

Assessment of Solar Power Generation



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Agenda

- ◆ *Introduction*
- ◆ *Overview*
- ◆ *Requirements*
- ◆ *The Solar System Description*
- ◆ *Test plan*
- ◆ *Conclusion*



Introduction

◆ Homeowner concerns

- Rising energy prices
- Energy conservation

◆ Alternative power generation is essential

- Reduce pollution
- Reduce foreign import dependence
- Reduce cost

Problem: Augment a home's energy supply?



Overview of Approach

- ◆ **The largest, clean energy source is the Sun**
- ◆ **The Sun is a renewable, alternative energy source**
- ◆ **Investigate upgrading a home's power to include solar power generation**
- ◆ **Solar Power Subsystem**
 - **Develop subsystem requirements**
 - **Create simple design**
 - **Develop the subsystem test plan**

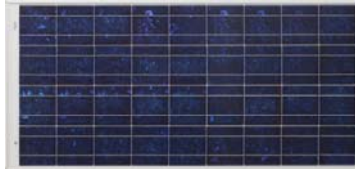


Subsystem Definitions

- ◆ **Grid – tie: Connected in Parallel to utility power services**
- ◆ **Inverter – converts DC power, generated by the solar array to AC**
- ◆ **PV – Photovoltaic module; solar array module**

Subsystem Components

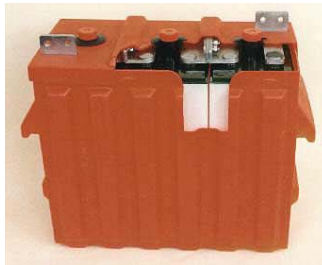
- ◆ **Solar Panels**



- ◆ **Inverter/ Charger**



- ◆ **Battery (s)**



- ◆ **DC disconnect meter**





High Level Requirements

- ◆ **The solar power subsystem upgrade**
 - Shall be easy to implement and use
 - Shall provide significant amount of household power (industry standard is ~ 50% or more of household power)
 - Shall be cost effective
 - Total power supply shall be reliable



Requirement Example

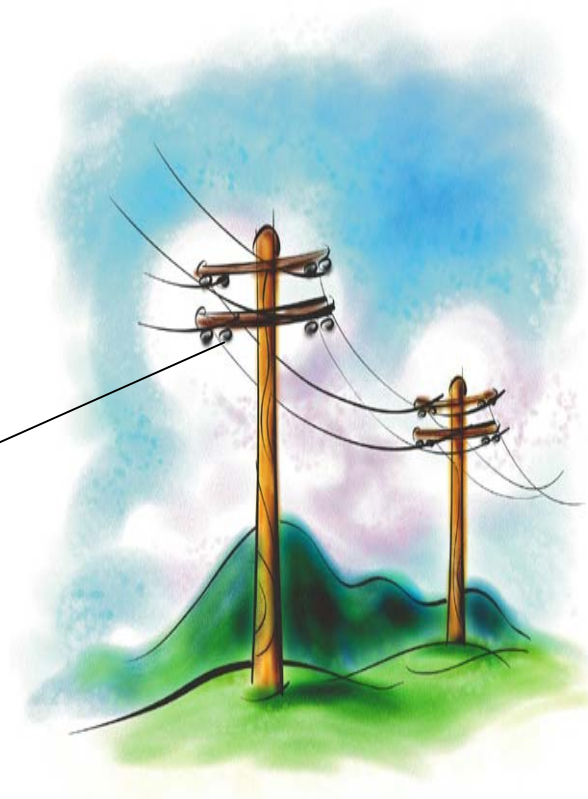
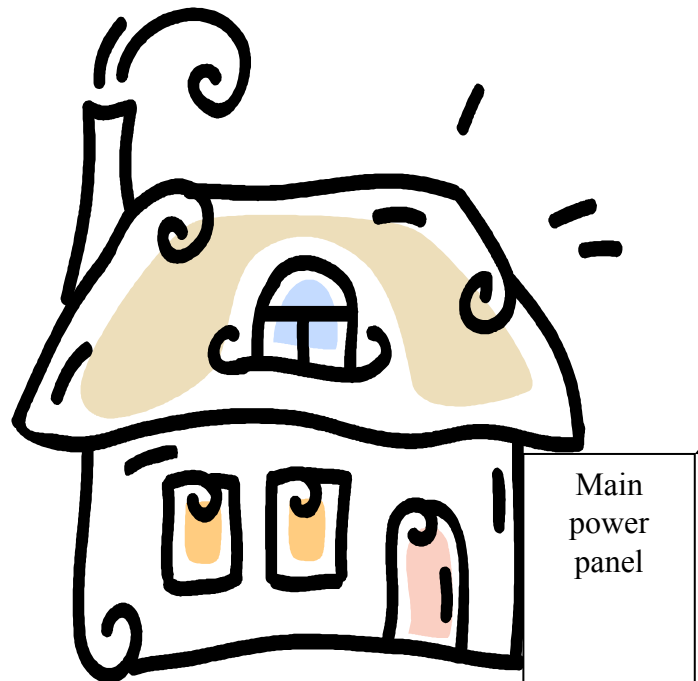
		Level 1 Requirements
	1- 1	Shall be easy to implement and use
	1-2	Shall provide significant amount of household power
		Level 3 Requirements
	2-1.1	Shall fit on the roof (28 ft x 14 ft)
	2-2.1	Shall not weigh more than 100 lbs per square foot.
	2-3.2	Shall create enough power to carry household load.
	2-3.1.2	The solar array shall support a household load maximum of 50kWh per day at 120 V.
	2-4.2	Shall create enough voltage for the household power load



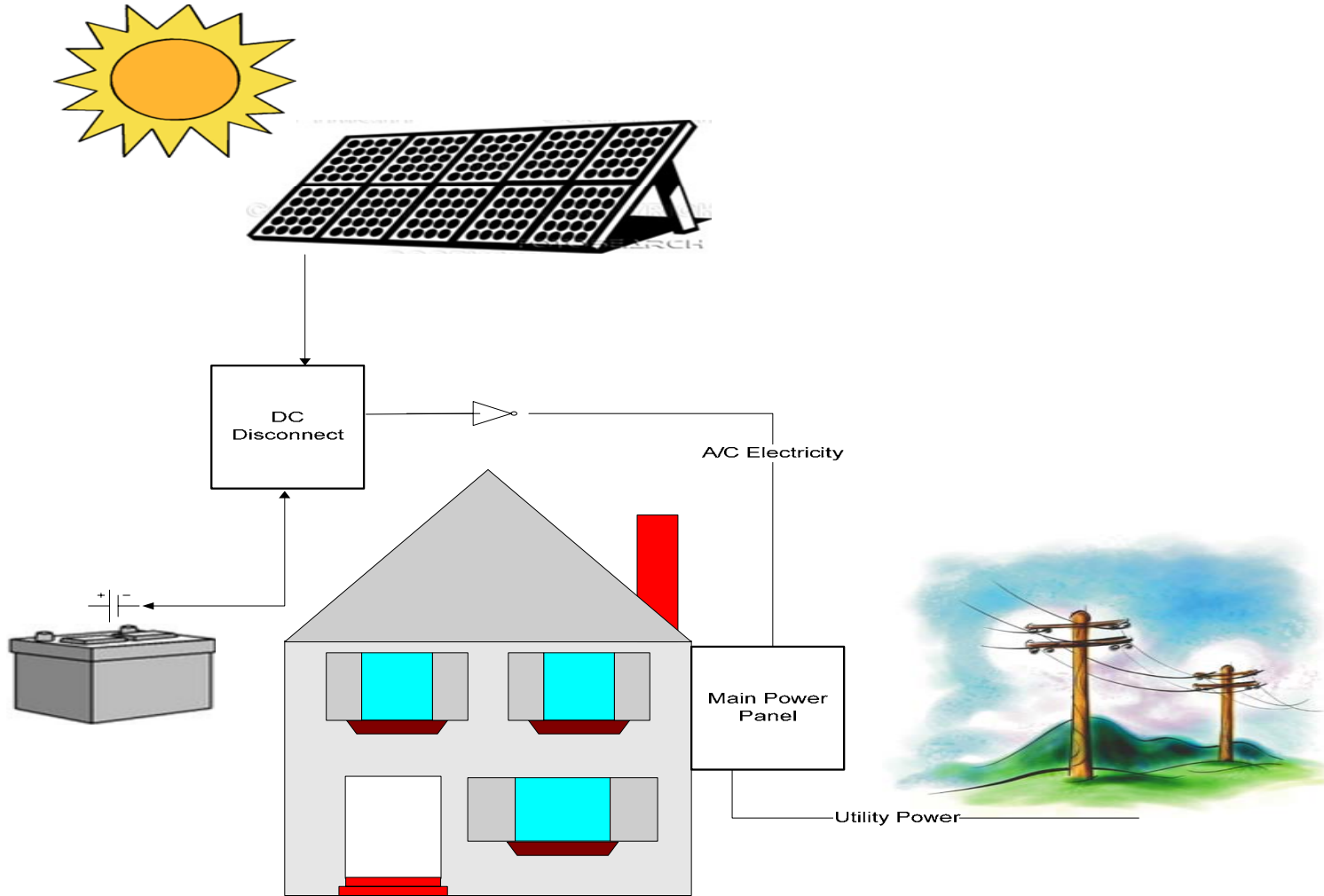
External System Constraints

- ◆ **Average direct Sunlight hours per day 4.47**
- ◆ **Local Maryland Code regulations**
- ◆ **Local Utility Company Regulations**

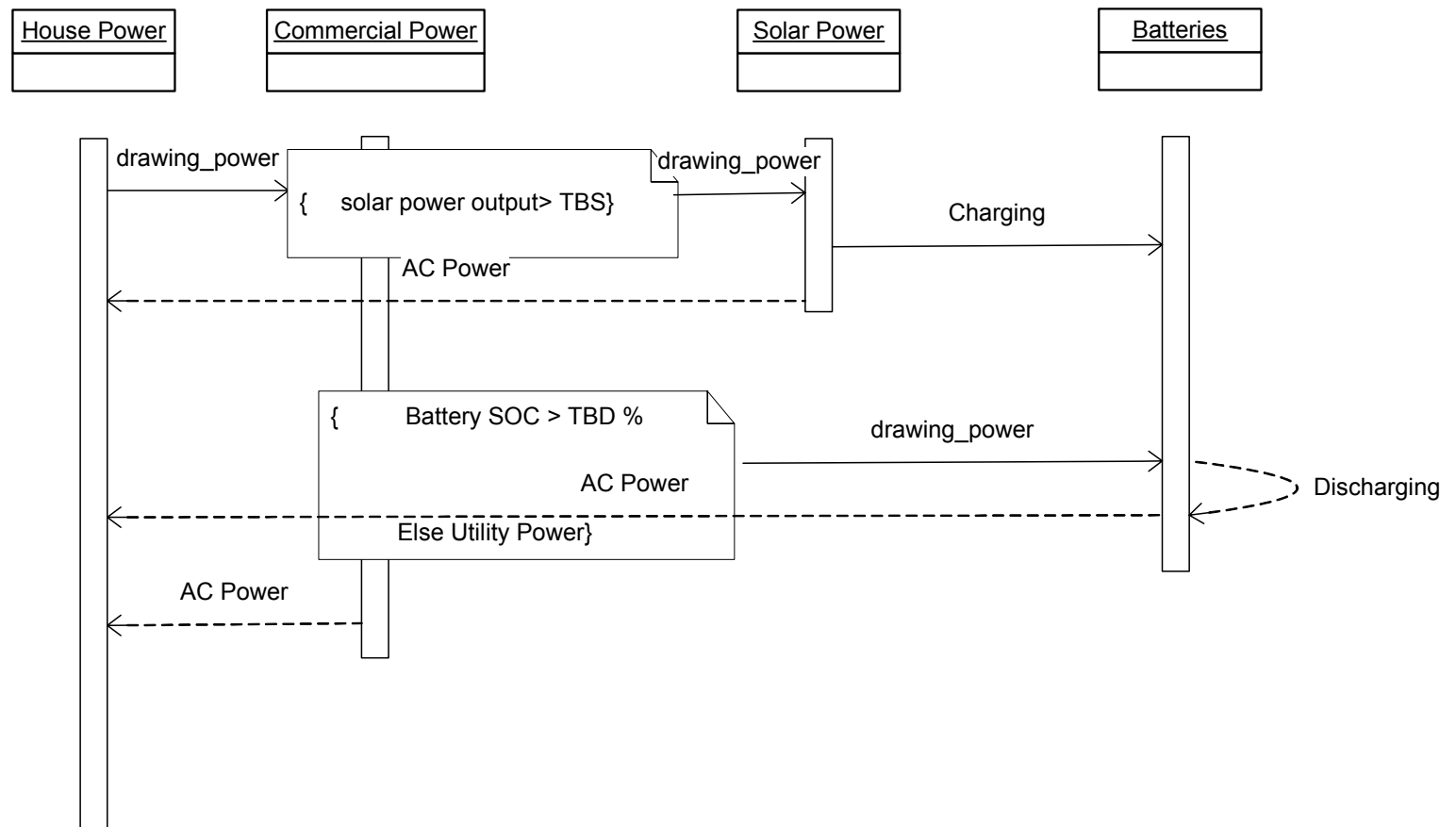
Typical Residential Power System



Residential Power with Solar System



Solar Subsystem Sequence Diagram





Test Planning

- ◆ **Mapped to requirements**
- ◆ **Focusing on the interfaces and component groups**
 - **Solar array modules: output**
 - **DC power disconnect**
 - **Inverter: input and output**
 - **Battery(s): input and output**
 - **Interactions between battery, solar array and power disconnect**
 - **Overall systems switching between utility, battery and solar power supplies**



Remaining Work

- ◆ **Finalize trade study for the components**
 - Will determine cost
 - Final Specs will be determined (power output, size, ect..)
- ◆ **Finalize test plan**
 - Traced to Requirements
 - Include verification method for each test



Conclusion

- ◆ **Demonstrated design of Solar Power Subsystem**
- ◆ **Requirements and design completed**
- ◆ **Requirements and test plan can be used for any home**
- ◆ **Solar Power Subsystem is a great alternative energy choice**

Go Green!