SOLARA breaks new ground in the field of green affordable housing as California’s first apartment community designed to be fully powered by the sun. SOLARA’s 141 kilowatt, grid-tied photovoltaic (PV) system supplies power separately to each of the project’s 56 energy-efficient apartment units, community center, and common areas. While SOLARA was built exclusively with easily obtainable off-the-shelf technology, its major breakthrough was financial. By taking advantage of funding sources available to most new affordable housing projects in California, the development team was able to cover more than 92% of the cost of the $1.1 million solar system with incentives and create a business model that can be replicated in affordable housing developments across the state.

SOLARA’s energy efficiency and renewable energy package may be its most obvious green feature, but the foundation of SOLARA’s success as a green affordable housing project lies in the design team’s holistic approach to sustainable development. The team focused on core elements such as community access and walkability, indoor environmental quality, water efficiency, and resource conservation throughout the design and construction process. The result is proof that quality, innovative, and environmentally-friendly housing can be accessible to everyone.

The selection of green building features at SOLARA was the result of an integrated design approach that focused on key performance goals such as energy use and resident health. For example, the amount of solar energy necessary to power the project was minimized by lowering electricity demand through proper solar orientation of the buildings, efficient heating and cooling systems, and energy-efficient lighting and appliances.

Indoor air quality was addressed first by designing the living units for cross ventilation and then incorporating finish products with low levels of volatile organic compounds (VOCs).

Moreover, SOLARA was designed to offer its residents a comfortable, community-oriented living environment. The development shares its western boundary with Rattlesnake Creek – a natural greenway – and is within walking distance of Poway City Hall, a library, schools, major transit lines, retail, and other services.

SOLARA offers its residents a number of classes in job training, computer skills, and financial fitness. These activities are complemented by an innovative bilingual Green Curriculum focused on energy conservation, recycling, and non-toxic cleaning and maintenance practices.
Faced with the tight budget of an affordable housing project, the SOLARA project team had to analyze the site’s ecological conditions in order to harness as many low-cost energy efficiency and ventilation strategies as possible. For example, early energy modeling showed that the initial site design (in blue) was less than optimal for deploying passive solar strategies and capturing prevailing winds.

Because this discovery was made early in the design process, it was possible to reorient the buildings (in black), which, in addition to maximizing energy efficiency, made it easier to position the roof-top solar panels for maximum electricity generation.
SOLARA’s principal funding structure is similar to most affordable housing projects. Federal Low Income Housing Tax Credits, administered through the California Tax Credit Allocation Committee’s (TCAC) low income housing tax credit program, account for most of the project’s $16.2 million budget.

What sets SOLARA apart are the additional rebates and tax credits it received for achieving high levels of energy efficiency and incorporating an extensive renewable energy system.

Additional sources include a state rebate for photovoltaics, additional Low Income Housing Tax Credits from TCAC, and federal business investment tax credits for renewable energy systems. While these sources are widely available, the project team had to work diligently to meet all of the regulatory requirements to capture them.

### Total Funding Sources

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Union Bank of America</td>
<td>$2,369,500</td>
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<tr>
<td>City of Poway Redevelopment Agency</td>
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<tr>
<td>County of San Diego Housing</td>
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<td>Deferred/Accrued Interest</td>
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<tr>
<td>CEC Utility, Tax Reimbursement</td>
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<tr>
<td>CEC Energy Rebate</td>
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<tr>
<td>Capital Contribution: General Partner</td>
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<tr>
<td>Capital Contribution: National Equity Fund, Inc.</td>
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<tr>
<td>Capital Contribution: Investment Tax Credit (NEF)</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$16,179,494</strong></td>
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### Solar Funding

<table>
<thead>
<tr>
<th>Cost of Solar PV System</th>
<th>Funding for PV System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Cost</td>
<td>CEC Rebate</td>
</tr>
<tr>
<td>$967,500</td>
<td>$409,000</td>
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<tr>
<td>Additional Costs¹</td>
<td>Add’l. Tax Credits</td>
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<tr>
<td>$135,500</td>
<td>$405,000</td>
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<tr>
<td>Total Cost</td>
<td>Fed. Tax Credits</td>
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<tr>
<td>$1,103,000</td>
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<td>Total Funding</td>
<td>Increased Debt</td>
</tr>
<tr>
<td>$1,103,000</td>
<td>$81,000</td>
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</table>

¹ Includes scope of work for other trades, general contractor costs, insurance and bonding.

Electricity consumption is included in the rent paid by SOLARA residents. This allows the developer to capture the value of the electricity utility allowance, which increases overall project cash flow. Some of this additional cash flow was leveraged to increase the size of the project’s conventional debt burden, with other funds used to cover utility interconnection payments and reserve requirements for future replacement of PV system components.

One major financing breakthrough at SOLARA involved having the tax credit syndicator bundle the federal renewable energy tax credits with the Low Income Housing Tax Credit and pay the same rate for them. This required extensive education of the syndicator on the long-term benefits and reliability of solar technology as well as introducing them to a new financing stream. Ultimately, this additional tax credit netted the project over $200,000 in extra equity.

### COST SAVINGS

A monitoring system was installed at SOLARA to track energy use, solar PV production, and ultimately, cost savings to the developer and tenants. In the first year of full operation, the average unit at SOLARA met 87% of its electricity needs through its on-site PV system, and annual electricity bills were 68% less – a $264 savings – than they were at a nearby affordable housing development ($126/unit vs. $390/unit).

Most of the cost savings accrue to the developer, while tenants benefit from a fixed monthly utility charge, insulating them against future energy cost increases and seasonal volatility.
Even with a committed developer and experienced design team, SOLARA faced a number of challenges in the process of creating a successful and innovative green project.

“Greening” the Design Team – Several members of the design team had little experience in the field of sustainable development, which resulted in a need for extensive education. However, this need ultimately strengthened lines of communication amongst team members throughout the design and construction process, and increased their capacity to take on similar projects in the future.

Integration of Design and Finance – Structurally, the financing package for the energy efficiency measures and solar PV system remained fairly steady throughout the project – tax credits, rebates, and permanent debt financed by cash flow. However, each design modification, such as a change in air conditioning efficiencies or a reduction in the angle of the solar panels, altered a complex set of financial formulas, further complicating the design challenge. A clear set of performance goals helped keep the entire project team on track.

Density and Design – Finding roof space for enough PV panels to pursue zero-energy goals is a challenge on dense sites, even with the implementation of aggressive energy efficiency measures. The project team discovered a rule-of-thumb that on a conventionally framed project with mechanical cooling, it would be nearly impossible to go above two story buildings and still achieve the energy performance targets. Even at two stories, SOLARA needed to place about one-third of its PV panels on carports to compensate for roof space lost for fire code reasons and less than optimal PV panel tilt angles required by the City of Poway due to aesthetic concerns.

Utility Payment and Metering Structure – SOLARA’s project team faced a major financing challenge in the area of electricity metering and bill payments. In an attempt to promote energy efficient practices, California codes require that each apartment unit be individually metered for electricity. For SOLARA, this meant each unit needed its own individual solar PV system and inverter, greatly increasing cost and design complexity. Utility allowance regulations also forced the developer – if they wanted to recoup any of the investment in the solar system – to agree to pay for all potential excess electricity consumption by residents, thus cancelling out the benefits of individual meters. Prompted by the experience at SOLARA, regulatory changes have been made to provide more flexibility on metering and utility allowances for projects that include renewable energy installations.

Photovoltaic Panel Supply – There was concern that with such an extensive solar power system, not all of the panels would be available in time to keep the project on schedule. If SOLARA had been behind schedule, it could have lost as much as $100,000 a month in equity. Likewise, if the panels had arrived too early, it would have been necessary to properly store and insure them, which also would have had cost implications. The design team developed a close relationship with the solar panel provider to ensure the panels would be delivered on time.

**CONTACTS**

- Community HousingWorks, Owner/Developer
  Mary Jane Jagodzinski, (619) 282-6647, mjjag@chworks.org
- Global Green USA, Green Building Technical Assistance
  Ted Bardacke, (310) 581-2700, tbardacke@globalgreen.org
- Rodriguez Associates Architects and Planners, Inc., Architect
  Carlos Rodriguez, (619) 544-8951, carlor@ra-architects.net
- Solar Power, Inc., Solar Integrator
  Kirk Stokes, (303) 279-8200, kstokes@solarpowerinc.net
Nueva Vista Family Housing

131-136 LEIBRANDT STREET
SANTA CRUZ, CALIFORNIA

Nueva Vista is a cutting-edge example of how a dedicated affordable housing developer can incorporate many green features into a project while working within a limited budget. A 48-unit urban infill project just steps from the Santa Cruz Beach Boardwalk, Nueva Vista reduces car trips by including a child care facility and a city community center on-site, improves the health of residents by using a variety of non-toxic finishes, and lowers operating costs by incorporating solar electricity and other energy efficient measures.

Nueva Vista grew out of a lengthy organizing and community design effort in conjunction with the project’s very low and low-income residents who work in the county’s tourism and agricultural sectors, and the green aspects of the project helped build political support from the Santa Cruz City Council. The example set by Nueva Vista was instrumental in leading the developer, Mercy Housing California, one of the state’s largest developers of affordable housing, to establish green building guidelines for all its future building projects.

**PROJECT INFORMATION**

**Project Size:**
Two buildings, 64,802 s.f. total, 48 units with child care facility and community center

**Construction Cost:**
$10 million ($154/s.f.)

**Completion Date:**
November 2003

**Owner/Developer:**
Mercy Housing California

**Architect:**
Van Meter Williams Pollack

**Mechanical/Electrical Engineer:**
MCT Engineers

**General Contractor:**
Devcon Construction

**Energy Consultant:**
Farber Energy Design

**Solar Consultant:**
EcoEnergies, Inc.

**Financial Consultant:**
Community Economics

**GREEN FEATURES**

Nueva Vista was conceived as a green project from the start, an aspect that greatly contributed to its overall success. Both green design and affordable housing experience were used as key criteria in the selection of the design team. The developer also identified potential funding resources early on, taking particular advantage of changes to the allocation criteria for affordable housing tax credits in California that support sustainable design. Because of this upfront commitment and the realization that some extra resources were potentially available, many of the project’s green features were not “add-ons” but integral to the design.

In the early design phases, attention was paid to building orientation so that the units could maximize the benefits of both sunlight and ocean breezes. Window-shading and through units enabled the project to eliminate air conditioning and rely purely on natural ventilation to cool the building. Hard-coat glazing allows for heat gain during the cold winter months but still reflects harmful ultraviolet rays.

Energy efficiency was also stressed. Gas-powered hot water heaters do double duty by providing space heating in each apartment. (See Diagram) Highly efficient refrigerators were also specified for each unit. As a result of these and other measures, the entire complex is expected to exceed the standards of the California Title 24 Energy Code by at least 15%. With all units individually metered for both gas and electricity, much of the energy savings will flow directly to the residents. Meanwhile, the owner will save approximately $5,000 per year in operating costs by directing the

[Continued on Next Page]
electricity generated by the 20 kW solar system to the common areas, including all exterior and interior common area lighting, the irrigation system, the elevator, and office machines, computers and appliances in the community room.

Researching, identifying and specifying green building materials, particularly those which have a positive effect on the health of residents, was a major challenge. The architect worked with their own appropriate materials checklist to set design criteria and explore cost implications. Later, a green design charrette, conducted by Global Green USA as construction documents were being prepared, helped narrow the choices and identify creative ways to pursue green building objectives. For example, a system of “bid alternates” was devised so that the contractor would obtain cost information for green materials that were not included in the original budget. This enabled Mercy Housing the flexibility to choose and prioritize which features could affordably be incorporated into the development.

Site Planning/Alternative Transportation
- Highly efficient drip irrigation system with scheduled timing
- Native, drought-resistant plants with low water needs
- Reduced parking
- Ample bicycle storage

Energy Efficiency and Renewable Energy
- Individual electrical and gas meters to promote energy conservation
- Hot water heaters also power space heaters (see illustration)
- Energy Star™ appliances
- All fluorescent lighting
- Double paned windows with low-E, hard-coat glazing
- No mechanical cooling
- 10 kW AC solar electric system installed on each building
- 140 roof-mounted solar panels generate approximately 35,000 kilowatt-hours per year
- Digital display of solar generation in each building, displaying $350/month in operating cost savings

Resource Conservation
- Sustainably harvested plywood, FSC-Certified
- Permanent flow restrictors reduce water use in sinks by two-thirds
- Natural linoleum flooring in kitchens and bathrooms
- Recyclable carpet with high level of recycled content
- Construction waste recycling
FINANCING

Like most affordable housing projects, a variety of public and private sources were used to build the project. These sources included the federal and state tax credit programs for affordable housing, the Federal Home Loan Bank’s Affordable Housing Program, the City of Santa Cruz and it’s Redevelopment Agency, a conventional mortgage from Citibank, and a grant from the David and Lucille Packard Foundation to assist with the costs of the child care facility.

Nueva Vista also benefited from a wide variety of special funds dedicated to green building. The project was awarded tax credits partially due to extra points it was granted in the tax credit allocation scoring system for besting Title 24 energy efficiency standards by 15% and for installing energy efficient appliances, fluorescent light fixtures, and water-efficient landscaping. The total cost of the solar electricity system, $211,000, was more than offset by special funds available for installing renewable energy systems, including federal and state solar tax credits bought by the project’s tax credit investor, AEGON Community Investments.

Green-specific financing included:

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Building Component</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG&amp;E Comfort Home Program</td>
<td>Energy Efficient Building Components</td>
<td>$ 11,500</td>
</tr>
<tr>
<td>Tax Credit Basis Boost (5%)</td>
<td>Solar Electricity Generating System</td>
<td>$ 289,000</td>
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<tr>
<td>Federal/State Solar Tax Credits</td>
<td>Solar Electricity Generating System</td>
<td>$ 21,000 (estimated)</td>
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<tr>
<td>California Energy Commission</td>
<td>Solar Electricity Generating System</td>
<td>$ 98,000</td>
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<tr>
<td>California Public Utilities Commission</td>
<td>Energy Star™ washers and dryers</td>
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</tr>
<tr>
<td>Packard Foundation</td>
<td>Non-toxic and other high quality building materials</td>
<td>$ 20,000</td>
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</table>
Even with a committed developer, experienced design team, and a host of extra funds available to the project, Nueva Vista faced a number of challenges in the process of creating a successful green project.

- **Construction Management**: Initially the contractor had some difficulty adjusting to the different “green” specifications being considered by the design team and was reluctant to accept changes to standard construction practice. After much discussion, a process familiar to the contractor was devised whereby the contractor was asked to price certain green materials as bid alternatives. This required the contractor to make an up-front commitment to providing the materials at a specified cost and allowed the developer to calculate which of various options fit within the budget. While this system of bid alternatives was crucial to moving the project forward, it does have some drawbacks. The shortcomings of this approach include: the need for the design team to do a great deal of research to develop the set of alternative specs; the potential that green building materials will forever be seen by contractors as an “alternate” rather than standard practice; and the possibility that many green features will be labeled as additional cost items and ultimately be rejected by a less committed developer.

- **Carpet Recycling**: In affordable housing developments, carpeting is typically changed every 5 to 7 years. This frequent rate of replacement generates thousands of pounds of landfill waste, an issue of particular concern in Santa Cruz county where existing landfills will reach capacity within 15 years. As a result, attention focused on specifying carpet that was made of recycled material and is recyclable as well. While many carpet manufacturers claim that their carpets are recyclable — with some even offering “take-back” programs — the actual infrastructure for carpet recycling is weak. For example, one option for recyclable carpet that was considered would have required the owner to cut the old carpet into pallet-size pieces and pay to have it delivered to another county. Another manufacturer agreed to take back the carpet after removal but could not guarantee that it would actually be recycled, indicating that it might be incinerated instead. Eventually the decision was made to specify carpet with recycled content and made from nylon-6, a material with recyclable properties, with the hope that the industry and recycling infrastructure will evolve significantly over the next several years.

- **Kitchen and Bathroom Flooring**: Great effort was put into eliminating vinyl flooring — which is generally not recyclable and generates harmful pollutants when manufactured — by using natural linoleum in both the kitchen and bath. While linoleum had a higher upfront cost ($5.00/sf versus $3.50/sf for sheet vinyl), it should last 40 years, compared to only 7 to 10 years for sheet vinyl, thus significantly lowering operating costs over time. Nevertheless, there continues to be concern about the potential for moisture-related problems with the linoleum in the bathroom. Great care was put into installing the linoleum properly, while moisture build-up is minimized by providing high-capacity fans with no manual override (as opposed to automatic humidistat controls) in the bathrooms. Tenants will also be given material explaining the environmental benefits of linoleum versus vinyl and the need for proper maintenance.

- **Water Metering**: To promote conservation, the developer investigated providing individual water meters to the units in addition to the individual electricity and gas meters. This proved to be more difficult than expected, as each meter would have required a separate and costly hook-up fee. A system of sub-metering, whereby individual flow meters are installed and residents are billed separately by a third party, could not be set up within the time dictated by the construction schedule but remains a promising option.
Colorado Court  502 COLORADO AVENUE, SANTA MONICA, CALIFORNIA

The Colorado Court project sets an ambitious new standard for energy- and resource-efficient affordable housing. An urban infill development, Colorado Court is located in a prominent location at 5th and Colorado in downtown Santa Monica, close to shops, jobs, civic buildings, and public transit lines.

The impetus to make the project a showcase of green technologies and design came from the City’s involvement with the Regional Energy Efficiency Initiative, a program that supports municipal energy-efficiency demonstration projects. The City of Santa Monica Environmental Programs Division worked in cooperation with the City Housing Division, the Community Corporation of Santa Monica, and the project architects to identify and implement the green features.

**PROJECT INFORMATION**

<table>
<thead>
<tr>
<th>Project Size: 29,900 s.f., 5 floors, 44 studio units</th>
<th>Owner/Developer: Community Corp. of Santa Monica</th>
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</thead>
<tbody>
<tr>
<td>Construction Cost: $4.3 million</td>
<td>Architect: Pugh Scarpa Kodama</td>
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<td>Completion Date: April 2002</td>
<td>Energy Consultant: Helios International, Inc.</td>
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<td>Mechanical/Electrical Engineer: Storms &amp; Lowe</td>
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<td>Structural Engineer: Nabih Youssef &amp; Associates</td>
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<td>Contractor: Ruiz Brothers Construction Co.</td>
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<td></td>
<td>Construction Manager: Guccione and Associates</td>
</tr>
<tr>
<td></td>
<td>Landscape Architect: Dry Design, Inc.</td>
</tr>
</tbody>
</table>

**GREEN FEATURES**

Numerous environmental considerations were incorporated in the early planning and design stages of the project. The architects and energy consultant collaborated from the outset to minimize energy use and best utilize natural features such as the sun and prevailing winds.

The orientation and shape of the building and the placement of windows maximize natural daylighting and natural ventilation and provide shading where needed. Because of these passive design strategies, it was only necessary to provide air conditioning in one small area of office space.

The building’s design and technologies allow it to achieve a level of energy efficiency that exceeds both the State of California Title 24 Energy Code and the local standards set by the City of Santa Monica’s Green Building Design and Construction Guidelines.

The project’s energy consultants expect that the building will exceed Title 24 efficiency standards by 50%, resulting in savings of almost $10,000/year (as of June 2001 energy rates). The consultants also estimate that almost 100% of the power needed by the building’s occupants can be generated on the site by solar photovoltaic panels and an on-site gas turbine. Over the course of a year, the site will probably produce more electricity than it consumes.

During and after construction, the energy consultants are conducting tests to ensure that the building’s systems and equipment were procured as specified and are working as intended—a process known as commissioning. The commissioning evaluation will continue throughout the first year of the building’s operation.
In addition to the energy-efficient measures, the project includes design features, materials, and systems that address the building’s impact on the site, water use, resource use, and tenant health and well-being (see list of features, below).

The building was designed to meet many of the rigorous criteria of the LEED (Leadership in Energy and Environmental Design) rating system, developed by the U.S. Green Building Council. The project has been registered for LEED certification and its owner and designers hope that it will attain the Gold rating.

**On-Site Energy Generation**
- Photovoltaic (PV) panels are integrated into the building facade and are on the rooftop. The 25-30 kW system will produce more electricity during the daytime peak hours than needed by residents. If the building is deemed eligible for net metering (see final paragraph of the case study), the surplus electricity that is generated on site can be sent to the power grid; the building owner will then be credited for that by the utility. During non-daylight hours, when the PV system does not operate, electricity will be generated by the turbine/cogeneration system and taken from the grid. However, the electricity obtained from the grid should be offset by the surplus sent into the grid. Therefore, under a net metering system, the residents’ electricity bills should be zero.
- A 28 kW natural-gas-powered turbine with cogeneration (waste heat recovery) system operates in the early morning and evening hours, to meet the remainder of the electricity demand. This system also provides 100% of the building’s domestic hot water needs and a substantial portion of the winter space heating requirements. This low-emission system has a conversion efficiency of approximately 70% (while primary energy delivered via the utility grid is only about 30% efficient). Also interesting to note is that, in California, the price of natural gas is discounted for consumers who use cogeneration systems.

**Energy Efficiency**
- Shading for south-facing windows
- Minimal glazing on the west facade
- Double-pane, low-E, krypton-sealed, high-efficiency glazing
- Compact fluorescent, low-mercury bulbs
- Indoor and outdoor motion sensors for lighting
- R-21 insulation throughout the building (recycled blown-in cellulose in 2x6 framing)
- R-30 insulation in the roof
- Integration of the water heating, space heating, and cogeneration waste heat systems
- Compact, energy-efficient, non-CFC refrigerators
- Energy-efficient heat pump with ozone-friendly refrigerant
- Reflective roof coating

**Site Planning/Landscaping**
- Existing palm trees kept on site
- Permeable gravel alley and underground stormwater retention system will retain 95% of the site’s stormwater runoff (and 100% of the entire block’s alley runoff) to allow its gradual absorption into the groundwater
- Drought-tolerant plantings, including native plants and ground cover
- Drip irrigation system with seasonal adjustment
- Parking spaces located underneath building to reduce heat island effect

**Resource Conservation**
- Construction site waste recycling
- Recycling bin storage area
- Recycled-content carpeting
Indoor Environmental Quality
- Operable windows and transoms for natural cross-ventilation
- Natural daylighting through courtyard design and window placement
- Low-VOC paint, formaldehyde-free MDF for cabinetry, natural linoleum instead of vinyl flooring

Alternative Transportation Provisions
- Bicycle racks and storage area
- Parking spaces for tenant vanpool vehicles
- Under consideration: Alternative fuel dispensing station for two vehicles

FINANCING
All of the project’s special energy measures, combined, cost approximately $500,000. This added cost is being covered, roughly half and half, by the City of Santa Monica and the Regional Energy Efficiency Initiative. The REEI is a joint program of Southern California Edison, the California Energy Coalition, and the Cities of Irvine and Santa Monica. It uses public goods surcharges from utility bills to fund energy-efficiency demonstration projects in those two cities. Because REEI funds energy efficiency features only, the City covered the cost of the energy generation systems (the photovoltaic panels and gas turbine generator). The Community Corporation of Santa Monica expects to receive a buy-down of almost $65,000 from the California Energy Commission for the photovoltaic system, which cost approximately $220,000. And Southern California Gas company is providing a $17,800 rebate on the $57,000 natural-gas turbine and cogeneration system (cost includes contractor’s prevailing wage for installation); the company will also be doing field testing on the unit to see how it performs. The system is expected to have a payback in fewer than ten years, and the project’s efficiency measures should have a payback (and net monetary benefit) in fewer than five years.

The stormwater retention system was paid for by the City of Santa Monica’s Public Works Department, as part of the department’s program to capture stormwater at key sites within the city, in order to prevent urban pollutant runoff into the bay.

CHALLENGES
As Colorado Court is a demonstration project, it is not surprising that its designers and developers encountered some obstacles in the course of its development. One of the main lessons learned was that the project never could have been accomplished without commitment towards the project goals from all members of the team. The following are some of the challenges that they faced:

Construction Waste Recycling: A new City of Santa Monica construction waste recycling ordinance will take effect in the spring of 2001. Once services are in place to handle such recycling citywide and the practice becomes commonplace, it is expected that contractors and owners will actually save money by recycling construction waste and thereby diverting it from landfills. Colorado Court served as a demonstration project to prepare for this ordinance. Because construction waste recycling is not yet common, and because the site was too small to allow for easy on-site waste separation, the Community Corporation has had to pay a premium (an estimated $10,000) from its contingency funds to have the site’s construction waste recycled.

Flooring: The architects would have preferred to have polished concrete floors with throw rugs in the apartments, rather than carpeting, because hard-surface flooring does not create the health problems that carpeting can, and because it would have saved money. However, it is common practice to include carpeting in affordable housing units, due to perceptions of comfort and to the extra soundproofing that carpeting provides. The architects also suggested natural linoleum flooring in lieu of synthetic vinyl flooring in bathroom and kitchen areas. At first, the higher cost of linoleum was considered prohibitive (even though linoleum is much more durable than vinyl flooring and therefore has a lower cost over its lifetime). In the end, the CCSM was able to negotiate a lower price for the linoleum, because they purchased it and the carpet from the same manufacturer.
Certified Wood: The original intent was to use wood from certified sustainably-harvested forests for framing. However, because the supply of certified wood was low during the course of the project, its price was prohibitively high.

Concrete: Cement used in this project will only contain up to 10% flyash. Flyash is a waste product from coal-burning power plants and trapping it in cement is a good way to use the waste material while also strengthening the concrete. The architects would have preferred to use cement with a higher flyash content. However, the added curing time required for higher flyash-content cement would have delayed the project, which would have made it more costly.

Equipment Downsizing: It took some time to convince the mechanical engineers to downsize the mechanical/electrical/plumbing equipment (hydronic radiators, piping, water pumps, and heat pump). But once the energy efficiency features were incorporated into the load analysis, downsizing and system integration were deemed feasible.

Tax Credits for Affordable Housing: The Colorado Court project was not selected for the highly competitive tax credits for low-income housing under the 2000 criteria. However, the new 2001 criteria issue points for energy efficiency. Had these criteria been in place last year, the project would have been more competitive.

Energy Generation Regulation: The architects, energy consultants, and CCSM have taken a creative and aggressive approach in incorporating the on-site, distributed power generation technologies into the project. Project team members have been involved in extensive coordination with state government officials. The most significant regulatory challenge they have faced concerns electrical net metering rules. Net metering means that when customers generate more electricity than they consume, the electricity can flow back into the grid and the customer’s meter will run backward. The customer is credited for up to 100% of their net generation of electricity. Until recently, the state only allowed for the net metering of systems rated at a maximum of 10 kW of renewable power; the Colorado Court PV system can generate up to 30 kW of electricity. The City encouraged the State Assembly to adopt new legislation to accommodate larger systems. Midway through the construction of Colorado Court, the legislation was passed, allowing for net metering of systems rated up to 1 MW (1,000 kW). However, this will not be applicable to Colorado Court because of the way that Southern California Edison interpreted a Public Utilities Commission ruling that seemingly precludes buildings with more than one source of on-site power generation from net metering. This means that the project cannot reap the full benefits of having both the photovoltaic panels and the gas turbine.
First Community Housing, a San Jose, California-based non-profit housing developer is demonstrating how an organization can better serve the housing needs of low-income families by making green building a core part of its overall mission. By designing all its buildings to be energy efficient and by specifying non-toxic building materials, First Community Housing ensures that its tenants benefit from lower utility bills and healthier living environments. Furthermore, First Community Housing encourages the use of alternative transportation by locating all its projects along mass transit routes and providing free monthly transit passes.

Since 1986, First Community Housing has built nearly 800 units of affordable housing, putting the long-term savings generated by energy efficient design and highly durable materials into new developments and into the maintenance of existing projects. By demonstrating that green building techniques can both lower a developer’s costs over the long-term and increase overall affordability for tenants, First Community Housing has gained a stellar reputation among the two entities that typically can make or break an affordable housing project – financial institutions and local government officials.

**Recent Major Projects**

<table>
<thead>
<tr>
<th>Project</th>
<th>Units</th>
<th>Construction Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Craig Gardens Senior Apts</td>
<td>90 (1 bedrooms units)</td>
<td>$123/SF</td>
</tr>
<tr>
<td>Murphy Ranch - First Phase</td>
<td>62 (2, 3, 4 bedroom townhomes)</td>
<td>$134/SF</td>
</tr>
<tr>
<td>Betty Ann Gardens</td>
<td>76 (1, 2, 3, and 4 bedroom units)</td>
<td>$145/SF</td>
</tr>
<tr>
<td>Paseo Studios</td>
<td>98 (Furnished SRO)</td>
<td>$161/SF</td>
</tr>
</tbody>
</table>

Four older properties have had photovoltaic solar systems installed to cover all common area electrical needs. The swimming pool at the 246-unit Los Esteros family development was converted to solar heating, a retrofit that had a four-year payback and extended the swimming “season” by two months.

**The Making of a Green Developer**

Founded in 1986, First Community Housing’s transformation into a green affordable housing developer began in 2000 when the FCH Board of Directors determined that FCH should refocus on being a development-driven firm whose sole mission was to build and manage high-quality affordable housing in the Silicon Valley area of California. During this transformation, staff resources were concentrated into areas most closely aligned with the development process – architectural design, construction management, development finance and asset management. With this expertise present within the organization, new Executive Director Jeff Oberdorfer, an architect with experience in both the private and public sectors, set about to develop green performance and program standards for all of First Community Housing’s developments.

These Minimum Standards for Finishes, Systems and Appliances are grouped by construction specification codes and set minimum green requirements in areas such as site work, structural framing, mechanical systems, interior finishes, appliances and lighting. Performance targets are also set, including exceeding the California Title 24 Energy Code by 15%, recycling 75% of
To ensure that the green practices are implemented, First Community Housing develops all its projects using a Design/Build system with a pre-selected General Contractor. In this process, the General Contractor and all the major sub-contractors, are involved with FCH and the project architect from schematic design onward. This avoids a “low-bid” system that could potentially eliminate some green building features from a project. FCH has also established a reputation for holding fast to its green building materials specifications, which enables it to negotiate substantial discounts on materials from product representatives who know that the specified materials will actually be purchased.

Even with these discounts, however, some of the green materials and systems used in First Community’s projects have higher first costs compared to standard construction practice. From a life-cycle perspective, though, these options add long-term value to the projects. Because First Community is required to own its properties for 40 years or more, items with a long-term payback are justified. Another budgeting strategy is to use contingency funds that remain as a project nears completion for an established “wish list” of green upgrades on finish materials.

First Community Housing’s reputation as an award-winning developer and green builder has helped negate the myth that affordable housing will create a negative impact on its “host” neighborhood and gives it a competitive edge when negotiating with local governments over potential future projects. As lenders start to evaluate the durability and long-term savings provided by green building materials such as linoleum, formaldehyde-free cabinets and photovoltaic panels, FCH will be well placed to take advantage of lower interest costs and lower replacement reserve requirements.
FAQ: How To Become A Green Affordable Housing Developer

Q: What is the first step towards becoming a green affordable housing developer?
A: Create organizational green design standards. Many green strategies and specifications can be common to different types of developments. Standardization works particularly well with interior and exterior finishes, roofing and insulation materials, flooring, appliances, and furnishings. Standardizing building materials also allows for the negotiation of volume discounts from suppliers.

Q: But every project is different. Are green design standards flexible enough?
A: Standardizing frees up time to focus on the individual challenges of each project. By standardizing certain elements, design costs can be concentrated on evaluating options for items that vary by project, including site preparation, building orientation, mechanical systems, and the type and scope of renewable energy systems.

Q: I am working on a limited budget and people always say that green building costs more. How can I get the right advice on cost-effective designs and materials?
A: Work with architects and contractors experienced in green building. Green building expertise is uneven across the design and building industry and for some professionals new to green techniques and strategies, the learning curve can be steep. By working with individuals and firms with prior green building experience – or at a minimum with those firms eager to do research and learn – developers can share the burden of paying attention to the right details while avoiding unnecessary and potentially costly experimentation.

Q: I’ve got some basic green design standards. How can I ensure that they are being met?
A: Do construction management in-house. In-house construction management allows the developer to both set the green standards and ensure that they are implemented. A developer who has strong construction management expertise in-house is at a distinct advantage when trying to green its projects. Without active design document and construction oversight, many building professionals, particularly subcontractors, revert to traditional (and wasteful) techniques and specifications.

Q: What can I do to realize the full benefits of being a green affordable housing developer?
A: Track and measure performance. Green building brings a number of benefits to developers and residents, including lower operating and maintenance costs, improved resident health, and less environmental impact on the surrounding community. But, as of yet, these benefits are difficult to fully capture in terms of lower financing costs or increased political support for affordable housing. Measuring performance and demonstrating actual improvements or savings in a clear and concise manner will help build credibility among financiers and government officials and ensure support for future green projects.

Murphy Ranch 62 FAMILY TOWNHOMES, MORGAN HILL, CALIFORNIA

Green Features

- Free mass transit passes for all residents
- Low-flow water fixtures
- Exceeds California Title 24 Energy Code by 27%
- Solar electricity generation for all common areas
- Solar-heated swimming pool
- Hydronic heating and cooling
- Blown-in cellulose insulation
- Double-glazed windows and sliding doors
- All gas appliances
- All fluorescent light fixtures
- Recycled-content carpet floors
- Hardboard fiber-cement siding
- Recycled-content interior trim and baseboard
- Engineered structural lumber
- Sustainably harvested teak pool and recreation area furniture
- Wheat composite office furniture
- 99% recyclable office chairs
- Formaldehyde-free batt insulation
- Low-VO C Paint
Via its Minimum Standards for Finishes, Systems and Appliances, First Community Housing now has a base set of green criteria that is incorporated into the planning and design of each of its projects. But this document is constantly evolving. Looking forward, FCH hopes to address a number of other environmental challenges.

- **Renewable Energy**: First Community Housing has so far used solar generated electricity to power site lighting and common areas and solar hot water to heat swimming pools and pool shower facilities. The developer would like to expand the use of solar electricity to meet at least part of the demand load of the units. FCH is considering using spaces like carports as generating facilities, with the long-term goal of selling electricity back to the local utility.

- **Sustainable Sites**: Most affordable housing developments are dense urban infill projects. Constrained site conditions make certain sustainable strategies such as stormwater management, permeable paving and natural greywater treatment challenging to implement. FCH sees this as a major area for innovation, perhaps by linking several projects in close proximity or combining future projects with larger community land preservation and smart growth strategies.

- **Carpet Recycling**: In affordable housing developments, carpeting is typically changed every 5 to 7 years. This frequent rate of replacement generates tons of landfill waste annually. FCH uses carpet tiles that have a high level of recycled content. While the carpet manufacturer guarantees that used carpet will not end up in landfill – by recycling, upcycling, or downcycling – the cost of shipping the used carpet is a potential barrier.

- **Indoor Air Quality**: Ensuring high quality air circulation and the proper number of air changes without oversizing the mechanical system or installing noisy components is a major challenge. This is particularly the case in kitchens and bathrooms, where moisture and other contaminants are present in high concentrations. FCH has been able to overcome these challenges on a project-by-project basis but would like to find ways to standardize this building element.

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