

Indicators of Interest in Low Energy Nuclear Reactions

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Hundreds of scientists, engineers and others have been working to advance the understanding, engineering and commercialization of LENR generators of heat and electricity since the Fleischmann and Pons announcement in 1989. That global community has established that it is possible to initiate nuclear reactions with chemical energies, and that energy gains of over 100 are possible. Now, it is seeking two basic changes. The most fundamental is the recognition that LENR is a legitimate area of scientific inquiry, which also has great practical promise. The second is financial support by governments, which is normally provided for study of such topics. In the U.S., many research subjects are heavily supported for their scientific value, even though they have little or no practical potential. One example is research by the National Science Foundation and its collaborators to develop capabilities to record gravity waves.¹ That effort has been funded by more than \$1100M.² The project has developed remarkably sensitive measurement capabilities, has indeed detected a gravity wave recently, and is significant scientifically. However, it does not have the near-term practical promise of LENR.

It seems incongruous to the LENR community that government support of LENR has not happened, again for two reasons. First, both the global population and the per capita use of energy are increasing. And, there are strong arguments for development of clean and distributed energy, which is free of radiation problems during and after operation, and also cost-effective. The reasons for this dichotomy between the promise of LENR and its appropriate funding are clear. The “scientific community” is viewed as the gate keeper in deciding what should be funded by governments. But, the community of recognized and relevant scientists has had, and still has, a pair of problems with LENR. Both are generally understandable. For one, a small cadre of vocal scientific leaders has declared that LENR is not worth funding. That group does not participate in the study of LENR. And, there is no evidence that it even stays abreast of developments. Such behavior might be due to some combination of unwillingness to spend time on LENR, attempts to maintain formerly good reputations, or personal financial interests. Further, the broader community of less influential scientists does not pay much attention to LENR, despite the field having many challenging questions.³

Most scientists seem to be busy with their own interests, and unwilling or unable to get into a new field. So, there is no pressure on funding agencies from such researchers.

Beyond the recalcitrant and uninformed scientific community, the general public has a great deal of information about LENR available to it on the internet. It is hard to quantify such interest. The number of hits on websites with articles on LENR would be a nice indicator of general interest, but such information is unavailable. Rothwell publishes the number of *downloads* of papers from the lenr.org website, as a function of month.⁴ That is a quantitative measure of interest in detailed information about LENR. However, it is likely that many, and maybe most, of the people who download articles are researchers and students, and not only the general public. Figure 1 gives Rothwell’s graphic for a dozen years. It shows that the average download rate has exceeded one per minute during a few months.

It is common to use the number of applications and patents granted per year as a measure of increasing activity in a developing field. Figure 2 presents such data from a recent review of LENR.⁵ As in Figure 1, there is a great deal of variation in the data. There is somewhat more activity in the last ten years than in the first ten years of the field. However, there is no clear trend indicating that LENR has “broken out.”

One measure of growing interest in LENR is the organization of academic programs for research and teaching of LENR. There were, and remain, significant efforts at many universities in at least seven countries involving a small

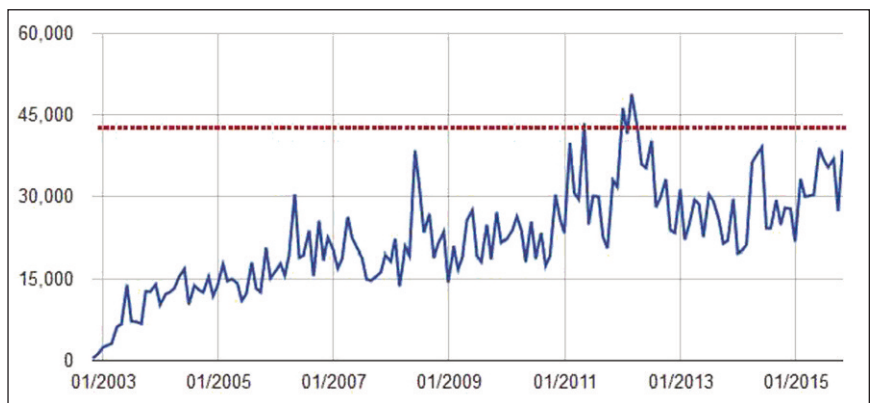


Figure 1. Plot of the number of downloads per month from the website lenr.org from the beginning of 2003 until the present. The horizontal dotted line gives the download rate of one per minute for a 30 day month. The average for the past six years is about 28K downloads per month (more than thirty per hour).

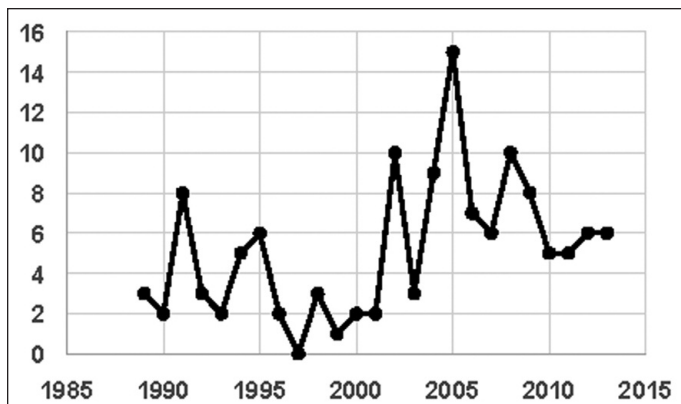


Figure 2. Plot of patent related actions, including applications and granted patents, for the years 1989 through 2013.

number of researchers. And, large university programs now exist. Three major university programs have been instituted in the past four years. They are mentioned briefly here, and detailed in two following summaries written by their leaders.

The Sidney Kimmel Institute for Nuclear Renaissance (SKINR) at the University of Missouri in Columbia, Missouri was organized in 2012. It was founded by Professor Robert Duncan, with Dr. Graham Hubler as the Scientific Director. The Center for Emerging Energy Sciences (CEES) was also set up by Professor Duncan, after he moved to Texas Tech University in Lubbock, Texas. It began in January of 2015. Like SKINR, CEES started as a research organization, with the option of working later on product development. An internal report stated that Texas Tech University sought “to establish a center which will initially bridge physics and chemistry in the scientific exploration for the origin of the Anomalous Heat Effect (AHE). Once the origin of the AHE is established, this center’s effort will shift toward energy engineering, with engagement with mechanical and electrical engineering.”⁶ The initial scientific report from CEES is available on the web.⁷ It describes early experimental results on characterization of electrolytic foils, and also lists planned experimental capabilities. The Condensed Matter Nuclear Reaction Division (CMNRD) was founded in April of 2015, when the clean energy company Clean Planet Inc. joined with Tohoku University in Sendai, Japan. It, too, is first a research organization, but the CMNRD aims to develop new technology for clean energy and innovative radioactive waste processing, in addition to enhancing the basic data and deepen the understanding of the CMNR mechanism.

Another measure of LENR activity is the increasing number of companies seeking to develop heat and electrical generators based on LENR. It is common practice for industries, old or new, to have Industrial Associations to support the common interests of their organizations and individuals. There are thousands of such associations, of which dozens are focused on energy production, transport, storage and utilization. However, none of them will represent the interests of the emerging LENR industry. Hence, in April of last year, Steven Katinsky and this author founded LENRIA.⁸ It is a not-for-profit company based in the U.S., but representing the interests of LENR companies and individuals globally. Initial activities and plans for LENRIA were described in a recent article in this magazine.⁹

Funding by private investors in LENR is an indicator that

is difficult to assess. There is no thorough compilation, partly because such funding is not always publically known. But, there are some available statements that show substantial recent interest. Brillouin Energy stated in November of last year that they have over \$9M of investment to date.¹⁰ Cherokee Investment Partners has reportedly funded Andrea Rossi with over \$10M.¹¹ Woodford Investment Management had made a “much larger investment” into Industrial Heat than Cherokee Investment Partners’ own \$10 million investment.¹² It is not known how much has been invested in companies in countries outside of the U.S. However, some such companies have substantial investments, as indicated by published photographs of their laboratories. One example is Nichenergy in Italy.¹³

LENR has not yet broken out of the unusual situation which has burdened and constrained it for over a quarter of a century. Hopes for real theoretical understanding have not materialized. Great efforts to design an experiment that is fully reproducibly, and also yields strong results, have not borne fruit. And, no LENR products are on the market yet. In short, LENR remains a research field having two contradictory characteristics: (a) significant global laboratory and other activity and (b) no recognition by the larger scientific community. The plots given in the two figures do not show great and relatively sudden increases in overall activity levels. They essentially provide baselines for what might be major increases in interest and activities, when LENR does shed its shackles to become legitimate science, as well as an area of increasing commercial interest.

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