# PV 101: The Crash Course

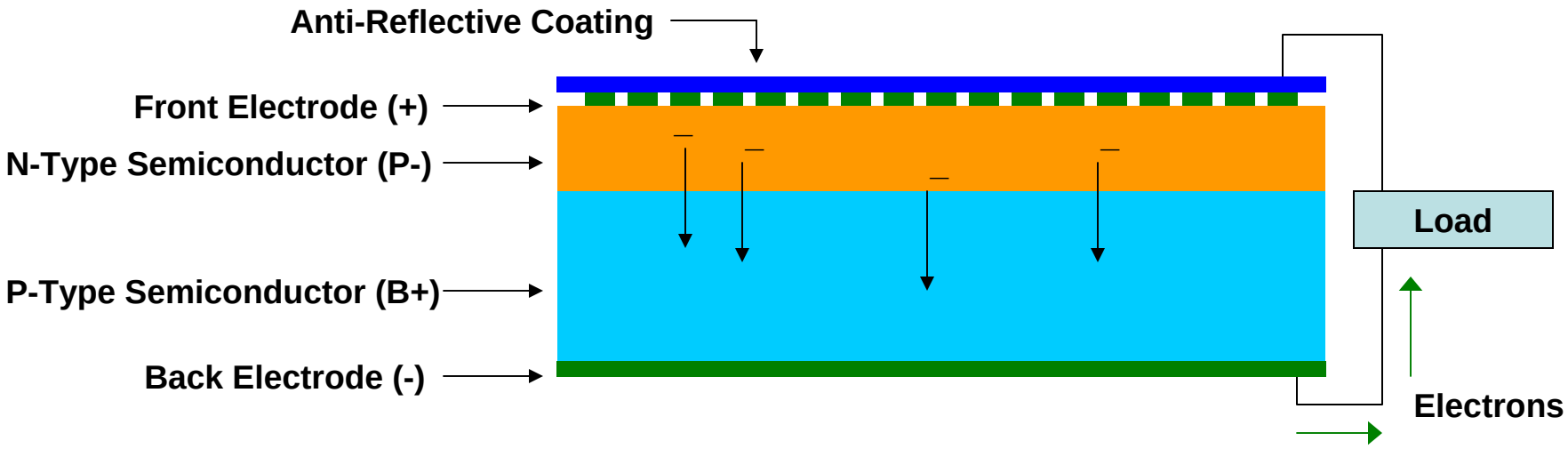
# Economic Opportunity Is Huge

- PV currently accounts for just 1% of electricity generated in the U.S.

- PV market grew 50% in 2007

**- Projections for 2030:** **Y**early revenues exceeding half a trillion dollars, and create more than 7 million jobs per year.

# How does solar electricity work?


Anti-Reflective Coating
Front Electrode (+)
N-Type Semiconductor (P-)
P-Type Semiconductor (B+)
Back Electrode (-)
Load
Electrons

DC Power Systems

Typical grid-tied PV system

# PV Modules (aka Solar Panels)

Poly-Crystalline

Mono-Crystalline

Amorphous
(Thin film)

# Inverters


Xantrex GT3.0

PV Powered 4800

SMA “Sunny Boy” 7000


Solectria 13kW


Fronius IG5100

# Racking: Roof Mount

-Most common option

-Rails (aluminum or steel) screwed into rafters

-Usually the least expensive (support structure is already there)

-Can be tilted for optimum sun angle

-Waterproofing issues

-Safety issues

# Racking: Ground Mount

-Typically used when appropriate roof space is unavailable, or insufficient

-More expensive than roof mount (requires support structure, increases parts and labor)

-Easier to access and maintain than roof mount

# Racking: Pole Mount

-Least expensive ground mount option

-Limited in size to ~12 modules

-Adjustable for seasonal variations

DC Power Systems

# Trackers:

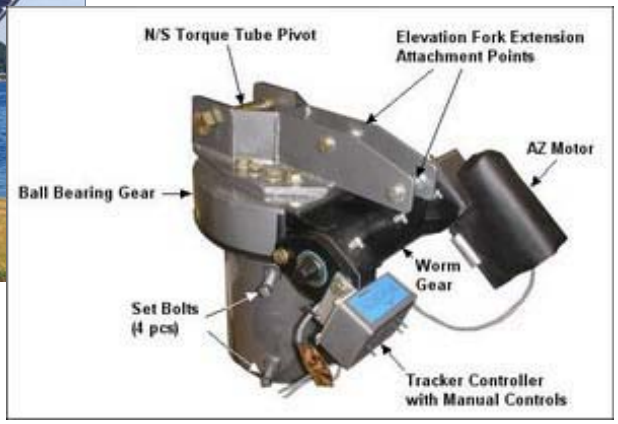
-Follow the path of the sun

-Up to 30% better system performance

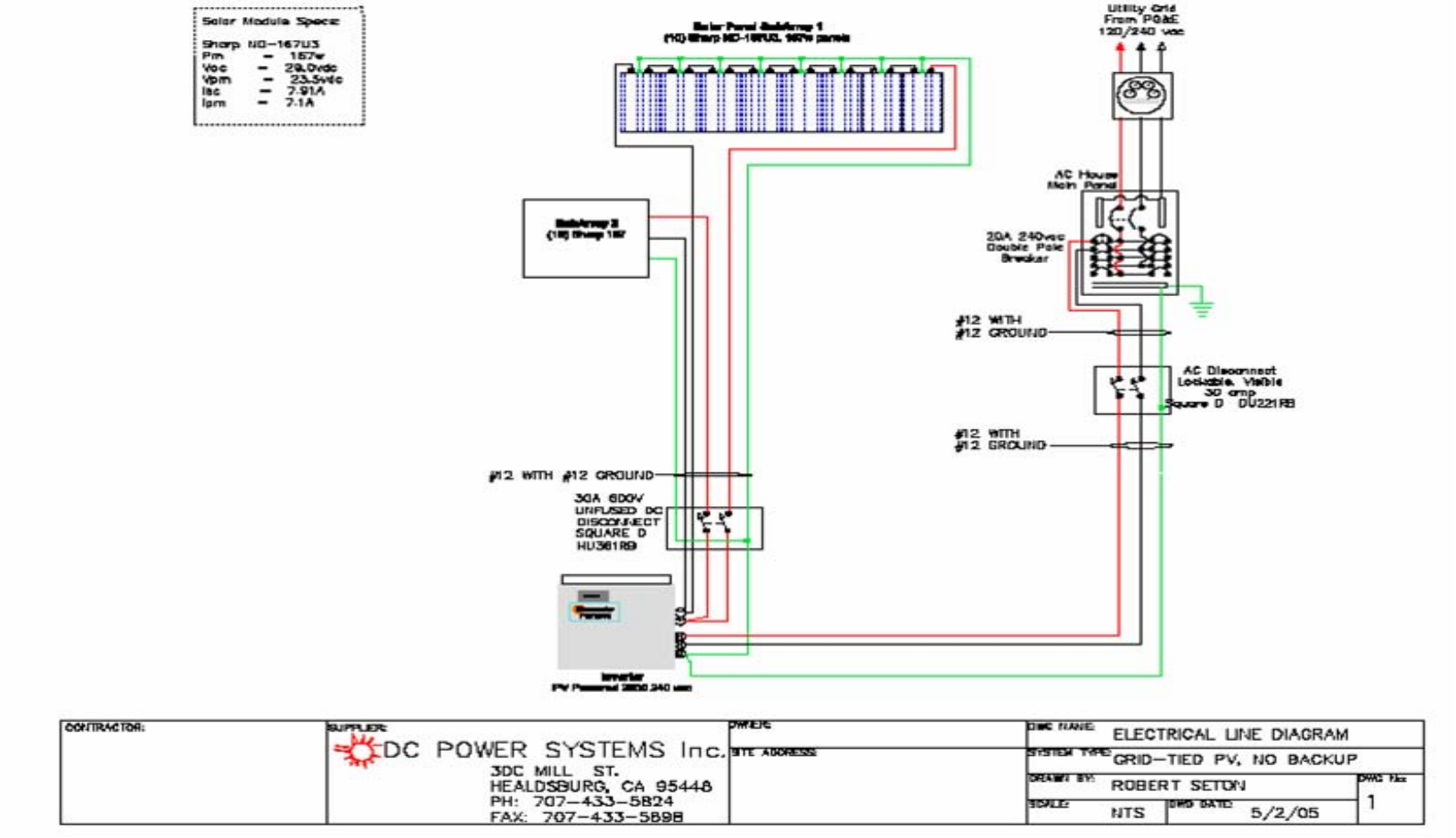
-Active or passive

-Single-axis or dual-axis

-Moving parts require maintenance, prone to problems



# Tying it all together



# System Types

## Grid Interactive (aka Grid-tied), net metering

Most economical, most “green”, but you lose power in a power outage

Uses grid as a “battery” – a free, 100% efficient battery

Accounts for the vast majority of systems being installed

## Off-grid

Expensive, requires larger system – “worst case scenario”

Batteries are expensive, not green

Can be cheaper than bringing grid power to remote locations

## Grid-tied with battery backup

Adds cost and complexity to the system, but you have power in a power outage, and can laugh at your neighbors

Good option in areas where grid goes down frequently

Is it worth it?

# Resources

John Wiles is a great resource for NEC issues. The DOE pays him to answer your code-related questions.

jwiles@nmsu.edu

www.nmsu.edu/~tdi – follow this link to his PV code manual, an excellent free textbook.

Another good free textbook is the NABCEP Study Guide – find it at www.nabcep.org

An excellent resource for system sizing is the PV Watts calculator. If you know how many kilowatt-hours your customer needs their PV system to produce, this program will tell you what you need to sell them. Find it at www.pvwatts.org. This is serious stuff – California uses PV Watts data to determine the rebate customers qualify for.