

strated efficiencies of the order of 20% at 800 Suns intensity.⁵ These unit cells were not optimized and were without anti-reflection coatings but, nevertheless, suggest that silicon VMJ solar cells may be designed to operate efficiently at intensities up to 1000 Suns.

The cost effectiveness of the VMJ solar cells in total energy concentrator systems has also been discussed in the literature.⁶ Achieving DOE's 1986 Photovoltaic Program Goals, of a cost of less than \$500/kWe peak with an annual production level of more than 500 MWe average, could be accomplished with such systems. This would be possible with today's silicon cost using only a few percent of the current single-crystal silicon supply and with no major industrial impact.

There is no doubt that the edge-illuminated VMJ solar cell should be a viable candidate for large-scale terrestrial applications. It certainly warrants funding so that its development can be pushed forward rapidly as the "Solar Photovoltaic Energy" article assumes.

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11/20/79

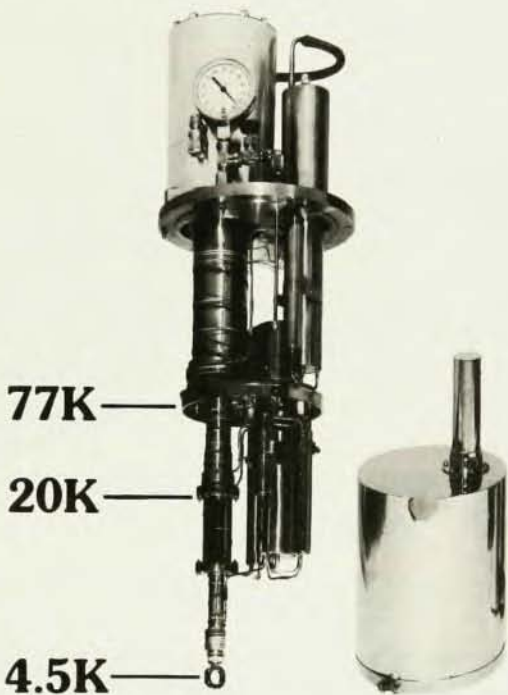
DC solar electricity

While I welcome the APS study on solar photovoltaic energy conversion as providing some needed quantitative inputs in this field (5 September, page 25), I think the conventional grid-connected orientation of the study requires some comment.

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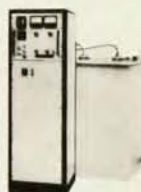


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letters

dences and office buildings, it may be necessary to design new structures where lighting and light-duty appliances operate directly on low-voltage dc produced on-site—a 12-volt dc system for which there are existing appliances—with a local dc utility grid available for auxiliary power. This approach would also simplify feeding consumer-generated power back into the utility grid by eliminating requirements for ac conversion and phase-matching. The historic adoption of ac power was partly based on transmission requirements that lose their relevance when substantial power is generated on-site.

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THE AUTHORS REPLY: The unregulated output of photovoltaic arrays can obviously be converted either to regulated dc or to ac, but the engineering studies known to us find no significant advantage for dc in system cost or overall efficiency under most circumstances. A good discussion of both photovoltaic systems and end-use issues in residential applications is given in reference 1. Low-voltage systems are of course quite feasible, but are penalized by current handling costs in systems of more than a few hundred watts.

Reference

1. E. J. Buerger, T. S. Chan, et al., GE Space Division, "Regional Conceptual Design and Analysis Studies for Residential Photovoltaic Systems," (Sandia report SAND78-7039, January 1979), Vol II, Appendix D.

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JOHN H. MARTIN

Harvard University

11/8/1979

Cambridge, Massachusetts

Ode to a Timon

The photon was discovered in ages past,
the particle of light that sped so fast.
This was considered a great advance
(by those whose careers it helped
enhance).

The phonon was next, a minute chunk of
sound—
a noisy little thing, six decibels to the
pound.

Then bosons and fermions with their
quantized spin—
the "on" explosion was about to
begin!

They've recently postulated the
graviton
as holding us to this earth we're on.
It's been the subject of heavy debate,
though acceptance has increased of
late.

But now I've done them all one better,
and that is why I write this letter: