Geothermal Energy's Future

I would like to comment on the Briefing of 22 November (p. 1113) concerning the outlook for geothermal energy in California. The Briefing's somewhat gloomy outlook is due largely to a confusion of the geothermal resource estimates made by the U.S. Geological Survey (USGS) in 1979 (contrary to the assertion in the Briefing, the 1979 inventory is the most recent USGS inventory) with the geothermal reserve estimates made by Ebasco Services in 1991. By definition, reserves represent only that fraction of the resource that can be exploited profitably with current technology. With an understanding of this difference, one can see that there is no actual conflict between the 1979 USGS study and the 1991 Ebasco report.

Although production at The Geysers has dropped significantly [to 1380 megawatts-electric (MWe) from the installed capacity of 2000 MWe], much of this drop can be attributed to overoptimism and overexploitation by the field developers. (The 1979 USGS study estimated a 1610 MWe capacity for The Geysers.) With new technological developments such as fluid injection, jointly researched by industry and government, it should be possible to recapture some of the lost generating capacity.

California's geology (and that in neighboring states) still promises an abundance of economical, environmentally acceptable geothermal energy. Supporting studies for the National Energy Strategy indicate that under reasonable assumptions approximately 11,000 MWe from hydrothermal resources can be on-line nationally by 2010, and 22,000 MWe by 2030. In addition, more advanced geothermal resources (hot dry rock, geopressed geothermal systems, and magma) can potentially play a significant role in satisfying America's long-term energy needs. Geothermal energy truly has a bright future in helping to satisfy America's energy needs.

John E. Mock
Geothermal Division, Conservation and Renewable Energy, Department of Energy, Washington, DC 20585

Response: Contrary to the comment by Mock, we find no methodological differences between the 1979 inventory by the U.S. Geological Survey (USGS) and the 1991 report by Ebasco Services, both of which estimate California's geothermal resources. According to Patrick Muffler of the USGS, who supervised the 1979 inventory, the terms "reserves" and "resources" were inconsistently applied in the Ebasco report, but the methods used were the same in the two studies. Muffler cannot vouch for the application of those methods in the "gloomy" Ebasco report, but finds it appropriate to directly compare the two studies.—Eds.

Bellcore Basic Research

Contrary to the impression created by the ScienceScope item "Bellcore basic researchers out of work" (10 Jan., p. 147), Bellcore is not "phasing out its basic research effort and closing down facilities." We have made a small reduction in the size of our effort in physical sciences and materials research and we are increasing our research in software and information technologies, but these changes are modest and do not involve the large-scale "retrenching" indicated in the ScienceScope piece. Only a handful of people were involved in our work with superconductivity, not the "20 to 25" mentioned in the ScienceScope piece. That is the number of all the affected people in physical sciences research. Several of our physical science researchers have been placed elsewhere in our research efforts, a few have chosen to retire, and ten have indicated they want to continue in their specific fields of research elsewhere.

The shifts we have made in our overall program, while significant to the individuals involved, are small and are the normal ones to be expected from time to time as technological progress is made. It should not be necessary to state that Bellcore intends to continue being a leader in those areas of research important to our owners and to the telecommunications industry, including materials and device research.

GEORGE H. HEILMEYER
President, Bellcore, 290 West Mt. Pleasant Avenue, Livingston, NJ 07039-0486

Fullerene Superconductivity and the Dynamic Jahn-Teller Effect

C. M. Varma et al. (Reports, 15 Nov., p. 989) attribute superconductivity in the fullerenes to electron-phonon coupling of $H_g$ vibrational modes of the component $C_{60}$ molecules induced by the dynamic Jahn-Teller effect of partially occupied degenerate $t_{2u}(p\pi)$ molecular orbitals. Superconductivity theory based on dynamic Jahn-Teller vibronic coupling of degenerate molecular orbitals was applied to organic superconductors in 1983 (1), to high-transition temperature oxides in 1987 (2), and to superconductive fullerenes in May 1991 (3). Indeed, dynamic Jahn-Teller coupling may provide a unifying quantum-chemical basis for high-transition temperature superconductivity in ceramics, organics, and fullerenes (4).

Experimental evidence for this mechanism in fullerene $C_{60}$ can be found in the unusual electron-spin-resonance spectrum (5), which shows temperature-dependent line width and highly shifted g value, well-established signatures of the dynamic Jahn-Teller effect (6). Raman spectra for superconductive fullerenes show only the lowest frequency $H_g$ vibrational mode (7), consistent with the dynamic Jahn-Teller scenario of (3). A recently reported carbon isotope shift exponent of $\alpha = 0.37 \pm 0.05$ for the transition temperature of superconducting $Rb_{x}C_{60}$ (8) is close to the value predicted from the dynamic Jahn-Teller mechanism in (3).

KEITH H. JOHNSON
Department of Materials Science, Massachusetts Institute of Technology, Cambridge, MA 02139
DENNIS P. CLOUGHVERY
Department of Physics, University of California, Santa Barbara, CA 93108
MICHAEL E. McHENRY
Department of Materials Science, Carnegie-Mellon University, Pittsburgh, PA 15213

REFERENCES

Response: We are happy to note that Johnson et al. have also thought of the intramolecular vibrations in metallic fullerenes as responsible for effective electron-electron attraction in the fullerenes. We would like to point out that there are essential differences between our results and theirs. (i) Johnson et al. consider the prob-

Response: We are happy to note that Johnson et al. have also thought of the intramolecular vibrations in metallic fullerenes as responsible for effective electron-electron attraction in the fullerenes. We would like to point out that there are essential differences between our results and theirs. (i) Johnson et al. consider the prob-
lems in terms of “real-space pairing,” where the
partners of a Cooper-pair reside on a
given ball. This requires Cooper-pair bind-
ing energy larger than the electronic band-
width. Superconductivity then occurs by the
coherent hopping of this pair from ball to
ball. Our calculations show that even
though the interactions are intramolecular,
superconductivity is of the conventional
BCS variety. (ii) Johnson et al. suggest that
low frequency vibrations with frequencies
of approximately 100 cm⁻¹ are responsible for
the pairing. Our calculations show that the
vibration modes with the dominant cou-
ping to electrons have frequencies over
1500 cm⁻¹. Finally, we do not believe that
the physics of superconductivity in the ful-
lerenes is relevant to the physics of high-
temperature superconductivity in the copper
oxide–based materials.

C. M. VARMA
J. ZAANEN
AT&T Bell Laboratories,
600 Mountain Avenue,
Murray Hill, NJ 07974-0636

Physical Activity and Cancer

A reduction of risk of sex hormone-
sensitive cancers in women in association
with regular physical activity, as suggested
in the review article by Brian Henderson et
al., “Toward the primary prevention of can-
cer” (22 Nov., p. 1131), has already been
documented (1). A study of more than 5000
American women college alumnae showed that
former college athletes had significantly
less breast cancer and cancers of the repro-
ductive system than their sedentary class-
mates (1). More than 80% of the former
athletes began their regular, moderate phys-
ical activity in high school or earlier, which
underscores the recommendation of Hen-
derson et al. that this lifestyle be adopted
early.

ROSE E. FRISCH
GRACE WYSZAK
Center for Population Studies,
Harvard School of Public Health,
9 Bow Street, Cambridge, MA 02138

TENLEY E. ALBRIGHT
Institute for Clinical Applications, Inc.,
126 Brookline Avenue,
Boston, MA 02215

NILE L. ALBRIGHT
Advanced Medical Research Foundation,
333 Longwood Avenue,
Boston, MA 02115

REFERENCES

20 MARCH 1992

NEW!

EndNote Plus
for the IBM PC
is shipping!
Upgrade
your old
Bibliographic
Software now!

Good News for DOS
and Windows users!

EndNote Plus on the PC is shipping! If you’re using Microsoft Word for Windows, Word-
Perfect, or WordPerfect for Windows, End-
Note Plus can save you hours of work! You
want to cite a paper? Simply switch to End-
Note Plus, select the reference and paste it
into any of these word processors! When you’re ready to submit your paper, select a
bibliographic style and EndNote Plus will for-
mot both the bibliography and the in-text
citations according to the selected style.

Why is EndNote Plus Better?
“It’s all in the details.”

Most bibliographic software packages in-
clude basic features like the ability to search
for references and output them in different
formats. But as one of our users told us
recently: “It’s all in the details.” The differ-
ences emerge when you ask yourself ques-
tions like these:

Can my records include expressions like α
or βC and diacritical marks like é or ü?
Does my software reformat the bibli-
ography or also the in-text citations?
Does it work directly with Windows word
processors? with WordPerfect?
Does it support different reference types?
(e.g. journal articles, books, theses, etc.)
Does it output the bibliography in my
word processor or just as an ASCII file?
Will it take me less than 5 minutes to
teach a student how to enter data?
Can it output authors with full names or
initials? with or without periods? with or
without spaces? with or without commas?
Does it have a TSR? If so, does it allow me
to add, edit and search references?
Can it output the first author’s name as J.
Smith and the second author as Johns, G.?
Will it find records quickly and easily?
Can I share data with Mac users without
loosing Greek characters and diacriticals?
Can I easily create my own style?
Is it completely free of copy-protect?
Was it updated in the last 12 months?

Can I easily move between fields even if
I’m not finished entering one?
Can I add fields for my own use? Are there
fields for abstracts and notes?

If you answered “yes” to all these ques-
tions, you’re using EndNote Plus.

Unbiased Opinion:

Obviously, we’re a little biased, but here’s
what the press has said about our products:
“the clear winner in the bibliographic data-
base management race.” —MacUser
“it does) practically everything except type
in the data” —Personal Computer World
“The results we got from EndNote Plus were
outstanding.” —MacWeek
“EndNote Plus is a terrific bargain.”

—Information Today

Import from Other Programs

We realize that you may have thousands of
records in your old program, so we made it
easier for you to switch. We have instruc-
tions on transferring data from several bibli-
ographic programs into EndNote Plus. Call
us to see if these instructions cover the soft-
ware you currently use.

Upgrade Now for $169

If you upgrade before 5/30/92, you’ll pay just
$169 instead of $249. Send a photocopy of the
first page of the manual of any biblio-
graphic software (PC or Mac). Attach it to
your check or fax it with your university pur-
chase order to (510) 649-8179. If you’re not
100% happy with EndNote Plus, simply
return it within 30 days and we will refund
your money.

Niles & Associates, Inc.
2000 Hearst Ave. #200
Berkeley, CA 94709
Phone: (510) 649-8176
Fax: (510) 649-8179

Purchase orders accepted only from universities
in the U.S. All trademarks acknowledged.