



**SUSTAINABLE  
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# Integrating Renewables Into Home Performance

## RENET 2008

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# Agenda

- The Dilemma
- An Integrated Approach
- Combining Efficiency and Production
- Working with the Solar Industry
- The “right” Solution
- Discussion

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# The Approach

- Building Fundamentals
- Major Systems
- Renewable Energy

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## How it should work..

- Whole House Audit
- Create a Road Map
- Reduce Energy by 30% to 50%
- Install Dramatically Smaller Renewables

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# Renewable and Efficiency

- Two sides of the same coin
- Built in tension
- Major opportunity

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# Reduce Then Produce

- Reduce energy consumption first
- Install smaller generation systems
- Address fundamentals first

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## How it often works today...

- Install 5kW of solar
- Call Home Performance Contractor
- Why install CFLs if you are already at zero!

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## Solar Electric (PV)

- Net Metering
- Major State Subsidies (\$2.20 per watt) CA
- Expensive
  - \$8.50 per watt
  - CA Average 3kW

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# California Solar Initiative

- **PBII Production Based Incentives**
  - Based on predicted outputs
  - Orientation, Inclination, Shading
- **New Construction Eligibility**
  - 15% Above Title 24
- **Existing Building Standards (COMING?)**

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## Conserve First

- Turn off extra refrigerator, save \$5K!
- Replace all incandescent with CFLs
- Reduce AC load
- Appliances / Phantom Loads, etc.
- Time of Use Metering is Required

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# Solar Thermal

- Size system for base loads
  - (unless there is a summer demand for heat)
- Consider Integrated Systems

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# Integrated Systems



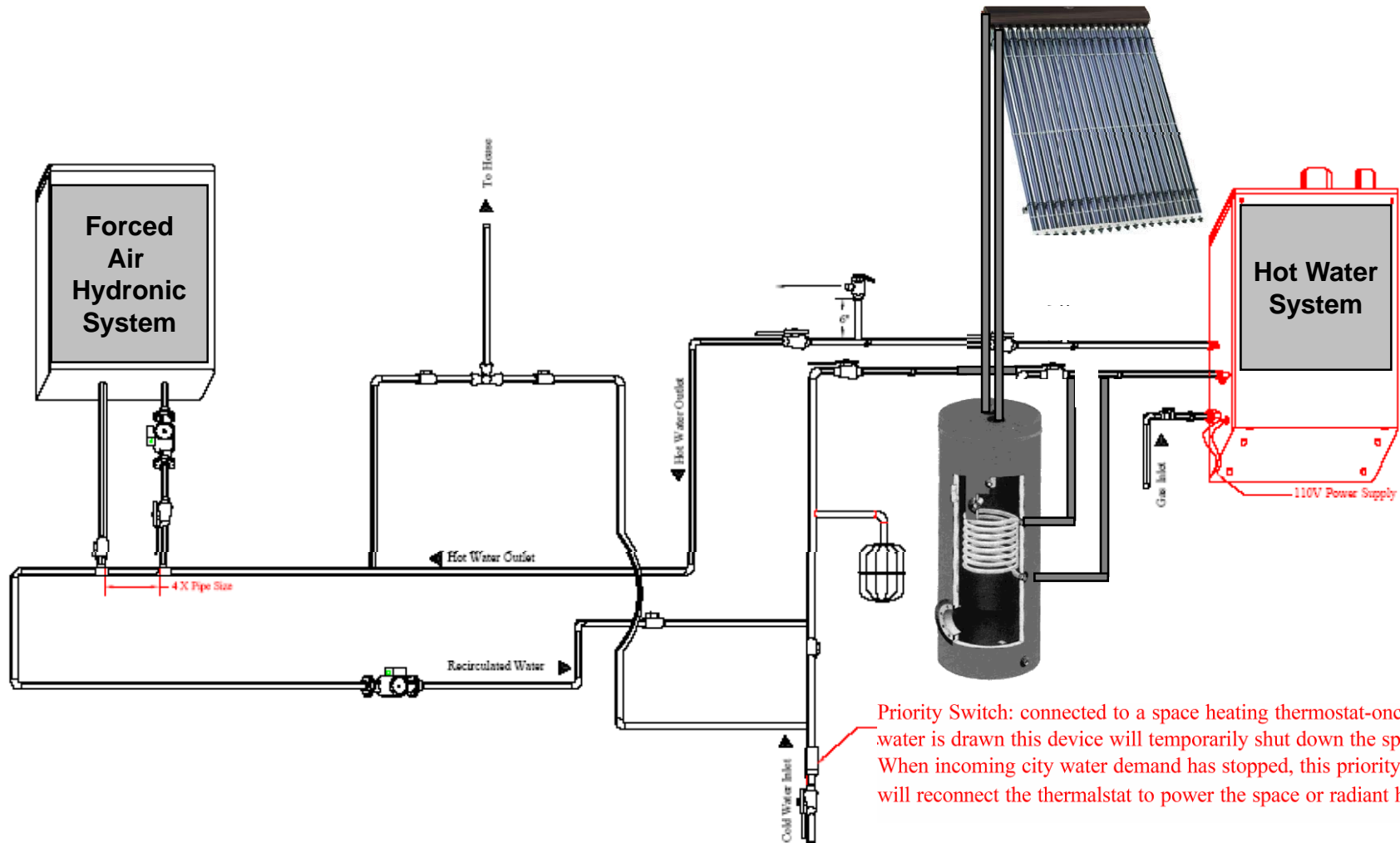
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# Integrated Solar Thermal Tankless System Domestic Hot Water and Forced Air Space Conditioning



|   |                                     |   |                            |   |                                    |   |                 |
|---|-------------------------------------|---|----------------------------|---|------------------------------------|---|-----------------|
|  | Min. Ø 3/4" Gas Shut-off Ball Valve |  | Pressure Only Relief Valve |  | Recirculation Pump<br>Min. 1/12 Hp |  | Mixing Valve    |
|  | Water Shut-off Ball Valves          |  | Unions                     |  | Check Valves                       |  | Priority Switch |



## The Basic Issue

- Solar Companies make money by the kW
- Home Performance makes money reducing energy
- We all understand the relationship, but how do we get over this?

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## Solar is Sexy!

- How do we make Energy Efficiency sexy?
  - Sell Health, Comfort, Durability!
- Energy Monitoring
  - Give them something to show off!
- Policy – if solar is so sexy, make people pay what it really costs...

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# When Should we recommend Solar

- Do ALL the low hanging fruit
  - Insulation
  - Air Sealing
  - Lighting and Appliances
  - Water Conservation
  - Moisture Management

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# Partnering With Renewable

- Tension – Where do people spend money
- How does it work
  - They pay for testing...
    - What Happens First?
    - Same Pool of Money

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## Different Models

- Solar Company “sells” a test
- Solar Company gives clients a test
  - When does the test occur?
  - Expense for solar
  - If we move people to Electric systems, we may increase the size of PV systems – music to solar ears!

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# The Carbon Neutral Home

- Future Model 2030
- Passive House
  - Massive Load Reduction
- All Electric! NO MORE GAS!
- Solar PV, Solar Thermal
- 100% Zero Energy, Carbon Neutral

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# Heat Pump Solutions

- All Climate Heat Pumps
  - Claim 2x COP at 0 degrees Celsius
- Traditional Air to Air Heat Pumps
  - May be costly in some climate zones
- Air to Water Heat Pumps
  - Add Solar thermal...
- Geothermal Heat Pumps
- Ductless Mini-Split Systems

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# Case Study

- 1930s Palo Alto House



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# Project Scope

- Project Budget \$750K
  - Includes energy retrofit
  - Solar PV and Solar Thermal
  - Addition of 1000 Sq. Feet
  - Sustainable Landscaping
- Sounds like a lot... it AINT!

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# Retrofitting of Existing Building

- Insulation and Envelope Upgrade
  - Dense Fill Cellulous in wall cavities
  - Spray Foam in attic
  - Bring Crawlspace / Basement into envelope
- Lighting Retrofit
- Window Retrofit
  - Interior Storm Windows (new product test)

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# Mechanical Systems

- Integrated All Electric Systems
- Air to Water Heat pump
  - Provides primary heat for Space Conditioning, DHW.
  - Forced Air Hydronics
  - Radiant Floor Systems

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# Renewable Systems

- Solar Thermal to Assist Heat Pump
- 9kW of Solar PV
  - Covers 100% of estimated electrical Load (tbd)
- Water Catchment system for Irrigation

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# Addition

- Master Bedroom and Artists Studio
- SIP construction
- Radiant floor in slab

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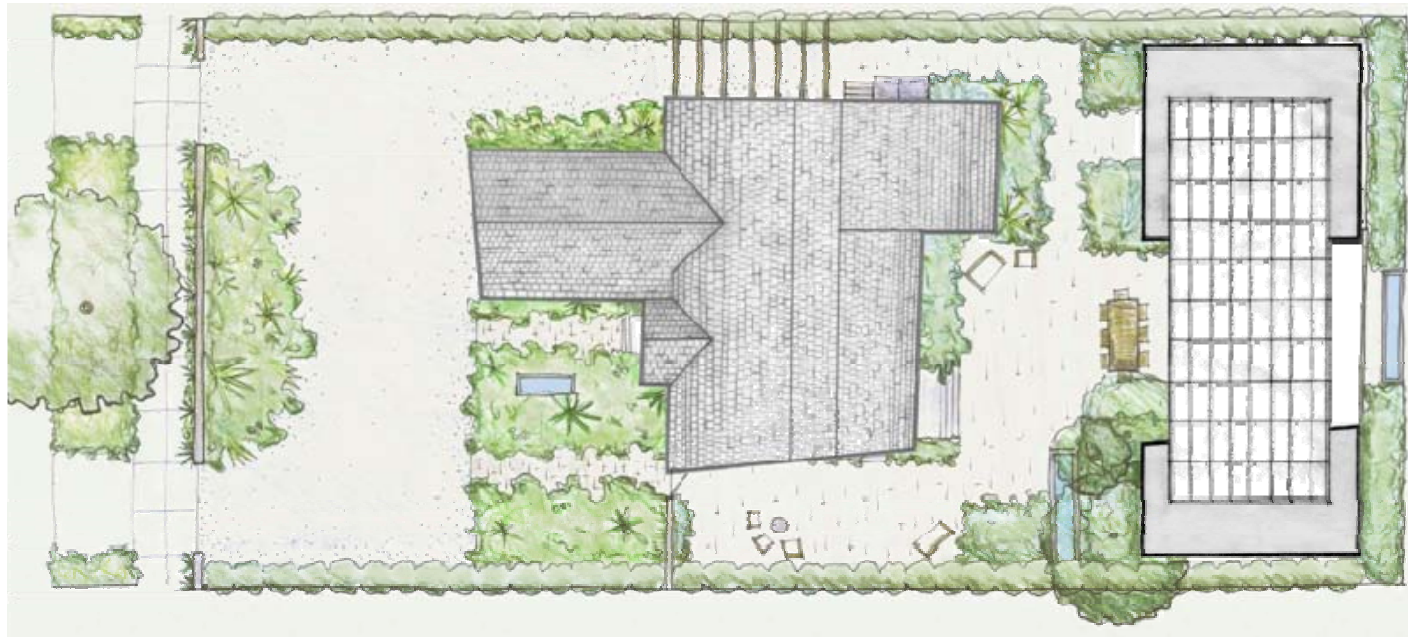
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# Final Design



**WILLIAM DUFF ARCHITECTS**

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POINT IN DESIGN - 71 FOR INTERIORS ALSO CONSULT US FOR

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# Sunset Idea House 2007



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# Integrated Approach

- New Construction / Major Remodel
- Too many standards
- Too many consultants
- Not enough accountability
- Too Complicated!

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# The Integrated Approach

- Planning
- Engineering / Design
- Construction
- Commissioning

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# Planning

- Basic Planning
- Types of Certifications
- HVAC type
- Goals

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# Engineering / Design

- HVAC Design
- Product Specifications
- Load Calculations / Building Model
- LEED-h, Title 24, Green Points, HERS

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# Construction

- Performance Testing
- Installation Quality
- Performance Contracting
  - High Performance HVAC
  - Insulation
  - Ventilation
  - Moisture Management

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# Commissioning

- System Commissioning
- Rating Paper Work
- Tune-Up
- Final HERS Rating (May be 3<sup>rd</sup> party)

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# Integrated Process

- Make it easier, make it clear
- People want to be shown the way
- Make sense out of many standards
  - LEED-h, Energy Star, local GB Standards
- Be the Systems Integrator

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# Question and Answer

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