Home Energy Series
Welcome to The Home Energy Series

Who are you?

• Who attended either the 1\textsuperscript{st} or 2\textsuperscript{nd} session?
• Who got value out of the previous sessions you attended?
• Who thought I talked too fast at the last session?
• Who already has installed solar?
• Who is interested in installing solar in the next 6 months?
• If you already have solar, who is interested in understanding energy storage? Or trying to add on to your solar system?
Introduction

Context for Seminar

• You are the expert.
• An affordably comfortable, safe and healthy home is possible.
• Knowledge is power and in this case financial savings.
• This is just the beginning.
Introduction

My Approach

• Have a goal in mind for where you want your home to be
  • Give up any resignation and dream a little.
  • STAY OPEN...

• Have a budget for what you’re willing to invest to get you there
  • Or a monthly investment that you’re comfortable with.

• Do the math “math it”

• Consider the additional benefits
  • Happiness, freedom, peace of mind...for 3% - 5% of the homes value
Introduction

Series Outline

Session 1: Home Evaluation
Understanding Your Home’s Energy Usage and Your Utility Bill

Session 2: Home Systems
Understanding Your Home’s Building Enclosure and its Major Systems

Session 3: Home Energy
Creating Your Whole House-Based Solar Strategy and Going Solar the Right Way
Session 3 – Home Energy: Creating Your Whole-House Based Solar Strategy and Going Solar the Right Way
Session 3: Understanding Your Home’s Energy Usage

Intended Objectives

- Establish a basic foundation for solar technology.
- Leave you empowered to design a solar solution for your home.
- Be a resource to answer questions about solar energy and creating a home energy project.
Session 3 Outline – Energy Systems

• Solar and Storage Technology
  • Panels
  • Inverters
  • Storage

• Designing Your Solar Project
  • NET Metering
  • System Sizing
  • Electrical Panels
  • Roofing
  • Financing
  • Cost

• Contracting for Success
Solar and Storage Technology
Solar Energy Basics

Grid-tied home solar power system.
Solar Panels

- Efficiency
- Warranty
- Manufacturer
- Performance
- Aesthetics
Efficiency

• The more efficient the panel the less space you need and the higher the price.
• Design Principal – If you have enough space go lower efficiency.
• 300 Watt – 370 Watt
• 18% - 22% Efficient
• Watch out for 72 Cell Modules
Warranty

• Power Out Warranty – Warranty of Output Usually at Year 25.
  • Panasonic - 90.76% @ Year 25
  • LG - 86% - 89% @ Year 25
  • Q-Cell – 85% @ Year 25
  • Silfab – 80% @ Year 30
  • (Linear or Step?)

• Product Warranty – 12 Years or 25 Years

• Shipping? Labor Included?
Manufacturers

• 3 Leading Brand
  • Panasonic
  • LG
  • Sunpower

• Tier 1 vs. Tier 2 Manufacturers

• Additional Manufacturers
  • Q-Cell
  • Longo
  • Canadian Solar
  • Silfab
  • Trina Solar, Etc.
Solar and Storage Technologies – Solar Panels

Performance

• STC vs. PTC
  • https://www.gosolarcalifornia.org/equipment/documents/PV_Module_List_Simplified_Data.xlsx

• Performance Characteristics
  • Degradation
  • Heat Co-Efficient
  • Low-Light Performance
  • Shade Tolerance – (Internal By-Passes)
  • Water Drainage
Solar and Storage Technologies – Solar Panels

Aesthetics
Inverters

- Are an essential device which converts DC power from the solar panels into AC power.
- Hub for monitoring
- Most likely point of failure
Types of Inverters

- String Inverter
- Micro Inverter (Enphase)
- Optimizer (Solar Edge)
Central / String Inverters

- Original technology
- Drawbacks:
  - 12 Year Life
  - String
    - Shading
  - Single Point of failure
Micro Inverters (Enphase)

• **Benefits:**
  • No single point of failure
  • Complete autonomy
  • All-AC (Safe AC)
  • 25 Year Warranty
  • Panel by panel monitoring
  • US Headquarters

• **Drawbacks:**
  • Slightly lower storage efficiency
  • Inverters on the roof
  • Increased cost
Optimizer and Inverter (SolarEdge)

- **Benefits:**
  - Panel by panel optimization
  - DC in the garage
  - Largest Company

- **Drawbacks:**
  - Single point of failure
  - Higher failure rate
  - More limited string performance
Reason 1 to Install Batteries

- Emergency Backup
  - Anti-Islanding Effect

Note: To install a Grid-Tied Hybrid System you need an Automatic Transfer Switch (ATS)
Reason 2 to Install Batteries

- Time-Of-Use Energy Shifting / Time-Of-Use Energy Arbitrage
Types of Batteries

DC Coupled

- LG Chem (SolarEdge)
- Generac Energy

vs.

AC Coupled

- Tesla Powerwall
- Enphase Ensemble
- Sonnen Batterie
Batteries Specs that Matter Most

• Power
  • What is the maximum amperage of the system?
    • 16 Amps? 32 Amps? 64 Amps?
    • Surge Capacity?
    • Scalable?

• Energy
  • How long will the battery last?
    • 10 kwh, 20 kwh, 40 kwh?

• Safety
  • What’s the chemistry of the battery?
    • Lithium Ion with Cobalt
    • Lithium Ferrous Phosphate
Solar and Storage Technologies – Batteries

Market Timing

![Graph showing the projected cost of Li-On Battery $/kWh]

- $300/kWh
- $200/kWh
- $100/kWh

Assumption: 15% /year Technology Cost Curve

Source: Bloomberg New Energy Finance
Source: Economist.com/graphicsdetail

*Forecast
Market Timing

A few potential coinciding catalysts:

1. ITC – 30% Tax Credit
   - 26% in 2020
   - 22% in 2021
   - 0% in 2022 and Beyond unless something changes

2. SGIP – Self Generation Incentive Program - $800 Million More

3. More EVs, more and more and more and more EVs
Break and Survey
Designing Your Solar Project
How the Net Energy Program Works

- Works like a bank account...
- Credits and debits are based on the time of day...you must go time of use.
- When you go solar your gas and electric bills split and you get billed annually.
- What are NBCs? Do I have to pay a $10 minimum monthly bill?
- How much will SDG&E pay me for the energy I overproduce?
- What will happen in the future?
Which Rate Structure is Ideal?

- It’s not always ideal to have your super-off peak at the lowest rate when you have solar!
- Usually DR-SES is ideal but you have to “Math It!”
How to Size Your System

• Typically 110% to 115% of your ideal usage...to all but eliminate your electricity bill. (Mostly depending on orientation and future usage...)

• What is your ideal usage?
  • More cooling?
  • Adding other loads? (Electric Vehicles)
  • Reducing loads through efficiency?
  • What else to take into account?
    • Degradation?
    • Trees?
    • Growing family? / Shrinking family?
    • Fuel Switching?
How to Size Your System

• Power vs. Energy
• My Back of the Envelop Calcs

5 KW System * .85% Efficiency * 5.5 Peak Sun Hours Per Day * 365 Days = 8,532 kWh per year

Where does the 85% Efficiency come from?
• Orientation, soiling, wire loses, degradation, etc.

• Gold Standard: https://pvwatts.nrel.gov/
How Much Power Can Your Meter Take

- **NEC 2011 NEC 705.12** – You can back feed 20% above the panel rating.
  - Plus any difference between the main panel and main breaker.
  - **6 KW System**
    - Watt = Volts * Amps
    - 6000 Watts / 240 Volt = 25 Amps
  - **125% Safety Factor**
    - 25 Amps * 1.25 = 31.25 Amps

- **100 Amp Panel = 20 Amps of Backfeed Capacity**
  - 3800 Watt Inverter / 240 Amps = 15.83 * 1.25 = 19.79

- **125 Amp Panel with 100 Amp Breaker = 50 Amps of Backfeed**
What are Ways to Address This?

1. Derate your Main Electrical Breaker
   • 125 Amps to 100 Amps
   • 200 Amps to 175 Amps

2. Install a Renewable Meter Adapter - $1,326

3. Upgrade the Main Electrical Panel
   • Watch Out for the 3’ Gas Meter Clearance
   • Underground or Overhead
Why Do Roofing with Solar

1. Tax Credit – Any structural required upgrade is not ineligible for the tax credit (Ie. Roofing)

2. You Never Want to Lift Your Solar Panels
   • $300 or More Per Panel
   • Peace of Mind
   • Do it once, do it right!

3. You Can Integrate the Flashings into the Roofing Work
How to Attach Solar Panels to the Roof

Retrofit

Shingles

Concrete Tile
How to Attach Solar Panels to the Roof

New Construction
Shingles

Concrete Tile

Designing Your Solar Project – Roofing
Designing Your Solar Project – Financing

Cash vs. Loans vs. Leases / PPAs vs. PACE

1. Cash

2. Loans – Watch out for points...

3. Leases and PPAs
   1. Only a good choice when you don’t have a tax appetite.
   2. Only a good choice when you can’t qualify and will be staying in the home.

4. PACE Loans
   1. Only a good choice when you can’t qualify and will be staying in the home.

I recommend Wheelhouse Credit Union in San Diego.
Designing Your Solar Project – Cost

Price - $ / Watt

Between $2.75 and $3.25 per watt DC is ideal for a quality system.

https://solartribune.com/your-home/solar-companies/california/san-diego/

Cost Depends on:

• Type of Roof
• Stories
• Size of System
• Type of Components
• Other Costs
Contracting for Success
Key Contract Components

• Details, details, details.
• Date for installation.
• Payment Schedule – Not to much upfront.
• Warranty Inclusions
• Performance Guarantee
• Insurance (Additionally Insured)
• [http://www.cslb.ca.gov/Resources/GuidesAndPublications/ContractingForSuccess.pdf](http://www.cslb.ca.gov/Resources/GuidesAndPublications/ContractingForSuccess.pdf)
Protect Your Home

• Job Account vs. Shop Account
• Preliminary Lien Notice
• Joint Checks
• Get Lien Releases Upon Payments – Equipment is Worth 50%