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The Future May be Better than You Think

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***Abstract*-- Cold fusion researchers are prone to be unduly pessimistic about the potential for cold fusion. They know too much; they are too close to the problem. They may also have unexamined assumptions. Researchers feel put-upon because of political opposition. The LENR-CANR.org website log file proves there is a great deal of interest in this field. There is broad, untapped, latent support for it. The log shows that every week scientists and engineers download thousands of papers on cold fusion.**

INTRODUCTION

Cold fusion is even more promising than many researchers realize. Many researchers fail to see, for example, that not only will it reduce the cost of energy; it will also reduce the cost of machines such as generators and water heaters. Researchers are also unaware that there is widespread interest in cold fusion.

The prospects for revolutionary technology based on cold fusion are described in my book, *Cold Fusion and the Future*. [1] The book is a compilation of essays I wrote, many co-authored by Eugene Mallove. It is the result of conversations I had with many people especially Mallove, Arthur C. Clarke and Martin Fleischmann. I should also give credit to Edmund Storms, John O'M. Bockris, David Nagel, Adm. Sir Anthony Griffin, Tom Passel, Tadahiko Mizuno, Christopher Tinsley and others listed in the footnotes. Many of these ideas came from Arthur Clarke's masterpiece, *Profiles of the Future*. [2] In the final edition of 1999, Clarke added several pages about cold fusion. [3]

EXPERTS TEND TO OVERESTIMATE THE DIFFICULTIES

Researchers tend to be overly pessimistic about the future prospects for cold fusion *because they are experts*. They know too much about the problems. Some have not given much thought to the potential advantages. They know how difficult the research is. They know there is powerful political opposition to it. They find it hard to envision a world in which everyone agrees cold fusion is real and the opposition vanishes.

Researchers are discouraged mainly because the effect is so hard to replicate and it seems to defy explanation. They have made great efforts, yet progress has been slow. In the book I envision a world with millions of ultra-reliable cold fusion devices, everything from pacemaker batteries to blast furnaces. I predict that not only will this drastically reduce the cost of energy; it will spur the development of countless revolutionary machines such as food factories; small autonomous robots that go around killing invasive insects; supersonic VTOL aircraft; desalination megaprojects that convert deserts into farmland, and many other marvels. I also predict it may give rise to some nightmare inventions that I hope can be prevented.

I ignore the technical difficulties. It is understandable that researchers who struggle to make an experiment work at milliwatt levels feel I am overdoing it. They think I am promising too much. I realize this is a leap comparable to the difference between the Curie's warm radium in 1898 and the first commercial fission reactor in 1956. I make this leap because I believe that any phenomenon that can be detected in the laboratory can, in principle, be understood, controlled and scaled up. Naturally, this will take more funding than we now have. It will take hard work and a measure of good luck. But it can be done.

My predictions are predicated on the many intrinsic advantages of cold fusion, shown in Table 1. There are so many advantages we lose track of them. We forget how promising this is. It is no wonder some skeptics feel cold fusion is too good to be true. It appears to be flexible, scalable, clean, safe, easy to use, with no emissions. It is millions of times more energy dense than chemical fuel. It is available nonstop, unlike solar or wind. The fuel is available in unlimited amounts; enough to vaporize the whole planet Earth. The nickel hydride version is even better: materials, manufacturing, distribution, maintenance and disposal appear to be inexpensive and safe. Cold fusion has many of these wonderful attributes already, even at this primitive stage of development. If researchers can learn to control the reaction, it will become the ideal source of energy.

TABLE I

INTRINSIC ADVANTAGES OF COLD FUSION

Intrinsic Advantages of Cold Fusion

- Flexible, scalable, clean, safe, easy to use, with no emissions.
- Compact; power density is high.
- Energy density millions of times greater than chemical fuel.
- Can be located anywhere: inside a building, underwater, implanted in body, in outer space.
- Available nonstop, unlike solar or wind.
- Fuel is inexhaustible.
- Fuel costs virtually nothing.

Nickel-hydride cells have additional advantages

- Ni catalyst is cheap and available in unlimited amounts.
- Materials, manufacturing, distribution, maintenance, disposal all appear to be inexpensive and safe.
- Rossi cells made with simple copper pipes; precision manufacturing or clean rooms apparently not needed.

These advantages are so obvious that if they become generally known, corporations will make frantic efforts to understand and control the reaction. They will launch crash projects. Nothing motivates people more than the prospect of making billions of dollars.

Researchers today are used to working on a shoestring. They should understand that if it becomes generally known this phenomenon is real, this field could soon be funded at the levels now spent on semiconductor R&D: $48 billion per year. [4] That comes to $132 million a day, which is more money than all of the funding for cold fusion in the last 23 years. Thousands of people in corporations, national laboratories and universities will be frantically working on this. A conference on cold fusion may resemble a major electronics trade show, such as the International CES, with thousands of exhibits and 150,000 attendees. [5] Many of the researchers who enter the field in a hurry will contribute little. But some will be smart, and some will be lucky. Progress will be far swifter than it has been up until now.

A Niagara Falls of money does not ensure progress, but it does ensure that if progress can be made, it will be made.

RESEARCHERS OVERESTIMATE THE TIMESCALE

Let us consider a major difference of opinion, where some researchers think I am wildly optimistic. How long will it be before most cars use cold fusion? Andrea Rossi predicts 60 years. James Dunn estimates 40 years. I predict only 20 years, as shown in the timeline in Fig. 1.

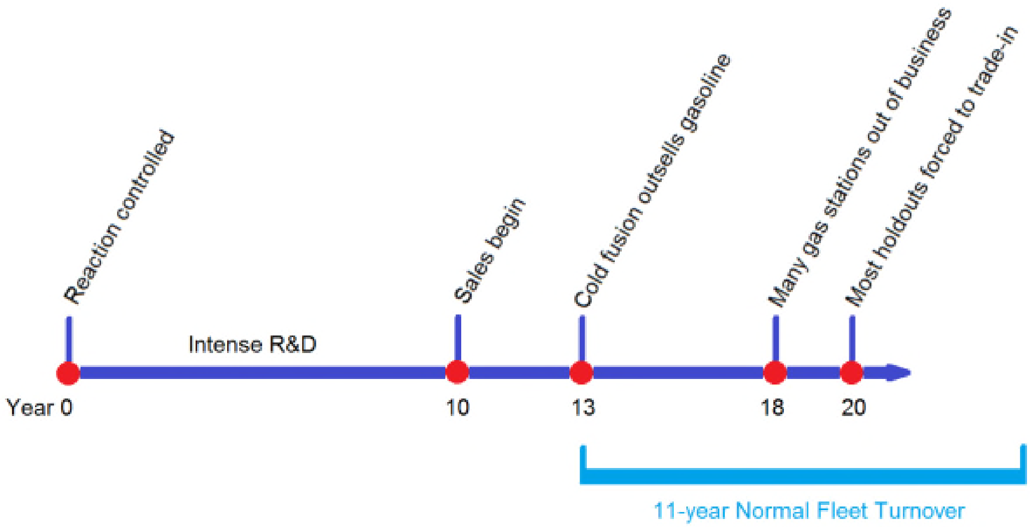

Fig. 1. Timeline showing my estimate of how long it will take before most cars use cold fusion.

This timeline begins on the day researchers learn to control the reaction. It is impossible to know when that day will come. We cannot be sure it will come, but assuming it does, the events that follow are easier to predict. Starting that day, it will take roughly 10 years to develop and begin manufacturing cold fusion cars. This is how long it took Toyota to develop the Prius. No doubt a cold fusion car is more difficult to design than a hybrid. On the other hand there will be more pressure on Toyota and the other manufacturers to work quickly. They will know this is a fight for survival. No company can afford to be three years late going into this market.

The first cold fusion vehicles will be far more expensive than conventional ones. Hopefully, in a few years competition will drive down the cost. The premium for hybrids fell rapidly after Honda, Toyota and others began competing.

I predict that a few years after sales begin most people will select the cold fusion model. Gasoline car sales will languish. In the timeline I show this happening only three years after the introduction of cold fusion cars. Dunn predicts it will happen much later, perhaps 15 years after sales begin. This is why he thinks the overall transition will take 40 years.

I think cold fusion sales will soon overtake gasoline for several reasons:

- Even at this early stage the premium for cold fusion cars will be small thanks to competition. They may soon become *cheaper than gasoline cars*, mainly because with cold fusion efficiency does not matter. You can trade off efficiency for a lower cost, for example by using cheap, heavier steel instead of light, expensive alloys. The cars will be inherently inexpensive to manufacture.
- Cold fusion cars will have enormous consumer appeal, mainly because the fuel cost is zero, but also because they will be simpler, more reliable, easier to maintain, and nonpolluting. They will be safer in accidents because they will not have flammable gasoline.
- Cold fusion heaters and generators are likely to be introduced during the 10-year period cars are being rushed to development. People will be used to the idea of cold fusion. They will see that it works, and that it is safe. This will generate pent-up demand for cold fusion cars. Especially among people who use a lot of gas, such as taxi drivers and people who use large pickup trucks to haul heavy loads every day. These people will be the first to buy cold fusion vehicles, so gasoline consumption will fall even faster than gasoline car sales.
- Dunn points to the small market share of Prius as evidence that cold fusion cars may have limited appeal. The Prius is only one model (a midsized hatchback) whereas I expect that manufacturers will quickly introduce a full range of cold fusion vehicles, from small cars to SUVs and trucks.

I expect that trying to sell gasoline cars in this market, at this stage, would be like trying to sell typewriters in 1985, after people realized how much better personal computers are.

Assuming I am right, the pace of change will pick up a few years after cold fusion begins to outsell gasoline. It will increase with positive feedback, because –

1. As shown in the timeline, normal fleet turnover is 11 years. With or without cold fusion, after 11 years most cars wear out.
2. During the 1970s oil shock, many gas stations went out of business. Their profit margins are thin. A 10% to 15% sales drop will knock many of them out of business.

Assume that people replace cars at the normal rate, without spending extra money. Five years after the tide turns, 20 to 30% of gasoline cars will be gone. Gasoline consumption will fall even more because, as noted above, cars that consume a lot of gasoline will be first to go. Gas stations will have lost roughly half their revenue. They will be going out of business in droves. In a dying industry, the number of retail outlets tends to fall even faster than sales do. Owners see the writing on the wall and they get out quickly.

At this stage, a person living in a city will have to drive miles to find a gas station every time he wants to fill up. A person driving on the Interstate in the middle of nowhere may find there are no gas stations left in business. He will run out of gas. When you take your gasoline car in for service, a young mechanic will say: “Gee, I have never worked on one of those. I wonder if we still have parts?” Maintaining obsolete technology is a nuisance. A reader who doubts this should try getting a film camera repaired. The holdouts still driving gasoline cars will soon be forced to trade them in. People who normally hang on to cars for 11 years will be forced to trade-in a few years ahead of schedule.

This is not to suggest that every single gasoline car on the road will be gone after only 20 years. They will be rare, the way horses on the roads were in the 1930s.

My conclusion: A changeover forced by obsolete technology tends to accelerate in the last stages.

This is one of the general rules described in the book. It will apply not only to automobiles but to other machines enhanced by cold fusion. That includes nearly every machine.

UNEXAMINED ASSUMPTIONS

People say we cannot afford to replace all of the vehicles on the road, or all of the water heaters in our houses. They forget that we replace all this equipment anyway, because it wears out. These are unexamined assumptions. Kleehaus and Eisner recently described the cost of new cold fusion water heaters as an investment that a family might make to save money, with a certain rate of return (ROI). [6] They forget that people must buy water heaters because they need hot water, and water heaters must be replaced every 15 to 20 years as they wear out. Cold fusion heaters will indeed save money but that is not why people will buy them. People will not spend any more on hot water heaters with cold fusion than they did previously with gas or electric heaters. In that sense there is no “investment” and no extra outlay of money, or burden on the consumer.

Here are some other unexamined assumptions I have heard from cold fusion researchers recently:

We will still need oil to run the equipment needed to mine palladium or nickel. People often say this, for some reason. It is not true. Mining equipment will also run on cold fusion.

We will still need oil for plastic feedstock. I doubt this. I predict it will be cheaper, faster and safer to synthesize hydrocarbons on site with cold fusion energy.

If it takes 10 minutes for a reactor to reach operating temperature, you cannot use it in a car because no one wants to wait that long before driving. This will not be a problem. The car will be a series electric hybrid, similar to the GM Volt. It will have a battery large enough to drive the car at least 10 minutes at top speed on battery power alone. After the car is parked, the cold fusion primary engine may continue to run for a while until the battery is fully charged again.

Cold fusion may not scale up. It has already been scaled up to commercially useful levels. That is, to 100 W by Fleischmann and Pons, and reportedly much more by Rossi and Defkalion.

The last and most interesting assumption is that *cold fusion will only reduce the cost of electricity, transportation, or space heating by the cost of fuel*. That is to say: if you spend $100 a month heating your house with natural gas, you will save $100 but the gas heater itself will not be cheaper. That is wrong. When the core technology in a machine improves dramatically, it often forces the rest of the machine to improve. That is why cold fusion will have a gigantic impact.

By “core technology” I mean the device that makes it possible to build the machine in the first place; the heart of the machine. In an automobile that is the internal combustion engine. In a mainframe computer it is the CPU. In a desktop computer it is the microprocessor. When the microprocessor drastically reduced the cost of computation, this in turn pushed down the price of everything else in the computer system. It created a mass market for peripherals such as screens, printers and especially hard disks. Then it went on to lower the cost of cell phones, photography and countless other things.

Cold fusion will lower the cost of electricity not only by eliminating the cost of fuel, but also by radically transforming the generator technology. It may spur the development of cheap, reliable thermoelectric devices. Or, if that proves to be a dead-end, some other type of cheap, simple generator will be discovered. When you spend $132 million a day, things get discovered.

Cold fusion will simplify the design of water heaters, and make them safer. It will lower the total cost of ownership: hardware, installation and maintenance. You dispense with the high voltage electric circuit or the gas pipeline and chimney. You do not need hot water pipes because these will probably be tankless heaters, like the ones common in Japan. You put one in the kitchen and another in the bathroom. They are mounted on the wall or under the sink. They last for decades. Installation is simple compared to a conventional U.S. water heater. Tankless heaters are not popular in the U.S. because of technical problems such as our use of 120 VAC. Cold fusion will make these problems go away.

Cold fusion will begin by expanding the market for conventional energy uses such as hot water, space heating, cooking and process heat. Then designers will realize they can do many new things with it. The Brave New World I described will be upon us. The deserts will bloom. I hope it will be more utopia than dystopia, but you never know. People can turn any blessing into a curse.

THE OPPOSITION TO COLD FUSION, AND LATENT SUPPORT FOR IT

Political opposition is another reason researchers feel discouraged. There is tremendous opposition. It is one part academic politics and two parts human nature. Martin Fleischmann said, “People do not want progress. It makes them uncomfortable. They don’t want it, and they shan’t have it.” [7]

On the other side of the debate, Francis Slakey, the Science Policy Administrator of the American Physical Society (APS), wrote in the *New Scientist* that cold fusion researchers are: “a cult of fervent half-wits.” He went on to say: “While every result and conclusion they publish meets with overwhelming scientific evidence to the contrary, they resolutely pursue their illusion of fusing hydrogen in a mason jar. . .” [8] I have encountered many people like Slakey. It is my impression they mean what they say. They are sincere.

This is a horrible situation. It is no wonder researchers doubt that funding will soon arrive, and utopia is just around the corner. However, there is reason to hope. Behind the scenes, things are better than they seem. I can tell because I am the webmaster at LENR-CANR.org.

When you access a website, everything you do is recorded in the log file of the site you are visiting. [9] The log record does not list you as an individual, but it does show what Internet Service Provider (ISP) you come from. When you access from home using a major ISP, the person at the remote website knows only that you came from a commercial ISP in a certain city (such as AT&T in Atlanta). When you access from an institution such as a university or bank, the log record often indicates which institution you came from. It also shows the date and time, the name of the screens you looked at, documents you downloaded and so on.

If the network technicians at an investment bank wish to, they can set up their computers to browse incognito. But at most universities, corporations, and other institutions they make no effort to cover their tracks. So, as webmaster, I can tell where our professional audience comes from, and what papers they are interested in.

TABLE II
VISITS TO LENR-CANR.ORG IN 2006

A look at visits to LENR-CANR.org in 2006
In the first 9 months of 2006 visitors came from over 12,000 ISPs in 42 countries. Examples: • 4,000 visits from 3,700 colleges and university departments (.edu) • 660 from about 150 U.S. military (.mil) sites at the Army Research Lab, the NRL, and so on. • 241 visits from 89 National Lab divisions, mainly at LANL, ANL, SGONE, PNL, ORNL. • Government institutions in China, Canada, and the U.S.; several U.S. State Environmental Protection Agencies. • Defense Ministries of Australia, France, Canada, most other major nations; defense research establishments worldwide. • Hundreds of corporations, investment firms and banks.

Table 2 shows a study of visitors for the first 9 months of 2006. Visitors came from more than 12,000 ISPs in 42 countries. They included people from many universities, military sites, national laboratories, and hundreds of corporations, investment firms and banks. This trend has continued.

Institutional visitors make about 10% of visits, but they download half to two-thirds of the papers; more in winter when universities are in session. I can estimate how many papers are downloaded by professionals and how many by the general public, using various methods. In Fig. 2 I did this by looking at the distribution of downloads over 1 year, from June 2011 to May 2012. During this period, 892 different papers were downloaded 401,196 times. The most popular paper was downloaded 7,224 times. Item number 40 was downloaded 1,007 times. Items 41 through 892 were less popular, and were downloaded fewer than 1,000 times each, in a "long-tail" distribution. The less popular papers were downloaded 303,907 times, which is 76% of total downloads. Most of them are highly technical. Most people reading them come from professional organizations.

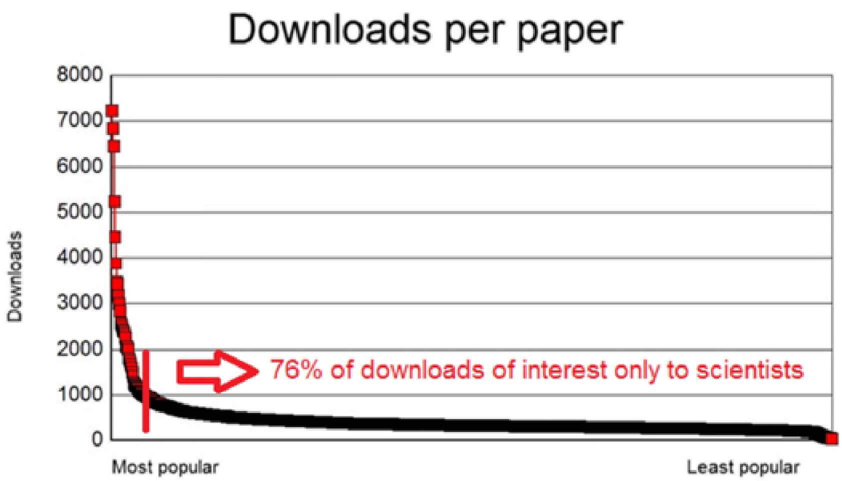

Fig. 2. Downloads per paper from June 2011 through May 2012.

In 2012 so far, readers have been downloading 9,700 papers per week on average. Since we began in 2002, readers have downloaded 2.4 million papers. Scientists and engineers worldwide know more about cold fusion than they let on. There is a great deal of interest in this research. There is goodwill, and latent support.

LENR-CANR.org lets researchers bypass the mass media, and the scientific journals. APS officials publish outlandish accusations in the *New Scientist*. Wikipedia is filled with misinformation about cold fusion. The public sees only misinformation, and knows nothing else. But week after week, scientists worldwide continue to download thousands of original source papers about cold fusion. LENR-CANR.org gives researchers direct, unfiltered access to their colleagues.

LENR-CANR.org is a library, not a journal. We do not review, judge or reject papers. We do not take sides in disputes. We publish no editorials, and no blogs.

If Rossi, Defkalion, Celani or someone else does a convincing demonstration of a commercial-scale device, they should provide us third-party data verifying this. During the August 2012 NIWeek conference and the ICCF17 conference following it, Celani demonstrated a nickel hydride reactor that apparently produced between 14 and 21 W of heat for four days. Celani announced that he plans to try to run this reactor in self-sustaining mode soon. Ideally, he should provide LENR-CANR.org with data from a self-sustaining reaction. This could make a large impact on public opinion. Within months after we upload this data, hundreds of thousands of professional scientists and investors will read it. These people are friends of cold fusion. Cold fusion researchers will be believed. They will be funded, and this research will finally triumph.

References

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[2] Clarke, A.C., *Profiles of the Future.* 1963: Harper & Row.

[3] Clarke, A.C., *Profiles of the Future, Millennium Edition.* 1999: Indigo.

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[5] International CES electronics trade show, http://www.cesweb.org/

[6] Kleehaus, A. and C. Eisner. *Potential Economic Impact of LENR Technology in Energy Markets*. in *17th International Conference on Cold Fusion*. 2012. Daejeon, Korea. http://lenr-canr.org/acrobat/KleehausApotentiale.pdf

[7] Fleischmann said this in a conversation with me in October 1997.

[8] Slakey, F., *When the lights of reason go out - Francis Slakey ponders the faces of fantasy and New Age scientists*. *New Scientist*, 1993. 139(1890): p. 49.

[9] Apache HTTP Server Project, Log Files, http://httpd.apache.org/docs/current/logs.html