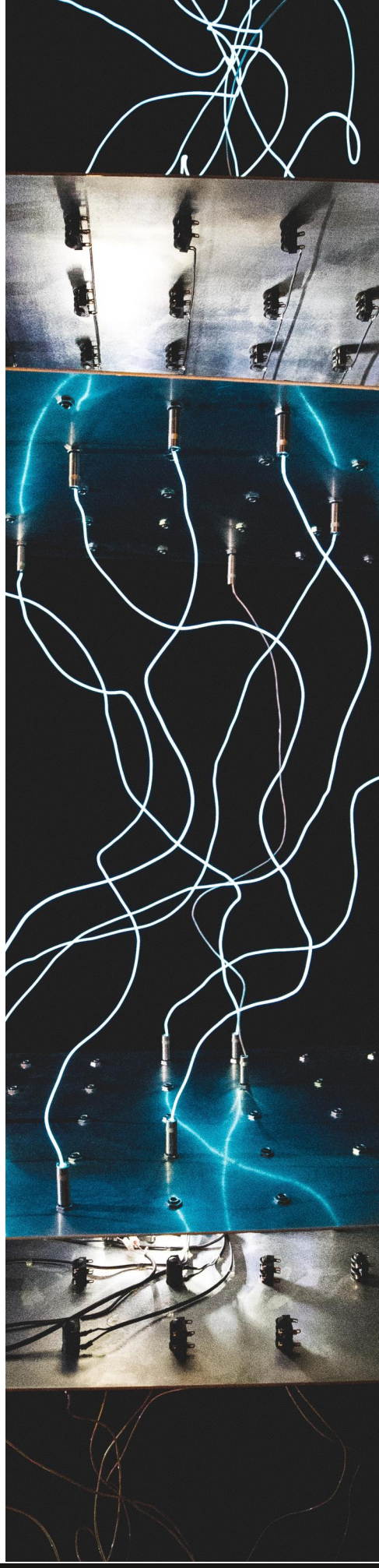
The produced device will be an application of the theory developed by Professor Christos D. Papageorgiou that is presented in detail in the upcoming section B.

The device and the method shall be patented if considered necessary. The PAP-LENR technology could be the basis for a plurality of respective engines and energy generators as well as respective power plants.

Our company will also focus on further developing the initial device so that it will eventually evolve to a power generation machine operating based on the principles and theory of PAP-LENR technology.

In any case, the PAP-LENR device will be protected as a private technology, intellectual property of our company, that can be sold to companies or institutions that are interested to further develop the product into practical PAP-LENR engines.

We Believe that the PAP-LENR technology will be a novel breakthrough technology that can address -together with renewables- the climate change threat.



Introducing
our Team

Board of Directors

A board of directors has been formed by individual shareholders, to define clear goals and directives, perform overall management and coordination and ensure the seamless operation of the subsequent company in relation to the initial expreriments as well as the design and development of the final product. The board of directors is formed by the following members:

Professor Doctor Engineer Christos D. Papageorgiou, founder and majority shareholder, will be the Chairman and CEO of the company

Prof Spyros Lioukas Prof Emeritus, AUEB, deputy Chairman of the company

Mrs. Dimitra Papageorgiou Secretary of the Board of Directors

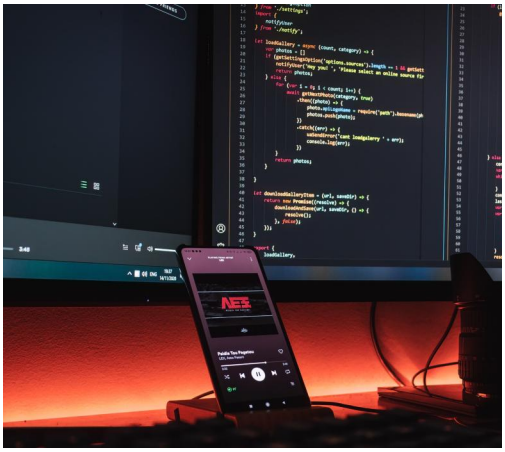
Dr Euripides Georgantzos Chief Technology Officer

Dr Georgios (George) Kyriakou Chief Operating Officer

Mr. Notis Paraskevopoulos Member of the Board of Directors

* Mrs. Dimitra C. Papageorgiou (SBD), will be responsible for the public relations of the company.
* Dr Euripides Georgantzos (CTO), supported by a proper team of experts (outsourcing), will be responsible for organizing technology and software development processes.
* Dr Georgios Kyriakou (COO), will be responsible for design and implementation of business operations and will also serve as the company's representative in the United States.

Our R&D Team



The R&D team of the company that will be responsible for the development of the PAP-LENR devices and the necessary auxiliary devices for the experiments, measurements etc. will be guided by the CEO of the company, **Prof. Christos D. Papageorgiou, a PhD of Imperial College**.
Prof. Christos D. Papageorgiou has spent many years of theoretical studies and experiments to analyze and understand in depth the series of theoretical phenomena that are involved in LENR, including those well known as cold fusion phenomena.

The following group of scientists will constitute a scientific board of experts as a scientific advisory team for Prof Christos D. Papageorgiou.

1. Emmanuel Protonotarios · Professor Emeritus, NTUA, Division of Communication, Electronic and Information Engineering.

2. Christophoros Provatidis – Professor, NTUA, Mechanical Engineering

3. T.E. Raptis – Independent Research fellow in Applied Technologies, in the NCSR "Demokritos" institute.

4. Dimitrios Korres – Famous inventor of the supercars of Korres Project 4

Marketing
Analysis

The Market

The target device utilizing PAP-LENR technology will be launched for the global energy market.
Annual energy investment is expected to increase from just over $ 2 trillion worldwide on average over the past five years to nearly $ 5 trillion by 2030 and to $ 4.5 trillion by 2050. The bulk will be spent on generating, storing, and distributing electricity, and electrical end-user equipment (heat pumps, vehicles). In the current year private investments in Fusion energy amount to a few billion Dollars
The innovative PAP-LENR engines can generate low-cost and clean energy for the planet. Details of the potential of the PAP-LENR technology are presented further in section B.
The demand for the PAP-LENR device, which will be the intellectual property of our company, is estimated to be great since, as a product, it will be eligible for sale to international companies or institutions interested in further developing their own LENR engines.
The selling price of our intellectual property to every interested company or institution cannot be defined yet but it is roughly estimated to be several tens of million Dollars. In any case, since the initial product will target the global market, the expected income will amount to many times the initial capital funding of our company.

Marketing
Analysis

Defining Competition

According to International Publications and news articles, we have noticed that recently, many candidate Technologies related either to Fusion or LENR technologies are presented. At this moment, very few – if any- technologies in this field are capable of producing actual results.
In the following paper the most important projects in FUSION technology are listed.

https://spectrum.ieee.org/5-big-ideas-for-making-fusion-power-a-reality

To conclude, practically the market for clean energy engines or technologies is so broad that there can be no immediate competition that could render PAP-LENR technology obsolete.

Initial Funding and next steps

The development of a device that will utilize the PAP-LENR technology to produce clean sustainable energy, is separated into two major phases and will be funded accordingly.

First Phase

The first phase of development involves the construction of an experimental device that will demonstrate the appearance of nuclear reaction phenomena based on the PAP-LENR theory. The device will prove beyond any doubt that Low Energy Nuclear Reactions (LENR) can be generated by that device, where input electrical pulses of low energy will **generate much higher output as thermal energy**.

The initial funding required in this phase is estimated at **500,000 USD**. The company will issue **500 million shares, of which 50 million shares** (10% of the company shares) will be offered in a crowdfunding platform at the price of **0.01 USD /share**.

The capital of 500,000 USD will be used for the purchase of special equipment and raw materials, for the sallaries of scientists and technicians that will execute the necessary experiments under the supervision of Professor Christos D. Papageorgiou.

As a first approximation it is estimated these funds will be used as follows:

- 40% will be used for special equipment and raw material for the execution of necessary experiments
- Another 40% will be spent for salaries of scientists and technicians that will work under the supervision of Professor Christos D. Papageorgiou
- And finally a percentage of 20% will be the overhead

These funds can be used also as equity for a subsidiary company in Greece that will participate in EU appropriate programs, as a start-up R&D company to be granted EU support funding (leverage)

The executions of the experiments and the construction of the experimental device are **estimated to be completed in a maximum period of 2 years**.

Initial Funding and next steps

Second Phase

In the second phase, the company will proceed in the construction of a basic prototype device based on PAP-LENR technology.
This device will continuously produce thermal energy, multiple times higher than the input electric energy provided in the form of electric pulses.

The second phase is estimated to demand the amount 10 million USD. This amount of **10 million USD** will be used for the development of a proper PAP-LENR device (product), issuing patents, if necessary, and finally marketing and selling the product in the global market.

The funding required in the second phase can be raised as follows:

1. The company may proceed to an Initial Coin Offer (ICO) of 100 million shares (20% of its shares) in the form of PAPL tokens in the market through a proper cryptocurrency platform, at the price at least of $ 0.10 /PAPL.
Each share will be of equivalent value to a marketed token named PAPL.

2. Alternatively, the company could approach a financial partner who could take over a substantial of the company's shares, offering a reasonable amount for the acquisition of the the shares.

Our Company’s Vision

We envision the construction of a machine that will operate on electrical input in the form of electrical pulses and will utilize Low Energy Nuclear Reactions with our PAP-LENR technology to output thermal energy, multiple times higher than the initial energy input.

In order to understand the importance of this machine let's see how Electric Energy Power Plants of fossil fuels, i.e. Coal, lignite or oil, actually work. All these power stations run on steam of a few hundred degrees Celsius, which is constantly supplied into steam turbines that rotate Electric generators, that finally are generating electricity.

The overall efficiency of these steam turbine power plants is about 35 %. This means that if the thermal energy produced by the combustion of coal, lignite or oil is 100 units, 35 units of electricity will be generated.
The coal, lignite, and oil fossil fuel thermal energy suply machines, for steam generation, can be replaced in existing power plants by LENR thermal power generating machines of several hundred degrees of Celsius. The PAP-LENR technology would under our estimations, provide thermal LENR machines operating with low cost LENR nuclear fuels and trigered by electric pulses.

Let's assume that the input electricity in the form of electric pulses in PAP-LENR machines is 10 units and the output thermal energy by the PAP-LENR thermal machines is 100 units.
Through these PAP- LENR machines, in existing coal, lignite or oil power plants, we can produce 35 units of electricity so as a final result 25 units of net electricity will be produced.
Thus the urgent problem to save our planet by the climate change threat can be solved, because all the major electric power plants (lignite, coal, or oil) that are generating 41% of world wide electricity and are responsible for at least 50% of CO_2 emmissions can replace the combustion machines with PAP-LENR technology machines for steam generation. Data receiced from the following source.

https://en.wikipedia.org/wiki/World_energy_supply_and_consumption

Our Company’s Vision

Using our PAP-LENR technology machines, that are generating electricity without CO2 emissions, in existing fossil fueled power plants and can keep the global temperature increase below the threshold of 1.5 degrees Celsius.

Also it is obvious that the thermal PAP-LENR machines's of low expected construction cost and the natural abundance of required LENR fuel materials (Li for example) can solve the energy problem for a few thousand years ahead.

The thermal PAP-LENR engine's low expected construction cost and the natural abundance of required materials (Li for example) can solve the energy problem for a few thousand years ahead. Also, the urgent problem to save the planet by the climate change threat can also be solved because all the major electric power plants (lignite, coal, or nuclear) can use PAP-LENR technology for steam generation. The machines of PAP-LENR technology are generating electricity without CO2 emissions and their urgent application can keep the global temperature increase below the threshold of 1.5 degrees Celsius.

“I believe that in a few hundred years, if not decades, newer versions of LENR machines operating with PAP-LENR technologies, or other future technologies, could provide humanity with unlimited clean energy.”
Professor Christos Papageorgiou, CEO

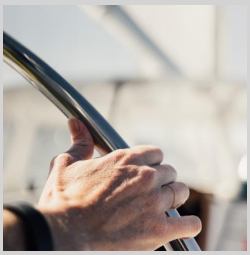
Why invest in PAPL

Invest Green

Be among the first to invest in a breakthrough green energy technology.

Low Initial Entry

Increase your chance of earning a lot by investing just a few.



Ride the Wave

Never before has there been such a strong need for a new innovative sustainable energy source

PAP-LENR Technology Principles of Operation

Introduction

Professor C. Papageorgiou's interest in research of what he now calls PAP-LENR technology, started several years ago with experiments related to phenomena of wire fragmentation or otherwise, exploding wires.

The exploding wire method or EWM is a way to generate plasma that consists in sending a strong enough pulse of electric current through a thin wire of some electrically conductive material. The resistive heating vaporizes the wire, and an electric arc through that vapor creates an explosive shockwave. Exploding wires are used as detonators for explosives, as momentary high intensity light sources, and in the production of metal nanoparticles.

https://en.wikipedia.org/wiki/Exploding_wire_method

These phenomena attracted the professor's interest because the explanatory theories at the time were either unsatisfactory or even in contrast to classic Maxwell electromagnetics. He then formed a team of scientists and proceeded with the execution of related experiments. For the execution of the experiments, an electric pulse generator machine was designed and prepared.

Research and Experiments

Many explosion experiments were carried out for several years, with various wire materials and dimensions, under variable electric pulses. Professor Papageorgiou presented the finding results of the experiments and his theory explaining the phenomena, using Maxwell equations, in acknowledged scientific magazines.

In the following articles the scientific team presented an alternative explanation of the phenomenon of wire fragmentation under high transient currents based on classical electromagnetism. These articles also explain how this phenomenon can be utilized as a primitive example of low energy-high power disruptive phenomena that can affect even nuclear matter.

https://www.epjap.org/articles/epjap/abs/2009/12/ap09174/ap09174.html

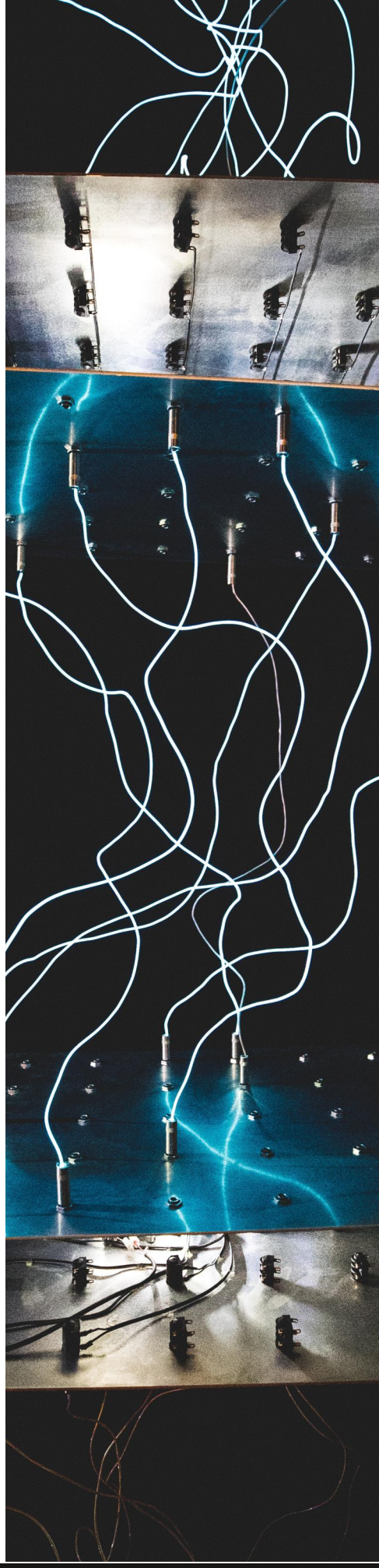
https://www.epjap.org/articles/epjap/abs/2011/04/ap100325/ap100325.html

During the experiments and in certain cases, it was noted that the explosions were probably related to Low Energy Nuclear Reactions (LENR), especially near the center area of the exploding wires.

In the course of the research it became evident that exploding wire phenomena have many similarities with the so-called Z-pinch phenomena, that are operating with higher voltage pulses and shorter wires. In the case of the Z-pinch phenomena, it is known that nuclear reactions are taking place.

Sandia’s Z machine is the world's most powerful and efficient laboratory radiation source. It uses high magnetic fields associated with high electrical currents to produce high temperatures, high pressures, and powerful X-rays for research in high energy density science. The Z machine creates conditions found nowhere else on Earth. Z is part of Sandia's Pulsed Power program, which began in the 1960s.

https://www.sandia.gov/z-machine/



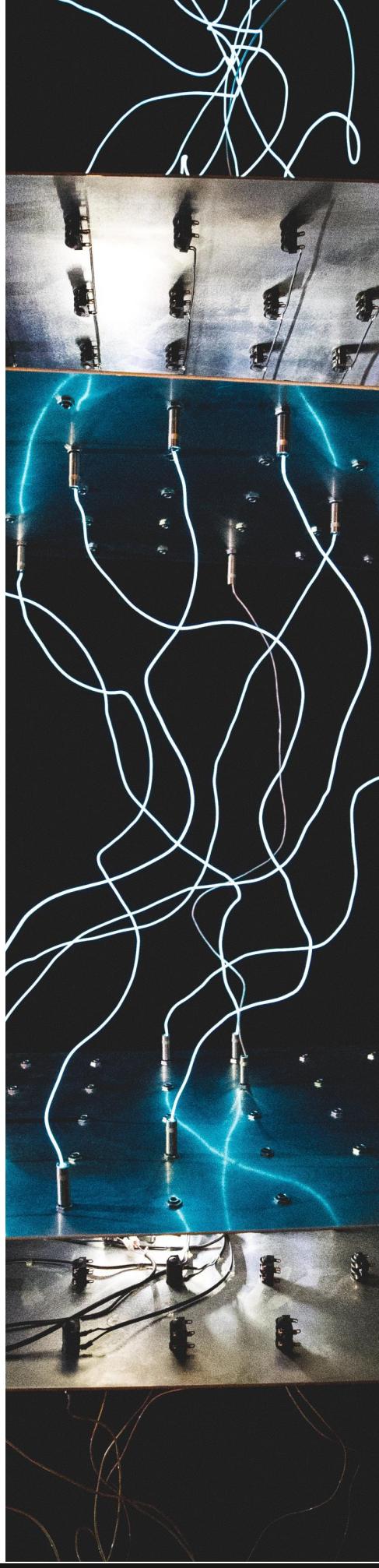
Our scientific team believes that the so-called pinch explosions are not related to implosions due to Lorentz's forces between parallelly moving free electrons. On the contrary, we support the known approach that the moving free electrons inside conducting wires are always repulsing between them (skin effect).

Our team's theoretical approach has led to an improved explanation for explosions occurring when conducting wires under strong electric pulses:
The origin of these explosions is of Coulombic nature, led by the huge number of free electrons moving instantly from the whole wire towards the center of it, after the driving electric pulse. By theoretical analysis, Professor C. Papageorgiou has proven that the instant motion of free electrons, after the electric pulse, as well as the electron concentration at the center of the conducting wire, are both defined by quantum mechanics theory. Furthermore it was proved that the collisions of the moving (in opposite directions) electrons are created by the so-called Coulomb explosions.

The Coulombic repulsion of particles having the same electric charge can break the bonds that hold solid materials together. With their low mass, outer valence electrons responsible for chemical bonding are easily stripped from atoms, leaving them positively charged. Given a mutually repulsive state between atoms whose chemical bonds are broken, the material explodes into a small plasma cloud of energetic ions with higher velocities; higher than the case of thermal emission.

https://en.wikipedia.org/wiki/Coulomb_explosion

However, the nuclear reactions that appeared in the pinch experiments and in certain cases in exploding wire experiments are demanding a more complicated theoretical explanation. Our team's theory regarding this Low Energy Nuclear Reactions (LENR) phenomenon is that instant heavy concentration of free electrons in the center of the conducting wire, is creating a strong electrostatic field. This strong electrostatic field can create the so-called Stark effect in some nearby atoms forming naked or partly naked atoms (i.e., atoms that are missing a part of their external shield of electrons).



Analyzing the Phenomena

The Stark effect can lead to splitting of degenerate energy levels.

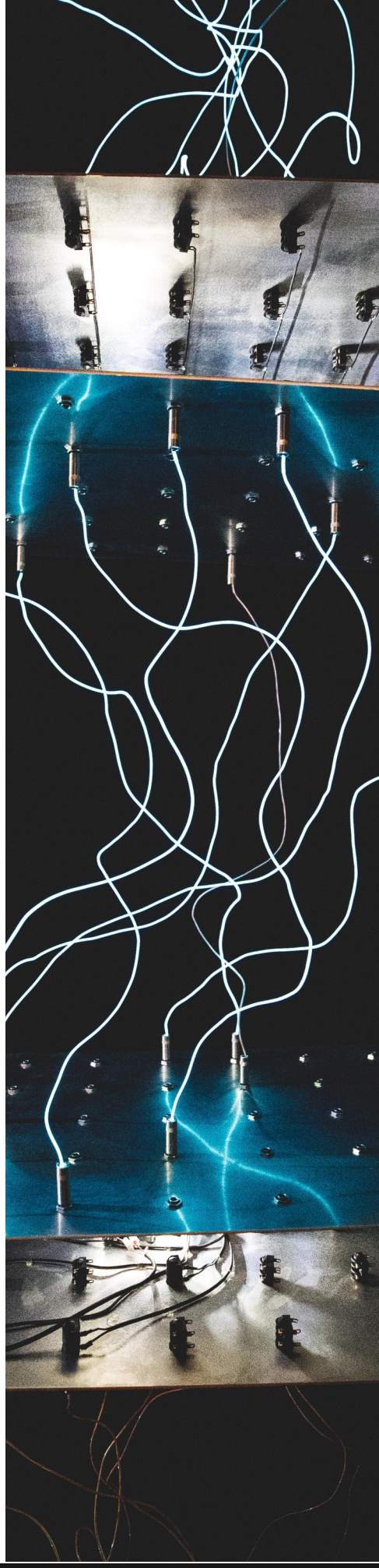
https://en.wikipedia.org/wiki/Stark_effect

All these phenomena appear, while the fast free electrons are moving irregularly against the center of the wire. Thus, it is statistically possible for several fast-moving electrons to enter the naked nucleus of nearby atoms. The entrance of free moving electrons inside the nucleus of nearby atoms of the material, transforms protons to neutrons and nuclear transmutations are taking place (a similar procedure takes place in the so-called electron capture phenomenon).

Electron capture (K-electron capture, also K-capture, or L-electron capture, L-capture) is a process in which the proton-rich nucleus of an electrically neutral atom absorbs an inner atomic electron, usually from the K or L electron shells. This process thereby changes a nuclear proton to a neutron and simultaneously causes the emission of an electron neutrino.

https://en.wikipedia.org/wiki/Electron_capture

Professor Papageorgiou has proven that the proper geometry curvature of the linear wires can facilitate the free electron concentration in the center of the conducting wire. In one of his recent papers titled “Geometry, Quantum Mechanics and Low Energy Nuclear Transmutations”, all the scientific equations and explanations are presented in detail.



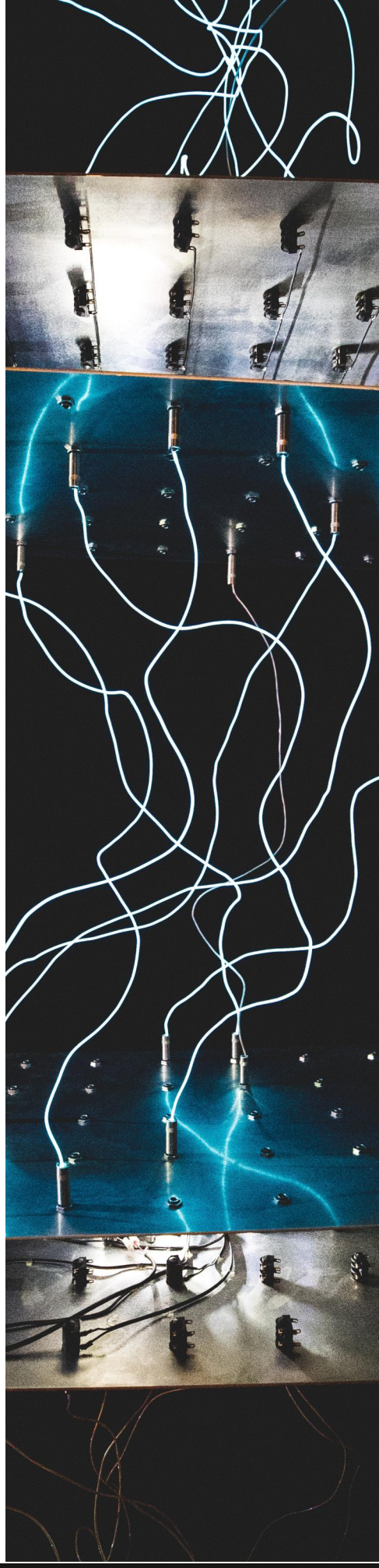
Quantum mechanics Geometry-generated potentials, in Curved conducting wires strips or paths, are related with various peculiar phenomena such as exploding wires and exploding Li-ion batteries. The proposed theory can be used in exploration of low energy nuclear transmutation devices. The origin of the so-called cold fusion could be possibly related to these phenomena.

https://www.researchgate.net/publication/342700991_Geometry_Quantum_Mechanics_and_low_Energy_Nuclear_Transmutations

This research has led Professor Papageorgiou to a deeper understanding of the reason and the nature of Low Energy Nuclear Reactions (LENR) in exploding conducting wires, or short cylindrical specimens, under strong electric pulses.

Based on this Theory he has designed several prototype PAP-LENR devices that, operating with proper chemical materials, very thin foils, on extremely thin wire threads and triggered by electric pulses by proper pulse generators, would create LENR phenomena.

The initial funds will be used for the construction of a prototype PAP-LENR device where the input electric energy (in form of electric pulses) will be transformed into multiple kinetic or thermal energy outputs.



Energy and cost comparison

The initially proposed fuel of the PAP-LENR technology could consist of lithium possibly mixed with Deuterium.
The main reason is that these materials can proceed in nuclear reactions and the Cold fusion experiments and the expired Li batteries explosions give them a priority
Alexander M. Bradshaw, a physical chemist at the Max Planck Institute for Plasma Physics, wrote that a 2 GW thermal output fusion reactor, will require 300 kilograms of Li6 per year that is equivalent to 4,000 Kg of natural Li.
A conservative estimation of Electric power output is **0.6 GW generating for 6000 hours/year 3,600 GWh or 3,6 million MWh per year**. The fuel cost of 4,000 Kg of Li is estimated to be 1,200,000 USD. We can assume reasonably that similar quantities of Lithium per generated kWh will be spent for PAP-LENR technology operation. Hence, the fuel cost of PAP-LENR technology is estimated to be in the order of 0.33 USD per MWh of electricity generated which is many times lower than the price of Natural Gas per MWh of electricity generated by gas turbines and similar fossil fuels. The PAP-LENR technology machines it is estimated also that should have a reasonable cost per MWh.
Hence the PAP-LENR technology has the potential to generate electricity at a lower price than the existing fossil fuel technologies and **does not produce any CO_2**, thus in a few years, the climate threat can be eliminated.

Deposits of Li-6, the possible nuclear fuel of PAP-LENR technology

The world's annual electricity consumption is estimated to be 27,000 TWh. of which 75% i.e. 20,000 TWh are produced by fossil fuels or nuclear.
Thus, if this annual amount of electricity could be generated by PAP-LENR technology the annual consumption of Lithium will be approximately 23.000 tons.
Taking into consideration that the world reserves in natural Lithium are estimated to be 80 million tons the whole world’s energy demand can be covered for at least 3500 years.
A further quantity of 230 billion tons of Lithium is estimated to exist in the oceanic seabed. Despite the higher cost of extraction, this quantity would cover the energy demand for millions of years.

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