Energy Usage

- The energy you don’t need is the most cost effective energy you can produce
Energy Usage
Where Does Our Energy Come From

Estimated U.S. Energy Use in 2012: ~95.1 Quads

Source: LLNL. 2013. Data is based on DOE/EIA-0335(2013-05), May, 2013. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU equivalent values by assuming a typical fossil fuel plant heat rate. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential and commercial sectors, 80% for the industrial sector, and 21% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MH-410127

https://flowcharts.llnl.gov/
Where Does Our Energy Come From
Two Types of Solar Energy

**Thermal** – which captures heat energy into storage directly from the sun

**Photovoltaic's** – which converts the rays of light from the sun into an electrical current
What happens when you turn on the water from a hose that has been sitting in the sun for an hour or so

This is thermal technology at its simplest form
Cold water is circulated through a solar collector on the roof of a house and stored in a collection tank to be used for domestic hot water usage.
Types of Thermal Collectors
Photo Electric or Photovoltaic
The PV Magic

Electrical load

Sun

DC current flow

Boron-doped (P-type) silicon layer ~ 250 μm

Photovoltaic cell

Phosphorous-doped (N-type) silicon layer ~ 0.3 μm
The Solar PV Solution
How it Works

The average cell produces ~1 – 4 watts of power per cell depending on quality.
The Solar PV Solution
How it’s made

- Low iron, water tight tempered glass front
- EVA encapsulated layer
- Solar cell circuit
- Vinyl encapsulated layer
- Tedlar back sheet
- Power Tolerance +/- 3%
- Anodized aluminum frame
- Cable Connectors
- 25 Year Manufacturer's Warranty
- Wind Load Designs available up to 180 mph
- UL, CEC, IEC, FSEC certified
A single Photoelectric cell is made of a special silicon.
As light hits the cell an electrical current is created.
A group of cells are combined to create a solar module.
PV Cell Ratings

PV Panels create Direct Current (DC) Electricity

PV Panels are rated by Wattage
150W, 200W, 240W, 260W

Wattage is a function of
Amperage X Voltage = Wattage \ (E=IR)

5 amps x 12 volts = 60 Watts
PV Cell Ratings

When you string panels in Parallel you increase Amperage
When you string panels in Series you increase Voltage

![Diagram showing Parallel and Series connections of PV panels.](Image)

- **Parallel**
  - 12 volts
  - 10 amps
  - 120 watts

- **Series**
  - 24 volts
  - 5 amps
  - 120 watts
PV Cell Ratings

When you Series and Parallel panels you can increase Wattage

Array
24 volts
15 amps
360 watts
PV Cell Ratings
Typical Solar PV Solution
Alternate Current

Direct Current

A GREEN FLORIDA FOR A BLUE PLANET
Inverters

• True sine wave output
• Ability to match frequency
• Clean consistent power
Inverters are sized to the power source
Micro-Inverters

- Each panel has its own inverter
- Output of each inverter in 120VAC
- Hook directly into electrical panel
- AC connection is not considered a power source
- Does not require matching to other panels
- Contains a communication port
Types of Distributive Systems

- **PV-Direct**
- **Stand-Alone Systems**
- **Battery-less Grid-Tied Systems**
- **Battery Based Grid-Tied Systems**
Electrical Storage

- Exterior lighting
- Interior lighting
- Cooling
- Ventilation
- Other

Notes: kW = kilowatt.

a. 24-hour period = midnight to midnight.

© E Source; data from ITRON
Grid Storage

Residential Grid-Connected PV System

Solar Panels

Utility Service

Home Power / Appliances

Inverter

Meter
Anti-Islanding

All utility-interactive systems use a safety feature known as “anti-islanding” to prevent the solar array from remaining connected to the electric utility when the grid is down.
Becoming your own Utility
Investment of energy generation

When you install solar on your home

You become your own utility
A GREEN FLORIDA FOR A BLUE PLANET

Cost of Fuel
vs.
Cost of Money

Cost of Fuel vs. Cost of Money

Series 1
Series 2

Cost of Fuel
Cost of Money
The cost of home ownership
Thank You
Where Does Our Energy Come From

Estimated U.S. Energy Use in 2012: ~95.1 Quads

Source: LLNL. 2013. Data is based on DOE/EIA-0335(2013-05), May, 2013. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential and commercial sectors, 80% for the industrial sector, and 21% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-M410327

https://flowcharts.llnl.gov/