



# APS

Altenergy Power Systems

## **MICROINVERTER**

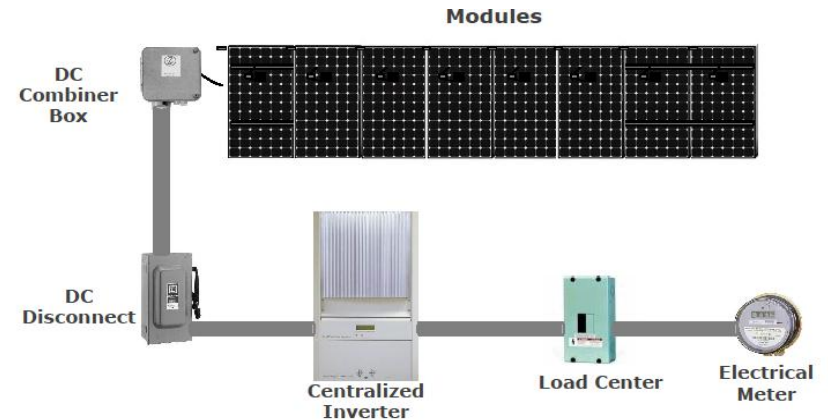
THE SUPER SOLAR INVERTER



# STRING INVERTER VS MICROINVERTER

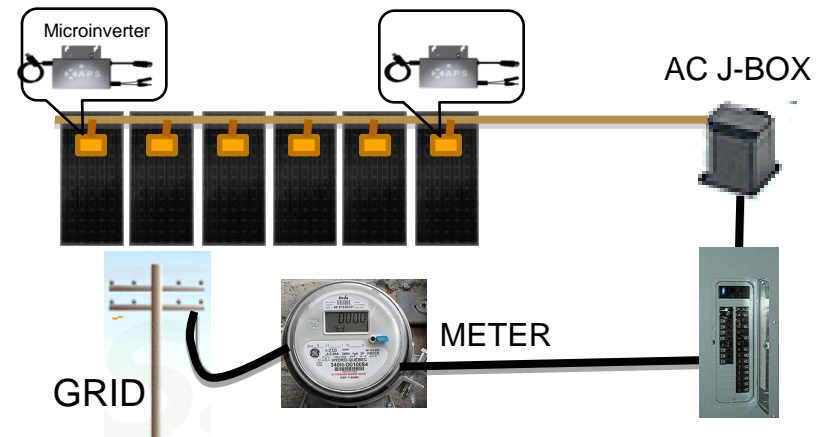
## STRING INVERTER

PV panels connect in a series to form a string, which then connects to the string inverter.



## MICROINVERTER

Each PV panel is connected to one microinverter, so each panel is independently controlled and monitored.





# THE FUTURE OF INVERTER TECHNOLOGY



DISTRIBUTED



SOLID STATE

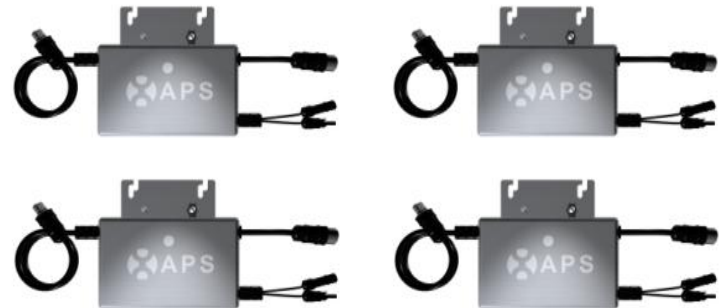


- Distributed and solid state technology are driving forces in electronics.

## STRING INVERTER



## MICROINVERTER



- Incorporating these new technologies into microinverters creates the future of inverter technology.



# MARKET FORECAST

Technology to Take Solar Market by Storm

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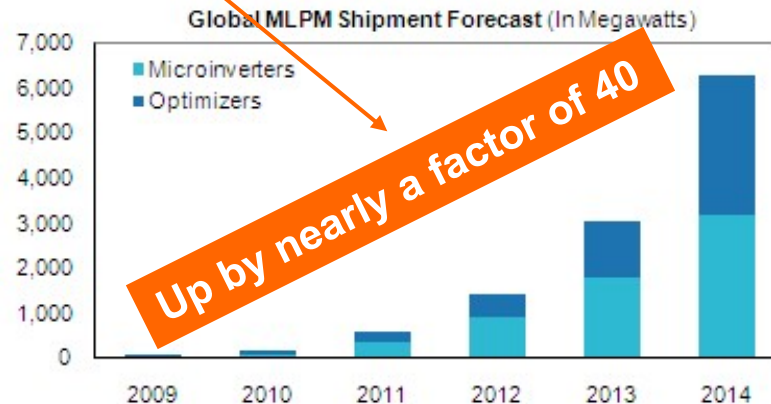
## Energy Efficiency Technology to Take Solar Market by Storm

February 17, 2011  
GREG SHEPPARD

With their capability to increase the efficiency of solar systems, module level power management (MLPM) solutions are set for fast growth, with almost 40 percent of residential photovoltaic (PV) installations expected to use the technology in 2014, new IHS iSuppli research indicates.

Global shipments of MLPM systems, a category consisting of microinverters and optimizers, are set to rise to 6.2 gigawatts (GW) in 2014, up by nearly a factor of 40 from 160 megawatts (MW). By the end of 2014, 38 percent of residential PV installations worldwide will employ MLPM solutions, up from 2 percent in 2010.

In 2010, 2% of residential PV systems used MLPM solutions. By 2014, that number will reach 38%.



Source: IHS iSuppli February 2011

In 2010, microinverter installation was about 80MW. By 2014, microinverter installations will reach 3GW.



# MICROINVERTER ADVANTAGES

## SIMPLE

- Design and installation

## SAFE

- No high DC voltage

## SMART

- Monitor and control each panel

## SAVE

- No DC component

## RELIABLE

- Component and system

## POWERFUL

- Maximum power for each panel



# MICROINVERTERS: The Safe Solar Solution

## STRING INVERTER SYSTEMS

600V DC travels between the PV array and the inverter.

- Lethal to humans
- High risk of DC arc faults
  - According to UL, almost all PV-related fire accidents are caused by arcing.

DC output is constant if the solar panels are exposed to sunlight.

## MODULE ARRAY



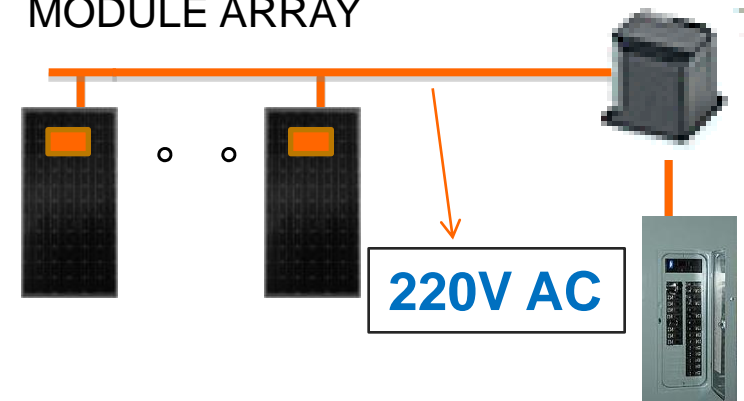
## MICROINVERTER SYSTEMS

220V AC travels between the microinverter and the electrical panel.

- No danger to humans
- Low risk of DC arc faults

No DC output occurs until the unit is connected to the AC grid.

## MODULE ARRAY



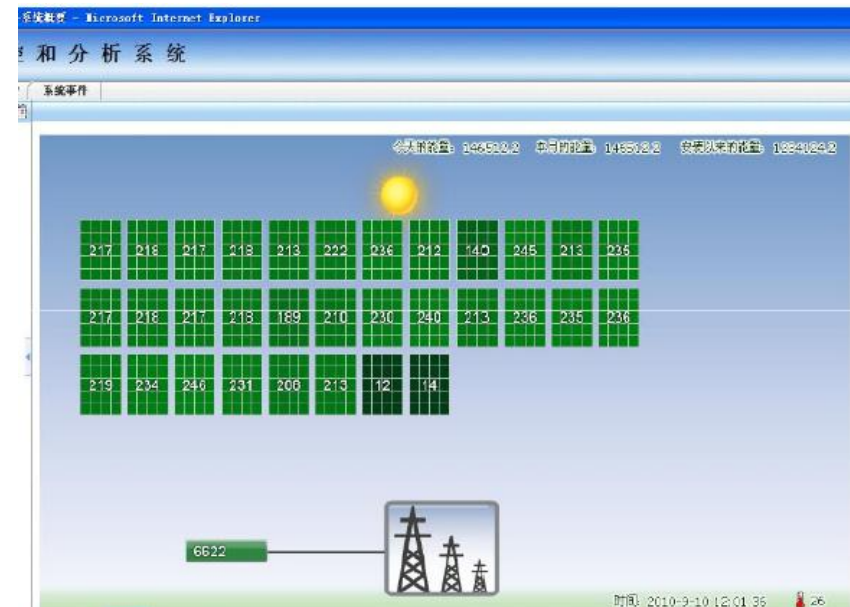


# REMOTE MANAGEMENT

## APS's EMA

(Energy Management and Analysis) System:

- Monitor system performance from any device connected to the Internet, anytime, anywhere.
- Receive system failure email alerts.
- Shut down the inverter remotely.





# RELIABLE SYSTEM



## MICROINVERTER SYSTEM

Availability: >99.8%

Warranty: **15** years

Designed for 25 years of use



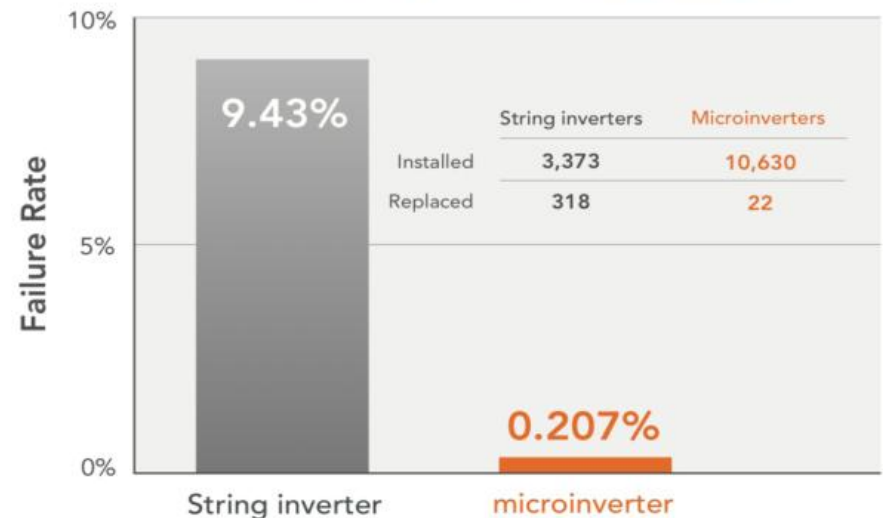
## STRING INVERTER SYSTEM

Availability: >95%

Warranty: **3-5** years

Failure of a microinverter results in the loss of power output from one solar module, while failure of a central inverter results in the loss of power output from every solar module in the connected system.

### Failure Rates: String Inverter vs. Microinverter



\*Source: Westinghouse Solar, March 2011





# SHADING EFFECT



Even a small object shading a portion of the solar module would trigger the protection bypass diode, resulting in a loss of **1/3** of the PV output power.



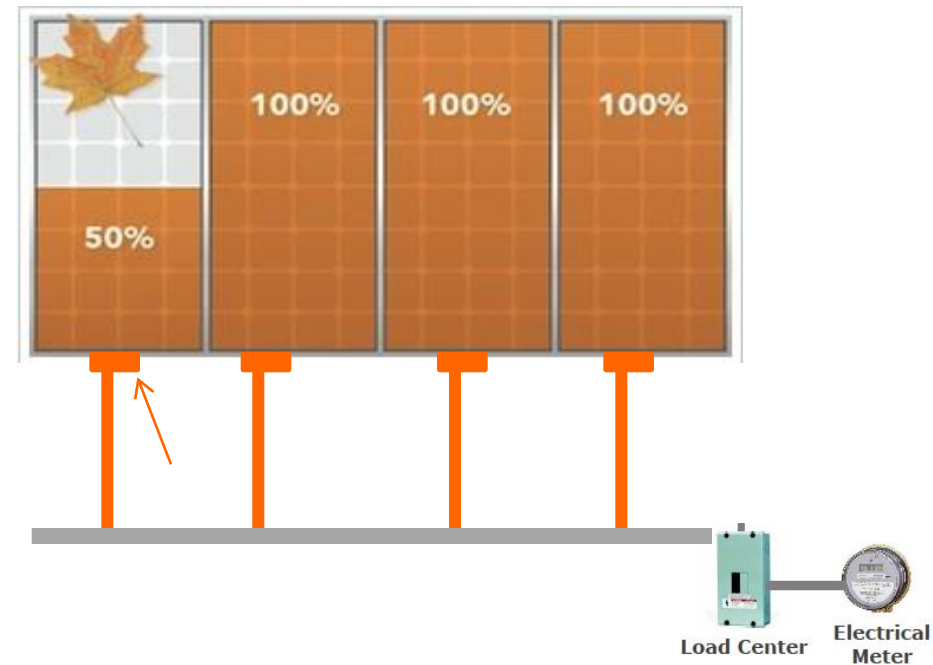
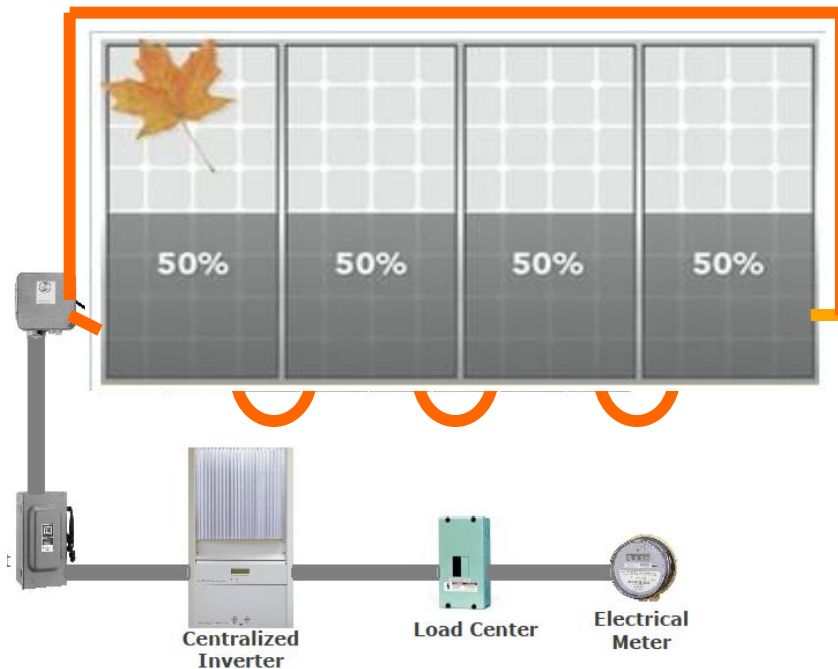
% of Array Shaded	Power Loss Due to Shade
13%	44%
11%	47%
9%	54%
6.5%	44%
3%	25%

Shading sources: Trees, chimneys, power lines, fallen leaves, bird droppings, and more.



# MICROINVERTERS INCREASE SOLAR POWER OUTPUT

- MPPT for each solar module
- No module mismatch power losses
- No variation effect from tile angle or installation orientation
- Minimized shading effect
- Independently-controlled solar modules





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