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Technical Paper Session I-A - Solar Energy for Disaster Response Using Space Program Resources

William Young
*Florida Solar Energy Center*

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“SOLAR ENERGY FOR DISASTER RESPONSE USING SPACE PROGRAM RESOURCES”

WILLIAM YOUNG

(ABSTRACT PRESENTATION ONLY)
SOLAR ENERGY FOR DISASTER RESPONSE USING
SPACE PROGRAM RESOURCES

WILLIAM YOUNG

Florida Solar Energy Center

ABSTRACT

We can be thankful for the many discoveries NASA and the space program has brought us over the years. Satellite pictures, solar radiation levels on the earth's surface, global positioning satellite, and many other resources are available through the efforts of many people and organizations. This paper describes how these resources can be integrated to assess the damage from disasters, evaluate the resources available to respond, and assist in recovery. These resources are being used by the American Red Cross, Federal Emergency Management Agency, and other organizations. The latest use is in evaluating utility and solar energy resources and deploying those resources for emergency power in response to a disaster.
Florida Solar Energy Center
A State Renewable Energy Research Institute Established 1975

Administered by: University of Central Florida
Staff: 140 members
Web site: www.fsec.ucf.edu
Agenda

• Impacts of disasters
• Damage Assessment
• GPS and GIS technologies
• Operating Software Package
• RADARSAT Image
• Renewable Energy Resources
• Questions

Examples of Disasters

<table>
<thead>
<tr>
<th>Natural</th>
<th>Man-made</th>
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<tbody>
<tr>
<td>Earthquakes</td>
<td>War</td>
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<tr>
<td>Hurricanes</td>
<td>Terrorist attack</td>
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<td>Tornadoes</td>
<td>Hazardous materials</td>
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<td>Floods</td>
<td>Nuclear accidents</td>
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<tr>
<td>Tsunamis</td>
<td>Power outages</td>
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<tr>
<td>Lightning storms</td>
<td>Structural failure</td>
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<tr>
<td>Mud slides</td>
<td>Fires</td>
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<tr>
<td>Volcanoes</td>
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<tr>
<td>Fires</td>
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Impacts of a Disaster

- Electrical Services
- Sewage
- Water
- Homes
- Communities
- Resources
- Medical Services
- Economy
- Businesses
- Jobs
- Environment
Loss of Electrical Power

Power outages:

- Disrupt basic life activities
- Re-direct all attention to basic life functions and survival
- Disrupt or halt business operations
- Create economic instability
- Impact the transportation sector
- Introduces elements of risk to people and property

Distributed Generation with Renewable Resources
Renewable Energy Sources

- Photovoltaic (PV)
- Solar thermal
- Geothermal
- Small hydro
- Biomass
- Wind
- Micro-Turbine

Damage Assessment

- Multi-organization effort
- Ground-based teams in vehicles in damaged area
- Damage assessment surveys
- GPS and GeoRover data collection
- Satellite survey data
- GIS data evaluation and reporting
- Effective decision-making
- Time and safety issues
GPS- L/L & Street

Field data entry device - data

-80.609814
28.318511

Heidelberg Restaurant.JPG

Minutemen Causeway
Locating GPS

• Make sure your GPS device is directly located on the object.
• If not, your waypoints and pictures are not going to correlate.

Solar Schools Data
Case Study

- Simulation of damage that occurred in Cocoa Beach
- Cocoa Beach FR, Building Dept, BCOEM, SAIC tested real-life application GeoRover
- Created two teams (blue and red) and utilizing existing GPS devices and cameras
- GeoRover allows damage assessment teams to quickly go from site to site with nothing more than a GPS and digital recording device (such as a camera, video-recorder, voice recorder, etc) to gather the data. Teams can seamlessly download their data directly into Arc GIS to better document the details of the damage.

GIS Multi-level
Login to Operations Database

Database Data
Data entry

Map locations with data
Characterize data

Database Data Layering
2 Color Multi-View Image

- Satellite data collection
- Radar Imagery/2CMV
- Comparison of two images
- Date of 1st Image May 06 2006
- Date of 2nd image May 30 2006

RADARSAT 2 Color Multiview

- SAR Technology (creates images from space by illuminating the ground through electromagnetic waves and recording the echoes)
- Advantages of utilizing SAR
- Interferograms created from 2 satellite passes (before and after incident)
- Baseline Image is currently being conducted
- Result: Differences in topography
2 Color Multi-View Image

Overlay Image
Hurricane Andrew damaged a Senior Center in Homestead, Florida. It became a medical clinic powered by a 1 kWp PV system with a 2 kW inverter and batteries. The Clinic was operated by University of Miami.
Solar Pool System Survived

Damage assessment in the city of Punta Gorda, Florida after Hurricane Charlie, 2004

DOE/FEMA Mobile PV Generators

0.5 kWp PV in Big Pine Key, FL
Powering a Salvation Army comfort station
Hurricane George

1.8 kWp PV in Knotts Island, NC
Powering special needs home
NCSC and FSEC team
Hurricane Bonnie
NREL Mobile PV Generator

Everett Cook’s new home is a FEMA tent (special needs person)

Powering an oxygen generator, lights and a fan after Katrina

0.5 kWp PV generator trailer in Pearlington, Miss.

PV on BP Gas Stations in Florida

- 32 BP gasoline stations in central Florida had 20 kWp of PV installed as grid tied systems in 2002
- Soon they will be changed to dual-mode inverters with battery backup.
FEMA/Florida DMAT

FSEC PV Power Trailer

Trailer powering medical treatment tent at Fawcett Memorial Hospital in Port Charlotte after Charlie (August 2004)

Critical Facilities Critical Power

2.5 kWp PV at Harford County Emergency Operation Center in Maryland
More Than Backup Emergency Power

25 kWp PV System on Fire Station
Mannheim, Germany

Zero Energy Homes

You generate as much energy as you consume.
The solution to your energy problem rises every morning.

Questions?

Contact:
Bill Young
Florida Solar Energy Center
1679 Clearlake Road
Cocoa, Florida, USA 32922
(321) 638-1443
young@fsec.ucf.edu

www.energyfordisasters.org