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Nuclear Green Energy

After 1950, began to appear nuclear fission plants. The fission energy was a necessary evil. In this mode it stretched the oil life, avoiding an energy crisis. Even so, the energy obtained from oil represents about 66% of all energy used. At this rate of use of oil, it will be consumed in about 40 years. Today, the production of energy obtained by nuclear fusion is not yet perfect prepared. But time passes quickly. We must rush to implement of the additional sources of energy already known, but and find new energy sources. In these circumstances this paper comes to proposing possible new energy sources.

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Nomenclature

Annihilation Energy: is the energy, renewable, clean, friendly (not dangerous), cheaper, obtained by the annihilation process between a particle and its antiparticle; For example, the annihilation of an electron with an antielectron (a positron);

Hot fusion: is fusion which works with very high temperatures: 4000 million degrees.

I. Introduction

Energy development is the effort to provide sufficient primary energy sources and secondary energy forms for supply, cost, impact on air pollution and water pollution, mitigation of climate change with renewable energy. Technologically advanced societies have become increasingly dependent on external energy sources for transportation, the production of many manufactured goods, and the delivery of energy services. This energy allows people who can afford the cost to live under otherwise unfavorable climatic conditions through the use of heating, ventilation, and/or air conditioning. Level of use of external energy sources differs across societies, as do the climate, convenience, levels of traffic congestion, pollution and availability of domestic energy sources.

All terrestrial energy sources except nuclear, geothermal and tidal are from current solar insolation or from fossil remains of plant and animal life that relied directly and indirectly upon sunlight, respectively. Ultimately, solar energy itself is the result of the Sun's nuclear fusion. Geothermal power from hot, hardened rock above the magma of the Earth's core is the result of the decay of radioactive materials present beneath the Earth's crust, and nuclear fission relies on man-made fission of heavy radioactive elements in the Earth's crust; in both cases these elements were produced in supernova explosions before the formation of the solar system. Renewable energy is energy which comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished).

In 2008, about 19% of global final energy consumption came from renewable, with 13%

coming from traditional biomass, which is mainly used for heating, and 3.2% from hydroelectricity. New renewable (small hydro, modern biomass, wind, solar, geothermal, and biofuel) accounted for another 2.7% and are growing very rapidly.

The share of renewable in electricity generation is around 18%, with 15% of global electricity coming from hydroelectricity and 3% from new renewable. Wind power is growing at the rate of 30% annually, with a worldwide installed capacity of 158 (GW) in 2009, and is widely used in Europe, Asia, and the United States.

At the end of 2009, cumulative global photovoltaic (PV) installations surpassed 21 GW and PV power stations are popular in Germany and Spain. Solar thermal power stations operate in the USA and Spain, and the largest of these is the 354 megawatt (MW) SEGS power plant in the Mojave Desert. The world's largest geothermal power installation is The Geysers in California, with a rated capacity of 750 MW. Brazil has one of the largest renewable energy programs in the world, involving production of ethanol fuel from sugar cane, and ethanol now provides 18% of the country's automotive fuel. Ethanol fuel is also widely available in the USA, the world's largest producer in absolute terms, although not as a percentage of its total motor fuel use.

While many renewable energy projects are large-scale, renewable technologies are also suited to rural and remote areas, where energy is often crucial in human development. Globally, an estimated 3 million households get power from small solar PV systems. Micro-hydro systems configured into village-scale or county-scale mini-grids serve many areas. More than 30 million rural households get lighting and cooking from biogas made in household-scale digesters. Biomass cook stoves are used by 160 million households. Climate change concerns, coupled with high oil prices, peak oil, and increasing government support, are driving increasing renewable energy legislation, incentives and commercialization. New government spending, regulation and policies helped the industry weather the 2009 economic crisis better than many other sectors.

II. First Energy Source

II.1. Life's First Energy Source

An obscure compound known as pyrophosphite could have been a source of energy that allowed the first life on Earth to form [1]. Researchers at the University of Leeds have uncovered new clues to the origins of life on Earth. The team found that a compound known as pyrophosphite may have been an important energy source for primitive life forms. There are several conflicting theories of how life on Earth emerged from inanimate matter billions of years ago – a process known as abiogenesis. "It's a chicken and egg question," said Dr Terry Kee of the University of Leeds, who led the research. "Scientists are in disagreement over what came first – replication, or metabolism. But there is a third part to the equation – and that is energy."

All living things require a continual supply of energy in order to function. This energy is carried around our bodies within certain molecules, one of the best known being ATP, which converts heat from the sun into a useable form for animals and plants. At any one time, the human body contains just 250g of ATP – this provides roughly the same amount of energy as a single AA battery. This ATP store is being constantly used and regenerated in cells via a process known as respiration, which is driven by natural catalysts called enzymes. "You need enzymes to make ATP and you need ATP to make enzymes," explained Dr Kee. "The question is: where did energy come from before either of these two things existed? We think that the answer may lie in simple molecules such as pyrophosphite which is chemically very similar to ATP, but has the potential to transfer energy without enzymes."

The key to the battery-like properties of both ATP and pyrophosphite is an element called phosphorus, which is essential for all living things. Not only is phosphorus the active component of ATP, it also forms the backbone of DNA and is important in the structure of cell walls. But despite its importance to life, it is not fully understood how phosphorus first appeared in our atmosphere. One theory is that it was contained within the many meteorites that collided with the Earth billions of years ago. "Phosphorus is present within several meteoritic minerals and it is possible that this reacted to form pyrophosphite under the acidic, volcanic conditions of early Earth," added Dr Kee. The findings, published in the journal *Chemical Communications*, are the first to suggest that pyrophosphite may have been relevant in the shift from basic chemistry to complex biology when life on earth began. Since completing this research, Dr Kee and his team have found even further evidence for the importance of this molecule and now hope to team up with collaborators from NASA to investigate its role in abiogenesis.

Human mitochondrial genetics is the study of the genetics of the DNA contained in human

mitochondria. Mitochondria are small structures in cells that generate energy for the cell to use, and are hence referred to as the "powerhouses" of the cell [2]. Mitochondrial DNA (mtDNA) is not transmitted through nuclear DNA (nDNA). In humans, as in most multi cellular organisms, mitochondrial DNA is inherited only from the mother's ovum. Mitochondrial inheritance is therefore non-Mendelian, as Mendelian inheritance presumes that half the genetic material of a fertilized egg (zygote) derives from each parent. Eighty percent of mitochondrial DNA codes for functional mitochondrial proteins, and therefore most mitochondrial DNA mutations lead to functional problems, which may be manifested as muscle disorders (myopathies).

Understanding the genetic mutations that affect mitochondria can help us to understand the inner workings of cells and organisms, as well as helping to suggest methods for successful therapeutic tissue and organ cloning, and to treatments or possibly cures for many devastating muscular disorders. Because they provide 36 molecules of ATP per glucose molecule in contrast to the 2 ATP molecules produced by glycolysis, mitochondria are essential to all higher organisms for sustaining life. The mitochondrial diseases are genetic disorders carried specifically in mitochondrial DNA; slight problems with any one of the numerous enzymes used by the mitochondria can be devastating to the cell, and in turn, to the organism. The pyrophosphite and human mitochondria are the principal motors of the human energetic processes. We should better understand these processes, to can prolong our life.

II.2. The Oldest Energy Source

Man started to use biomass for energy on the day that our ancestors discovered fire, and used it for cooking. Biomass is actually just another word for biological-mass. Biomass is anything that has been grown or has lived, except for fossil fuels (coal, oil, natural gas etc). Fossil fuels were of course created by the decay of living organisms many millennia ago in pre-history and are biomass in that sense, but these are not included within the term 'biomass' as used by renewable energy experts [3]. Biomass takes many forms; some of the most well known are: wood, straw, bio waste, wood chip, waste paper, organic slurries from the processing of foodstuffs, livestock farming, sewage treatment, etc.

So biomass can also be grown as a crop for use as fuel. If the biomass is to be grown it will need to be selected to be of high calorific value (give of lots of heat when burnt), grow fast, need little fertilizing or watering, require low power requirements during growing and be cheaply harvested. However, the growing of biomass to use as biofuel on a large scale would have the effect of reducing available land for food crops.

III. New Energy Sources

Energy development is the effort to provide sufficient primary energy sources and secondary energy forms for supply, cost, impact on air pollution and water pollution, mitigation of climate change with renewable energy. Technologically advanced societies have become increasingly dependent on external energy sources for transportation, the production of many manufactured goods, and the delivery of energy services. This energy allows people who can afford the cost to live under otherwise unfavorable climatic conditions through the use of heating, ventilation, and/or air conditioning.

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III.1. Wind Power

Airflows can be used to run wind turbines. Modern wind turbines range from around 600 kW to 5 MW of rated power, although turbines with rated output of 1.5–3 MW have become the most common for commercial use; the power output of a turbine is a function of the cube of the wind speed, so as wind speed increases, power output increases dramatically. Typical capacity factors are 20-40%, with values at the upper end of the range in particularly favorable sites. Wind energy is the cleanest and sufficient, the safest, cheapest and most sustainable. Where land space is not enough, wind farms can be built and in the water. We must put the wind to work.

III.2. Hydropower

Among sources of renewable energy, hydroelectric plants have the advantages of being long-lived (many existing plants have operated for more than 100 years). Also, hydroelectric plants are clean and have few emissions.

III.3. Solar Energy

Solar panels generate electricity by converting photons (packets of light energy) into an electric current. Solar energy is the energy derived from the sun through the form of solar radiation. Solar powered electrical generation relies on photo voltaic and heat engines. A partial list of other solar applications includes space heating and cooling through solar architecture, day lighting, solar hot water, solar cooking, and high temperature process heat for industrial purposes. Strano's nanotube antenna boosts the number of photons that can be captured and transforms the light into energy that can be funneled into a solar cell [5].

III.4. Biomass

Biomass (plant material) is a renewable energy source because the energy it contains comes from the sun. Through the process of photosynthesis, plants capture the sun's energy. When the plants are burned, they release the sun's energy they contain. In this way, biomass functions as a sort of natural battery for storing solar energy.

As long as biomass is produced sustainably, with only as much used as is grown, the battery will last indefinitely.

In general there are two main approaches to using plants for energy production: growing plants specifically for energy use, and using the residues from plants that are used for other things. The best approaches vary from region to region according to climate, soils and geography.

III.5. Biofuel

Liquid biofuel is usually either bio alcohol such as bioethanol or oil such as biodiesel. Bioethanol is an alcohol made by fermenting the sugar components of plant material and it is made mostly from sugar

and starch crops. With advanced technology being developed, cellulosic biomass, such as trees and grasses, are also used as feed stocks for ethanol production. Ethanol can be used as a fuel for vehicles in its pure form, but it is usually used as a gasoline additive to increase octane and improve vehicle emissions. Bioethanol is widely used in the USA and in Brazil [6].

III.6. Geothermal Energy

The geothermal energy from the core of the Earth is closer to the surface in some areas than in others. Where hot underground steam or water can be tapped and brought to the surface it may be used to generate electricity. Such geothermal power sources exist in certain geologically unstable parts of the world such as Chile, Iceland, New Zealand, United States, the Philippines and Italy. The two most prominent areas for this in the United States are in the Yellowstone basin and in northern California.

III.7. Tidal Energy

Tidal power can be extracted from Moon-gravity-powered tides by locating a water turbine in a tidal current, or by building impoundment pond dams that admit-or-release water through a turbine. The turbine can turn an electrical generator, or a gas compressor, that can then store energy until needed. Coastal tides are a source of clean, free, renewable, and sustainable energy.

III.8. Hydrogen Obtained by Artificial Photosynthesis

Artificial photosynthesis is a research field that attempts to replicate the natural process of photosynthesis, converting sunlight, water, and carbon dioxide into carbohydrates and oxygen. Sometimes, splitting water into hydrogen and oxygen by using sunlight energy is also referred to as artificial photosynthesis. The actual process that allows half of the overall photosynthetic reaction to take place is photo-oxidation. This half-reaction is essential in separating water molecules because it releases hydrogen and oxygen ions. These ions are needed to reduce carbon dioxide into a fuel. However, the only known way this is possible is through an external catalyst, one that can react quickly as well as constantly absorb the sun's photons. The general basis behind this theory is the creation of an "artificial plant" type fuel source.

Artificial photosynthesis is a renewable, carbon-neutral source of fuel, producing either hydrogen, or carbohydrates. This sets it apart from the other popular renewable energy sources — hydroelectric, solar photovoltaic, geothermal, and wind — which produce electricity directly, with no fuel intermediate. As such, artificial photosynthesis may become a very important source of fuel for transportation. Unlike biomass energy, it does not

require arable land, and so it need not compete with the food supply.

Since the light-independent phase of photosynthesis fixes carbon dioxide from the atmosphere, artificial photosynthesis may provide an economical mechanism for carbon sequestration, reducing the pool of CO₂ in the atmosphere, and thus mitigating its effect on global warming. Specifically, net reduction of CO₂ will occur when artificial photosynthesis is used to produce carbon-based fuel which is stored indefinitely.

III.9. Blacklight Power

Beginning in 1986, Dr. Randell L. Mills developed the theory on which the BlackLight Process is based [7]. In 1989, the original patent applications were filed and the conclusions of the theoretical work were published. Dr. Mills believes that he has succeeded with the unification of gravity with atomic physics.

III.10. Waves Power

Wave power is the transport of energy by ocean surface waves, and the capture of that energy to do useful work — for example for electricity generation, water desalination, or the pumping of water (into reservoirs). Wave power is distinct from the diurnal flux of tidal power and the steady gyre of ocean currents. Wave power generation is not currently a widely employed commercial technology although there have been attempts at using it since at least 1890. In 2008, the first experimental wave farm was opened in Portugal, at the Aguçadoura Wave Park.

IV. New Methods of Obtaining Energy

IV.1. Submarines Power Plants in the Future

LONDON: A massive underwater river flowing along the bottom of the Black Sea has been found by scientists - a discovery that could help explain how life manages to survive in the deep oceans away from the nutrient-rich waters found close to land [8].

IV.2. Obtaining Energy with Alpha Stirling Engines

We can try the Alpha Stirling Motors for to obtain energy from two locations with different temperatures, ground and underground for example. A Stirling engine is a heat engine operating by cyclic compression and expansion of air or other gas, the working fluid, at different temperature levels such that there is a net conversion of heat energy to mechanical work.

IV.3. We Can Get Energy from Inside a Volcano

We will install various pipes, serpentines, boilers, inside of some volcanoes, and by pumping the cold water in them we will obtain hot water to the outer. As an alternative, we can install a Stirling engine hot source inside a volcano.

IV.4. Capture and Keeping of the Energy Liberated by a Lightning

The lightning has a power of 3000000000000 [W]
 $=3 \times 10^{12}$ [W]
 $=3 \times 10^9$ [kW]
 $=3 \times 10^6$ [MW]
 $=3 \times 10^3$ [GW].

Lightning is produced at Earth surface with an average of 300 kicks per second. If we could collect and keep all this energies, who are liberated by a single lightning, we could obtain 1-7 GJ=1-7 GWh/second, 1-7 GWh/hour=8760-61320 GWh/year. The lightning can be attracted and retained by huge balls buried in the planet's surface, in places where are more frequent rains. The areas chosen should be as well insulated and removed, to prevent unauthorized access inside them.

IV.5. Extracting Energy from Electron

Getting energy, renewable, clean, friendly (not dangerous), cheaper, by the annihilation process; For example, the annihilation of an electron with an antielectron (positron), [9]. Electron and positron are obtained by extracting them from atoms; the extraction, consume a negligible amount of energy. Then, the two particles are brought near one another (collision); now it occur the phenomenon of annihilation, when the rest mass is converted totally into energy (gamma photons). Occur gamma photons, as many as needed to retrieve the total energy of the electron and positron (rest energy and kinetic energy); usually one can get two or three gamma particles (when we have a lower annihilation, ie two antiparticles with lower energy, each with a little beyond rest mass, ie the particles are accelerated at a low-speed motion), but we can get more particles when we have a high annihilation (ie when the particle energy is high and the particles were strongly accelerated before the collision).

Rest energy of an electron-positron pairs exceeds slightly 1 MeV (what is an extremely large energy from some as small particles, comparable energy with that achieved by the merger of two much larger particles, having rest mass of about 2000 times higher). Hence the first great advantage of the new method proposed, namely that if the most complex physical phenomenon so far tried to get inside the material energy (hot or cold fusion), draw only about a thousandth part of the rest mass of the particle, resulting in the fusion of two particles practically only the energy gap between energy particles being free and their energy when they are united, the proposed method to extract virtually all the internal energy of the particles annihilated.

We started with the electron positron pair because these small particles are more easily extracted from the atoms (the atoms are then immediately regenerated naturally, which determines the nature of renewable energy from the annihilation of

particles). Next step is to test the annihilation between a proton and an antiproton, because their mass is about 1800 times higher than that of the electron and positron, resulting in their annihilation as an energy by about 1000 times higher, ie instead of 1 MeV, 1 GeV (is considered as the only real obtained energy, the energy donated by the proton of the hydrogen ion; but the energy of an antiproton is considered to be donated by us almost entirely, for now, because to obtain today an antiproton we must accelerate some particles at very high-energy and then collide them).

So the real comparison must to be made between the deuterons fusion and annihilation process of a hydrogen ion (proton) with an antiproton. It will be a difference of energy of about 1000 times higher per pair of particles used, in favor of the annihilation process. Practically it realizes the dream of extracting energy from all the matter. Another great advantage of this method is that no radioactive substances and are not radioactive wastes from the process. From this process we obtain only gamma photons (i.e. energy) and possibly other energetic mini particles. The process does not pose any threat to humans and the environment.

The energy produced is clean. The technology required is much simpler than nuclear (fission or fusion), cheaper and easier to maintain. Enough energy is given by the annihilation process (virtually unlimited), cheap, clean, safe, renewable immediately (sustainable), with technology made simple. We can extract the energy of the rest mass of an electron. For a pair of an electron and a positron this energy is circa 1 MeV. The "synchrotron radiation (synchrotron light source)" produces deliberated a radiation source. Electrons are accelerated to high speeds in several stages to achieve a final energy (that is typically in the GeV range).

We need two synchrotrons, a synchrotron for electrons and another who accelerates positrons. The particles must to be collided, after they are being accelerated to an optimal energy level. All the energies are collected at the exit of the Synchrotrons, after the collision of the opposite particles. We will recover the accelerating energy, and in addition we also collect the rest energy of the electrons and positrons. At a rate of 10^{19} electrons/s we obtain an energy of about 7 GWh / year, if even are produced only half of the possible collisions. This high rate can be obtained with 60 pulses per minute and 10^{19} electrons per pulse, or with 600 pulses per minute and 10^{18} electrons per pulse.

If we increase the flow rate of 1,000 times, we can have a power of about 7 TWh / year. This type of energy can be a complement of the fusion energy, and together they must replace the energy obtained by burning hydrocarbons. Advantages of the annihilation of an electron with a positron, compared with the nuclear fission reactors, are disposal of

radioactive waste, of the risk of explosion and of the chain reaction. Energy from the rest mass of the electron is more easily controlled compared with the fusion reaction, cold or hot. Now, we don't need of enriched radioactive fuel (as in nuclear fission case), by deuterium, lithium and of accelerated neutrons (like in the cold fusion), of huge temperatures and pressures (as in the hot fusion), etc.

Discussion

How much energy, can we get from inside of the matter? Einstein has showed that from one kg of matter we could get the energy needs for entire Earth for a year:

$$E=mc^2=1[\text{kg}](3\cdot 10^8)^2[(\text{m/s})^2]=9\cdot 10^{16}[\text{J}]=2,5\cdot 10^{10}[\text{KWh}]=2,5\cdot 10^7[\text{MWh}]=2,5\cdot 10^4[\text{GWh}]=25[\text{TWh}]$$

We could do this, but only if we could extract all the energy from inside the matter. Through nuclear fusion reaction can be extracted only a part of the rest energy of the particles used. This drop of energy (1 / 1000 of the mass energy of a proton-neutron pairs) is called, discrepancy. For a kg of particles proton-neutron pairs, fusion energy is about a thousand times smaller than the total energy of a kilogram of matter (only 29 [GWh] from the total internal energy, 25 [TWh]); and considering that a return of 100% fusion reaction, which can't be done anyway.

Theoretically speaking, we can't draw from within the matter (through nuclear fusion reaction) than at most the thousandth part of its energy. Having in view the yield of the nuclear fusion reaction, this obtained energy is and less. Through reaction of nuclear fission, the energies obtained will be even smaller. The solution proposed in this work, obtaining energy by the mutual annihilation of two opposite particles, makes possible the requirement of extracting whole energy contained in matter. A pair formed by a particle and its antiparticle, are brought side by side, at a distance which allow the process of reciprocal annihilation.

To increase the yield of the annihilation reaction (the number of annihilated particles from all particles that exist), we can accelerate the particles and antiparticles separately, and then we may send them into a room where they encounter annihilation at speeds and energies high, or at velocities and energies very high. If we use electrons and positrons for the reaction of annihilation, it results photons of the gamma type. In this case, to prevent the possible decay of the obtained photons, again into electrons and positrons (for beginning of this annihilation process with success), the antiparticles and particles used in the process of annihilation, should be collided at low speeds and with low energy. We can test then the optimum energy particle which permits the reaction with the maxim yield. It is necessary that most particles and antiparticles used, to meet

and annihilate each other, and it should be stable as many of the obtained gamma particles.

We must rush to implement of the additional sources of energy already known, but and find new energy sources. In these conditions the proposed method to obtaining energy by annihilation of matter and antimatter, can be a real alternative sources of renewable energy.

IV.6. Ocean Wave Energy Captured Directly from Surface Waves

Ocean wave energy can be captured directly from surface waves [10]. Blowing wind and pressure fluctuations below the surface are the main reasons for causing waves. But consistency of waves differs from one area of ocean to another. Some regions of oceans receive waves with enough uniformity and force. Ocean waves contain tremendous energy. Currently scientists and companies are considering exploiting the wave power of oceans to harness clean and green energy.

IV.7. Scientists at US Laboratory Ready to Create Fusion Energy

The long quest for fusion energy is about to pass a milestone. Scientists at the Lawrence Livermore National Laboratory in California say they are ready to test a giant laser system. The laser beams expect to start a nuclear reaction that could lead to practical production of energy with an infinite fuel source and no carbon waste. The goal is to produce energy the same way the sun does - efficiently, cleanly and infinitely. It is called fusion - and that is what these scientists at the Lawrence Livermore National Laboratory in California are trying to achieve.

Ed Moses directs the Lab's National Ignition Facility, or NIF. "Fusion energy is the long term solution," Moses explains. "It is infinite, essentially infinite fuel. And it has no carbon waste."

"Sun in a Bottle" is how science writer Charles Seife describes fusion.

"Basically all life comes eventually from fusion, the fusion of the sun," he said. "And so if we could replicate this on earth, we've got the clean elemental power that powers everything on earth essentially."

Using a newly-completed \$4 billion laser system that took 10 years to build, scientists at NIF say they are very close to producing controlled fusion. If successful, the experiment could be a giant step towards satisfying the world's increasing demands for energy. They say they expect to start experiments next month that they believe will lead to "ignition."

"When we talk about ignition, we talk about making a small sun on earth; getting thermonuclear burn in the laboratory in a controlled manner," Moses clarified.

That burn, or fusion, is what happens in the sun, stars, and in hydrogen bombs: atoms are merged together and fused at very high temperatures, producing enormous amounts of energy.

Scientists at the National Ignition Facility will focus the intense energy of 192 giant laser beams on a hydrogen-filled target the size of a pill, in order to fuse, or ignite, the nuclei of the hydrogen atoms.

"It will make energy as Einstein told us; the neutron will fly off and if we collect the energy that's coming out of that, we have fusion energy to use for electricity or a variety of other purposes," Moses said.

But Charles Seife cautions it will be important for the project to generate more energy than it uses. "But is this going to actually produce more energy than the laser consumes?" he questioned.

"Almost certainly not. And in fact, if you press them, they hedge a little bit, maybe we'll get ignition, maybe we won't."

For now, the focus is on ignition. In the future, the scientists at NIF hope fusion will be a long term energy solution, with the goal of creating more power than they use.

"It is the silver bullet, Moses said. "Of course, there's a lot to do along the way."

Moses says he thinks pilot fusion power plants will be running within a dozen years, and he adds, soon after that, fusion power will be part of our lives [11-12].

Using the most powerful laser system ever built, scientists have brought us one step closer to nuclear fusion power, a new study says.

The same process that powers our sun and other stars, nuclear fusion has the potential to be an efficient, carbon-free energy source—with none of the radioactive waste associated with the nuclear fission method used in current nuclear plants.

Thanks to the new achievement, a prototype nuclear fusion power plant could be operating within a decade, speculated study leader Siegfried Glenzer, a physicist at Lawrence Livermore National Laboratory in California. Glenzer and colleagues used the world's largest laser array—the Livermore lab's National Ignition Facility—to heat a BB-size fuel pellet to millions of degrees Fahrenheit.

"These lasers are pulsed, and for a very short amount of time"—one ten-billionth of a second—"the power they produce is more than all the power generated by the entire electrical grid of the United States" at any given moment, Glenzer said.

The test confirmed that a technique called inertial fusion ignition could be used to trigger nuclear fusion—the merging of the nuclei of two atoms of, say, hydrogen—which can result in a tremendous amount of excess energy. Nuclear fission, by contrast, involves the splitting of atoms.

The laser demonstration means scientists are now much closer to triggering nuclear fusion in a controlled setting—something that's never been done before and which is necessary if fusion is to be harnessed for energy.

Nuclear's Nice Side?

Performing nuclear fusion in the lab requires enormous amounts of laser power, but if perfected, controlled fusion should generate ten to a hundred times more electrical energy than is used to spark the nuclear reactions. Nuclear fusion, after all, is what allows stars to burn for billions of years.

And fusion could be not only powerful but clean and green as well.

Not only does nuclear fusion not produce long-lasting nuclear waste, but fusion could potentially be used to chemically neutralize radioactive pollutants and has been "proposed as a cure to our nuclear waste problem," Glenzer said.

Simply put, neutrons released by fusion could rearrange radioactive atoms so they aren't radioactive anymore.

(Related: "Nuclear Archaeologists' Find World War II Plutonium.")

Nuclear fusion energy is also potentially carbon free, meaning it could be used to generate power without creating any more carbon dioxide gas, which contributes to global warming.

And while fossil fuels, such as oil and coal, and nuclear fission fuels, such as uranium, are limited resources, there's enough nuclear fusion fuel on, in, and around our planet "to power the Earth longer than the lifetime of the sun," Glenzer said.

(Related: "Cheap Oil to Last, 'Doomsday' Fears Overblown, Author Says.")

Gold Fusion

During the laser experiment, the fuel pellet was placed inside a solid-gold cylinder about the size of a pencil eraser, which was hit by multiple laser beams [12].

The gold cylinder absorbed the laser energy and converted it into thermal x-ray energy.

The x-rays then ricocheted inside the cylinder and struck the fuel pellet from all sides. As the pellet absorbed the x-rays, it heated up—eventually reaching about 60 million degrees Fahrenheit (33 million degrees Celsius)—then collapsed in on itself. The experiment was designed only to test the lasers' ability to heat the cylinder efficiently. Made largely of plastics and helium, the fuel pellet was not filled with enough actual fuel—chemical variants of hydrogen called deuterium and tritium—to actually trigger nuclear fusion.

Actual fusion, Glenzer said, will occur sometime this year.

With a fully loaded fuel pellet, "the implosion will be like squeezing a soccer ball to the size of a pinhead," he added. "The center of that spherical ball will get so hot that nuclear fusion starts."

Nuclear Fusion Plant by 2020?

If successful, the upcoming nuclear fusion experiment will create two classes of energetic particles: alpha particles and neutrons.

"The neutrons escape and can be used to do things like heat up water"—which could potentially be

used to produce steam to drive turbines in an electrical plant, Glenzer said.

"The alpha particles remain trapped (in the burning sphere) and continue to heat the fuel and make it burn," as happens in a star.

Scientists estimate that if they can get to the point where they can burn about five fuel pellets a second, a power plant could continuously generate up to a gigawatt of energy—about what the city of San Francisco is consuming at any given moment.

A working prototype of a such a plant could be built in a decade, Glenzer said.

Cheaper to Burn Cash?

Nuclear fusion researcher Michael Mauel is "very excited" about the recent experiment and said it shows the ignition method works as expected.

But "whether or not we'll have lasers imploding pellets to make fusion energy—it's way too early to tell," said Mauel, who was not involved in the study, which will be published in the journal *Science* tomorrow.

In addition to the considerable engineering challenges involved in ramping up the laser systems for wide-scale use, the cost of the fuel pellets will also have to come down, said Mauel, a Columbia University physicist.

"Each one of these costs between ten (thousand) and a hundred thousand dollars," Mauel said. To use the pellet method to generate nuclear fusion power, "they'll have to cost less than ten cents a piece" [12].

The origin of the energy released in fusion of light elements is due to an interplay of two opposing forces, the nuclear force which draws together protons and neutrons, and the Coulomb force which causes protons to repel each other.

The protons are positively charged and repel each other but they nonetheless stick together, portraying the existence of another force referred to as a nuclear attraction. The strong nuclear force, that overcomes electric repulsion in a very close range.

The effect of this force is not observed outside the nucleus. Hence the force has a strong dependence on distance making it a short range force.

The same force also pulls the neutrons together, or neutrons and protons together. Because the nuclear force is stronger than the Coulomb force for atomic nuclei smaller than iron and nickel, building up these nuclei from lighter nuclei by fusion releases the extra energy from the net attraction of these particles.

For larger nuclei, however, no energy is released, since the nuclear force is short-range and cannot continue to act across still larger atomic nuclei. Thus, energy is no longer released when such nuclei are made by fusion (instead, energy is absorbed in such processes).

Fusion reactions of light elements power the stars and produce virtually all elements in a process called nucleosynthesis.

The fusion of lighter elements in stars releases energy (and the mass that always accompanies it).

For example, in the fusion of two hydrogen nuclei to form helium, seven-tenths of 1 percent of the mass is carried away from the system in the form of kinetic energy or other forms of energy (such as electromagnetic radiation). However, the production of elements heavier than iron absorbs energy.

Research into controlled fusion, with the aim of producing fusion power for the production of electricity, has been conducted for over 60 years. It has been accompanied by extreme scientific and technological difficulties, but has resulted in progress.

At present, controlled fusion reactions have been unable to produce break-even (self-sustaining) controlled fusion reactions.

Workable designs for a reactor that theoretically will deliver ten times more fusion energy than the amount needed to heat up plasma to required temperatures (see ITER) were originally scheduled to be operational in 2018, however this has been delayed and a new date has not been stated.

It takes considerable energy to force nuclei to fuse, even those of the lightest element, hydrogen.

This is because all nuclei have a positive charge (due to their protons), and as like charges repel, nuclei strongly resist being put too close together.

Accelerated to high speeds (that is, heated to thermonuclear temperatures), they can overcome this electrostatic repulsion and get close enough for the attractive nuclear force to be sufficiently strong to achieve fusion.

The fusion of lighter nuclei, which creates a heavier nucleus and often a free neutron or proton, generally releases more energy than it takes to force the nuclei together; this is an exothermic process that can produce self-sustaining reactions.

The US National Ignition Facility, which uses laser-driven inertial confinement fusion, is thought to be capable of break-even fusion.

Energy released in most nuclear reactions is much larger than in chemical reactions, because the binding energy that holds a nucleus together is far greater than the energy that holds electrons to a nucleus.

For example, the ionization energy gained by adding an electron to a hydrogen nucleus is 13.6 eV—less than one-millionth of the 17 MeV released in the deuterium–tritium (D–T) reaction shown in the diagram to the right.

Fusion reactions have an energy density many times greater than nuclear fission; the reactions produce far greater energies per unit of mass even though individual fission reactions are generally much more energetic than individual fusion ones, which are themselves millions of times more energetic than chemical reactions.

Only direct conversion of mass into energy, such as that caused by the annihilation collision of matter

and antimatter, is more energetic per unit of mass than nuclear fusion.

A substantial energy barrier of electrostatic forces must be overcome before fusion can occur. At large distances two naked nuclei repel one another because of the repulsive electrostatic force between their positively charged protons.

If two nuclei can be brought close enough together, however, the electrostatic repulsion can be overcome by the attractive nuclear force, which is stronger at close distances.

When a nucleon such as a proton or neutron is added to a nucleus, the nuclear force attracts it to other nucleons, but primarily to its immediate neighbours due to the short range of the force.

The nucleons in the interior of a nucleus have more neighboring nucleons than those on the surface.

Since smaller nuclei have a larger surface area-to-volume ratio, the binding energy per nucleon due to the nuclear force generally increases with the size of the nucleus but approaches a limiting value corresponding to that of a nucleus with a diameter of about four nucleons.

It is important to keep in mind that the above picture is a toy model because nucleons are quantum objects, and so, for example, since two neutrons in a nucleus are identical to each other, distinguishing one from the other, such as which one is in the interior and which is on the surface, is in fact meaningless, and the inclusion of quantum mechanics is necessary for proper calculations.

The electrostatic force, on the other hand, is an inverse-square force, so a proton added to a nucleus will feel an electrostatic repulsion from all the other protons in the nucleus.

The electrostatic energy per nucleon due to the electrostatic force thus increases without limit as nuclei get larger.

H-hour

With the help of powerful lasers one can create dense and highly ionized plasma. We need highly ionized dense plasma to achieve nuclear fusion (cold or hot) [13]. Since 1989, it talks about achieving nuclear fusion hot and cold. Another two decades have passed and humanity still does not benefit from nuclear fusion energy.

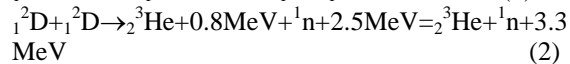
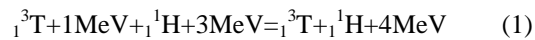
What actually happens? Is it an unattainable myth? It was also circulated by the media that has been achieved nuclear fusion heat. Since 1989 there are all sorts of scientists with all kinds of crafted devices, which declare that they can produce nuclear power obtained by cold fusion (using cold plasma).

Maybe that these devices work, but their yield is probably too small, or at an enlarged scale these give not the expected results. This is the real reason why we can't use yet the survival fuel (the deuterium). Unfortunately today the dominant processes that produce energy are combustion (reaction) chemical combination of carbon with oxygen. Thermal energy

released from such reactions is conventionally valued at about 7000 calories per gram.

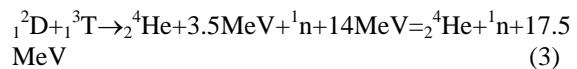
Only the early 20th century physicists have succeeded in producing, other energy than by traditional methods. Energy release per unit mass was enormous compared with that obtained by conventional procedures. The Kilowatt based on nuclear fission of uranium nuclei has today a significant share in global energy balance. Unfortunately, the nuclear power plants burn the fuel uranium, already considered conventional and on extinct. The current nuclear power is considered a transition way, to the energy thermonuclear, based on fusion of light nuclei. The main particularity of synthesis reaction (fusion) is the high prevalence of the used fuel (primary), deuterium. It can be obtained relatively simply from ordinary water.

Deuterium was extracted from water for the first time by Harold Urey in 1931. Even at that time, small linear electrostatic accelerators have indicated that D-D reaction (fusion of two deuterium nuclei) is exothermic. Today we know that not only the first isotope of hydrogen (deuterium) produces fusion energy, but and the second (heavy) isotope of hydrogen (tritium) can produce energy by nuclear fusion. The first reaction is possible between two nuclei of deuterium, from which can be obtained either a tritium nucleus plus a proton and energy, or an isotope of helium with a neutron and energy (1-2).

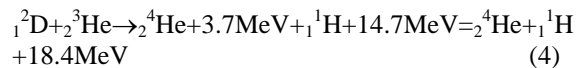


Observations: a deuterium nucleus has a proton and a neutron; a tritium nucleus has a proton and two neutrons.

Fusion can occur between a nucleus of deuterium and one of tritium (3).



Another fusion reaction can be produced between a nucleus of deuterium and an isotope of helium (4).



For these reactions to occur, should that the deuterium nuclei have enough kinetic energy to overcome the electrostatic forces of rejection due to the positive tasks of protons in the nuclei. For deuterium, for average kinetic energy are required tens of keV. For 1 keV are needed about 10 million degrees temperature. For this reason hot fusion requires a temperature of hundreds of millions of degrees.

The huge temperature is done with high power lasers acting hot plasma. Electromagnetic fields are arranged so that it can maintain hot plasma. The best results were obtained with the Tokamak-type installations.

ITER: the world's largest Tokamak

ITER is based on the 'tokamak' concept of magnetic confinement, in which the plasma is contained in a doughnut-shaped vacuum vessel. The fuel—a mixture of deuterium and tritium, two isotopes of hydrogen—is heated to temperatures in excess of 150 million°C, forming a hot plasma. Strong magnetic fields are used to keep the plasma away from the walls; these are produced by superconducting coils surrounding the vessel, and by an electrical current driven through the plasma. Deuterium fuel is delivered in heavy water, D₂O. Tritium is obtained in the laboratory by the following reaction (5).



Lithium, the third element in Mendeleev's table, is found in nature in sufficient quantities. The accelerated neutrons which produce the last presented reaction with lithium, appear from the second and the third presented reaction. Raw materials for fusion are deuterium and lithium. All fusion reactions shown produce finally energy and He. He is a (gas) inert element. Because of this, fusion reaction is clean, and far superior to nuclear fission.

Hot fusion works with very high temperatures. In cold fusion, it must accelerate the deuterium nucleus, in linear or circular accelerators. Final energy of accelerated deuterium nuclei should be well calibrated for a positive final yield of fusion reactions (more mergers, than fission). Electromagnetic fields which maintain the plasma (cold and especially the warm), should be and constrictors (especially at cold fusion), for to press, and more close together the nuclei.

The potential energy with that two particles reject each other, can be approximately calculated with the following relationship (6).

$$U = E_p = q_1q_2 / (4\pi\epsilon_0d_{12}) = (1.602E^{-19})^2 / (4\pi \times 8.8541853E^{-12} \times 3.653771E^{-15}) = 5.7664E^{-14} \text{ [J]} = 5.7664E^{-14} \times 6.242E^{18} \text{ [eV]} = 3.599E^5 \text{ [eV]} = 360 \text{ [keV]} \quad (6)$$

At a keV is necessary a temperature of 10 million °C. At 360 keV is necessary a temperature of 3600 million °C. In hot fusion it need a temperature of 3600 million degrees (see the relation 9). Without a minimum of 3000-4000 million degrees we can't make the hot fusion reaction, to obtain the nuclear power. Today we have just 150 million degrees made.

To replace the lack of necessary temperature, it uses various tricks. In cold fusion one must accelerate the deuterium nuclei at an energy of 360 [keV], and then collide them with the cold fusion fuel (heavy water and lithium).

Cold Nuclear Fusion

Because obtaining the necessary huge temperature for hot fusion is still difficult, it is time to focus us on cold nuclear fusion [13]. We need to bomb the fuel with accelerated deuterium nuclei. The fuel will be made from heavy water and lithium. The optimal proportion of lithium will be tested. It would be preferable to keep fuel in the plasma state. Between deuterium and tritium the smallest radius is the radius of deuterium nucleus (7).

$$\begin{aligned} \text{Deuterium } A=2 \quad A^{1/3} &= 1.259921 \rightarrow \\ R_D &= 1.8268855223476E^{-15} \text{ [m]} \\ \text{Tritium } A=3 \quad A^{1/3} &= 1.44224957 \rightarrow \\ R_T &= 2.0912618769457E^{-15} \text{ [m]} \end{aligned} \quad (7)$$

We calculate the minimum distance between two particles which meet together. This is just the diameter of a deuterium nucleus, d_{12D} (8).

$$d_{12D} = 2R_D = 2 \times 1.8268855223476E^{-15} \text{ [m]} = 3.6537710446952E^{-15} \text{ [m]} = 3.653771E^{-15} \text{ [m]} \quad (8)$$

The deuterium nuclei which will bomb the nuclear fuel, will be accelerated with the (least) energy which reject the two neighboring deuterium nuclei (see the below relationship, 9).

$$\begin{aligned} U = E_p = q_1q_2 / (4\pi\epsilon_0d_{12}) &= (1.602E^{-19})^2 / (4\pi \times 8.8541853E^{-12} \times \\ &\times 3.653771E^{-15}) = 6.3128464855E^{-14} \text{ [J]} = 6.3128464855E^{-14} \\ &\times 6.242E^{18} \text{ [eV]} = 3.94E^5 \text{ [eV]} = 3.94E^2 \text{ [keV]} = 394 \text{ [keV]} \end{aligned} \quad (9)$$

IV.8. Solar Greenhouse to Produce Food and Electricity

Imagine a greenhouse that is producing solar power and food too. This excellent experiment is being done in Italy. The companies responsible for this project are Renewable energy company Solar ReFeel, CeRSAA and solar panel manufacturer Solyndra. The test site has been constructed at CeRSAA's Albenga, Italy.

The project intends to attain the production of both food and electricity. The research team also wants to validate the crop growth benefits of Solyndra's technology by taking help of independent testing by a leading agricultural research institution [14].

(From <http://www.alternative-energy-news.info/solar-greenhouse-food-electricity/>)

IV.9. Hydrogen Gas Production Doubled with New

Super Bacterium

Hydrogen gas is today used primarily for manufacturing chemicals, but a bright future is predicted for it as a vehicle fuel in combination with fuel cells. In order to produce hydrogen gas in a way that is climate neutral, bacteria are added to forestry or household waste, using a method similar to biogas production. One problem with this production method is that hydrogen exchange is low, i.e. the raw materials generate little hydrogen gas. Now, for the first time, researchers have studied a newly discovered bacterium that produces twice as much hydrogen gas as the bacteria currently used. The results show how, when and why the bacterium can perform its excellent work and increase the possibilities of competitive biological production of hydrogen gas [15].

IV.10. Splitting Water in to Hydrogen and Oxygen

We often want to imitate nature for near perfect results. But sometimes it just remains a desire. In its quest for green and clean energy mankind is searching for that magical method that can split water into hydrogen and oxygen. Nature performs this task wonderfully through the process of photosynthesis. Man is still facing challenges in duplicating that process in the laboratory. If we are able to split water into oxygen and hydrogen in the presence of sunlight we will be able to harness the potential of hydrogen as a clean and green fuel. Till date man-made systems are quite inefficient, time consuming, money consuming and often require additional use of chemical agents [16].

IV.11. Capturing Concentrated Energy Near the Source and Forwarding Directly to Earth in Concentrated Form

Should start some spatial projects, to capture a large amount of energy somewhere near the source (near the Sun), energy which can be sent then to the Earth in a concentrated form (LASER, MASER, IRASER, etc). The enormous energy emanating from the sun is spreading in all directions of the universe, and dilute with the distance. On Earth no longer reach than a small amount from the energy emanated by the sun. We try here (on the Earth) to capture a drop from a very small amount of energy, who came from Sun. And we also complain that the yield is low, and technological costs are high.

A large amount of energy is transmitted to long distances with low losses, naturally, because is emitted by a sun (a star) in concentrated form, with natural lasers. This is exactly what should we do. This sun strange and extremely rare in Universe, shows us what must we do. Our sun's energy is diluted when the distance from sun grows. The third halo surrounds the planets Mercury and Venus, and barely touching the Earth.

The fourth sun's halo (the most pale from those which are visible with the naked eye) reach Jupiter.

Mercury is hot, and Saturn is cold. Installations which must do capturing the solar energy, could be installed over the Mercury. From the Mercury, the concentrated energy will be transmitted directly focused on the Moon. On the Moon, the energy will be conserved and forwarded to Earth in doses non-hazardous (with lower concentrations), using multi-channels microwaves.

V. Final Conclusions

Renewable energy is energy which comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished). In 2008, about 19% of global final energy consumption came from renewables, with 13% coming from traditional biomass, which is mainly used for heating, and 3.2% from hydroelectricity.

New renewables (small hydro, modern biomass, wind, solar, geothermal, and biofuels) accounted for another 2.7% and are growing very rapidly. The share of renewables in electricity generation is around 18%, with 15% of global electricity coming from hydroelectricity and 3% from new renewables. This paper aims to disseminate new methods of obtaining energy.

After 1950, began to appear nuclear fission plants. The fission energy was a necessary evil. In this mode it stretched the oil life, avoiding an energy crisis. Even so, the energy obtained from oil represents about 66% of all energy used. At this rate of use of oil, it will be consumed in about 40 years. Today, the production of energy obtained by nuclear fusion is not yet perfect prepared. But time passes quickly. We must rush to implement of the additional sources of energy already known, but and find new energy sources. In these circumstances this work comes to proposing possible new energy sources.

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