

Solar Energy: Ready, Set, Go!



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Agenda



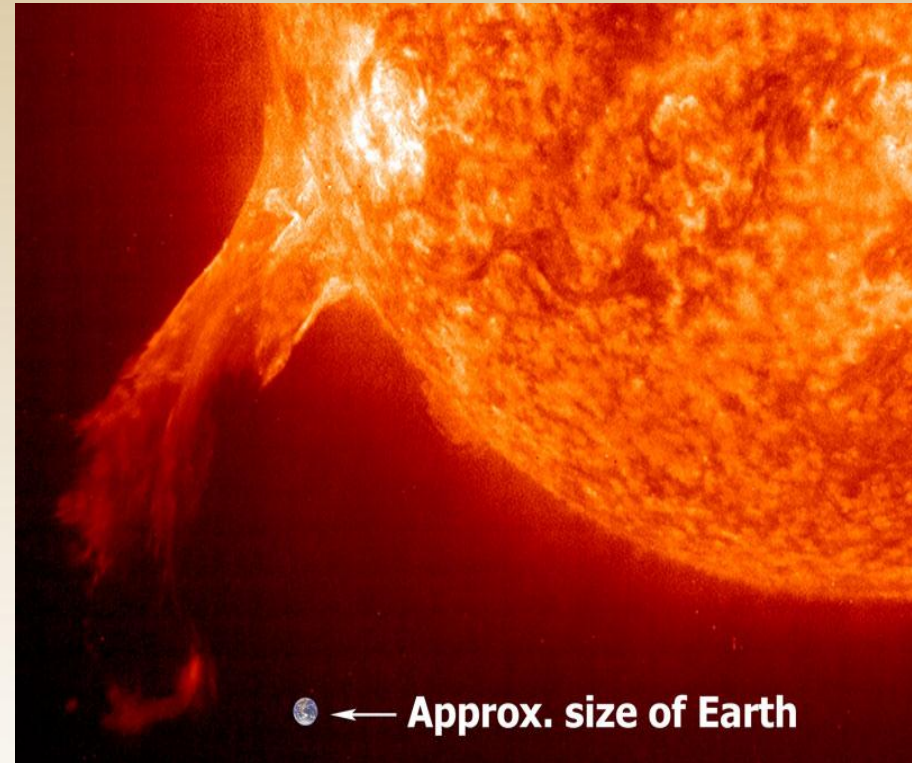
- **PART ONE**
 - Solar Energy
 - Types of Systems
- **PART TWO**
 - Photovoltaics
 - Design / Installation
 - Solar “Ready”
- **PART THREE**
 - Solar Thermal
 - Design / Installation



Solar Energy: Energy from the Sun

- Drives the climate
- Drives the weather
- Drives wind and water cycles
- Drives the ocean currents
- Supports all life on Earth

- Solar Photovoltaic (PV)
- Solar Thermal
- Other Renewables:
- Wind Energy
- Biomass
- Wave and Tidal Power
- Low Impact Hydro-electric
- Geothermal





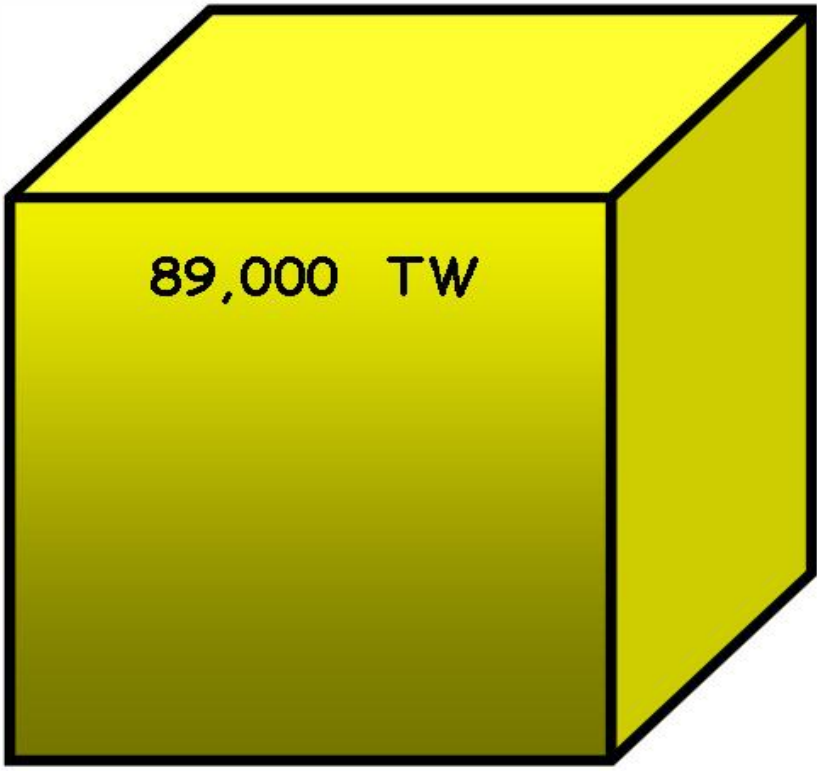
Solar Energy Available on Earth (annual basis)

- Units: Zettajoules (ZJ)
- (10^{21} Power = A LOT!)

- Total energy available: 3850 ZJ
- Oceans absorb approximately 285 ZJ
- Biomass captures approximately 1.8 ZJ
- Winds can theoretically supply 6.0 ZJ
- Worldwide energy consumption: 0.471 ZJ



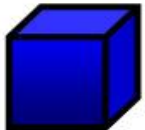
Solar Availability



Solar

The amount of solar energy available to the Earth in one minute exceeds global energy demand for a year

370 TW



Wind

15 TW



Global Consumption

Solar Energy: Two Basic Categories



- **Photovoltaics (PV)**
 - Electricity
- **Solar Thermal**
 - Heat



Solar Power: Photovoltaics



- **Photovoltaics: Electricity**
 - Cell
 - Panel
 - Array
- **Various Shapes and Styles**
 - Flat Panels
 - Flexible / Thin film
 - Amorphous
- **Ratings in Watts (or kW)**
 - Allow 100 Sq Ft per kW
 - \$4.50 - \$7.50 / Watt



Solar Power: Installation

- Main Components

- Panels
- Mounts
- Electrical routing
- Inverter
- Battery

- Grid connection

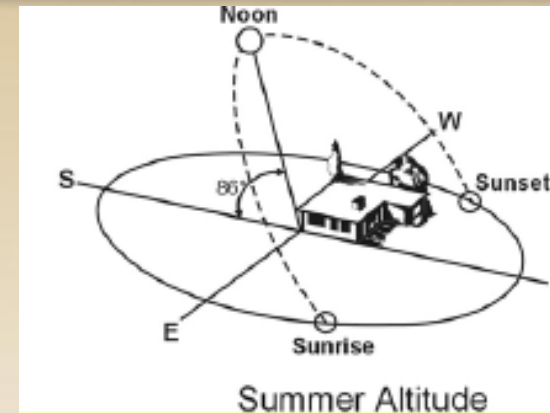
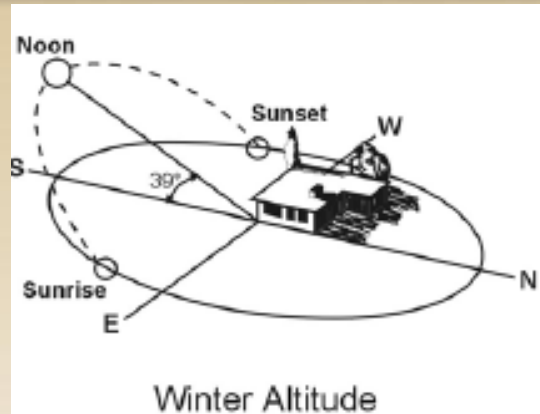
- Certified Installer (please!)





Solar Power: Sizing And Design

- **How much?**
 - Budget
 - Roof space
 - Power generation
- **Sun availability**
 - Surrounding obstacles
- **Building orientation**





Solar Ready

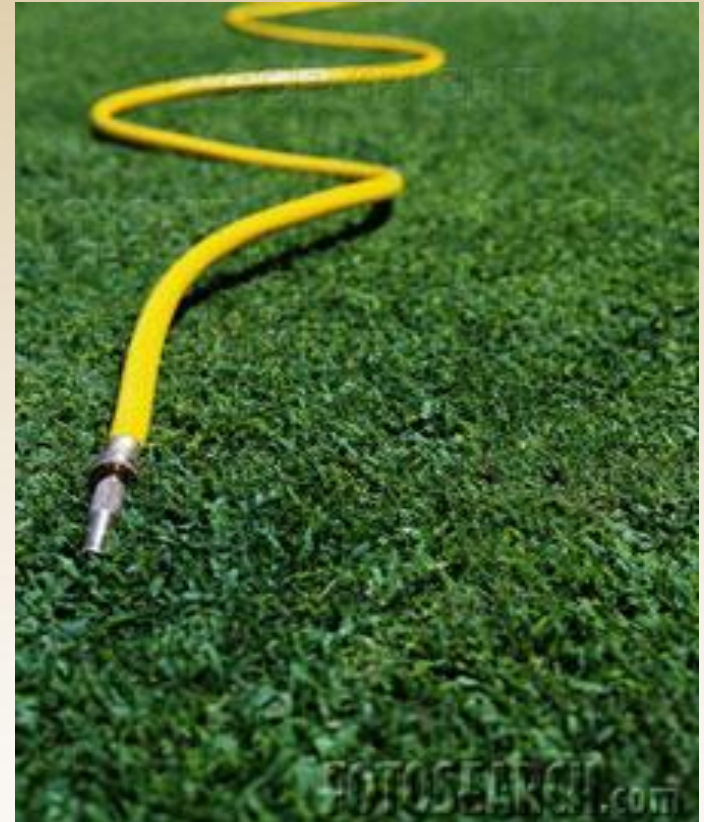
- Good solar power designs do not just “happen”
- Start with a high efficiency building
- Make the building suitable for solar at the design stage
 - Roof orientation
 - Conduits
 - Electrical space
- Provide for future expansion capability

Plan Ahead



Solar Thermal

- Use of Sun energy to heat a fluid
- Typically water
- Space heating
- Ventilation
- Industrial process heat
- Cooking
- Water distillation / disinfection
- Other





Solar Thermal



- Relatively simple / Inexpensive
 - Two main types of residential collectors
 - Flat panel
 - Evacuated Tube
- Have been commercially available since late 1800's
 - Been used for millennia
- Installed at both poles





Solar Thermal - Types

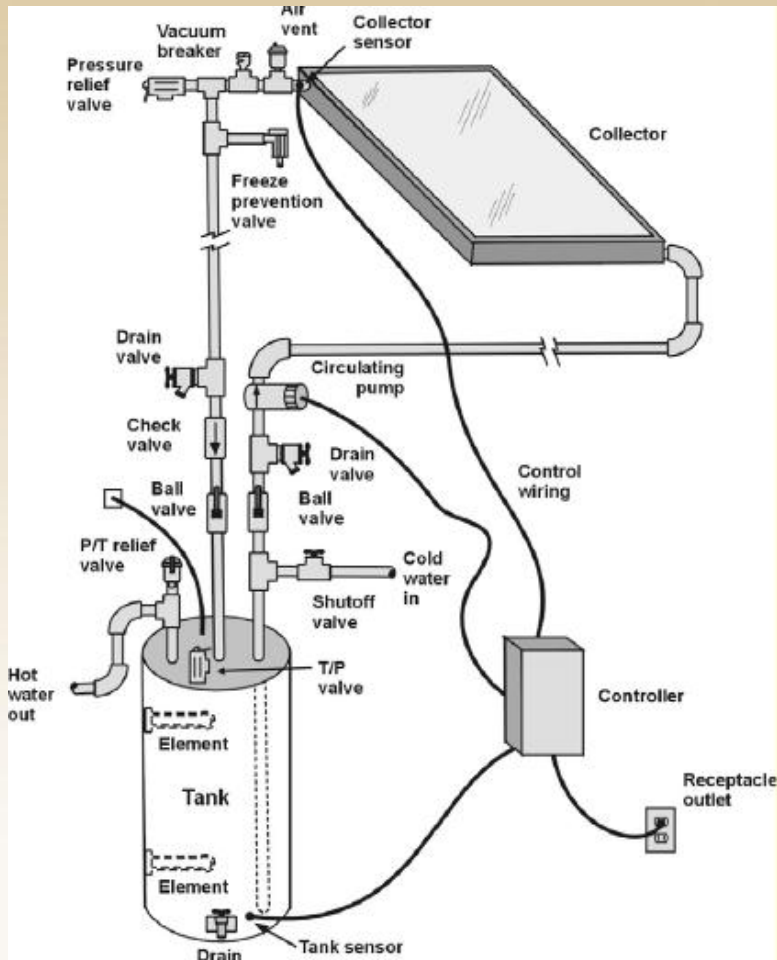


Flat Panel



Evacuated Tube

Solar Thermal – Design / Installation

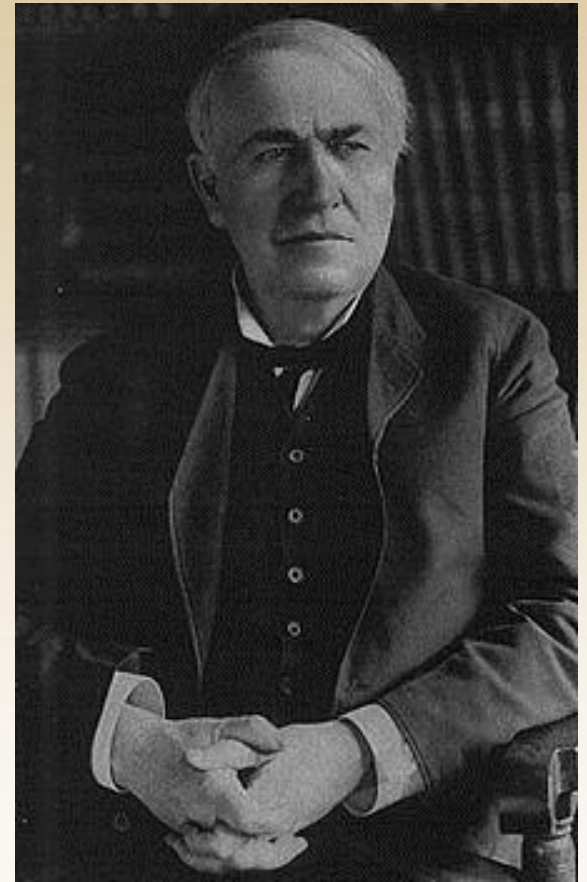


- Insure an adequate need!
 - Not suitable for low hot water use
- Systems have many components
 - Collector, storage tank
 - Pump
 - Controls
 - Plumbing
 - Electricity (not all)
- Challenging for existing buildings
- Use a certified installer. (Please!)



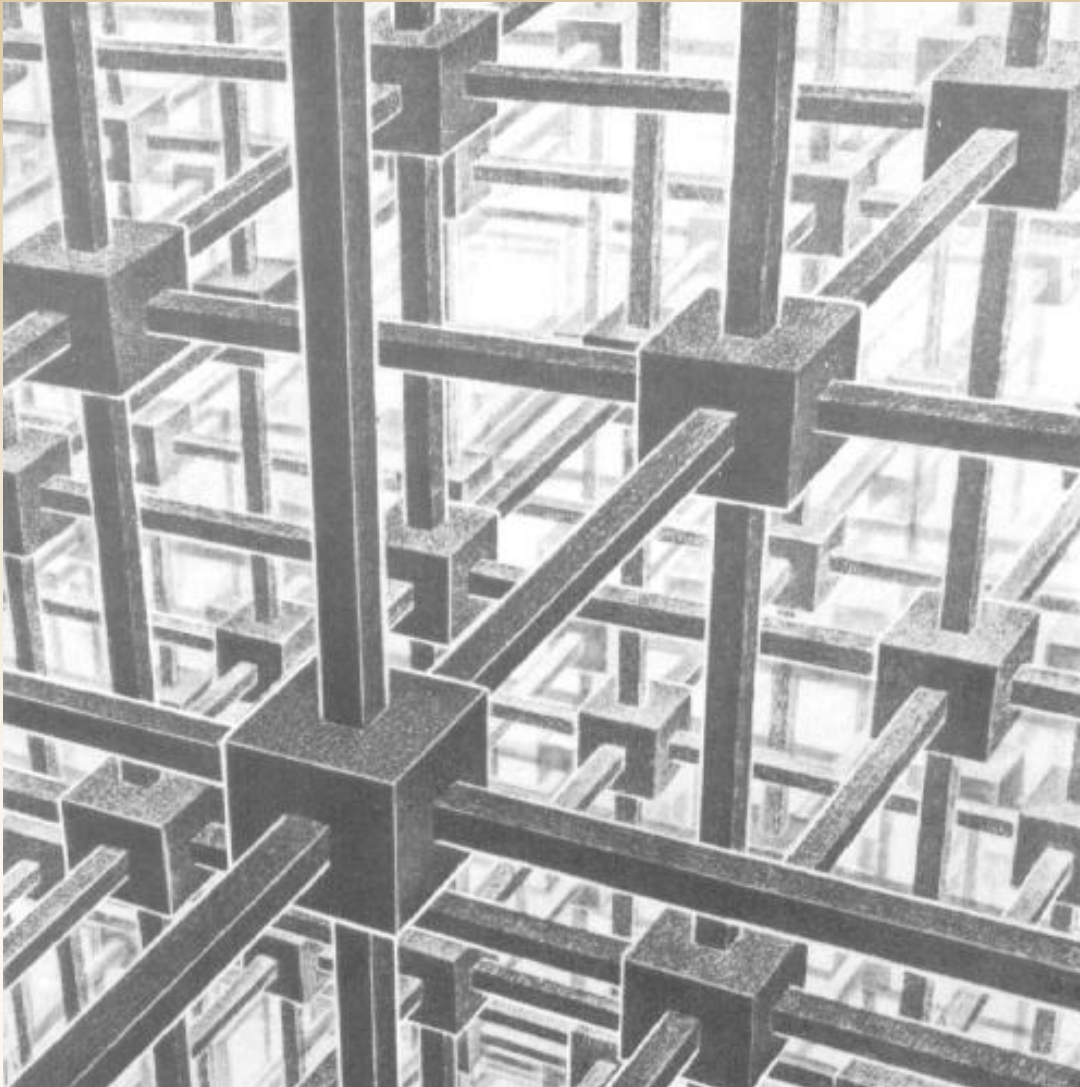
Thomas Alva Edison (1847 – 1931)

“We are like tenant farmers chopping down the fence around our house for fuel when we should be using nature’s inexhaustible sources of energy – sun, wind and tide. I’d put my money on the sun and solar energy. *What a source of power!* I hope we don’t have to wait until coal and oil run out before we tackle that.”





Thank you!



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