

ELECTRICITY IN YOUR HOME

SESSION ONE

- **Electricity**
- **Generation/Distribution**
- **Components of a home electrical system**
- **Ways we connect**

SESSION TWO

- **Volts, Amps and Ohms – why we “blow fuses”**
- **Working with electricity**
- **Improvements**
- **Your questions**

ELECTRICITY

- **The movement of electrons**
- **Static - Current**

STATIC ELECTRICITY

- **The imbalance of electrons between two elements**
- **Generated by friction**

STATIC ELECTRICITY



STATIC ELECTRICITY

- Chemically stored
- Ions in solution



CURRENT ELECTRICITY

- **The “flow” of electrons**
- **Created by movement of wire through a magnetic field (induction)**
- **Mechanical energy to electrical energy**

HOW IS IT CREATED IN CA?

Steam turbines

- Natural gas – 81
- Coal – 2
- Oil – 2



Los Alamitos Generating Station - Gas

HOW IS IT CREATED IN CA?

Steam turbines

- Nuclear - 2



Diablo Canyon – Nuclear Generating Station

HOW IS IT CREATED IN CA?

Biomass – 19



Puente Hill Gas-to-Energy Facility

HOW IS IT CREATED IN CA?

Pumped storage – 7



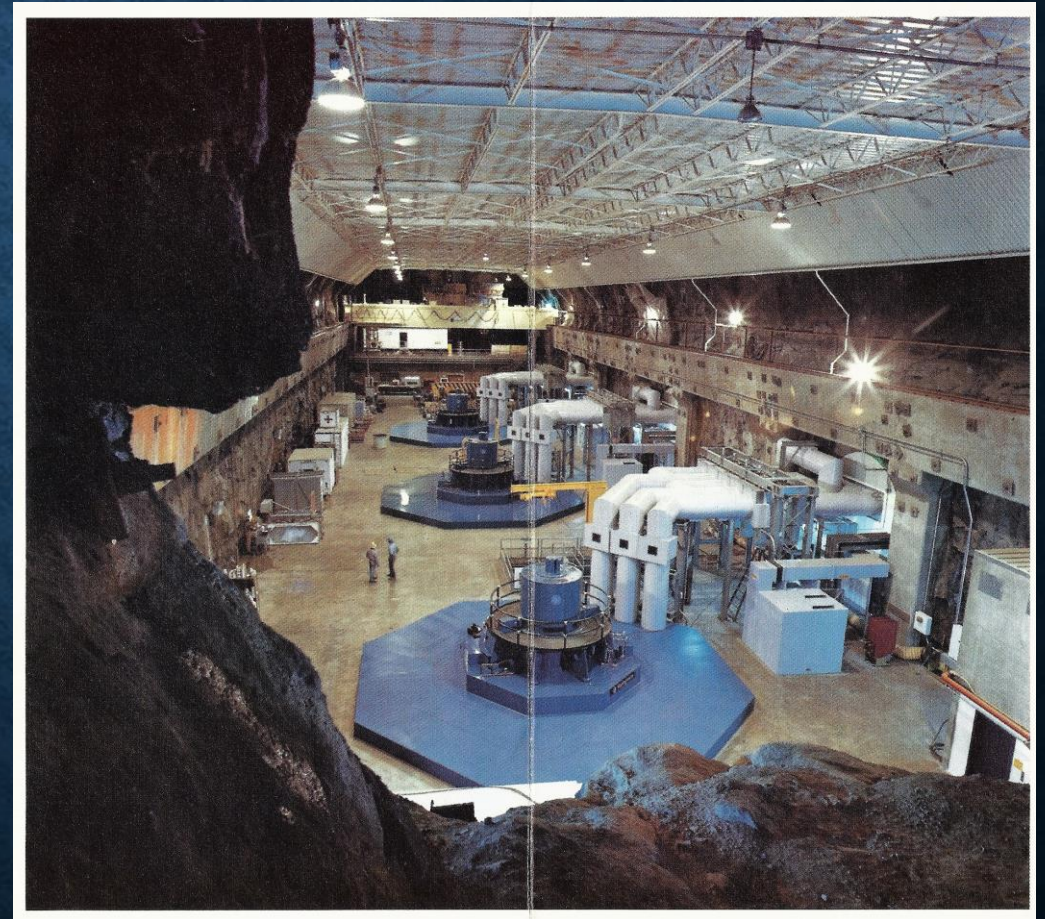
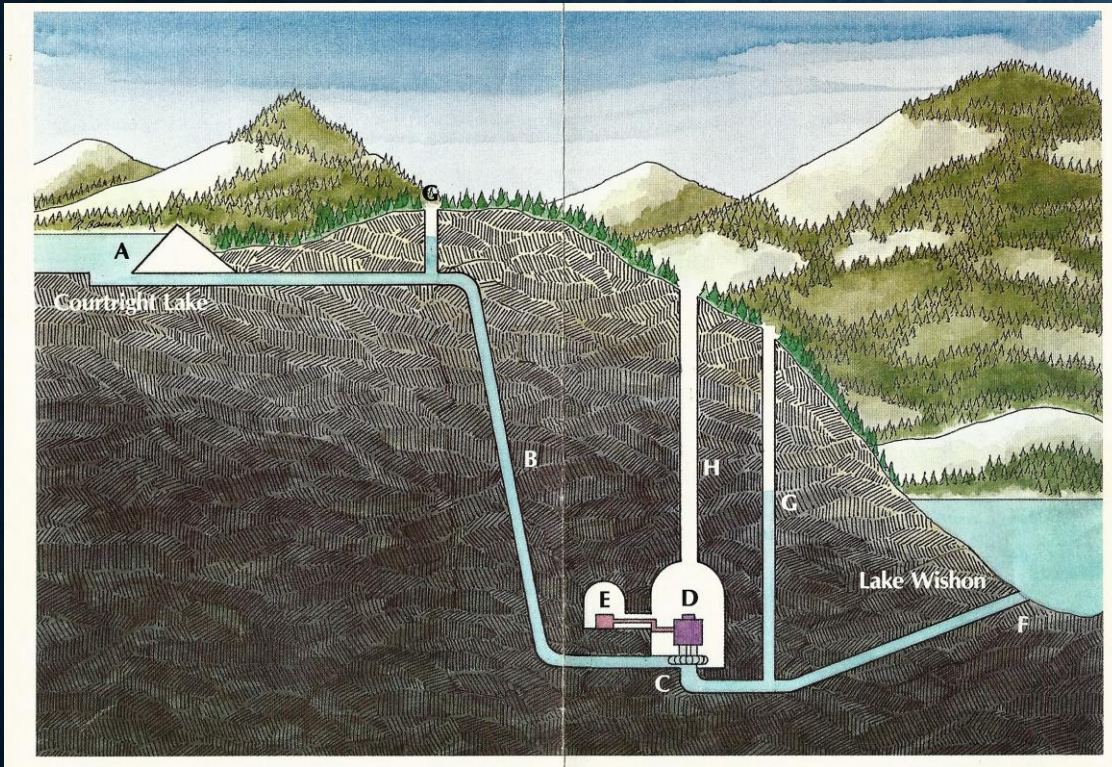
Castaic Power Plant

HOW IS IT CREATED IN CA?

Hydroelectric -28



Oroville Dam



HOW IS IT CREATED IN CA?

Solar - 32



Topaz Solar

HOW IS IT CREATED IN CA?

Geothermal



The Geysers

HOW IS IT CREATED IN CA?

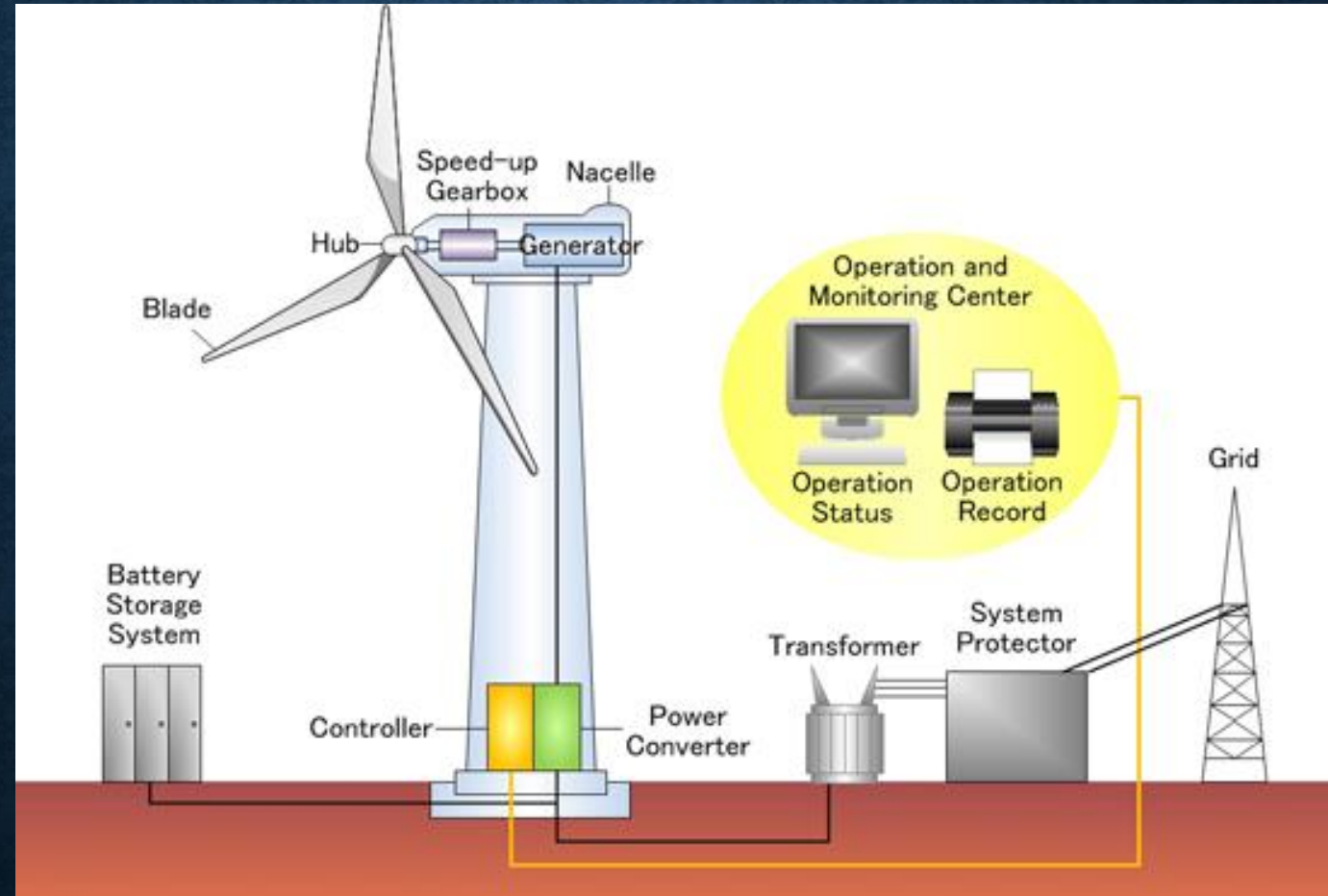
Wind - 16



San Geronio Pass Wind Farm

HOW IS IT CREATED IN CA?

Wind - 16



DELIVERY STEPS

1 – **Generation**

2 - **Transmission** – Converted to a very high voltage from the power plants to neighborhoods

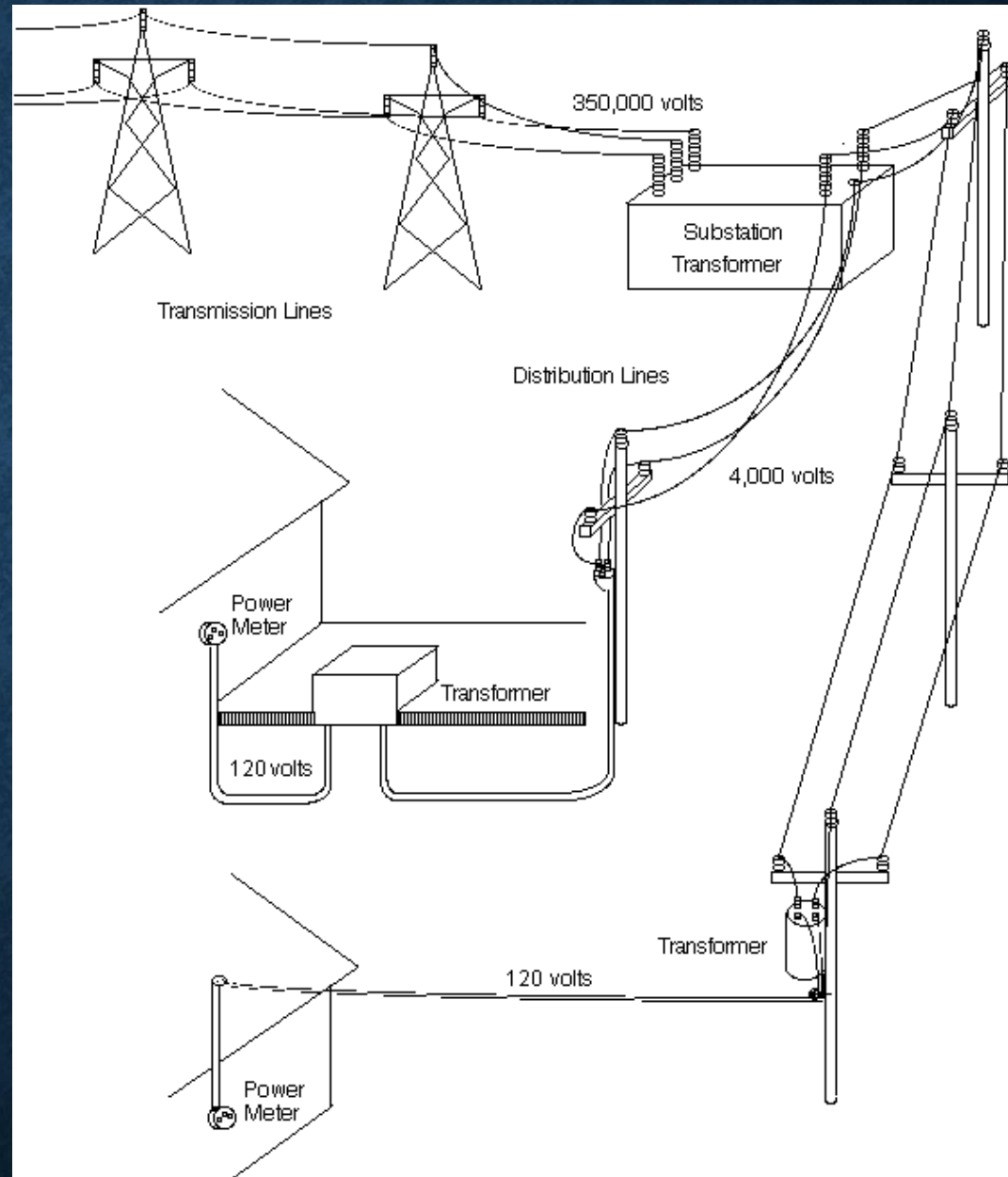
3 - **Distribution** – Then converted to a lower voltage via a step-down transformer to be safely distributed to homes

4 - **End Use**

DISTRIBUTION VIDEO



POWER DISTRIBUTION



METER & CUTOUT



WATT?

- **(Watt = 1 Joule/second)**
- **Watts = the rate of power consumption**
- **Kilowatt hours = The total amount consumed**

WATT?

Lifting 110 lbs. box
5 feet in one second
= 550 Watts



WATT?

- **Cooking in a 2,000-watt oven for half an hour**
- **Less than an hour using a dishwasher (1,000 - 1,500 watts)**
- **Around three hours watching a plasma TV (280 - 450 watts)**
- **Keeping a fridge-freezer (200 - 400 watts) on for about three hours**
- **Using a laptop (20 - 50 watts) all day**
- **Keeping a broadband router (7 - 10 watts) on for five days**

HOUSE DISTRIBUTION OVERVIEW



DO NOT REMOVE - STRUCTURAL PEST CONTROL
Regulation 1006.1

AIR COMP.

DEN

WASH

SMOKE

FALL

M. 300

Stove

110V BACK YARD

Micro

GARAGE

Kitchen tv garage

AC

SPA Disconnect

DO NOT REMOVE - STRUCTURAL PEST CONTROL
Regulation 1996.1

CIRCUITS THROUGH THE HOUSE

| WIRING COLOR GUIDE | |
|--------------------|---------|
| WHITE WIRE | NEUTRAL |
| BLACK WIRE | HOT |
| RED WIRE | HOT |
| BARE WIRE | GROUND |

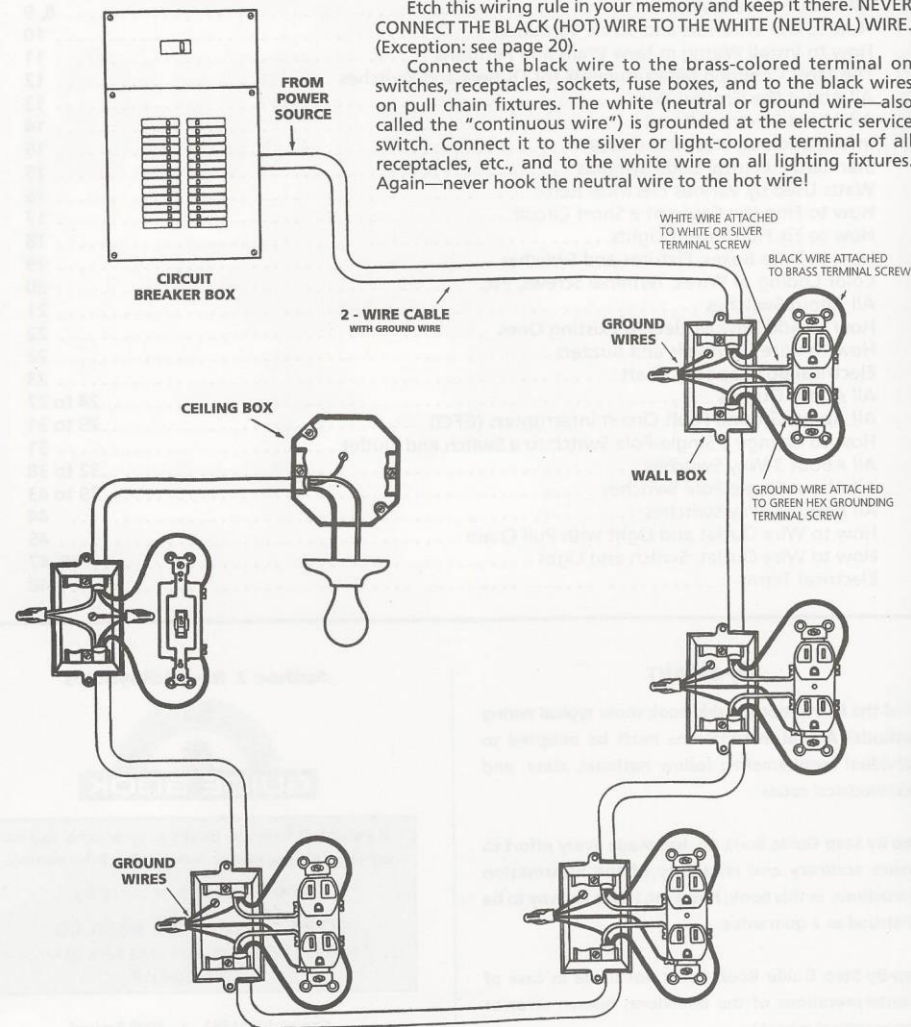
How the Home Electrical System Works

Color Coding of Wire

- The black wire is HOT
- The white wire is NEUTRAL

Etch this wiring rule in your memory and keep it there. NEVER CONNECT THE BLACK (HOT) WIRE TO THE WHITE (NEUTRAL) WIRE. (Exception: see page 20).

Connect the black wire to the brass-colored terminal on switches, receptacles, sockets, fuse boxes, and to the black wires on pull chain fixtures. The white (neutral or ground wire—also called the “continuous wire”) is grounded at the electric service switch. Connect it to the silver or light-colored terminal of all receptacles, etc., and to the white wire on all lighting fixtures. Again—never hook the neutral wire to the hot wire!



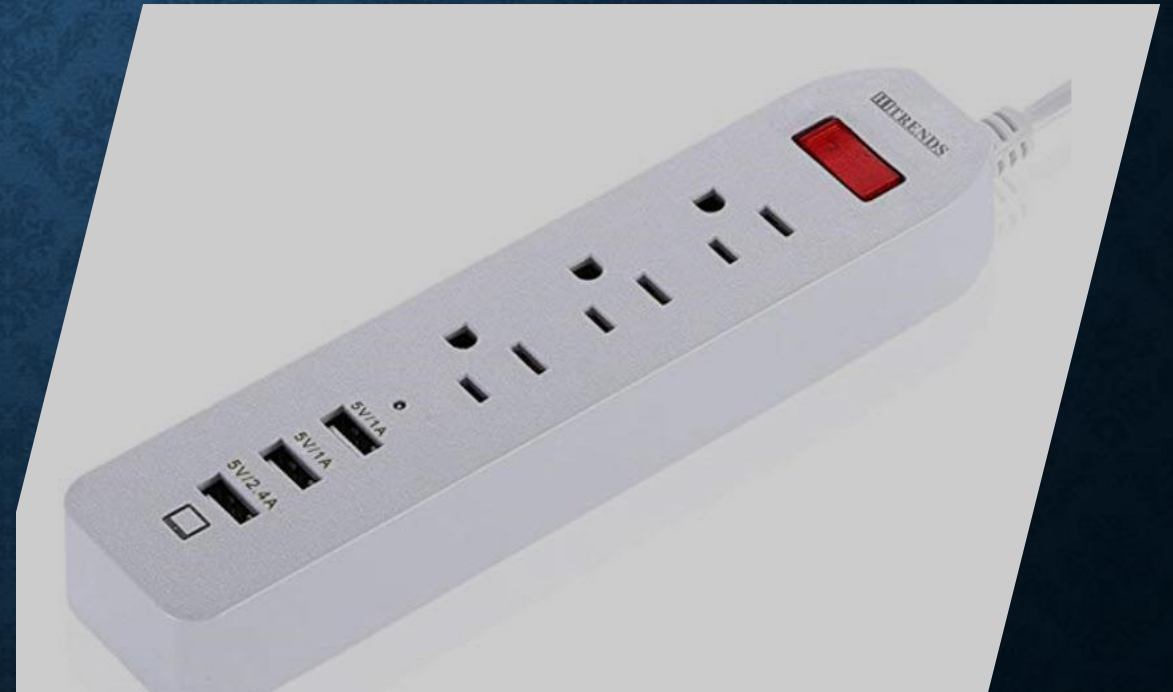
115VAC , 15A WALL PLUGS



GFCI PLUGS



- For surge protection – **Power strip**
- Overload protection-**Power strip**
- For temporary use - **extension cord**
- ~~When devices exceed plugs -
extension cord~~



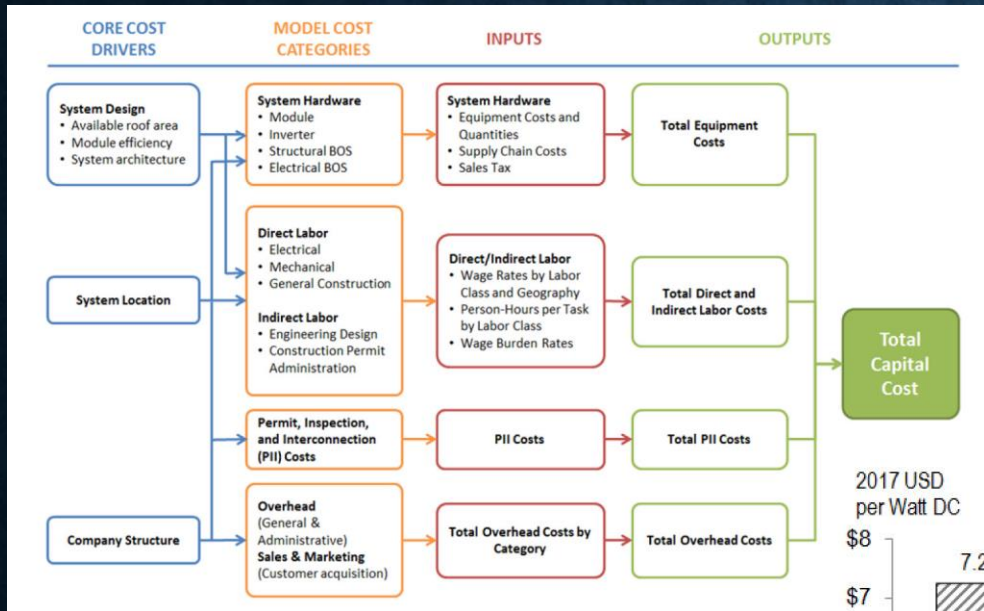
UNIVERSAL POWER SUPPLY (UPS)

- Prevents computer damage during power failure.
- Protects data
- Automatically shuts down computer during power failure
- Provide surge protection



ADDING SOLAR POWER - VALUE

- **Reduced electrical consumption cost/month**
- **Increase in property value**
- **Materials/labor costs decreasing**
- **Federal tax credit**
 - 26% until 12/31/20
 - 22% 1/1/21 – 12/31/21
 - 0% after 1/1/22
- **Purchase/lease options**
- **Annual true/up programs**



SOLAR COST TRENDS

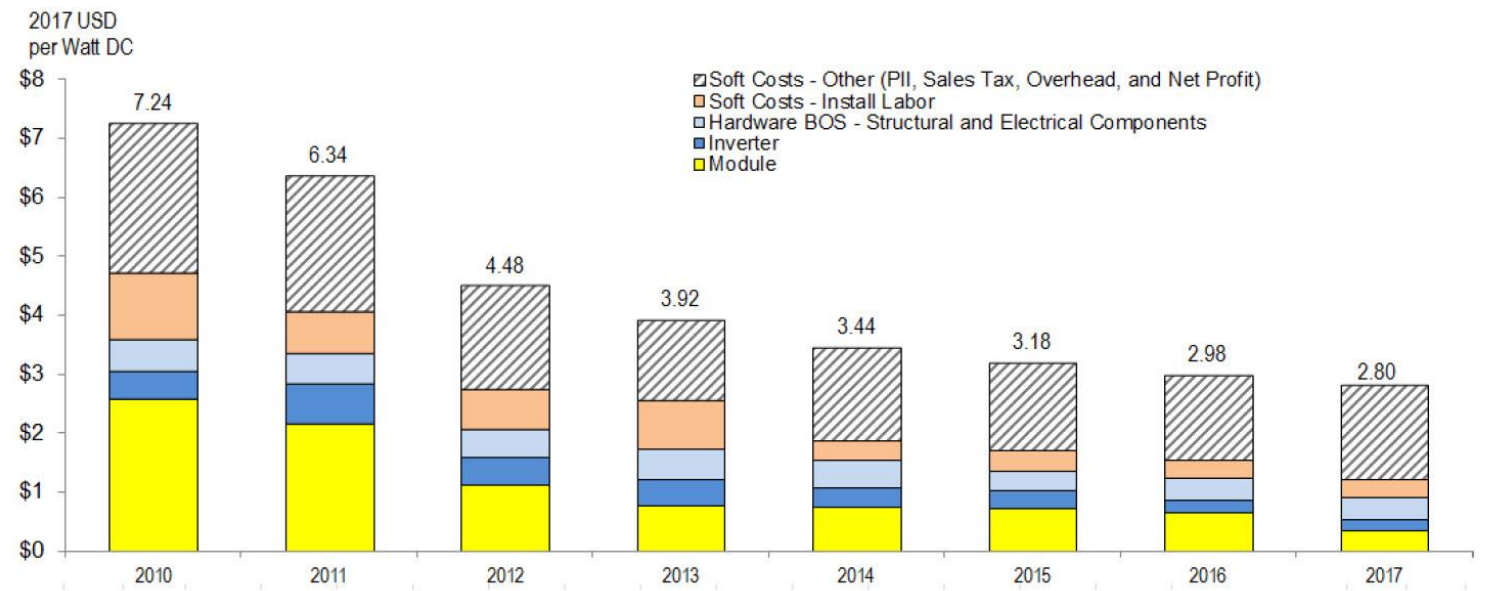
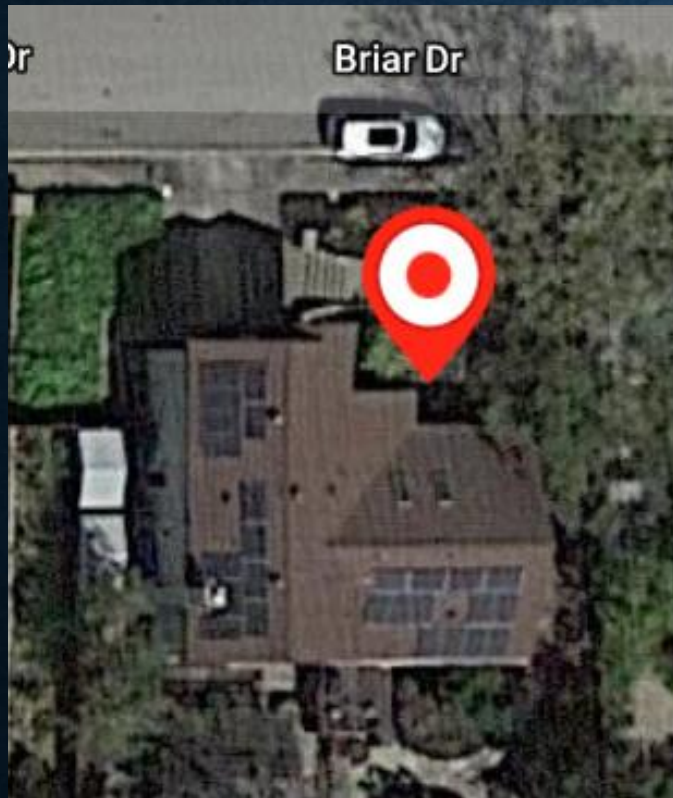


Figure 17. NREL residential PV system cost benchmark summary (inflation adjusted), Q4 2009–Q1 2017

MY SOLAR SYSTEM



MY SOLAR SYSTEM COSTS

| | |
|----------------------------------|--------------------------|
| Average annual usage | 9,500 kWh |
| Solar production annually | 10,800 kWh |
| Net electrical usage | <1,300 kWh> |
| Return of Investment | 7 years |





PG&E NET METERING ADJUSTMENT



MCE (CCA) NET METERING ADJUSTMENT



PROTECTING YOUR POWER - CONSIDERATIONS

| | Battery Backup | Generators |
|--|---|---|
| Starting costs | \$10k - \$20k | \$3k - \$5k |
| Can connect to solar Time of Use rates? |  |  |
| Fuel/Maintenance |  |  |
| How long/how much? | A few hours and selecting what to power | Until the fuel runs out |

| | <u>Battery</u> | <u>Generator</u> |
|---|--|---|
| Noise | Low | Moderate |
| Environmental impact | Depends on charging source | Uses fossil fuels and produce exhaust |
| Internet connected/controlled | Yes | No |
| Activation time following outage | Nearly instantaneous (no noticeable power loss) | 10-30 seconds (devices will lose and then regain power) |
| Installed cost for the equivalent of 20kW system | \$28-40K | \$9-\$12K |
| Eligible for federal tax credit? | Yes | No |
| Replacement lifespan | 10 years for lithium ion and 5 years for lead acid | 5 years |
| Maintenance | None | Replacement fuel costs; or oil change every thousand hours (at least once a year) for line-connected generators |
| Recommended usage | Emergency backup, smaller loads, off grid | Critical loads that require a reliable source of large amounts of power |

- **Thursday**

Volts, Amps, Ohms (?)

Breaker panels and loads

Wiring plugs, switches

Black, white, & green (?)

Addressing your questions