Disaster Resistant Buildings

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www.fsec.ucf.edu/pvt/Projects/disaster
How did the disaster affect you.

- No effect – passed by
- Minor damage
- Major damage
- Building destroyed
- Building structurally sound but no power
During and After, how will you live

- Live in your own home
- Visit friends or family
- Stay in a shelter
- Stay in a hotel/motel
- No home, no stores, no job, start over some where else
Your plan calls for?

- **Need for response and recovery**
  - In proper location causes damage
  - Building damaged due to improper design or construction

- **Mitigation provided for needs**
  - Building still there, structurally sound and usable through codes
  - Disaster Resistant Buildings and Communities
If you have no electricity,
What price are you willing to pay for it.
The building should be built to withstand the effects of a disaster structurally and be still be functional and operational to the user to reduce damage and cost of a disaster.
Why have disaster resistant communities

- Save lives
- Reduce risk
- Reduce property damage
- Reduce cost of recovery and insurance
- Shorten recovery period
- Reduce hardships
Key Concepts of a functional building

- Passive building design for a livable structure
- Improving energy efficiency through conservation
- Maintain manageable loads
- Application of distributed generation
- Use of renewable energy sources
Can I provide my own power in a disaster?

- **Portable Backup Power**
  - Gasoline/ diesel generator
  - Batteries
  - Solar or renewable energy source

- **Critical Power System - CPS (uninterruptable power systems)**
  - Solar or renewable energy source
  - Other sources

- **Zero Energy Homes using renewables**
Integrating Photovoltaics into Buildings

- Use PV as a critical power supply as a power source for critical items only
- Use PV as the major power source to totally power the building such as with a Zero Energy Building.
- Mix PV with other renewables for a Zero Energy Building
Enhance disaster resistant buildings by incorporation of critical power supply systems using solar and renewable energy into building designs.
What we need to know about disaster resistant communities

- Conservation
- Synergism among PV, building energy efficiency and load management
- Code enforcement
- Structural Integrity
- FEMA Project Prepare
What we need to know about PV and energy efficient buildings:

- Most effective combinations of building energy efficiency and PV production
- Marketability of energy efficient PV buildings
- Building energy management
Exterior Color Impacts

“White hot” versus “cool blue” roofs

Control Home

PVRES Home
Energy Efficiency First

![Energy Efficiency Bar Graph](image)
Annual Average Day (1998-1999)

- **PV Output** (5180 kWh)
- **Gross Use** (6960 kWh)
- **Net Use** (1780 kWh)

Power (kW)

Time of Day (h)
Key elements of a PV system

- Energy source
- Energy conversion
- Energy inversion & conditioning
- Energy storage
- Energy distribution
- Energy use
- Electric utility
What we need to know about fault- and weather-tolerant buildings:

- Marketability of uninterruptible building power systems
- Economic and performance tradeoffs
- Integration into weather-tolerant buildings
What we need to know about distributed generation:

- More than one source of energy
- Effects on utility operations
- Time value of PV production
- Sufficient information for business planning
PV can be attached to the top of the roof on the roofing material.

PV can be the roofing material.
What we need to know about PV array-roof configurations:

- Durability of standoff arrays on metal roofs
- Durability of standoff arrays on tile roofs
- Durability of other configurations
- Life-cycle analyses of durable array-roof configurations
What we need to know about factory-installed PV systems:

- Cost reductions for complete or partial installation within a factory
- Prospects for improving quality control within the factory environment
2 kWp PV System on portable classroom

Lakeland, Florida
PV and Solar Thermal Roofing Material

Atlanta, Georgia
Transparent photovoltaic panels let you see outside.
PV Shingle Roofing Material - Atlanta, Ga.
PV Shingle Roofing Material - (Japan)
Metal Roof Installation - Mass.
Utility Backup Power

- 800W system
- Grid independent
  - Computers
  - Security system
  - Garage door opener
  - Two emergency service outlets
- Utility goes down: these systems still work
Earthquake in 1995 caused massive power outages.

No power for gas stations resulted in no fuel for emergency vehicles.

10.77 kWp
Other - Transpired Collector wall
One kW PV System - critical power supply

One kW PV Array → Disconnect → Controller → Battery Bank → 2 kW Inverter → AC Loads → DC Loads
Critical Power Supply - Business Loads

AC Main Panel

AC Sub Panel - CPS

Cash register

Security Lighting

Radio
Zero Energy Homes

You generate as much as you consume or more.
Backup Power

2.5 KWp PV at Emergency Operation Center in Maryland
Solar Hot Water System Still There

Hurricane Charles in Port Charlotte, Florida August 2004
Questions?

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