

Presentation on the

300 kW Generating Facility at 3M Austin

by Tom Penick

Note: Most links will use a second browser window.

I. INTRODUCTION

- A. Tom Penick
- B. Subject - 300 kW Photovoltaic Generating Facility at 3M Austin
- C. Significance - PV is a growing field

II. PROJECT TEAM MEMBERS

- A. [U. S. Department of Energy](#)
- B. [State of Texas](#)
- C. [City of Austin](#)
 - 1. The City of Austin has four smaller PV projects going online this year.
- D. [Sandia National Laboratories](#)
 - 1. Helped with system testing.
- E. [ENTECH](#)
 - 1. Provided PV modules and arrays.
- F. [3M Company](#)
 - 1. Provided site and prismatic Lensfilm.

III. OBJECTIVES

- A. "Develop a mass-producible, high-performance, low-cost photovoltaic concentrator system"
 - 1. A concentrator system is one which gathers the sun's rays and focuses them on a smaller cell area. In this case, the result is 20 times more sunlight on the photocells.
- B. Build a 300 kW example of this design at 3M Austin

1. Plant went online in 1990. Installed on top of 3M parking garage, 1/2 acre in size.

IV. PHOTOVOLTAIC MODULES

A. Lens

1. 3' x 10' x 1/8" acrylic, laminated with 3m Lensfilm (prismatic fresnel lens).
2. 90% optical efficiency, highest in production.

B. Photovoltaic receiver

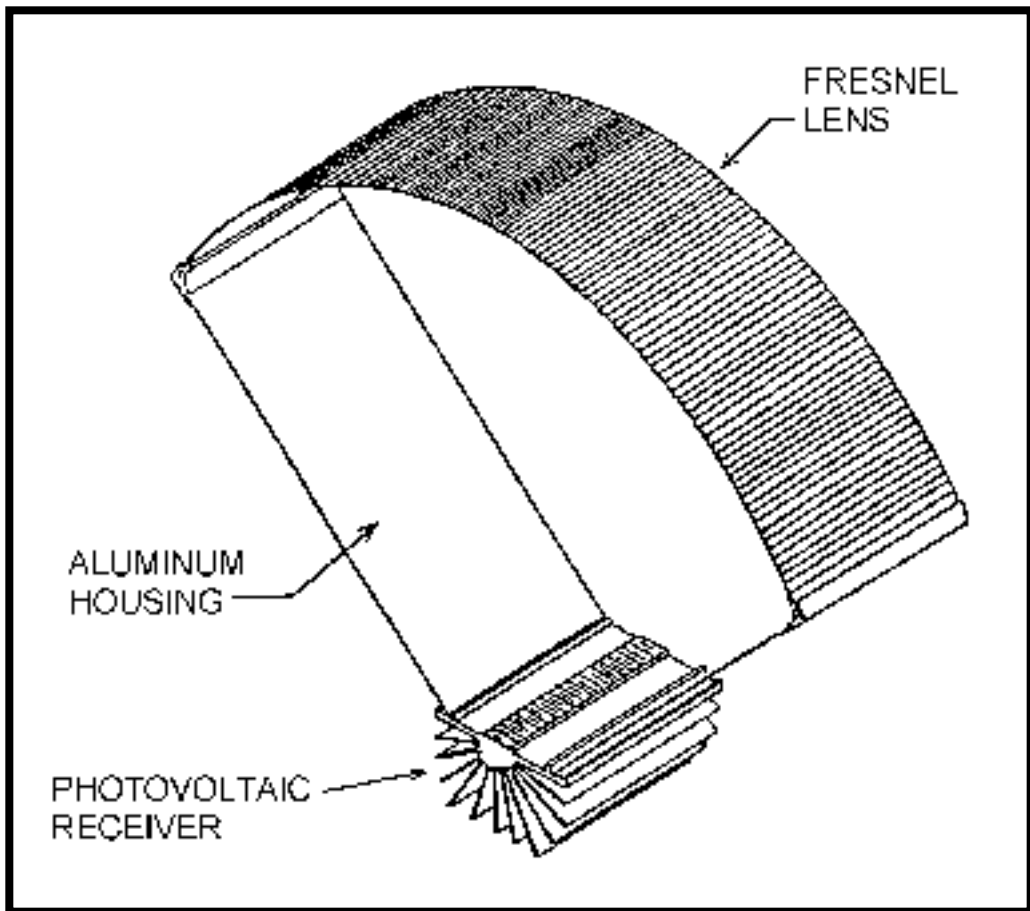
1. Solar cells made by [Solarex Corp.](#)
2. 31 cells per module, 1-1/2" wide, series connected, bonded to heat sink, operate at about 150°F.
3. 20A cell current requires 20% conductive grid coverage. Prismatic covers are used to direct sunlight away from grid material onto semiconductor material.
4. 18.8% efficiency @ 20 suns, 25°C. Highest 1990 production efficiency; highest PV efficiency achieved in laboratory conditions at this time is 27% by others.

C. Housing

1. Six pieces snap together to form a unit 10' long and about 3' wide.

D. Output

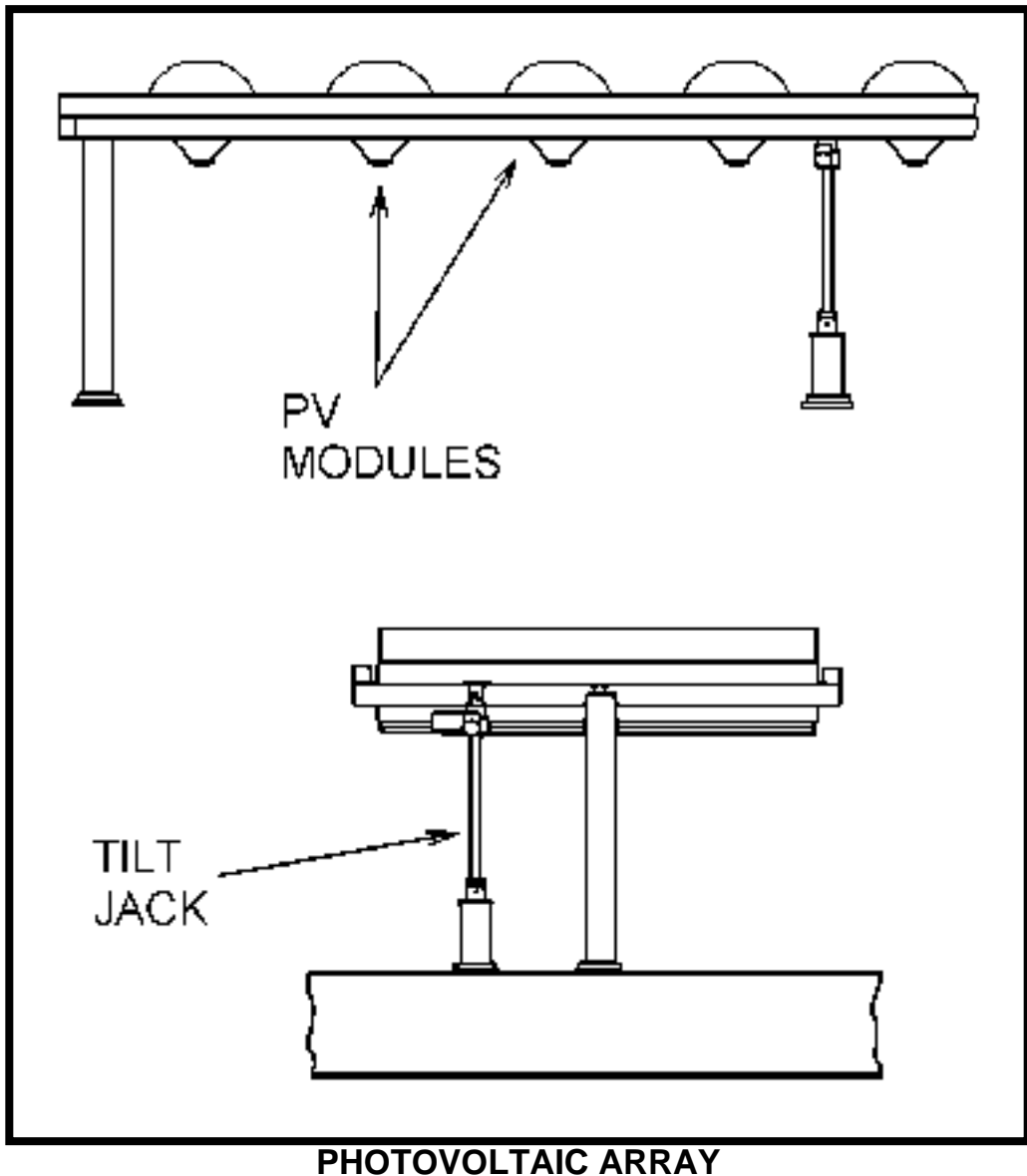
1. 460 W @ 1000 W/m², highest of any production module.



PHOTOVOLTAIC MODULE
Cutaway View

V. PHOTOVOLTAIC GENERATING SYSTEM

- A. Array contains 60 modules and is 162' long
 1. 3 circuits per array, 27A @ 290 VDC
 2. 2-axis alignment using 2 motors. Tilt jack drives array frame to southern horizon. Another motor rotates all 60 modules east to west.
 3. Microprocessor-based controller calculates sun's position based on latitude and longitude and time and adjusts position every few seconds. Position is determined by counting motor revolutions from the stowed position (horizontal).
- B. System consists of 12 arrays (60 circuits, 720 modules) covering 2000 sq. ft., or 1/2 acre.
 1. System results in 28% solar obscuration.
- C. Inverter by [Omnion](#), 96% efficient, connected to City of Austin power grid.
- D. Testing showed an operational efficiency of 12.7% @ receiver temperature of 61°C, which was 10% below calculated results. Lower performance was attributed in part to dust collected on the lenses after six months exposure.



VI. CONCLUSION

- A. The cost per watt for solar cell production has been decreasing at an average rate of 15% per year for the last 25 years.
- B. Production volume has been increasing at a similar rate over the last decade with the exception of 1997 when the increase jumped to 40%. This is due in part to the use of solar cells moving from mainly remote areas to on-grid installations.
- C. Some electric customers are willing to pay extra for power produced from renewable resources. The City of Austin has a "[Solar Explorer](#)" program to allow customers to volunteer to have an amount added to their bill to be allocated for solar projects.
- D. Increased production and use of solar cells should require more engineers.

E. www.teicontrols.com/notes/3m.html

Information for this presentation came primarily from

M. J. O'Neal, R. R. Walters, J. L. Perry, A. J. McDanal, M. C. Jackson, W. J. Hesse, "Fabrication, Installation, and Initial Operation of the 2,000 sq. m. Linear Fresnel Lens Photovoltaic Concentrator System at 3M/Austin (Texas)," *Twenty First IEEE Photovoltaic Specialists Conference--1990, vol. 2, pp 1147-1152.*

Other Photovoltaic Technology Links

- The [28th IEEE Photovoltaic Specialists Conference](#)
 - The [Photovoltaic Quarterly](#), Published by Sandia National Laboratories
 - [Photovoltaic Solar Energy Conversion: An Update](#), by Professor M A Green FAA FTSE.
 - [World Conference On Photovoltaic Solar Energy](#) - Vienna 1998
 - The [Journal of Solar Energy](#), with searchable index.
 - [International Solar Energy Society](#) (ISES)
 - [National Renewable Energy Laboratory](#)
 - The [American Solar Energy Society](#) with database
 - [PV Power Resource Site](#) with newsbriefs
 - [Texas Photovoltaic Coalition](#) (Texas PVC)
 - [Texas Solar Energy Society](#) (TXSES)
 - A summary of an article on [a recent development in thin film technology](#)
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Tom Penick tomzap@eden.com