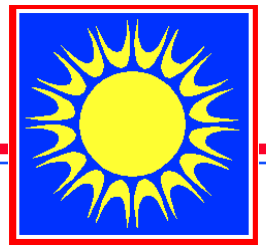

FLORIDA SOLAR ENERGY CENTER

A Research Institute of the University of Central Florida

Disaster Resistant Buildings

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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 do to in proper design or construction
- Mitigation provided for needs
  - Building still there, structurally sound and usable through codes
  - Disaster Resistant Buildings and Communities

How can I recover with no power

- If you have no electricity,

  What price are you willing to pay for it.

Concept of Disaster Resistance

- The building should be built to with-stand 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

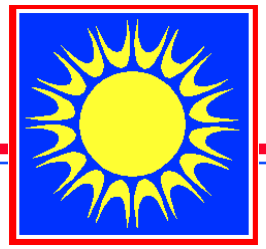
- Save lives
- Reduce risk
- Reduce property damage
- Reduce cost of recovery and insurance
- Shorten recovery period
- Reduce hardships

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 (uninterrupable 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

Concept of Operation

- 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

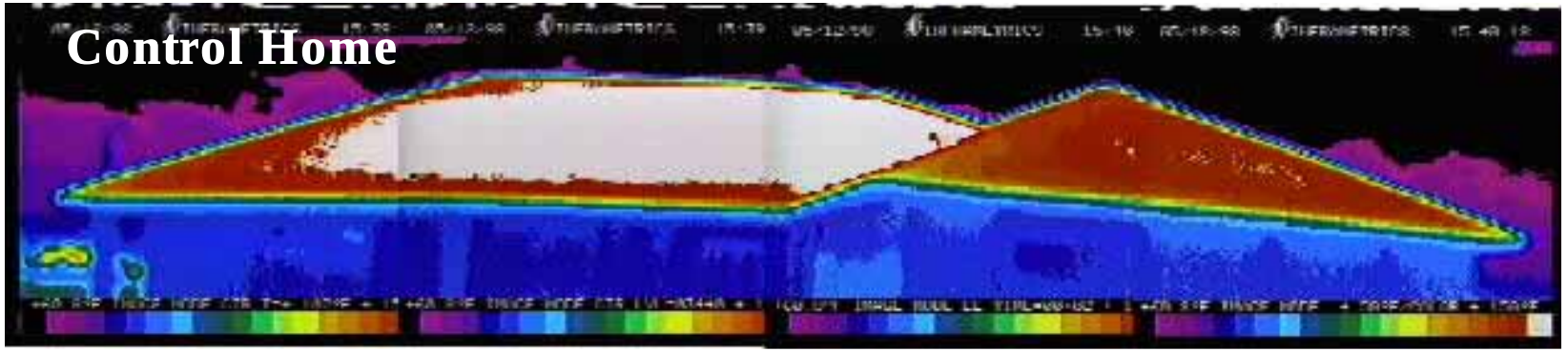
What we need to know about

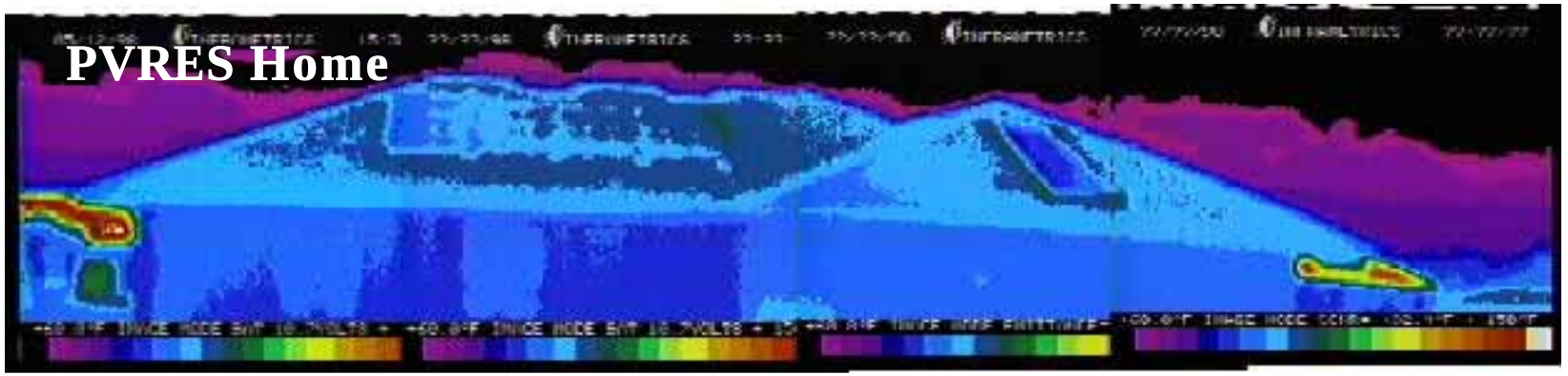
PV and energy efficient buildings:

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

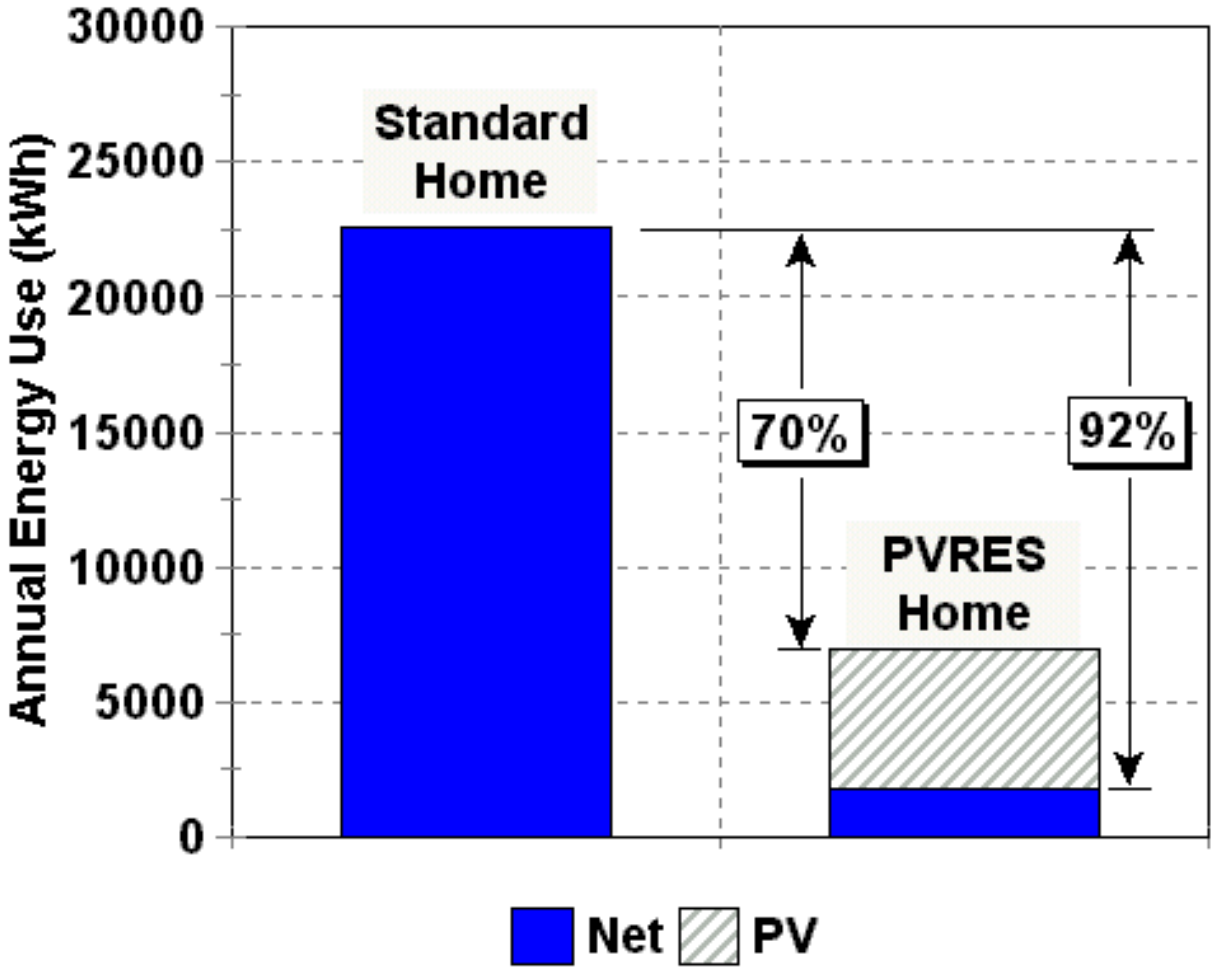
Exterior Color Impacts

"White hot" versus "cool blue" roofs

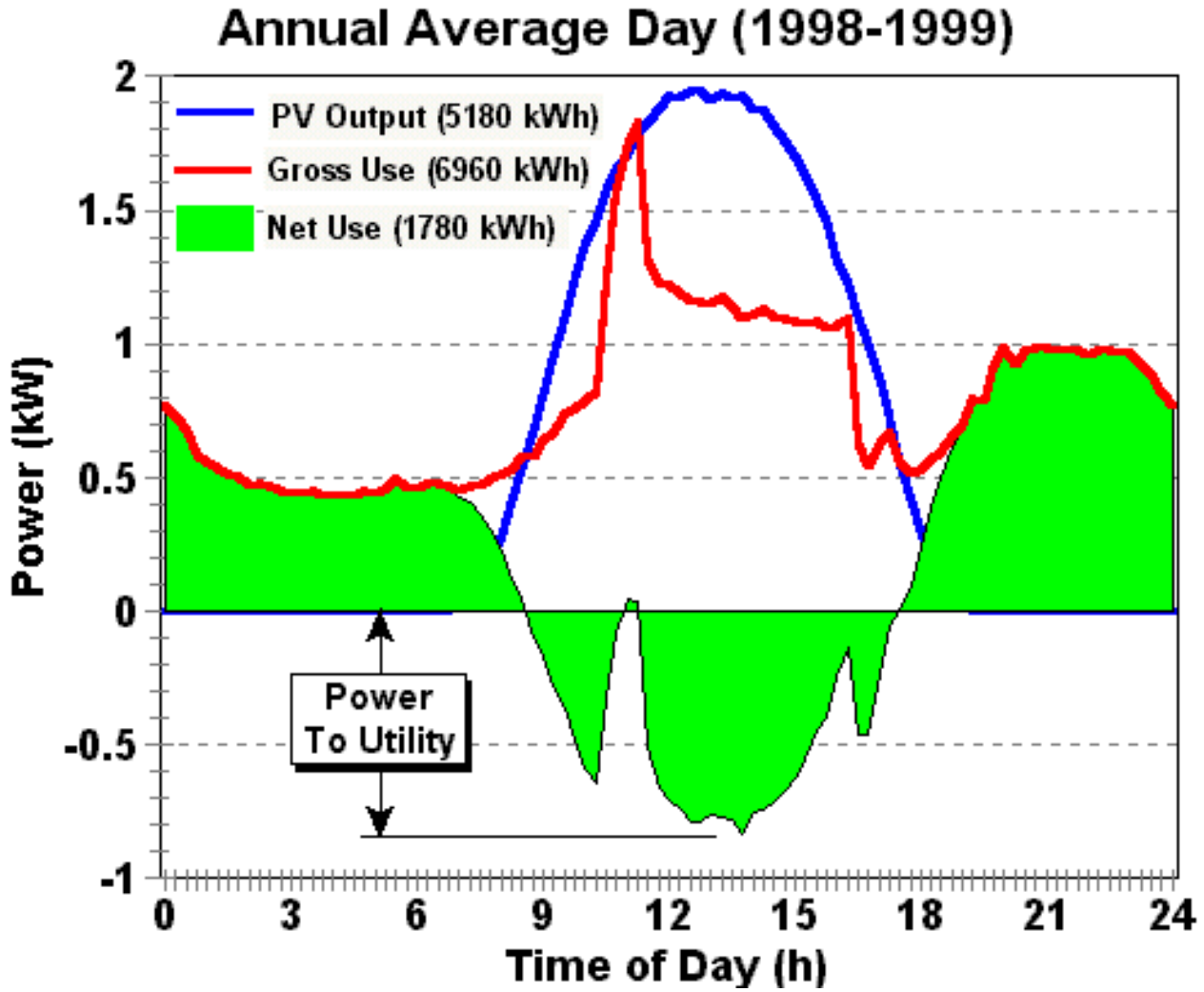




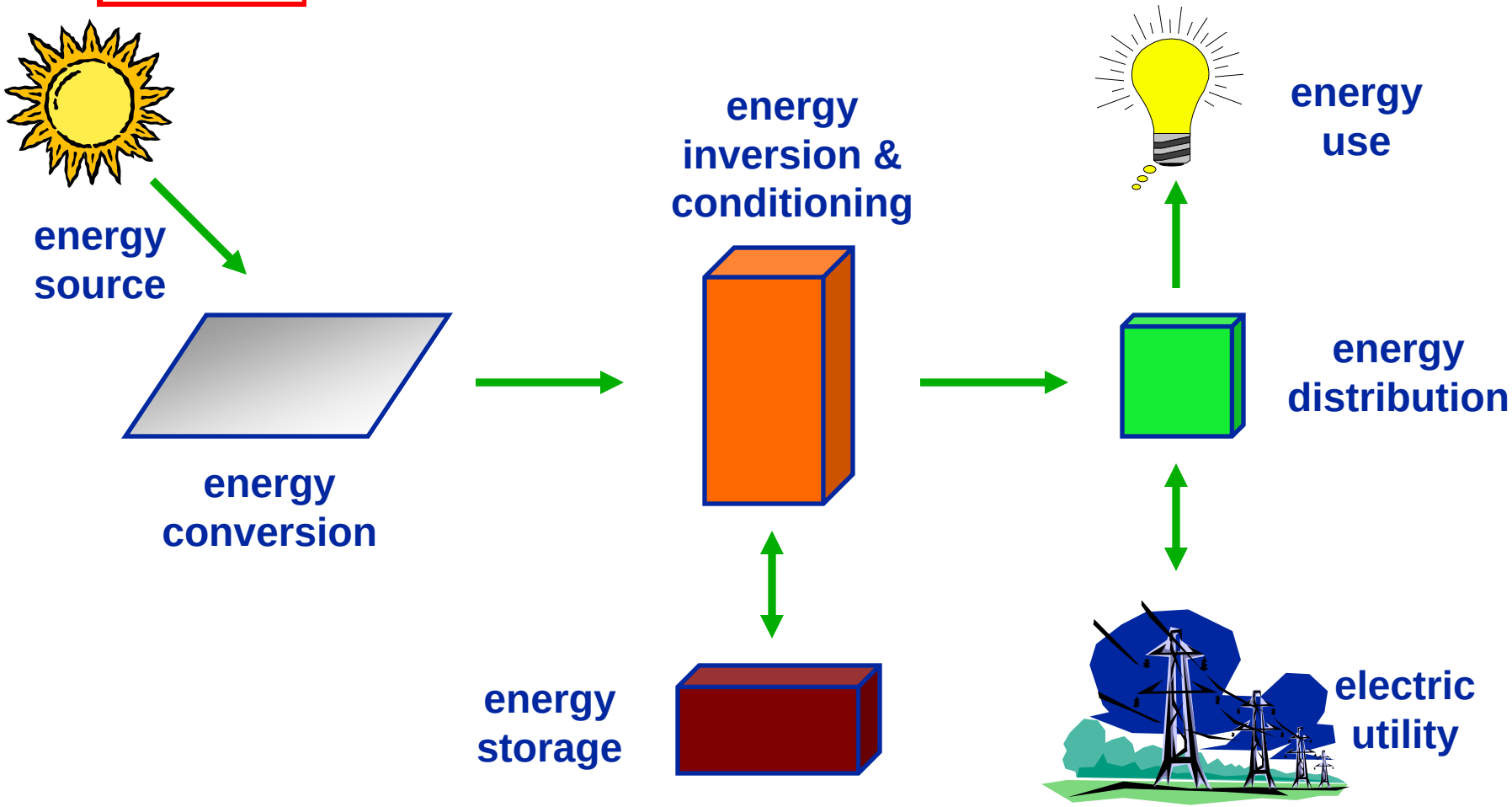
Energy Efficiency First



Net Energy Use



Key elements of a PV system



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 Buildings

- 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

Array in Pennsylvania

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

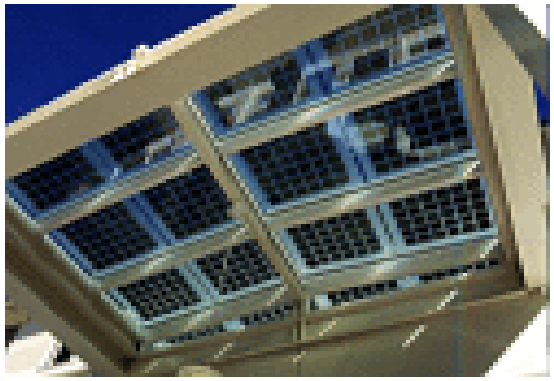
2 kWp PV System on portable classroom

Lakeland, Florida

PV and Solar Thermal Roofing Material

Atlanta, Georgia

PV Roofing Material



University of Wisconsin

Transparent photovoltaic panels let you see outside.

PV Shingle Roofing Material – Atlanta, Ga.

PV Shingle Roofing Material – (Japan)

Metal Roof Installation – Mass.

Metal Roof Installation - Florida

Utility Backup Power

- 800W system
- Grid independent
  - Computers
  - Security system
  - Garage door opener
  - Two emergency service outlets
- Utility goes down: these systems still work

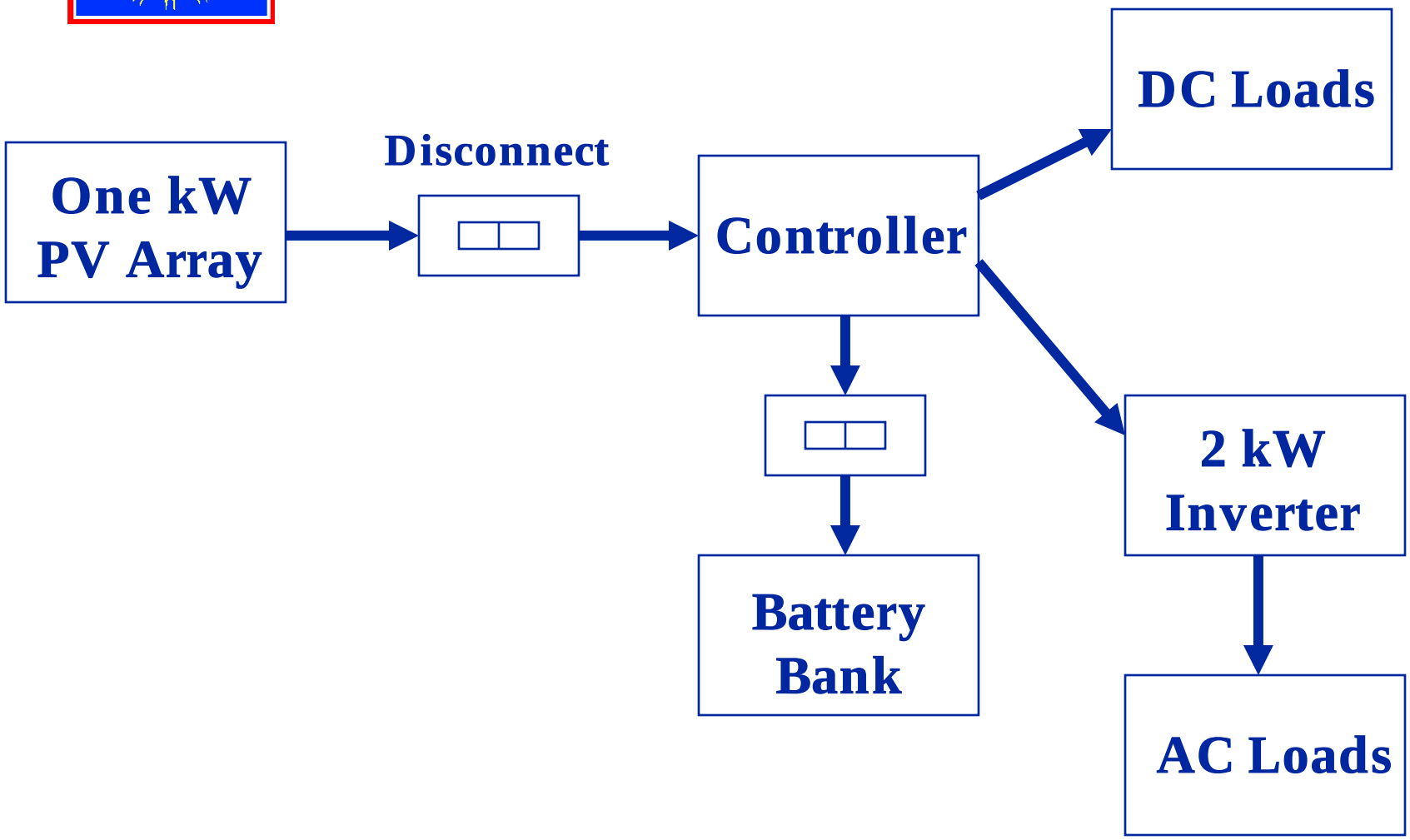
Disaster Relief in Japan

- Earthquake in 1995 caused massive power outages
- No power for gas stations resulted in no fuel for emergency vehicles

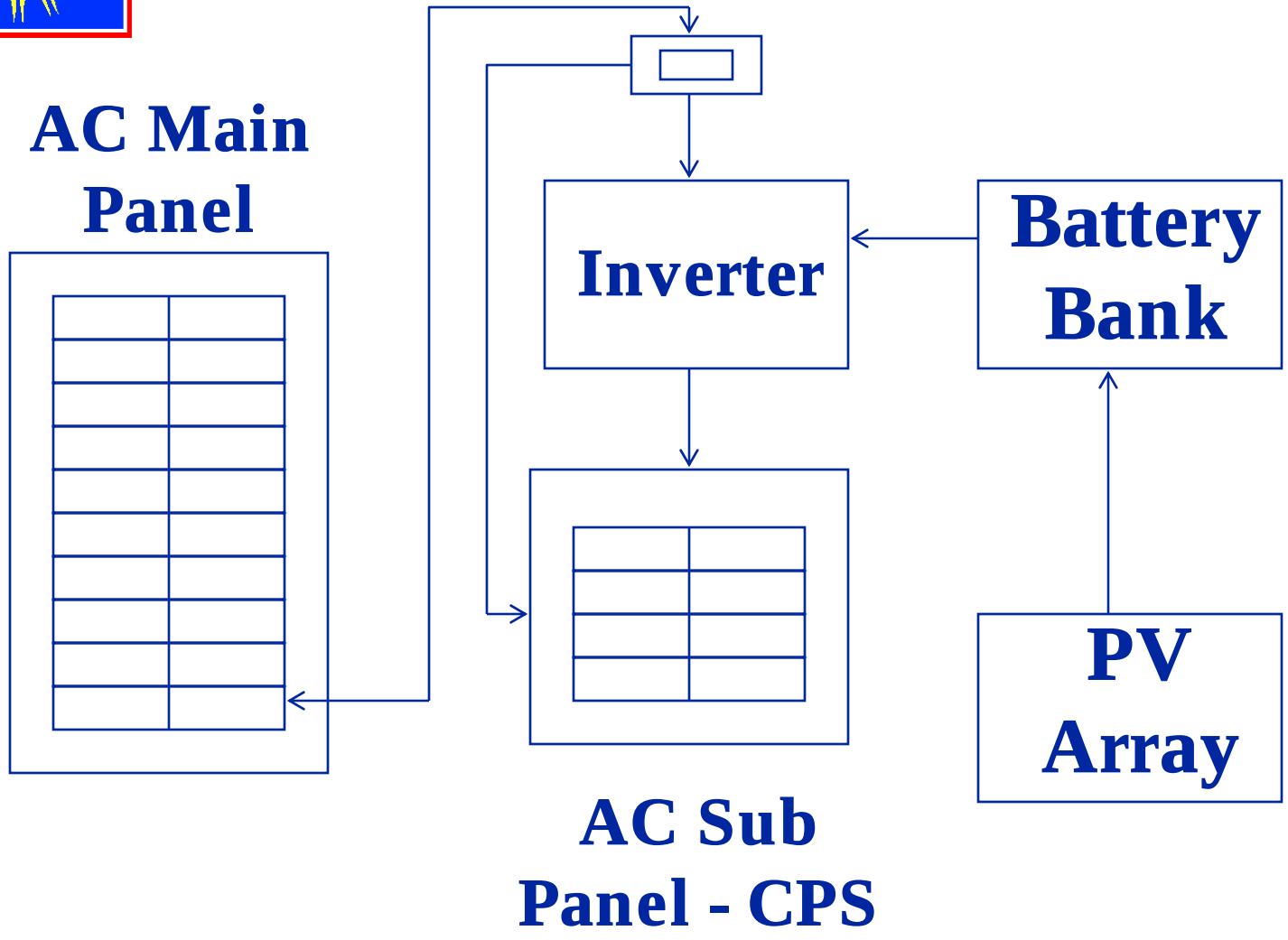
10.77 kWp

Other - Transpired Collector wall

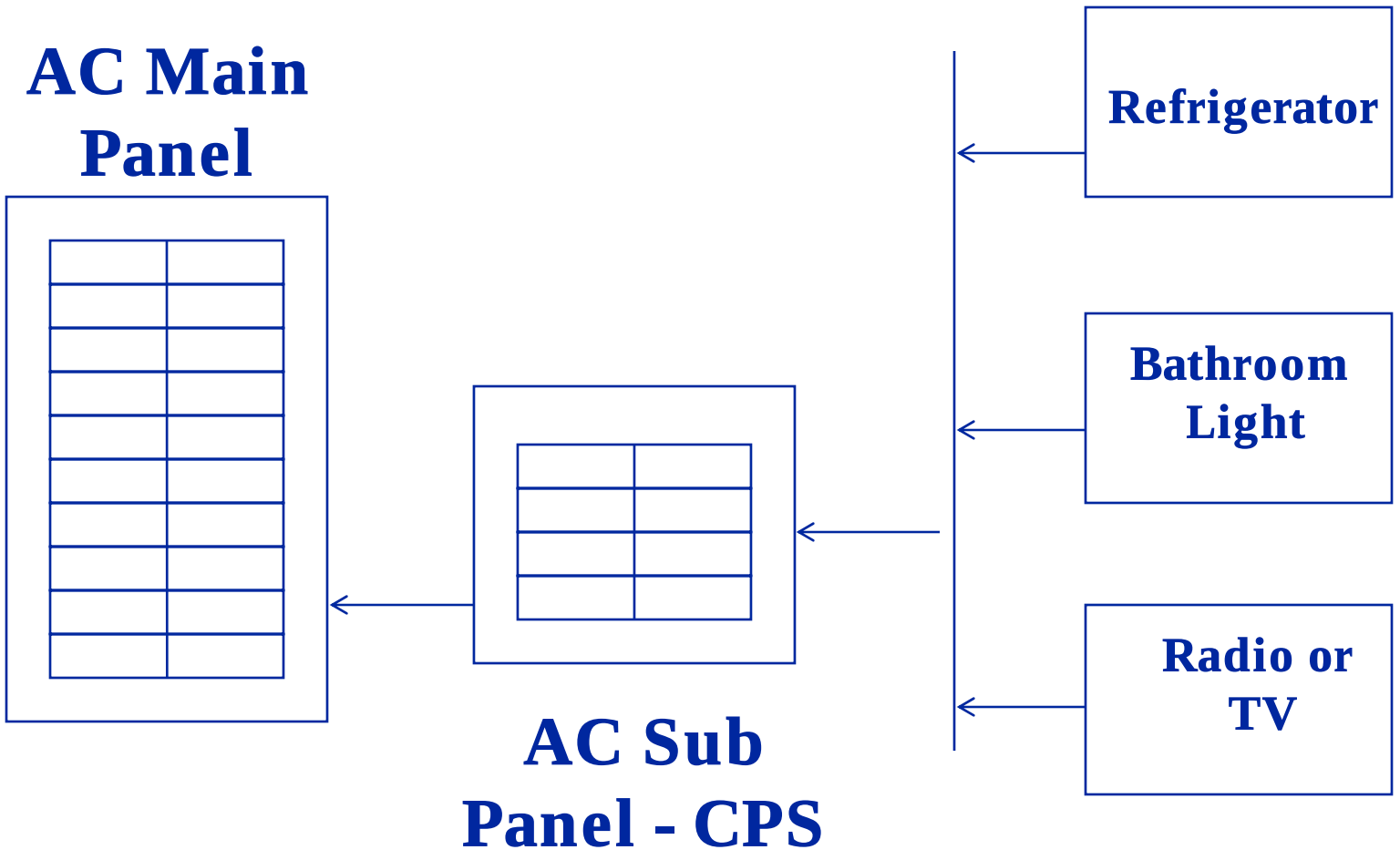
One kW PV System - critical power supply



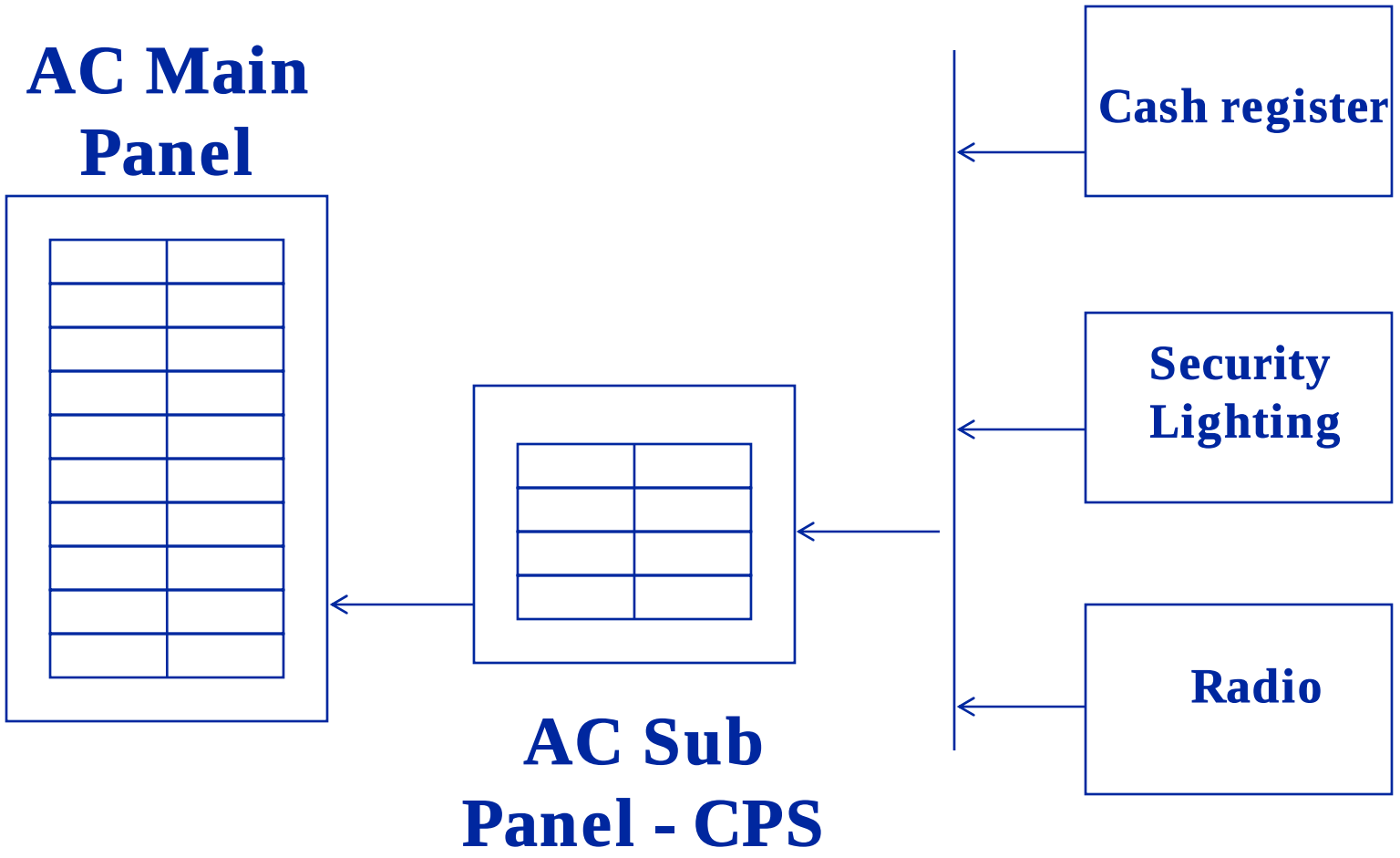
Utility Backup Power - CPS



Critical Power Supply – Home Loads



Critical Power Supply – Business Loads



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

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Questions ?

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