What’s New Under the Sun: Recent Advances in Photovoltaics

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Operation of a Photovoltaic (PV) Cell

Sunlight ("photo")

Electric power (voltage) ("voltaic")
Improvements in Efficiency

The Best One-of-a-Kind Laboratory Cell Efficiencies for Thin Films (Standard Conditions)
Flexible PV
Communications Power
Communications Power
Oil and Gas Field SCADA
Pipeline Control and Monitoring
Solar Shingles on Residence
East Lansing, Michigan
Flexible Solar Shingles
Grid-Connected PV at the Pentagon
Flexible PV for Standing Seam Metal Roofs
Silverthorne, Colorado
Renewable Power for FERC
Washington, D.C.
240 KW Rooftop PV System  
Arden Realty • Irving, California
Building Integrated Photovoltaics

Germany
PV-Powered Gas Station
London, UK
Natatorium at Georgia Tech
1996 Olympics • Atlanta, Georgia
4 Times Square • Manhattan, New York City
Electric Vehicle Charging
Emergency Operations
PV Systems are Disaster-Resistant

Before Hurricane Andrew, Picture facing N.E.

After Hurricane Andrew, Picture facing N.W.

Before

After
Photovoltaic System Production (kWh/year)\(^1\)

For a 1 kWac rooftop PV system, due south, modeled with PVGRID\(^\text{TM}\)

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\(^1\text{For a 1 kWac rooftop PV system, due south, modeled with PVGRID}^\text{TM}\)
How Much Sunshine Does It Take to Energize America?
Cost Comparisons for PV Systems and Line Extensions

Source: PG&E
Bus Stop Lighting • Las Vegas, Nevada
PV Manufacturing Cost/Capacity
(DOE/U.S. Industry Partnership)

"Average" module manufacturing cost ($/Wp)

Total manufacturing capacity (MW)

2001 Data
12 PVMaT participants with active manufacturing lines
Direct module manufacturing costs only

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Automated Manufacturing
One of the World's Best Kept Secrets — Photovoltaics!

• $3–3.5 billion in sales in 2001
• Average annual sales growth of 20-35% for last five years
• 70% of U.S. production exported at profit
• Annual growth nearly twice that of U.S. PC market
• World demand exceeds world supply
What's Driving the Domestic PV Market?

- Relatively high capital cost
- Difficult to compete with established central power
- PV often competes on capital cost
- PV rarely competes on energy cost
- State incentives, net metering, green power programs
What's Driving the International PV Market?

• World demand exceeds supply
• Available in affordable sizes
• Commercially available systems meet current needs, i.e., water pumping, telecommunications, community power
Comparison of U.S. and World Total PV Module Shipments

Data sources: PV Energy Systems, Photon International
Blackout! It Can Happen To You.
July 2, 1996

Before

After
What is the Value of Electricity if you don't have any?
Contact Information

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