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Living Green

- My Life Style
- Straw Bale Passive Solar Home, Living Roofs, Zero Fossil Consumption
- Micro/mini Solar PV Farm with Battery Backup
- Electric Vehicles
- Water Wise
- Natives and Wildlifes

My Life Style

- Living in Nature
- Vegetarian since 1990, became vegan in 2000
- When doing purchases, think whether it is a “needed item”
- Buy only used Furnitures
- Airplane travels, once a year weed wracking, and purchase of electronics are my most fossil fuel use items

Straw Bale Passive Solar Home

✤ Design is based on

- Try to Eliminate Direct Fossil Use
- Reduce Energy/Water Consumption
- Reuse exiting, and use of green materials with special emphasis in use of waste materials
- Use of green construction and method
- waidy.com/home [photos]

Our Solar Straw-Bale Home
(Trying to eliminate direct fossil fuel use)

- Photovoltaics
  - Barn (crystalline)
    inverters/batteries in barn
  - House south roof (thin-film amorphous)
    inverters in basement
  - House flat roof (crystalline)
    inverters in basement
  - Pasture (crystalline)
    32 micro inverters at the back of each panel
  - 24,962 peak watts
  - Battery storage and backup
  - Generate more than we use in a year (a surplus of 14 MWh/yr, or 14,000 kWh/yr)
  - Over 40 MKh (40,000 kWh) power generation per year
- Passive Solar
  - Straw insulation
  - High thermal mass
    Concrete, tile, plaster, etc.
  - Winter sun helps heat the house
  - Crawl space helps cool house
- Secondary heating and cooling
  - Radiant floors
  - Electric heat pump in basement
  - Domestic hot water is heat pump too
  - Whole house fan

Our Solar Straw-Bale Home
(Green Construction Methods & Materials)

- Deconstruction of old house, reuse old house materials and sale of unused materials
- Flyash in concrete
- Use of recycled wood to make roof joists
- Significant use of FSC certified framing lumber
- Use of “dead spaces” for closet and storage so to reduce furniture purchases
- Insulation
  - Straw bale (provide great acoustic)
  - Cotton batts, Cellulose
  - Blue jean
- Bamboo flooring in basement
- LED lightings
- Energy star appliances
- Two Living Roofs
- ECO

First Floor Plan

Master Bedroom

Study

Library

Stairs

Pantry

Mud Room

Foyer

Living Room

Dining Room

Kitchen

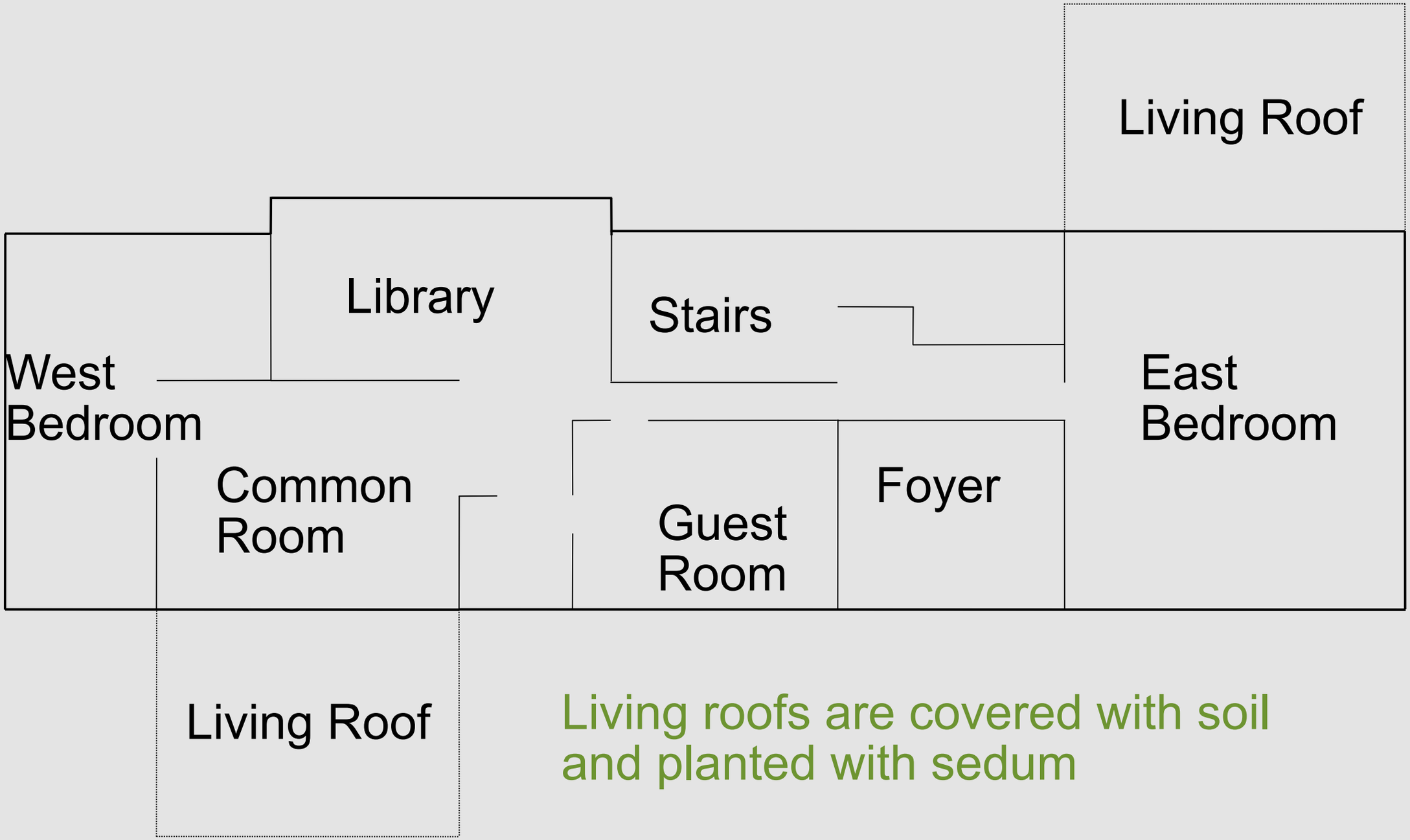
Family Room

Nook

Summer sun

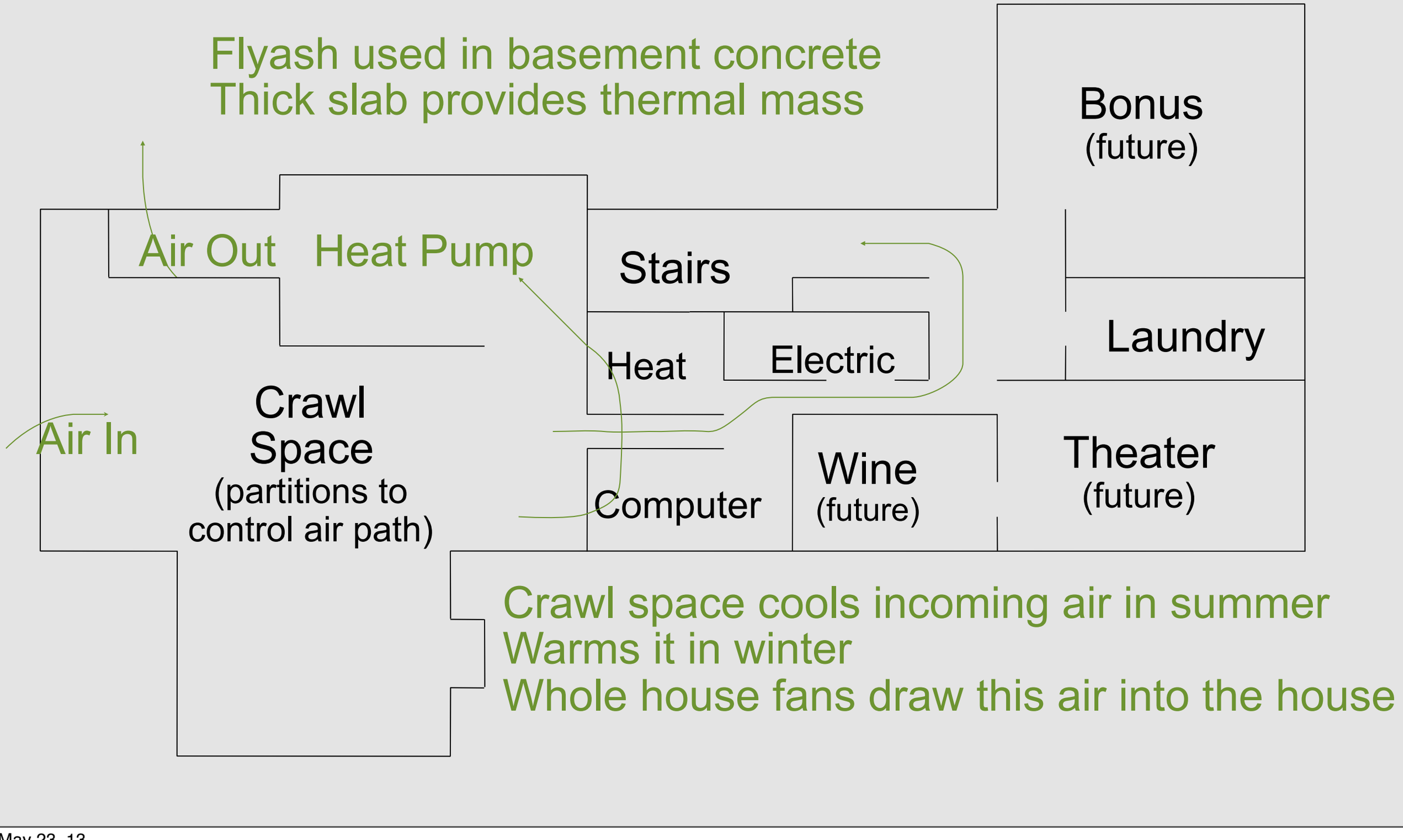
Winter sun

Second Floor Plan



Living roofs are covered with soil and planted with sedum

Basement Floor Plan



Micro Nano Farm

- **The Challenges in 2004 (Phase I) and 2009 (Phase II)**
  - Not much PV manufacturers and installers in 2004
  - In 2004, cost on both panels and installation were very high
  - Trade off between sustainable roof materials deployment and PV efficiency
  - Inverters made in 2004 do not have logging capability
  - Not a lot of tracker installer to choose from (Phase II)
  - Tracker installers are all bonded with certain brand of PV (Phase II)
- **Array sizing**
  - Create Spreadsheet on kWh required for all the lightings, appliances, EVs, computer servers, etc.
  - Use of Path Finder.
  - Due to the high cost of installation and discount in “bulk order”, we filled up all the available roofs.
  - By calculations, the 18kW system is more than what we need.
  - Array sizing for Phase II is based on $/kWh (generation), and use of PVwatts calculator from NREL, Tracker spacing tool from Wattsun and the digital version of path finder.

- waidy.com/solar

Power Generation Dec '11 to Apr '13

This Year			Last Year		
Month	Energy	Cost	Month	Energy	Cost
Apr 2013	-665 kWh	$ -144.50	Apr 2012	-1402 kWh	$ -214.07
Mar 2013	-1110 kWh	$ -195.49	Mar 2012	-1052 kWh	$ -189.22
Feb 2013	-668 kWh	$ -147.77	Feb 2012	-941 kWh	$ -170.77
Jan 2013	-355 kWh	$ -135.07	Jan 2012	-465 kWh	$ -139.44
Dec 2012	-41 kWh	$ -107.69	Dec 2011	-33 kWh	$ -10.45
Nov 2012	-316 kWh	$ -121.55	Nov 2011	0 kWh	$ 0.00
Oct 2012	-664 kWh	$ -150.99	Oct 2011	0 kWh	$ 0.00
Sep 2012	-13007 kWh	$ -97.45	Sep 2011	0 kWh	$ 0.00
Aug 2012	-1080 kWh	$ -175.33	Aug 2011	0 kWh	$ 0.00
Jul 2012	-1207 kWh	$ -190.13	Jul 2011	0 kWh	$ 0.00
Jun 2012	-1272 kWh	$ -185.88	Jun 2011	0 kWh	$ 0.00

Electric Vehicles

- EV driver since 2000
- Use of portable charging stations and EVSEs when driving to out-of-range places
- Have had six EVs, currently own three. My entire family drives EVs.
- Farthest distant driven in EV: Los Angeles
- waidy.com/EV
- waidy.com/EVSE

Fuel Facts

- To extract and refine one gallon of gasoline takes about 6kWh of energy. That much electrical power can power a typical electric vehicle about 20-24 miles.
- In 2010, US imported oil from Mexico (11%) and from Canada (21%), however 42% comes from OPEC.
- Only about 25% of the energy of gasoline is used to propel an ICE. The other 75% of the energy is wasted as heat, in addition to energy to extract, transport and refine.
- It costs 2 cents per mile, while hybrid costs 8 cents per mile (4 times more) and ICE costs 30-35 cents per mile, pending on the price of the gasoline (15 times more).
- Never need to go to gas station, it can be refilled while it's parked.

Why EV

- No gasoline motor; no smog checks, oil change, camshaft belts, tune-ups, air and oil filters, or oil drips in your garage. The Volt uses a gasoline motor in addition to the electric motor, as does a Toyota Prius and Fisker Karma. Other EV are Coda, Tesla Roadster and Model S, Ford Focus EV, Nissan LEAF, BMW ActiveE, Honda FitEV, iMiEV, ThinkCity, Wheego Whip LiFe, Tango. Coming soon is Smart ED, Chevrolet SparkC, Tesla Model X, Fiat 500e, and BMW i3
- It costs 2 cents per mile, while hybrid costs 8 cents per mile (4 times more) and ICE costs 30-35 cents per mile, pending on the price of the gasoline (15 times more).
- Never need to go to gas station, it can be refilled while it's parked. Opportunity to source your own fuel (electricity).
- It's quiet, reduce pollution and carbon emissions, reduce fuel cost and maintenance.
- You can drive on HOV lane solo, discount on toll bridges/roads

Your milage may vary

	Tank Size	Efficiency	Fill Rate
ICE	gallon	mpg	Gal/min
EV	kWh	m/kWh	kW

★ Tank Size: 15 gallon gas tank vs. 20 kWh
★ Efficiency: 22 mpg vs. 4 m/kWh
★ Fill Rate: 3 gallon per min vs. 6.6 kW

- Thermal Management System
  - Current technologies: passive, fan, liquid
- Charge Level (EV fill rate)
  - SAE AC L1: 120V up to 16 Amp = 1.9 kW
  - SAE AC L2: 240V up to 80 Amp = 19.2 kW
  - SAE DC L1: 200V - 500V up to 80 Amp = up to 90 kW
  - SAE DC L2: 200V - 600V up to 200 Amp = up to 400 kW (NR)
  - Tesla SuperCharger: 440V up to 225 Amp = 99 kW
  - CHAdeMO (Japanese TEPCO standard): 50 kW

Water Wise

- Low water flow valves and toilets throughout inside the house
- Water efficient washer/dish washers
- Only well water is used outside the house
- Native and waterless plants and trees
- waidy.com/GreenRoof
- waidy.com/ECOlawn

Natives and Wildlifes

- Coyote
- Deer
- Rabbit
- Snake
- Many others: birds, meadow mouse, squall, mountain lion, raccoon, gopher, etc.

Challenges

- Santa Clara Health Department dis-approved grey water
- Town of Los Altos Hills disapproved geo-thermal (is now called ground source)
- Hight limitation to install PV panels at the ideal angel.

What drives me?

- Climate change due to Global Warming
- Concern on Earth's resources and ecology
- Animal right
- Passion(ate on anything that I have interest)
- High expectations on outcomes
- Love challenges, ***stress me please***

FAQs

- How well does the passive solar work?
  - Summer: we never had a need to use the secondary cooling (i.e. Whole house fans)
  - Winter: we did have a need to turn on the secondary heating (i.e. radian floor) from mid December to end of January
  - We achieve 50,000 BTU/SqFt/year
- How many sqft is the home?
  - 7000-9000 depending on how you measure
- What does your PV system cost?
  - Wrong question. You should size a system based on your usage. As systems get larger, the cost per watt is lower. Figure around $2.5 per watt (or $12,500 for a 5 kW system) depending upon which incentives your utility may offer. See database of State Incentives for Renewables & Efficiency
- What is the R-value of straw bale wall?
  - R-value of straw bale walls is ~R 2.38 per inch. Therefore, my 2 feet thick straw bale wall is R-57.

FAQs (Continue)

- Why is your PV system so big?
  - Though our appliances and lighting is efficient, we have a lot of them, and we substituted electric heat pumps for natural gas. Our battery electric vehicles use about 23% of the power we generate (but we buy almost no gas).
- Why do you emphasize elimination of fossil fuels?
  - Global warming is the most serious threat we face. Fossil fuel use is simply not an option for anyone who cares about the Earth. The only safe amount is zero.
- Why use Straw Bale?
  - Bales insulate extremely well, provides high insulation;
  - Plaster walls act as thermal mass;
  - Straw is inexpensive in compare to lumbers;
  - While supply of lumber is limited, Straw is a waste product from grains. There is not much use in straw and they usually are burn in which create air pollutions. Hence, it's renewable and sustainable.