BROOKHAVEN NATIONAL LABORATORY

Laboratory Link

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Scientific American *cover story of January 2008*

Energy Sciences Researchers Propose 'Solar Grand Plan' To Free U.S. From Foreign Oil and Slash Greenhouse Gases

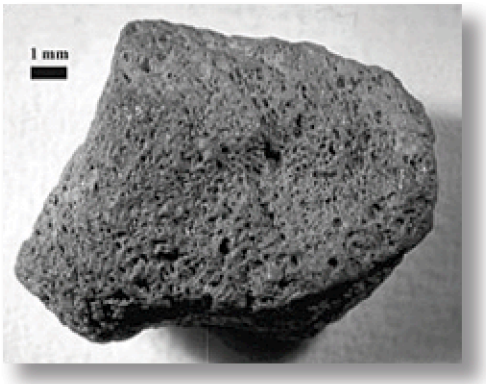
- The opening line of the cover story of the January 2008 Scientific American summarizes the current perception of many Long Islanders: "High prices for gasoline and home heating oil are here to stay."
- The article is "A Grand Plan for Solar Energy," written by Dr. Vasilis Fthenakis, who heads the National Photovoltaic (PV) Environmental Research Center at Brookhaven Lab, and two collaborators: Mr. Ken Zweibel of PrimeStar Solar, Golden, Colorado; and Dr. James E. Mason of the Hydrogen Research Institute in Farmingdale on Long Island.
- Supported by the U.S. Department of Energy since the 1980s, the PV Center at Brookhaven Lab is a national resource that identifies and finds solutions to potential environment, safety and health (ESH) issues associated with photovoltaics, or solar cells. By providing the most up-to-date information on ESH risks and on cost-effective ways to mitigate those risks, BNL's PV Center assists the U.S. photovoltaic industry, with the goals of ensuring safe and environmentally benign solar cell manufacturing and recycling, and, therefore, the economic viability of solar cells.
- In their plan, the three solar energy experts propose to cover thousands of square miles of the Southwest U.S. with photovoltaic arrays to convert sunlight into electricity, and to distribute this solar cell-produced electricity across the U.S.—which would put an end to foreign-oil dependence, reduce the trade deficit, cut air pollution, and slow global climate change.

- With oil now around $90-100 per barrel, solar power is no longer impractical, the authors say. Its time as an affordable and technically implementable solution is upon us — but only if the U.S. makes the commitment and the investment.
- As the authors note, "A massive switch from coal, oil, natural gas and nuclear power plants to solar power plants could supply 69 percent of the U.S.'s electricity and 35 percent of its total energy by 2050." For this to happen, however, the U.S. would have to invest $420 billion in subsidies over the next 40 years.
- But, as Dr. Fthenakis and his co-authors point out, while that seems like a lot of money, it is less than the federal government is spending for the U.S. farm price-support program. They propose one way of paying for government subsidy of solar power is through a half-cent per kilowatt hour carbon tax on coal.
- "Without subsidies, the solar grand plan is impossible," comment the authors. And, they point out, Japan and Germany have already concluded the same thing—and so those two countries are embarking on their own nationally supported solar energy programs.
- Dr. Fthenakis and his collaborators conclude: "The greatest obstacle to implementing a renewable U.S. energy system is not technology or money, however. It is the lack of public awareness that solar power is a practical alternative . . .. Once Americans realize that potential, we believe the desire for energy self-sufficiency and the need to reduce carbon dioxide emissions will prompt them to adopt a national solar plan."

Discover *magazine's 2007 year-in-science Top 100 list*

'Black' Diamond Research at BNL's Light Source Among *Discover*'s Top 100 Science Stories of 2007

- "Diamonds Are a Girl's Best Friend," or so it was proclaimed by Marilyn Monroe in the 1953 film *Gentlemen Prefer Blondes.* And the type of diamonds that most girls and women prefer are known for their pleasing shape and what are known as the "4 Cs" of diamond grading: cut, color, clarity, and carat weight.
- Composed of carbon subjected to the high pressure and temperatures within the Earth's mantle where they are made, gem-grade and industrial diamonds are brought to the surface by the eruption of volcanoes. In addition, very tiny, nano-sized diamonds have been found in other areas subjected to high-enough pressure at suitable temperatures—sites of where meteorites have hit Earth.
- Unbeknownst to most diamond gemstone-purchasers and wearers, however, there is another type of diamond — what is called carbonado, or "black diamond."
- As described in the January 2008 issue of *Discover* magazine, it is not known for its 4 Cs: "Pumice-like, dark, and exotic, carbonado diamonds don't look like the gemstones on engagement rings. That's because they may have been created by an exploding star and delivered to Earth by an asteroid billions of years ago."



A typical, black, 5.3-carat carbonado diamond

- As its cover story for that issue, *Discover* lists the top 100 science stories of 2007 — and ranking number 60 was the first complete study of the absorption spectra of black diamonds using infrared light, which was conducted at the National Synchrotron Light Source (NSLS) at Brookhaven Lab..
- At the NSLS, scientists from Case Western Reserve University and Florida International University analyzed the interaction of the NSLS's intense light with carbonados, which are only found in Brazil and the Central African Republic. In doing so, they confirmed something that has been long-suspected: that carbonados are extraterrestrial in origin.
- By studying samples of from both locations, the researchers found strong similarities among carbonados and the diamonds found in meteorites and diamond dust found in space.
- In addition, the NSLS-users found a lack of similarities between carbonados and Earth's mantle-created diamonds—dissimilarities that account for black diamonds' lack of the typical diamond's color and clarity.
- Based on this evidence, the researchers concluded in their original research paper, published in the *Astrophysical Journal,* that their NSLS-made findings "are consistent with an origin of carbonado diamonds in an interstellar environment."

SciAm Names Two BNL Discoveries Among the Top 50 of the Year 2007

Nanoscience made possible both* SciAm *50 discoveries

- As it has done since 2002, the popular science magazine *Scientific American* has come out with its annual SciAm 50 awards, which recognize the top 50 science and technology discoveries of the previous year. As announced in *Scientific American's* January 2008 issue, two discoveries made at Brookhaven Lab were named to SciAm's top 50 for 2007.
- BNL's two discoveries among SciAm's top 50 are:
  - the world's smallest pipette (see Lab Link, May & June 2007), which was developed by researchers Eli Sutter and Peter Sutter at BNL's Center for Functional Nanomaterials, which is the only Long Island facility dedicated to nanoscience research and development. There, resident and guest scientists are working on finding nanoscale-structured solutions to U.S. energy challenges.
  - an effective method to retain the catalytic ability of platinum within hydrogen fuel cells, which was developed by Radoslav Adzic of the Lab's Chemistry Department and his collaborators, who studied the improved catalyst at BNL's National Synchrotron Light Source.