SOLARA: Case Study of Zero Energy Home Development

Hawaii Build and Buy Green:
Green Communities and Greening Affordable Housing
10:45 a.m.

May 8, 2007

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Community HousingWorks

Overview

- Overview: SOLARA and Community HousingWorks
- Why Don't Affordable Housing Developers Use PV? What do Affordable Housing Developers Need?
- SOLARA: Process of Design Decisions
- SOLARA: Green Elements and Finance
- Green Building: Challenges
- SOLARA: Completion and Operations

Overview

Overview

- Community HousingWorks:
  - San Diego-based nonprofit, 20-year history, 1,500 units
  - Owner 26 affordable rental apartment communities in San Diego County
  - Part of NeighborWorks network
- "Helps people and neighborhoods move up in the world"
- Nationally recognized awards: AIA; Fannie Mae Maxwell Foundation; Urban Land Institute; Pacific Coast Builders Conference
- 14% of residents who moved out last year became first time homebuyers

Overview

- Community HousingWorks: Previous projects
  - -Energy Efficient
  - -Energy Star rated
- Fall 2004 - CHW made decision to build “green”, “solar”; City requested that we use “solar”
  - -Right thing to do, Greenhouse emission reduction
  - - Example of leadership
  - - Help residents with monthly utility budgets
- Architect and General Contractor already chosen
- What does “green” mean? How to do green and solar?

Overview

- SOLARA – Completed March 2007 in Poway
- Poway- Climate Zone 10, inland approx 20 miles
- Poway Redevelopment Agency is landowner (99 year ground lease), lender
- SOLARA Physical:
  - 56 units (1, 2, 3 bedroom), family units
  - 2 story wood (no elevators)
  - 2,100 sf Community Center
  - 90 parking spaces (w 56 carports)
- Affordable Housing- income restricted (55 yrs)
  - 30%-60% AMI (approx low $15k – mid $40k)
  - Rents - $388 - $1,075/mo (includes all utilities)

SOLARA

Community HousingWorks

Overview

Similarities of San Diego region and Honolulu:

- Precious and beautiful natural resources, Pacific Ocean
- High median income (over $70k AMI in San Diego)
- High wealth area
- Historic military presence
- Limited land
- Respect for land, rigorous entitlements
- High construction costs
- Area economy with tourism, service sector individuals
- Presumed strong need for affordable housing in both

Overview

Difficulty of Development:

- Time – needed to break ground in less than 12 mo
- Site – flood plain, adjacent to FEMA floodway greenbelt; expensive sitework to level site and increase density
- Opposition by neighbors to affordable housing
- Team – not green (inexperienced), but not “green”
- Costs– heading into height of cost increases for cement, wood, iron, etc
- No “LEED” guidelines for low rise residential
- Unknowns

Overview

Opportunities of Development:

- Be a leader and pioneer
- Site– visible, walking distance
  - Ideal for affordable housing – smart growth
- Adjacent to City park
- Infill and revitalization
- Treat floodway as greenbelt amenity – breathing room
- Unknowns

Why Don’t Affordable Housing Developers Use PV?

Why Don't Developers Use PV?

Perspective

- Currently, less than 2% of affordable housing uses renewables
- Less than 1% of the California CEC solar rebates go to affordable housing, despite rebates higher for bona fide affordable installations

Why Don't Developers Use PV?

Unknowns

- Technical – how to do it? Who to trust?
- Finance – where to find additional funds?
- Entitlements – more complicated, delayed
- Construction – more complicated, delayed
- Utilities – more complicated, delayed

Why Don't Developers Use PV?

Assumption that's too costly

- System costs
- Construction upgrades (e.g., carports)
- Additional Soft Costs – design, permitting, consulting
- Construction delays result in lost equity
  - Entitlements
  - Delivery / installation
  - Acceptance by utilities

Why Don't Developers Use PV?

Complexity of Operations

- Maintenance – what to do with them? who services?
- Replacements – will they last?
- Operating Expenses:
  - Fear of exposure to utility expenses if use Zero Utility Allowances (mgt pays all utilities)
  - Can't raise rents if expenses increase – HUD limits

Why Don't Developers Use PV?

"Below the radar"

- Projects are hard to find / pencil
- Local Entitlements and NIMBYism
- Increasing construction costs, but not rents
- Very complex financing (e.g. 13 sources)
- Architects and contractors – specialists in affordable housing do not have experience in "green"

What Do Affordable Housing Developers Need to Begin Using Solar?

What Do Developers Need?

Successful examples

- Success stories from known colleagues in industry

Education and Technical Assistance

- Speak each other's language
- Outreach to Affordable Housing "industry"
- Education of City Building / Planning / Fire Departments re solar
- User-friendly Local Utilities – Regulators can encourage local utilities to provide incentives by giving preference in planning / processing for projects with solar

What Do Developers Need?

State Agency Coordination

- In California, 2 agencies involved with energy – Public Utilities Commission (PUC) and Energy Commission (CEC)

Regulators exert influence with manufacturers

- Late Deliveries can financially ruin a project
- Loss of tax credit equity
- “Placed in Service” date for tax credits

What Do Developers Need?

Funding for Capital Costs

- Market for PV still too expensive
- Rebates work best
- California has rebate reservation – but period req'd for completion has been too short
- Quick processing of rebates
  - Lenders / investors anxious if total loan is "out of balance"
  - Payment – need before conversion to Perm loan

What Do Developers Need?

- Involvement of Affordable Housing Developers As New Policies Conceived
- Regulators can help :
  - Expedited processing of new utilities if using PV
  - Net Metering
    - Individual meters for each unit – good, but results in separate arrays, many inverters, billing constraints

Process of Design Decisions for SOLARA

Design Decisions

Advice for Green Design

- Make Decision Early for green, renewables
- Get Team Involvement
  - Architect, Civil Engineer
  - General Contractor
  - Utility Consultant
  - Lenders
  - City
  - Utility Company
  - Asset Management, Resident Services

Design Decisions

- Engage Green Consultant
  - CHW's Selection of Global Green USA as advisor
  - Subsequent enlargement with CEC grant to use SOLARA as demonstration project
- Early Comprehensive Design Charrette
  - Plan all day
  - Prior to site plans
  - Involve all
  - Based on LEED guidelines

Design Decisions

Charrette and Decisions

- Do what's right for *your* site, team
- Push your team
- Self education
- Don't be intimidated– ask the "*dumb question"* again and again!
- Think of integrated whole – "360^{o} Green Design

SOLARA: Green Elements

SOLARA: Green Elements

- Green is ***not*** uncomfortable
- Zero Energy New Homes: Reduce energy demand by 60-70%, use renewable energy to supply balance of demand
- What 5 elements make a project “green”?
  - Energy Efficiency
  - Renewable(s) – Energy Supply
  - Water Efficiency
  - Recycled / Recyclable Materials
  - Indoor Air Quality (IAQ)

SOLARA: Green Elements

Site Design – Passive elements

- Building Orientation on site
- Overhangs, balconies, etc
- Cross ventilation
- Very visible site
- Plan for IAQ, landscape, etc
  - Challenges for density, site constraints

SOLARA Green Elements: Site

SOLARA Green Elements: Energy Efficiency

"Loading Order"

- Before thinking about solar or renewables, reduce energy demand through design

Building Envelope

- Insulation
- Radiant Barrier
- Low E windows
- Overhang of Balconies, shading

SOLARA Green Elements: Energy Efficiency

Mechanical Systems

- Central, gas-fired tankless boilers for hot water and hydronic space heating (units not individually metered for gas or water)
- Programmable thermostats with max/min
- Air conditioning (Climate Zone 10) – 13 and 14 SEER (higher than Title 24), uses Puron (R410A) refrigerant -more environmentally friendly
- Ducts Inside Conditioned Space; tested during construction

SOLARA Green Elements Energy Efficiency

Tankless Gas-Fired Boilers (Rinnai)

SOLARA Green Elements: Energy Efficiency

Lighting Systems

- Interiors: Pin Florescent hard wired
  - Ceiling lights in bedrooms
  - Encourage use of CFL for lamps
  - Luminescent Exit signs
- Exteriors: Low sodium, pin florescent (timers/motion detectors)

Appliances

- Energy Star, including Laundromat

SOLARA Green Elements: Energy Efficiency

Title 24 – energy "grade"

- California's Energy code- "Title 24" since 1974
  - Perspective: If CA not changed code in 1974, would need 1 nuclear plant every 8 miles between San Diego and San Francisco!
  - Per Capita Energy use in CA – lowest in US, level
- Title 24 (2001) – exceeded by 42%
- Title 24 (2005, effective 10/05) – exceeded by more than 15%
- Climate Zone 10

SOLARA Green Elements: Photovoltaic

Renewable Energy *Supply*: Photovoltaic

- Photo Voltaic – "energy from sun"
- Silicon "wafers" – chemical reaction of light waves hitting and creating electrical current
- Sun's energy in 1 hour could create all the electricity used on Earth for 1 year
  - But, Photovoltaic panels not 100% efficient
- Technology invented in late 1940's, used in 1960s for space

SOLARA Green Elements: Photovoltaic

Renewable Energy *Supply*: Photovoltaic

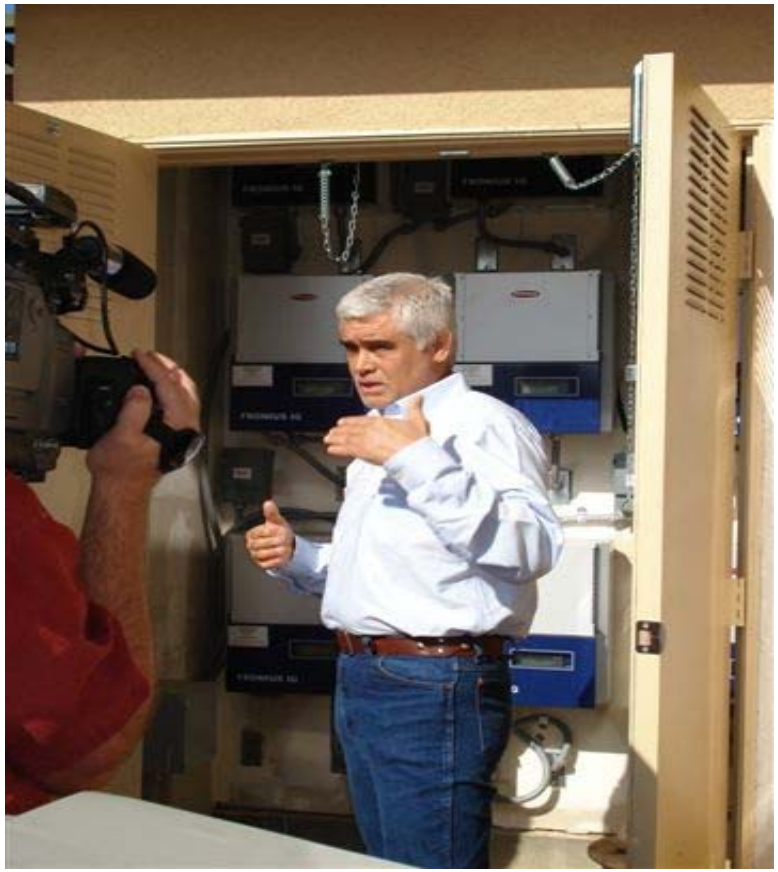
- Connected to utility grid – if blackout, power goes down
- Mini power plant on roof
- Each array feeds 1 meter – electricity drawn first from array, excess sent to utility grid
- Takes pressure off the grid

SOLARA Green Elements: Photovoltaic

Renewable Energy *Supply*: Photovoltaic

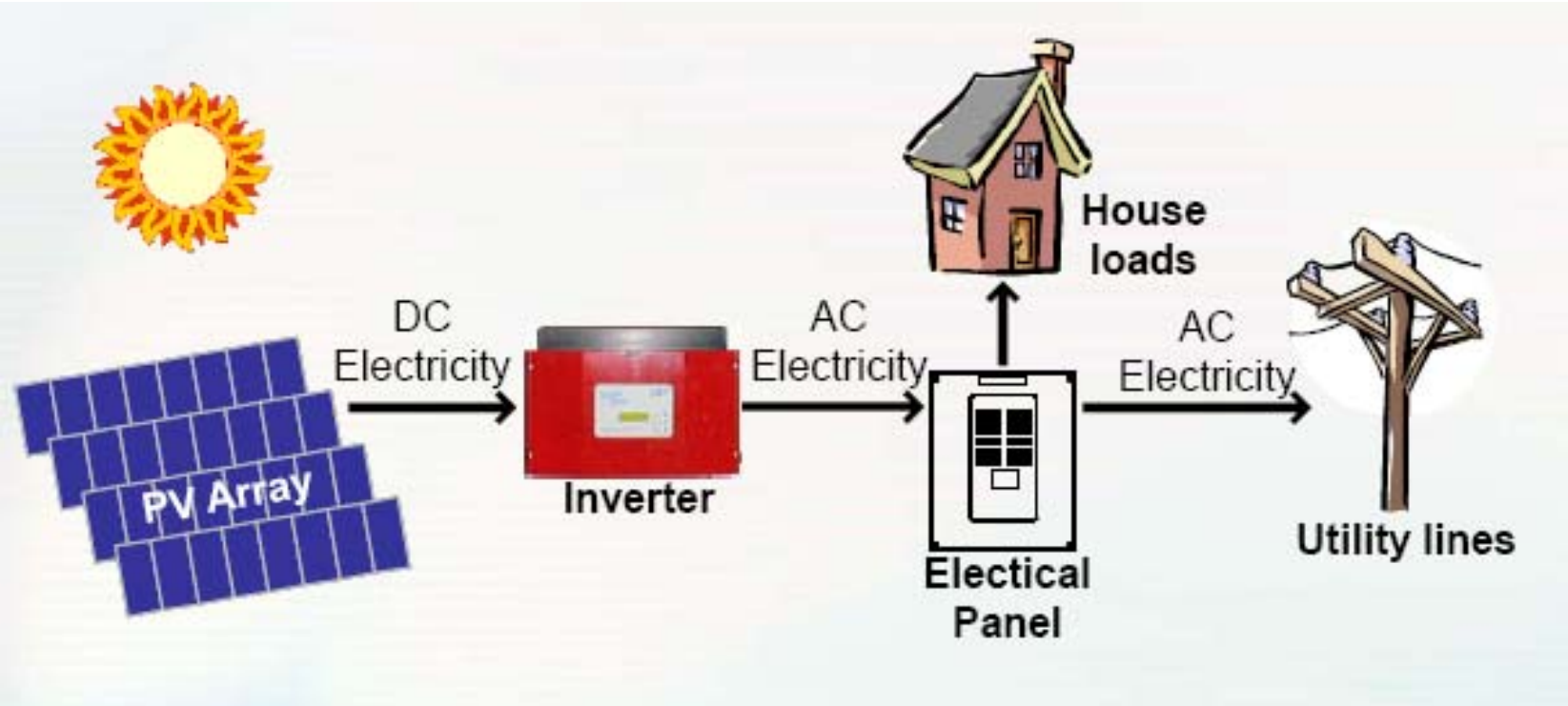
- Electricity created in panels / array
- DC energy
- Feeds into inverter, converts to AC
- Electrical panel uses AC – or passes it upline to grid

SOLARA Case Study: Photovoltaic



SOLARA Green Elements: Photovoltaic

Example: Daytime and PV feeding the SDGE grid



SOLARA Green Elements: Photovoltaic

Utility Billing– Interconnection Agreements with utility to allow feeding electricity

- Net metering– bill is net of what was pulled from grid less what was sent to grid – but no $$ refund

- Solara: Purchased system – not Power Purchase Agreement (PPA)
- 141 kw; Sharp USA
- Roof mounted and carport mounted
  - 2 story-buildings, carports allow space

SOLARA Green Elements: Photovoltaic

- PV Maintenance

  Inverters have EUL of 5 years- include in Replacement Reserves
- Panels have EUL of 25 years
- Video of maintenance walk
- Wash panels– hose, long handled squeegee, ladder

SOLARA Case Study: Photovoltaic

SOLARA Green Elements: Photovoltaic

Lender/Investor RFPs – knew project would be "green" and have almost 100% PV

- Concerns with PV systems - unknown
- Concerns with timing of CEC rebates – underwrote as perm conversion funding, not construction loan
- Concerns with utility Interconnection Agreement timing – will there be delays?

SOLARA Green Elements: Photovoltaic

Financing

- Exploration of costs and financing for PV
- Tax credit boosts (9% project)
- Zero Utility Allowance– first in San Diego Co
- CEC rebates
- Federal ITC (30%) for solar

SOLARA Green Elements: Photovoltaic

Cost (approx)	$1,103,000
Sources (approx)	
CEC Rebates	$409,000
Tax Credit Basis Boost	405,000
Investment Tax Credit (30%)	208,000
Perm Mortgage	81,000
Total Sources	$1,103,000

SOLARA: Project Finance

(prevailing wage)

Loan (soft): City of Poway	**$ 775,000**
Loan (soft): San Diego County HOME	**1,000,000**
Loan: Union Bank of California	**2,370,000**
Rebate: CEC's ERP	**409,000**
Deferred Developer Fee	**150,000**
Misc. Reimb / Interest	**152,000**
Equity:	
Business Tax Credits: NEF	**208,000**
LIH Tax Credits (9%): NEF	**11,266,000**
TOTAL	**$16,330,000**

(excludes $2.2 m for land, 99-yr ground lease w/ Poway Redev.Agency)

SOLARA Green Elements: Water Efficiency

- Saving water also saves power
  - Interiors:
    - Flow restrictors in faucets/showers
    - Dual flush toilets
- Landscape
  - California Native plants; citrus grove
  - No mown grass, low allergy trees/plants
  - Site water treated, released to greenbelt
  - Art path

SOLARA Green Elements: Water Efficiency

Solara's recycled glass art path, winding through Meyer lemon grove

SOLARA Green Elements: Recycled Materials

Recycled Materials

- Cannot throw “away”
- “Cradle to Cradle” for materials– continual life cycle
- Choose materials that will last or be recycled
- Plan recycle program, bins

SOLARA Green Elements: Recycled Materials

Recycled Materials

- Rubber/tires – Tot Lot surface
- Newspaper – Homasote tackable surface in computer room
- Glass – art path
- Fly ash (coal) – in concrete
- Milk Cartons – Play equipment
- Plastic – site furnishings, Trex decking
- Wood – Trex decking
- Aluminum tailings– Alkemi in Com Bldg kitchen
- Haworth furniture in Prop Mgr office

SOLARA Green Elements: IAQ

Today's New Residential Construction

- VOC's and other chemicals compromise indoor air quality
- Formaldehyde – insulation and pressboard in cabinets in most new homes (recent CA Air Resources Board ban for future)
- Chemicals in caulking, carpet pads, paint, etc
- Mold is part of Indoor Air Quality (IAQ) concern – result of moisture and no ventilation, poor caulking, leaking pipes

SOLARA Green Elements: IAQ

Solara addressed these issues:

- Cross ventilation, many units have windows in bathrooms
- Venting to outside
- Bathroom fans– light/fan on same switch and fan stays on for 15 minutes
- Ducting sealed during construction
- Formaldehyde –
  - Insulation is free of formaldehyde
  - Cabinets – edges sealed, wood fronts

SOLARA Green Elements: IAQ

Solara addressed these issues:

- Low VOC paint
- Linoleum – natural materials
  - Cork and wood
  - Longer life – 25-30 years
  - Different care– cannot soak
  - Sealed– but looking at additional sealer
  - Installation at 70-72 degrees for replacements
- No “new home” smell at Solara

SOLARA Green Elements: IAQ

Solara addressed these issues:

- Community Bldg – concrete floor chosen for reason
  - Care in the sealer of floor – hold up to spills but is not permeating
- Manager's Office and Computer room– Haworth furniture
- Regular unit walks for linoleum, mold
- Green manual re cleaning materials, pesticides, insecticides

SOLARA Green Elements: Art

Art Designed to echo message of sustainability

SOLARA Green Elements: Art

Art Designed to echo message of sustainability

Green Building: Challenges

Green Building: Challenges

PV required lots of coordination among design team, construction, inspectors

- Location of vent stacks of roof
- Sizing of meter rooms
- Quick couplers for hoses
- Shutoffs
- Setbacks for Fire Dept on roof
- Landscape design– shade or leaves are bad for PV

Green Building: Challenges

Construction Process

- Sub contractors and designers- industry standard
  - Sizing of Air Conditioning compressors
  - Installation of insulation
- Monitoring of site and testing
- Education and motivation of team ongoing
- Construction waste
- New Materials - subcontractors hesitant
  - Cabinets
  - Counter (Alkemi)

Green Building: Challenges

- Inspectors
- Role of project leader
  - Keep asking “dumb” questions
  - Keep pushing
  - Recognize you’re leader and pioneer

SOLARA: Completion and Occupancy

SOLARA: Completion and Occupancy

- Green Does not end at Certificate of Occupancy
- Sustainable is ***MORE*** than green
- Green Maintenance/Management Manual
  - How to keep it green in maintenance, replacements
  - Operations– paper, copier, etc
  - PV – monitoring software to check production

- Briefings of Asset and Property Management
  - 360° Green Design: Operations and Maintenance
    - Asset / Property Management must buy into green
    - Project manager must be project's leader

SOLARA: Completion and Occupancy

Resident Services

- Learning Center– 7 computer station
  - Homework Help, Computer Training, other services
- Development of Green Curriculum
  - Enterprise Communities capacity grant to CHW
  - Organized into 5 basic green concepts
  - Activities- families and children, bilingual
  - Art projects created by 2 project artists

SOLARA: Completion and Occupancy

Resident Services Green Curriculum

- Unique opportunity to make working class residents ambassadors of “green” through example, education
- Solara – Green briefings of residents prior to occupancy
- Incentive Program for resident utility conservation
- Shopping carts to encourage walking to shopping, Farmer’s Market, services

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