APPENDIX M:
ENERGY TECHNICAL APPENDIX

APPENDIX M-1:
PLAYA VISTA, RESIDENTIAL SUSTAINABLE PERFORMANCE GUIDELINES, MARCH 19, 1999

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
Atmospheric Pollution Prevention Division
EPA ENERGY STAR Homes Program
Mail Code 6202J, 401 M St., SW, Washington, D.C. 20460

Mr. Peter Denniston - President
Playa Vista
12555 West Jefferson Blvd., Suite #300
Los Angeles, CA 90066
PDenniston@PlayaVista.com

March 19, 1999

Dear Mr. Denniston:

This letter is to officially inform you that EPA has reviewed the methodology and results of energy simulations conducted by your consultants modeling the 12 styles of homes being built in the Playa Vista development. We have ascertained that these homes, if confirmed to have been built to IBACOS's specifications, would be >/=28% more energy-efficient than Title-24 compliant base-case homes, and therefore would qualify as EPA **ENERGY STAR® Homes**.

In order to receive an EPA **ENERGY STAR® Home** certificate for any constructed home in the Playa Vista development there are three paths:

(1) **HERS (or C-HERS) Rating of individual homes**: A home energy rater can perform a full energy rating with the HERS methodology (or the C-HERS methodology utilizing MICROPAS) and send EPA the rating results documentation certifying that the home has achieved >/= 86.0 on the rating scale, with field-testing substantiation of duct leakage and infiltration levels if values better than the reference home default values are utilized.

(2) **Title-24 Comparison Rating of individual homes**: A home energy rater can perform a full energy rating and send EPA the rating results documentation certifying that the home is at least 25% more energy-efficient than a Title-24 base case house, with field-testing substantiation of duct leakage and infiltration levels if values better than Title-24 default values are utilized. EPA requests that the rater add a statement to the rating documentation containing the information paraphrased below:

'{Energy Rater} certifies that according to its energy evaluation utilizing {software}, {this} home, using [choose applicable term] {measured} [or] [otherwise substantiated] values for infiltration and duct leakage rates; and field inspection confirmation of insulation levels, window properties and HVAC/water heating equipment efficiencies; meets or exceeds by at least 25% the energy use levels of a Title-24 base case house of similar design. This is equivalent to an EPA ***ENERGY STAR Home****, with a minimum Home Energy Rating System (HERS) rating score of 86.'*

(3) **Builder Option Packages (BOP)**: You may decide to use IBACOS's specifications as an

"energy model" for the entire project. Each home is inspected to determine if it conforms to the "checklist" of specifications of the BOP. A fraction of the structures undergo a complete energy testing and rating regimen (see below). All homes are inspected, and if values of infiltration and duct leakage more stringent than HERS or Title-24 default values are assumed, these must be confirmed by field testing.

Statistical sampling protocol: In conjunction with the BOP path mentioned above, there is a pilot statistical sampling protocol that can be applied at Playa Vista. Although the sampling algorithm is too detailed to go into in this letter, it basically consists of a full rating with duct leakage and infiltration testing (or assumed default values) for the first three houses built of a particular model, followed by a minimum 15% random sampling strategy for subsequent batches of structures built as long as the sampled houses meet the criteria in the paths defined above (if any homes in a "batch" fail the testing/inspection, all homes in the "batch" must be tested and inspected). If Playa Vista is interested in applying this protocol please let us know and we will discuss the details.

We are pleased and excited about Playa Vista's participation in our program, and we are confident that your home buyers will experience significant monetary savings in owning and operating those homes compared to typical homes, that considerable energy will be saved, and greenhouse gas emissions prevented. If you have any further questions, please contact our office.

Sincerely,

Glenn T. Chinery

Glenn T. Chinery
Technical Coordinator, EPA **ENERGY STAR Homes** Program
202/233-9784, FAX: 202/233-9583, E-mail: Chinery.Glenn@EPA.gov.

cc:
David Herbst, Vice President of corporate affairs, Playa Vista
Robert Sulnick
Brad Oberg, IBACOS Inc.
Malcolm Lewis, Constructive Technologies Group, Inc.
John Zinner, Zinner Consultants
Robert Turbin

PLAYA VISTA

RESIDENTIAL SUSTAINABLE PERFORMANCE GUIDELINES

SECOND EDITION
SEPTEMBER 1, 1999

RESIDENTIAL SUSTAINABLE PERFORMANCE GUIDELINES

SECOND EDITION
SEPTEMBER 1, 1999

TABLE OF CONTENTS

1. Introduction

Playa Vista and Sustainable Design

Playa Vista is committed to integrating sustainable design strategies throughout the community. Playa Vista recognizes the compelling economic, environmental and marketing rationale for incorporating sustainable principles. The bottom line is that sustainable development makes sense not only for Playa Vista, but for all developments everywhere.

These **Residential Sustainable Performance Guidelines** are a key part of Playa Vista's commitment to sustainable development. All residential buildings constructed at Playa Vista must meet these Guidelines, including those built by firms who purchase property for development.

What Is Sustainable Design?

The accepted international definition of sustainability is **meeting the needs of the present without compromising the ability of future generations to meet their own needs.** Sustainable design is a response to the depletion of the earth's resources and the pollution caused by an economy based upon the continued reliance on non-renewable resources.

Sustainable design incorporates designs, technologies and practices to significantly improve the efficiency, quality and environmental responsiveness of traditional development. Sustainable design results in a number of key benefits:

- **Efficiency** in the use of energy (28 percent more efficient than required by California's 1998 Title 24 Building Energy Efficiency Standards, which became effective July 1, 1999), and water (both indoor and landscaping). Renewable energy will be used, including passive (design) solar heating and cooling and active (pool and spa heating) solar heating. Appliances will be both water and energy efficient, as defined by the U.S. Environmental Protection Agency's "Energy Star" designation. Reclaimed water will be used for landscaping. Low flow toilets, faucets and showerheads will be installed.

- **Improved Indoor Air Quality** through ventilation and the use of environmentally friendly, low toxic materials such as low or zero VOC (volatile organic compound) paint, finishes and adhesives.

- **Waste Minimization** through recycling solid waste during construction and after occupancy and the use of appropriate materials and construction strategies. Each dwelling unit will have two built-in bins and each high density building will be equipped with two chutes, one for trash and one for recyclables, to make recycling easy for occupants and to conform to the waste minimization policy of the City of Los Angeles. Materials will contain a high percentage of recycled content or be made from certified sustainable grown lumber; examples include insulation, gypsum board and cabinets.

- **Enhanced comfort** through glazing selection, insulation, natural ventilation and proper space conditioning system sizing.

- **Consumer savings** through a reduction in energy and water bills and reduced maintenance cost.

Builder Impacts

- **Economics:** Sustainable design is cost effective when a total system approach is used. These guidelines minimize the impact on construction costs by offsetting cost increases in some components with decreases in others, particularly from the base case centralized HVAC and domestic hot water systems in high density units. The result is that these guidelines are expected to reduce building loads substantially with a modest increase in

first costs.

- **Marketing**: Sustainable design will give Playa Vista a market advantage; Playa Vista's sustainable design strategy will therefore be prominently featured in the Residential Marketing Pavilion. The sophisticated buyers of Playa Vista will understand the advantages of purchasing or renting a dwelling with sustainable design features. Playa Vista's buyers could:
  1. Qualify for energy efficient mortgages because of lower utility bills
  2. Realize health advantages through cleaner indoor air
  3. Live in units that are both more durable because of the materials utilized and more flexible for remodeling and upgrading to meet quickly changing technology.

- **Design and Engineering**: Sustainable design needs to be incorporated from the earliest design stages to insure success. Architects and engineers are thereby able to work together as a team to integrate the building's systems rather than design an independent series of architectural, structural, mechanical and electrical components.

- **Product Procurement**: Builders will have to purchase materials and products which are efficient, low in toxicity, contain a high percentage of recycled content and, ideally, are purchased from local manufacturers. Playa Vista will facilitate these purchases where practical.

- **Labor**: Contractors may require training in the installation of the sustainable design measures; Playa Vista will facilitate the training. Learning these skills will be in their best interest as sustainable design is a growing trend.

Guideline Summary

The three basic elements of the Playa Vista Residential Performance Guidelines are mandatory, energy base case and optional measures.

- **Mandatory Measures**: Mandatory measures are required because of conditions place on the project, City of Los Angeles ordinance or other Playa Vista design standard.

- **Energy Base Case Measures**: The energy base case measures or their equivalent (28 percent more efficient than the 1998 California Building Energy Efficiency Standards (Title 24)) must be implemented.

- **Optional Measures (Minimum Number Required)**: Each building must incorporate a minimum number of optional measures. The required number varies with the sustainable design category.

The measures impact all residential buildings, though some are specifically for high density (equal to or greater than 25 dwelling units (DU) per acre) or low density (less than 25 DU per acre) structures.

The Residential Sustainable Performance Guidelines are divided into nine major categories:

- **Construction Waste**
- **Building Materials**
- **Energy**
- **Domestic Water**
- **Recycling and Solid Waste**
- **Power, Signal and Control**
- **Adaptability**
- **Landscape**
- **Transportation**

There is a separate section for each category that details the principals, guidelines and mandatory, energy base case and optional elements of that topic. References, documentation and application details are also included. Additional explanatory material is included in the appendix.

Sustainable Mandates

Playa Vista must meet the requirements of both State and City of Los Angeles statutes as well as the specific requirements in Playa Vista's Conditions of Approval and Mitigation

Monitoring and Reporting Program. A number of these mandates address sustainable design.

State and City Mandates

- **Title 24** (State): Energy efficiency standards for all new buildings, revised for 1999.

- **AB 939** (State): A requirement that every city reduce its flow of waste to landfills by 50 percent by the year 2000. Los Angeles has set additional goals of 62 percent by 2010 and 70 percent by 2020.

- **Recycling Space Allocation**, Ordinance No. 171687 (City): Requires the designation of space for the collection and loading of recyclables.

- **Landscaping**, Ordinance No. 170978 (City): Requires the design and installation of drought tolerant (xeriscape) landscaping, and the planting of one tree for every four surface parking lot spaces such that these trees will shade 50 percent of the parking lot within 10 years.

Playa Vista's Conditions of Approval and Mitigation Program

- **Construction Waste**: Develop a city-approved plan to recycle construction waste.

- **Energy**: Exceed 1993 Title 24 standards (known as the 1992 standards because they were adopted that year) by 15 percent for lighting and 10 percent for HVAC; use energy efficient appliances, water heaters, heating units and light fixtures; and install automatic lighting timers, charcoal or electronic air filtration systems, solar pool and hot tub systems, and double pane windows where a line of site of Lincoln or Jefferson exists.

- **Recycled Building Materials**: Incorporate recycled materials where economically feasible.

- **Water Efficiency**: Irrigate landscaping using reclaimed water; use sprinkler control systems, water-efficient dishwashers, washing machines (if built in) and faucet fixtures; and install plants of which at least 50 percent are native or drought resistant and which minimize the generation of landscaping waste.

- **Recycling**: Install commingled recycling bins and insure their maintenance.

- **Air Quality**: Use building materials, architectural coatings and cleaning solvents that comply with South Coast Air Quality Management District regulations.

Related Mandates

Sustainable design is a broad topic. There are a number of additional topics with sustainable design benefits that are not covered in these Guidelines but that nonetheless must be followed. These include, among other topics, construction health and safety, fugitive dust, storm water runoff and handicapped access. A number of agencies, including OSHA, the South Coast Air Quality Management District, the Regional Water Quality Control Board and the City of Los Angeles, issue regulations governing these topics.

The U.S. Department of Energy generously supported the development of these Guidelines through the Building America program

The Playa Vista Residential Sustainable Performance Guidelines were prepared by Zinner Consultants, Constructive Technologies Group, Environmental Problem Solving Enterprises, IBACOS and the National Renewable Energy Laboratory.

2. Guidelines Summary and Compliance Review

Guidelines Summary

The Playa Vista Residential Sustainable Performance Guidelines include approximately 100 measures. The matrix on the next five pages summarizes each measure and indicates whether it is mandatory, energy base case or optional.

These measures are for all Playa Vista residential structures. The great majority of the measures impact all residential buildings. Some, however, are specifically for **high density** structures (stacked units equal to or greater than 25 dwelling units per acre), while others are for **low density** structures (on grade units and single family detached homes less than 25 dwelling units per acre).

The **mandatory measures** are required because they are in the adopted Playa Vista Environmental Impact Report or Conditions of Approval, are required by City of Los Angeles ordinance or are required by other Playa Vista design standards. The source of each mandatory measure is referenced.

The **energy base case measures** establish a required level of performance. The energy base case is 28 percent more efficient than required by the 1998 California Building Energy Efficiency Standards (Title 24), effective July 1, 1999. Substitutions are permitted for non-mandated energy measures as long as the performance of the substitute package (not the individual measures) meets or exceeds the 28 percent performance target and is approved through the compliance review process. Parking built below a concrete slab and appliances are not part of Title 24 and are therefore not part of the energy base case.

The **optional measures (minimum number required)** also have sustainable value but are less central to meeting the goals. Each builder must, at a minimum, implement the number of optional measures indicated on the title line identifying each category or subcategory.

Each measure is applicable only if the builder has control. If the purchaser of a unit is selecting the appliances and finishes (i.e. paint and carpet), the corresponding measure does not apply. However, if the builder is offering appliance or finish packages as options to buyers, these options must meet the Guideline requirements.

Substitutions are permitted as long the performance of the substitute package (rather than the individual measure) meets or exceeds the energy and environmental performance of the Guidelines and is approved through the compliance review process.

Each measure is explained in greater detail in the sections that follow. This detail makes clear the meaning of each measure and what must be done for compliance.

Compliance Review

Playa Vista review for compliance with the Sustainable Performance Guidelines has been incorporated into the required design review process. The official written approval required for each of the three design stages shall include review and approval of the sustainable strategy.

1. **Concept Alternatives:** Alternative conceptual plans shall be reviewed for such features as orientation, natural ventilation, shading and mechanical systems. The general strategy for complying with the Sustainable Performance Guidelines shall also be submitted and reviewed.

2. **Design Development Review:** This stage shall be a progression of the approved Concept Alternative plans, refining the specific sustainable strategy. Energy calculations must be submitted.

3. **Construction Document Review:** This stage may be simultaneously submitted for review and processing through the City of Los Angeles. The intent is to establish sustainable measure consistency with previously approved plans and to review specifications.

PLAYA VISTA
RESIDENTIAL SUSTAINABLE PERFORMANCE GUIDELINES

SUSTAINABILITY MEASURES MAJOR CATEGORY SUBCATEGORY		Mandatory Measures	Energy Base Case	Optional Measures (Min. No. Required) ♦
CONSTRUCTION WASTE				
Reduction of construction waste enables builders to save money on disposal costs while reclaiming large amounts of material for recycling.	Construction materials recycling to Playa Vista plan (mitigation measure #0GF)	X		
	Prefabricated systems for structural components			X
	Design out-to-out dimensions on two-foot increments			X
BUILDING MATERIALS				2
The attributes of sustainable construction materials are recycled or renewable content, environmentally benign ingredients and local sourcing. Sustainable rough construction materials are those based on sustainable practices and need to be appropriately managed on site. Finish construction decisions focus on materials that occupants live with and address indoor air quality and material sourcing.	Recycled content insulation (mitigation measure #N.G.4)	X		
	Recycled content gypsum board (mitigation measure #N.G.4)	X		
	Low VOC paint, finishes & adhesives (mitigation measure #B.1.D.13)	X		
	Materials manufactured or reprocessed within a 300 mile radius.			X
	Rough construction from recycled light gauge, rebar and structural steel			X
	Rough construction from certified sustainable forest products			X
	Recycled content roofing materials			X
	Finish materials from reclaimed or remilled wood, excluding flooring			X
	Cabinets made of certified sustainably harvested lumber or plywood, non-formaldehyde fiber board or particle board			X
	Recycled content architectural materials, i.e. countertops, glass tile, carpet & carpet pad			X
	Renewable material flooring such as bamboo or cork based linoleum			X
	Hard wood flooring from certified sustainably harvested wood			X
	Common area carpet system that allows replacing worn sections without removing majority of carpet			X
	Zero VOC paint and finishes			X

1. **Mandatory Measures**
Mandatory measures are required because they are in the adopted Playa Vista Environmental Impact Report or Conditions of Approval, are required by City of Los Angeles ordinance or are required by other Playa Vista design standards. The source of each mandatory measure is referenced.

2. **Energy Base Case**
The energy base case or an *approved equivalent* must be implemented. The energy base case is 28 percent more efficient than required by the 1998 California Building Energy Efficiency Standards (Title 24), effective July 1, 1999. Substitutions are permitted for non-mandated energy measures as long as the performance of the substitute package (not the individual measures) meets or exceeds the 28 percent performance target and is approved through the compliance review process. Parking built below a concrete slab and appliances are not part of Title 24 and are therefore not part of the energy base case.

3. **Optional Measures**
A minimum number of optional measures must be implemented, varying by section. The required minimum is on the title line identifying the category or subcategory and is either:
- The number shown or
- At least two measures from the three sections with the ♦ symbol

4. **Residential Building Types**
All measures pertain to all residential buildings except those marked as follows:
- ♦ **High density structures** only, i.e. equal to or greater than 25 dwelling units (D.U.) per acre (stacked units)
- ♦♦ **Low density structures** only, i.e. structures less than 25 dwelling units (D.U.) per acre (on grade units and single family detached homes)

SUSTAINABILITY MEASURES				
MAJOR CATEGORY / SUBCATEGORY		Mandatory Measures[1]	Energy Base Case[2]	Optional Measures (Min. No. Required)
ENERGY				
BUILDING ENVELOPE				n/a
Architectural choices significantly impact space conditioning and lighting loads.	Architectural design must reduce energy loads by 10% (mitigation measure N.G.1)	X	X	
	50% reduction in summer window solar gains		X	X
	Shading or glazing modifications on sliding glass doors		X	X
	70% light-colored exterior walls		X	X
	Light-colored or high albedo (reflective) roof finishes			X
SPACE CONDITIONING				n/a
Reductions in heating and cooling energy usage can be achieved through efficient system selection. Durability, especially corrosion, noise and aesthetics need to also be addressed	Medium efficiency air filtration (mitigation measure #B 1.R, condition of approval #97)	X	X	
	No equipment on walls, balconies or patios (Playa Vista architectural standard)[3]	X	X	
	Architecturally aesthetic enclosures for roof mounted equipment (condition of approval #98e)	X	X	
	Outside equipment noise minimization and rust protective coatings (Playa Vista architectural standard)	X	X	
	Naturally or mechanically ventilate subterranean garages using high efficiency or two-speed fans (mitigation measure N.G.2)	X		
	Carbon monoxide (CO) sensors to control subterranean garage ventilation (mitigation measure N.G.2)	X		
	Water source heat pump system[3,4]		X	X
	High efficiency pulse boilers[3]		X	X
	Efficient forced air gas furnaces and cooling equipment or high efficiency air-to-air heat pump for both heating and cooling[3,4]		X	X
	Cross-ventilation for each dwelling unit			X
	Fans to assist natural ventilation			X
	Operable inlet air dampers for natural ventilation			X
	Premium efficiency electric motors			X
	Direct-drive, variable speed motors			X
INTERIOR & EXTERIOR LIGHTING				n/a
Lighting typically utilizes 20 percent of the connected residential load and contributes to the need for cooling. Non-incandescent sources can reduce lighting demand by 75% and the efficient use of task lighting can further reduce lighting loads.	T8 lamps & electronic ballasts (mitigation measure #B.1.P)	X	X	
	Hard-wired compact fluorescent porch & patio lighting fixtures (mitigation measure #B.1.Q)	X	X	
	Common area hard-wired compact fluorescent lamps (mitigation measure #B.1.P, B.1.Q)	X	X	
	Photocell controls on common area exterior fixtures (mitigation measure #B.1.Q)	X	X	
	Fluorescent or HID lighting in common areas		X	X
	Hard-wired compact fluorescent lamps in residential units			X
	Photocell & motion controls on unit exterior fixtures			X

1. **Mandatory Measures**
Mandatory measures are required because they are in the adopted Playa Vista Environmental Impact Report or Conditions of Approval, are required by City of Los Angeles ordinance or are required by other Playa Vista design standards. The source of each mandatory measure is referenced.

2. **Energy Base Case**
The energy base case *or an approved equivalent* must be implemented. The energy base case is 28 percent more efficient than required by the 1998 California Building Energy Efficiency Standards (Title 24), effective July 1, 1999. Substitutions are permitted for non-mandated energy measures as long as the performance of the substitute package (not the individual measures) meets or exceeds the 28 percent performance target and is approved through the compliance review process. Parking built below a concrete slab and appliances are not part of Title 24 and are therefore not part of the energy base case.

SUSTAINABILITY MEASURES				
MAJOR CATEGORY SUBCATEGORY		Mandatory Measures	Energy Base Case	Optional Measures (Min. No. Required)[3]
ENERGY (Continued)				
WATER HEATING				n/a
Water heating energy usage can be minimized through efficient system selection.	Central water heating distribution system❖		X	X
	High efficiency pulse boilers❖		X	X
	High efficiency individual water heaters❖❖		X	X
	Hot water supply and return insulation inside each unit		X	X
	Tankless water heaters❖❖			X
RENEWABLE & ALTERNATIVE ENERGY SOURCES				n/a
On-site production of electric or thermal energy supplants energy requirements from utility sources and reduces utility bills.	Solar heating assist for pools & spas (condition of approval #4)	X	X	
	Conduit to roof for future photovoltaics (mitigation measure #N.G.3)	X	X	
	Solar heating assist for domestic hot water			X
	Photovoltaic-powered landscape lighting			X
	Photovoltaic-powered in-building common area lighting			X
	Waste heat recovery for fuel cells or micro-cogeneration			X
CONTROLS & FEEDBACK				n/a
Energy resources can be made tangible through access to information and timely feedback to residents.	Enhanced feature setback thermostats		X	X
	Remote utility meter reading		X	X
	Energy use feedback to residents			X
	Digital control for central systems			X
APPLIANCES				n/a
Fifty-six percent of residential energy use falls under the "other" category. Efficient appliances result in a reduction in energy consumption in an area typically controlled by residents' behavior.	Low water and energy consumption clothes washing machines (mitigation measures #B.1.O, O.3.B3)	X		
	Low water and energy consumption dishwashers (mitigation measures #B.1.O., O.3.B3)	X		
	Energy efficient clothes dryers (mitigation measure #B.1.O)	X		
	High efficiency, HFC refrigerator freezers (mitigation measures #B.1.O, O.3.B3)	X		
	Ducted kitchen exhaust system		X	X
	Make-up air for individual exhaust fans over 100 cfm			X
	Medium pressure gas distribution to units			X

3. **Optional Measures**
A minimum number of optional measures must be implemented, varying by section. The required minimum is on the title line identifying the category or subcategory and is either:
- The number shown or
- At least two measures from the three sections with the ❖ symbol

4. **Residential Building Types**
All measures pertain to all residential buildings except those marked as follows:
- ❖ **High density structures** only, i.e. equal to or greater than 25 dwelling units (D.U.) per acre (stacked units)
- ❖❖ **Low density structures** only, i.e. structures less than 25 dwelling units (D.U.) per acre (on grade units and single family detached homes)

SUSTAINABILITY MEASURES				
MAJOR CATEGORY / SUBCATEGORY		Mandatory Measures	Energy Base Case	Optional Measures (Min. No. Required)
DOMESTIC WATER				◆
The majority of water conservation is addressed by existing city code.	Reduced water consumption fixtures (mitigation measure #O.3.B3, City ordinance)	X		
	Water conserving appliances (see Energy-Appliances, mitigation measure #O.3.B3)	X		
	Hot water demand system within each unit			X
	Water use feedback to residents			X
RECYCLING & SOLID WASTE				◆
Enhanced levels of recycling will enable City and State to reach waste reduction goals.	Dual container kitchen system for recyclables & trash (mitigation measure #O.6.A, condition of approval #9a)	X		
	Dual chute building system & bins for recyclables & trash (mitigation measure #O.6.A, condition of approval #9a)◆	X		
	Self rolling containers for recyclables & trash◆◆	X		
	Recycled steel in chute system◆			X
	Trash compactors in each unit and smaller self rolling containers◆◆			X
POWER SIGNAL & CONTROL				4
Rapidly evolving communications and entertainment technologies provides occupants with improved fire and life safety systems, increased access to information and more choices for a home office and for entertainment. A new level of power conditioning is needed to accommodate computer-based activities and the growth of home automation.	Fire detection & signal in each unit (City ordinance)	X		
	Wire each unit to Playa Vista standard (Playa Vista design requirement)	X		
	Gas service seismic shutoff (City ordinance)	X		
	Automatic signal to fire department & link to ventilation operation			X
	Visual alarm in each unit & common space & unit enunciator			X
	Power service sized for expansion			X
	Separate lighting & convenience circuits			X
	Circuit capacity & conduit for electric vehicle charging			X
	Mounting space for surge protection, power conditioning & battery backup			X

1. Mandatory Measures

Mandatory measures are required because they are in the adopted Playa Vista Environmental Impact Report or Conditions of Approval, are required by City of Los Angeles ordinance or are required by other Playa Vista design standards. The source of each mandatory measure is referenced.

2. Energy Base Case

The energy base case *or an approved equivalent* must be implemented. The energy base case is 28 percent more efficient than required by the 1998 California Building Energy Efficiency Standards (Title 24), effective July 1, 1999. Substitutions are permitted for non-mandated energy measures as long as the performance of the substitute package (not the individual measures) meets or exceeds the 28 percent performance target and is approved through the compliance review process. Parking built below a concrete slab and appliances are not part of Title 24 and are therefore not part of the energy base case.

SUSTAINABILITY MEASURES				
MAJOR CATEGORY / SUBCATEGORY		Mandatory Measures	Elements of Base Case	Optional Measures (Min. No. Required)
ADAPTABILITY				4
Homes can easily adapt to the changing needs of the occupants and to rapidly evolving home technologies with proper planning. This flexibility will meet the needs of the many users and increase the useful life of the Playa Vista residential units.	City of Los Angeles disability residential standards (City ordinance)	X		
	Reinforce bath walls for grab bars			X
	Accessible door sizes & swings			X
	Adequate access for service of common area trunk lines◆			X
	Electronic or written construction, product & system documentation			X
	Allow kitchen counter height adjustment			X
LANDSCAPE				1
Appropriate plantings minimize outdoor water, green waste and maintenance and contribute to cooler local climates. The use of reclaimed water, drip irrigation and automatic controls also greatly reduce water consumption.	50% minimum native or drought tolerant plants (mitigation measure #O.3.C)	X		
	Plantings with minimum maintenance & waste (mitigation measure #O.6.B)	X		
	Tree shaded parking areas (City ordinance)	X		
	Reclaimed water for landscape irrigation (condition of approval #90)	X		
	Drip or soaker-based irrigation (mitigation measure #C.2.B.H3)	X		
	Automatic controls for irrigation systems (mitigation measure #O.3.B2)	X		
	Slope to retain maintenance water in planting areas (mitigation measure #C.2.B.H.3.e)	X		
	75% native or drought tolerant plants			X
	Deciduous trees and vines for shading			X
	Slow storm water run-off			X
	Permeable pavement			X
TRANSPORTATION				1
Alternate modes of transportation and alternative fueled vehicles minimize air pollution. Alternative modes also reduce traffic.	Secure bicycle storage◆			X
	Electric vehicle chargers◆			X

3. Optional Measures

A minimum number of optional measures must be implemented, varying by section. The required minimum is on the title line identifying the category or subcategory and is either:

- The number shown or
- At least two measures from the three sections with the ◆ symbol

4. Residential Building Types

All measures pertain to all residential buildings except those marked as follows:

◆ **High density structures** only, i.e. equal to or greater than 25 dwelling units (D.U.) per acre (stacked units)

◆◆ **Low density structures** only, i.e. structures less than 25 dwelling units (D.U.) per acre (on grade units and single family detached homes)

3. Construction Waste

Principles

Approximately 33 percent of all landfill waste comes from construction and demolition waste. The reduction of construction waste enables builders to save money on disposal costs while reclaiming large amounts of material for recycling.

Some construction waste can be reused on-site, such as wood waste that can be ground up and used as mulch or wood chips for landscaping. Other construction materials can be recycled to make new products. For example, steel can be recycled into steel framing, I beams, cars, appliances and office furniture.

Guidelines

Builders can reduce construction waste through a number of strategies:

- The appropriate selection of material sizes and quantities and careful attention to purchasing practices can eliminate much of the "scrap" materials.
- Daily collection and craft team clean-up responsibility will reduce clutter and material loss, and maintain a safe work environment.
- Using separate collection bins for recycles results in clean materials ready for marketing.

Mandatory Measure

- Playa Vista is required to recycle demolition and construction waste according to a plan approved by the City of Los Angeles Department of Planning and Bureau of Sanitation. The Playa Vista Construction Materials Recycling Plan was approved by the City in June 1999.

  The plan focuses on complying with California's mandated goal of diverting 50 percent of waste from landfills by the year 2000 and providing full reuse, recycling and solid waste services to builders. All builders are required to recycle construction materials as outlined in the approved Plan.

It is likely that Playa Vista's builders will save money on tipping fees and hauling costs as a result of construction materials recycling.

Optional Measures

- Utilize prefabricated systems for all the structural components of the walls, floors or roofs. If sub-components such as plumbing trees or panelized wall sections can be utilized, as much as 20 percent of the materials can be saved and the scrap materials can be centralized, making it easier to recycle. This will also create the potential to reuse or recycle sub-components in the event the building is remodeled or demolished.
- Design out-to-out dimensions for roof, floor or wall sheathings based on two-foot increments to permit pre-constructed panel & dimensional lumber minimization.

Performance Metrics

- Meet and exceed state-mandated 50 percent recycling goal.
- Full reuse, recycling and solid waste services for each builder.
- Provide and remove collection bins in a timely and efficient manner for all builders.
- Proper recycling or disposal of all materials with documentation.
- Documentation of program results.

References and Documentation

1. Playa Vista Construction Materials Recycling Plan, April 1999.
2. City of Los Angeles Bureau of Sanitation, Integrated Solid Waste Management Office.
3. Environmental Problem Solving Enterprises.

Application

The Playa Vista Construction Materials Recycling Plan contains the following elements:

- The Plan focuses on the reuse and recycling of:
  1. Scrap metal
  2. Wood (which can be given to non-profit groups as a tax-deductible donation)
  3. Dry wall
  4. Corrugated cardboard
  5. Concrete/asphalt
  6. Ceramics
  7. Glass
  8. Other materials as identified
- Source separating (as appropriate) and/or co-mingled waste.
- Collection bins located at individual construction sites and a centralized staging area for recycling operations.
- Analysis of construction schedules to identify the timing of specific phases of work and the associated generation of materials such as drywall and insulation, thereby allowing for the provision of an appropriate number of collection bins during those phases.
- A minimum of two bins for each building site at all times, one for recoverables and one for waste materials; extra bins or more frequent pick-up for waste surge periods.
- A contract hauler to rotate bins as needed and an on-site coordinator to ensure efficient bin replacement and quality control.
- Separate processing of hazardous wastes encountered as part of the construction period.
- Monthly recovery reports.
- Education of the builders to distinguish between recyclable and reusable materials and waste and to the environmental and social importance of reuse and recycling.
- Printing of all recycling information, including bin labels, in both English and Spanish.
- Ongoing monitoring of the program to ensure full implementation
- A public relations effort to promote the environmental benefits of the program and prepare case studies of the program results with cost benefit analysis when appropriate.

Additional construction materials reduction strategies include:

- Utilize off-site prefabrication of wall, floor or roof structural components to minimize site waste.
- Apply design principals to use full dimension sheets of panel products and full lengths of dimension lumber. This will reduce waste and result in fewer materials purchased and reduced labor and disposal costs.
  1. To achieve this goal, utilize two-foot out-to-out dimensions.
  2. Another option is to design rooms using 4 foot multiples (wallboard and plywood sheets come in 4 and 8 foot lengths). One dimension of a room can be designed in 6 or 12 foot multiples to correspond with the length of carpet and linoleum rolls. At a minimum, rooms should be designed whenever possible with 2 foot incremental dimensions.
- Request that suppliers minimize unnecessary packing materials.

4. Building Materials

Principles

Building materials are usually selected based on code standards, cost, availability, durability and aesthetics. Producing and using building materials, however, consumes natural resources, energy and water, and generates pollution and waste.

"Green" building materials have become widely available in response to concerns about human health and the environment. These materials frequently save energy, improve indoor air quality, last longer and require less labor than traditional materials.

It is important to carefully compare products. In general, indoor air quality is more important than recycled content. For example, a product may contain 100 percent post-consumer fibers yet have a higher level of toxic chemicals than a non-toxic product with only 40 percent recycled content.

Guidelines

Use building materials with some or all of the following characteristics:

- Zero or low VOC (volatile organic compounds).
- No or low toxicity.
- Durability.
- High recycled content.
- Made from renewable resources.
- High potential for recyclability after use.
- Locally manufactured.

Mandatory Measures

- Recycled content insulation (fiberglass minimum 30 percent, cellulose 85 percent).
- Recycled content gypsum board (wallboard minimum 25 percent, facing paper 100 percent).
- Low VOC paint, finishes and adhesives (less than 250 grams of VOCs/liter).

Optional Measures

The following measures are recommended whenever the builder has control and when the builder offers packages to purchasers:

- A minimum of 15 percent of architectural building materials manufactured or reprocessed within 300 air miles of the building site to reduce shipping costs, pollution and energy consumption. Calculated by total materials cost, exclusive of costs for concrete, mechanical, electrical, plumbing systems, labor, overhead and fees.

  Provide a compilation of submittals for local materials that includes material, manufacturer, location of manufacturing facility, distance in miles from project site and cost for materials. Provide a summary of all local materials supplied to project, the cost for these materials, the total material cost for the project and calculations that show that the percentage requirement is met.

  If, in the course of the project, any changes are made in the materials originally reviewed, file an amendment for review and approval by Playa Vista. This will serve as a monitoring system to ensure measure target is met.

- A minimum of 25 percent of total building materials from recycled light gauge, rebar or structural steel. Calculated by total materials cost, exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead and fees.

  Provide a list of the materials used on the project that will be used to meet the requirement; cost for these materials, the total material cost for the project and calculations that show the percentage requirements have been met.

  Provide a certified copy of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items, including attesting that the structural steel furnished contains no less than 25% recycled scrap steel and meets the requirements specified.

  If, in the course of the project, any changes are made in the materials

originally reviewed, file an amendment for review and approval by Playa Vista. This will serve as a monitoring system to ensure measure target is met.

- A minimum of 20 percent of total building materials **and** 70 percent of rough construction wood from certified sustainable forest products. Calculated by total materials cost, exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead and fees.

  Wood product shall originate in forests that are certified well managed by an agency accredited by the Forest Stewardship Council (FSC). "Well-managed" are those forests managed through professionally administered forestry management and logging plans that ensure regeneration of desired species so that timber growth equals or exceed harvesting rates in both quantity and quality over the long term. Other considerations include protecting rivers and streams from degradation, minimizing damage to the forest when harvesting, promoting biodiversity, operating in concert with the lawful interests of local populations, and maximizing both the yield and value of the forest products.

  Provide documentation confirming the certified status of all wood products for approval prior to fabrication. Acceptable documentation shall include:

  1. A copy of the wood supplier's certificate issued by an FSC-accredited certifying agency.
  2. A copy of the supplier's invoice detailing the quantities of certified wood products supplied for this project.
  3. A copy of a letter from one of the certifying agencies corroborating that the products detailed on the wood supplier's invoice originate from certified well-managed forests.

  Ensure that certified wood products are kept separate from non-certified materials and comply with auditing procedures mandated by the certifier.

  If, in the course of the project, any changes are made in the materials originally reviewed, file an amendment for review and approval by Playa Vista. This will serve as a monitoring system to ensure measure target is met.

- Recycled content roofing materials, i.e. metal (minimum 30 percent), wood (25 percent) and rubber pad (25 percent).

- A minimum of 5 percent of finish materials (inside face of drywall) from reclaimed or remilled wood, excluding flooring. Calculated by total materials cost, exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead and fees.

  Provide a list of the salvaged and refurbished materials used, the cost for these materials, the total material cost for the project and calculations showing percentage requirements have been met. Provide highlighted product data and a signed letter by corporate office holder identifying "chain of custody" from demolition through resale of the product, thereby verifying salvaged or refurbished status.

  If, in the course of the project, any changes are made in the materials originally reviewed, file an amendment for review and approval by Playa Vista. This will serve as a monitoring system to ensure measure target is met.

- Cabinets made of Forest Stewardship Council (FSC) certified sustainably harvested lumber and plywood, non-formaldehyde medium density fiber board or particle board.

- A minimum of 20 percent of architectural materials, i.e. countertops, glass tile, carpet & carpet pad, that contain at least 20% post-consumer recycled content OR a minimum of 40% post-industrial recycled content. Calculated by total materials cost, exclusive of costs for mechanical, electrical, plumbing systems, labor, overhead and fees.

  Provide a signed letter from product manufacturers that identify their

product(s) as having recycled content with the percentages of post consumer and/or post-industrial materials clearly stated. Provide a list of all recycled content materials that meet the requirements used on the project, the percentage of post-consumer and/or post industrial recycled content, the cost for these materials, the total material cost for the project and calculations that show percentage requirements have been met.

If, in the course of the project, any changes are made in the materials originally reviewed, file an amendment for review and approval by Playa Vista. This will serve as a monitoring system to ensure measure target is met.

- Renewable material flooring such as bamboo or cork based linoleum.

- Hard wood flooring from FSC certified sustainably harvested wood.
- Common area carpet system that allows replacing of worn sections without removal of the majority of the carpet.

- Zero VOC paint and finishes.

Performance Metrics

- Product specification including information on manufacturer and recycled content submitted for approval.
- Visual site inspection.

References and Documentation

1. City of Los Angeles Sustainable Building Reference Manual, Citywide Sustainable Task Force, updated June 1998.
2. A Technical Manual for Material Choices in Building and Construction, California Integrated Waste Management Board, March 1998.
3. Environmental Resource Guide, American Institute of Architects
4. Steel Recycling Institute.
5. Forest Stewardship Council (FSC).

Application

Hundreds of products are made from recycled or renewable materials and have good indoor air quality characteristics; more such products are being released all the time. The following discussion focuses on those materials that will be used in the largest volumes at Playa Vista.

Concepts

Recycled Content includes two sub categories: **Pre-consumer waste** is industrial waste or finished material that is not marketed. **Post-consumer wastes** are products at the end of their intended use such as bottles, newspapers and corrugated cardboard. Many manufacturers can include the specific desired amount of recycled content for large projects such as Playa Vista.

Framing

Recycled Steel contains a minimum 25 percent recycled content and is itself recyclable. Steel is a lightweight material that does not warp, shrink, split, twist or lose moisture, thereby improving performance, quality and design flexibility. Steel is termite proof, fire resistant, more resistant to earthquakes and costs less to assemble. Its high thermal conductivity requires unique insulating measures to minimize heat transfer through exterior walls. Grommets are needed when running wires and pipes to avoid chafing. Workers may require training.

Forest Stewardship Council certification ensures that lumber is harvested from well-managed forests; a 3 to 6 month product lead time is required. FSC certified **engineered wood products** (EWPs) use less wood for equal or greater load bearing characteristics. Examples include glulams, laminated trusses, I-joists, laminated veneer lumber and oriented strand board.

EWPs require less material than solid sawn lumber for the same application and generate little or no on-site construction waste. Their higher cost can be offset by the reduced need for labor since they can be framed more quickly using longer, lighter spans. Headers, joists, and other elements can be manufactured to specification reducing cutting time and on-site waste. Knockouts on I-beams may not be ideally located and special hangers and fasteners may be needed.

Some of the strandboards, particleboards and waferboards may swell or disintegrate during wet conditions. Laminates, glues and adhesives used in manufacturing may emit VOCs that contribute to indoor air pollution.

Insulation

Cellulose insulation made with recycled paper can achieve a high R-value in stud walls as it fills the entire wall cavity and can provide added acoustical control. Chemicals are added to provide flame resistance as well as certain processing and handling characteristics. **Fiberglass** insulation must have a minimum of 30 percent post-consumer glass in California.

Roofing Materials

Metal roofing alternatives include sheet metal, metal shingles, shakes and tile made from post-consumer aluminum and steel. **Cement composites** contain recovered materials such as fly ash and wood fiber. **Concrete-based** materials can have a significant recycled content, be recycled and last a long time. Shingles made from post-consumer **rubber, plastic or glass** are other options, as are **roofing mats** (walkway pads) and **roof membranes** made from post-consumer plastic and roofing felt paper from post-consumer paper.

Paints, Finishes and Adhesives

Paints, finishes and adhesives must meet the South Coast Air Quality Management District low VOC standard of 250 grams/liter (2.08 pounds/ gallon), which is expected to be tightened. **Low VOC adhesives** are less toxic and include acrylic latex glues, contact cements and vinyl tile and vinyl sheet flooring adhesives. These adhesives are competitively priced and widely available.

Finish Materials

Formaldehyde-free **medium density fiber board or particle board** prevents indoor air pollution and can be used to manufacture countertops, cabinets and other applications requiring flat, paintable, machineable panels.

Bamboo is very durable and is a renewable resource since it grows to maturity in four to five years. **Cork** is combined with linseed oil and other natural materials to make flooring tile. It is harvested on an ongoing basis without harming the tree. **Linoleum** uses renewable resources without compromising aesthetics, and is installed similarly to vinyl. **Ceramic and glazed tile** are very durable and can be made with up to 70 percent recycled glass. **Carpet** can be made from reclaimed or recycled content materials such as wool, scrap yarn, nylon or recycled plastic bottles.

5. Energy: An Overview

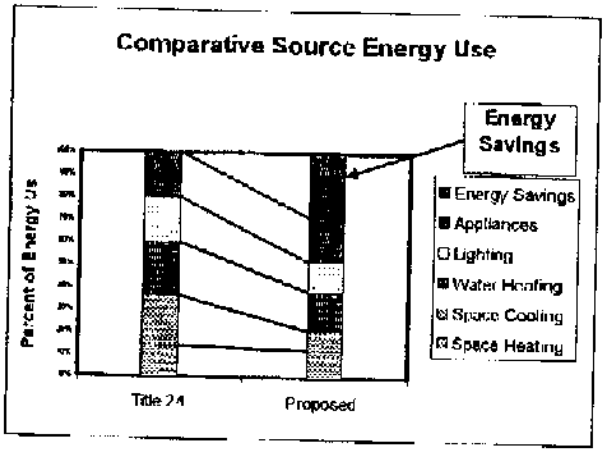
Introduction

The need for shelter, comfort and light drive energy use in a typical California household in four categories: space conditioning, lighting, appliances, and water heating. Space conditioning requirements are largely dictated by climate, siting orientation, building envelope (especially glazing) and mechanical systems.

Mechanical systems (space heating, space cooling and water heating) account for 39 percent of energy consumed by a typical household in California. The remaining 61 percent of consumed energy is used to operate lighting and home appliances. Efficient energy systems can reduce a resident's utility bills and lessen the impact on the environment.

Energy saving measures can require an initial investment in equipment that requires time to pay for itself through reduced energy expenses. In multiple-unit buildings, however, careful energy efficient choices can lead to construction cost savings.

The proposed building packages will save an estimated 28 percent of energy use compared to the 1998 California Title 24 Building Energy Efficiency Standards. It does not include the substantial savings potential of energy efficient appliances because these are not included in Title 24



Once climate and building siting/orientation are specified during the design process, a whole-building systems approach in the design and selection of equipment and materials can help optimize a building's mechanical systems and minimize energy use. A whole-building systems approach to **high density** buildings allows consideration of the sharing of mechanical equipment among several units and capitalizes on synergies among designer's choices. **Low density** housing requires the selection of high efficiency equipment for meeting space conditioning and water heating needs.

Incorporating efficiency in building design increases comfort, lowers energy use and reduces maintenance costs, and can improve aesthetics and indoor acoustics. These factors add value to the entire building and to individual units, whether high or low density.

Occupants of both high and low density homes benefit from the selection of energy and water efficient appliances (refrigerators, washer/dryers and dishwashers). This is especially important in coastal southern California where heating and cooling demand is low. Efficient appliances can be identified by the U.S. Environmental Protection Agency's "Energy Star" labeling (See "Appliances", section 5.7).

The following sections describe energy-efficient design options and their rationale, provide guidelines for implementation and prescribe base case and discretionary measures that can be combined to progressively achieve higher efficiency.

Guiding Principles

- Improve building envelope, glazing orientations and shading and natural ventilation prior to specifying mechanical systems.
- Consider central and shared component systems.
- Consider the first-cost savings benefit as well as operating cost savings at the "whole building" level.
- Specify energy and water efficient appliances when these are either installed by the builder or included by the builder in optional packages for purchasers of condominiums or apartment tenants.

Overall Requirements

- Lighting systems must consume 15 percent less lighting energy than the 1992 California Title 24 standard (which became effective in 1993).
- Building envelope measures must achieve a 10 percent total building energy use savings below the current Title 24 standard before consideration of space conditioning (heating and cooling) and water heating.
- Heating and cooling systems must consume 10 percent less total building energy than the 1992 California Title 24 standard, over and above building envelope savings. Water heating energy use can be included. There are no differences between the 1992 and 1998 standards regarding HVAC equipment energy efficiency.
- Water heating and other appliances must meet the minimum 1998 California Title 24 efficiency requirements.

Performance Metrics

- Source energy use, the raw energy required at the source, accounts for any conversion losses. It is expressed in 1,000 Btu per square foot per year (kBtu/sf/yr).
- Total or "whole building" cost of equipment installation and cost of construction.
- Simple payback to measure how many years an energy savings measure will require to payback the initial investment.

References and Documentation

1. Household Energy Consumption and Expenditures, 1993. Supplement – State, U.S. Department of Energy, Energy Information Administration.
2. Buildings for the 21st Century, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.
3. Energy Star Buildings Manual, U.S. Environmental Protection Agency.
4. www.energystar.gov/products/appliances.html
5. International Performance Measurement and Verification Protocol, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.
6. Sustainable Building Technical Manual, U.S. Green Building Council.

5.1 Building Envelope

Principles

The shell of the building, or the building envelope, is a protective skin between the indoor environment and outside conditions. The building envelope allows heat to pass into or out of the building in several ways:

- Conduction – Heat transfer through walls, roof and floor driven by a temperature differential. This generally creates a heating load during cool nights or a cooling load on hot days. Increasing insulation is the traditional method for reducing heat gain by conduction.
- Solar Heat Gain (Radiation) – Sunlight coming through windows and skylights provides both visible light and radiant heat and is responsible for most of the heat load in residential buildings. Shading and glazing (fenestration) options can significantly reduce this load.
- Infiltration – The building envelope invariably allows some outside air to seep in through cracks or around windows, adding to mechanically induced air changes. While outside (or make-up) air usually enhances indoor air quality, the air often requires conditioning, which in turn increases energy use.

In the mild coastal climate at Playa Vista, these methods for heat transfer can pose unique concerns. In most climates increasing insulation reduces loads significantly. However, in a mild coastal climate, improved insulation produces only minimal savings. Natural ventilation can produce comfort when the outside air condition and architecture permit and can eliminate the need for mechanically assisted heating and cooling.

Solar heat gain is the primary cooling load for residential buildings in this climate. Windows on each face of a building should be designed to allow ambient daylight to enter the space while limiting heat gain from direct sunlight.

The sun's movement from east to west through the sky concentrates light and heat on building surfaces with those exposures and on southern exposures in the winter.

Guidelines

East and west facing window size should be minimized. Shading with vertical louvers or side fins can limit radiation from direct sunlight. Use of low emissivity glazings reduces solar heat gain, making larger windows possible.

The northern and southern exposures can be larger because they receive less direct sunlight, but low emissivity glass will still help reduce the heat load from these exposures. Horizontal overhangs can provide seasonally effective shading on southern exposures.

The goal is to minimize heating and cooling loads while meeting acceptable aesthetic requirements in the number and size of windows and the color of the glass.

Mandatory Measure

- Reduce energy use through architectural design by 10 percent relative to 1998 Title 24 standards utilizing conventional Title 24 compliant gas space heating, gas water heating, and electric air conditioning systems. Additional base case HVAC savings are achieved as described in the "Space Conditioning" section.

Energy Base Case Measures

- Provide a 50 percent reduction in summer window solar gain by limiting aperture area (e.g.,15 percent of floor area) or through the use of fins, insets and overhangs.
- Provide shading or glazing modifications on sliding glass doors as part of the mitigation that requires double-glazed windows on openings facing Lincoln or Jefferson Blvd.
- Use 70 percent light-colored exterior walls.

Optional Measure

- Use light-colored or high-albedo (reflective) roof finishes with a

reflectance of 60 percent or greater for a minimum of 75 percent of all roofing materials. These materials save cooling energy directly by reducing the heat gain through the roof. Use diffusely reflecting materials to prevent undesirable reflective glare from impacting neighboring buildings.

Performance Metrics

- R-values of insulation provide a measure of their resistance to heat transfer.
- Solar Heat Gain Coefficient (SHGC) should be minimized to reduce solar heat gain. Increasing U-values and increasing shading coefficient (SC) of glazing choices reduces SHGC.
- Visual Light Transmittance (VLT) of the windows should remain high enough to provide adequate daylight and view without excessive coloration.
- Cubic feet per minute (cfm) and air changes per hour (ACH) are two measures of air infiltration. An ACH below 0.15 is considered undesirable from an air quality perspective.

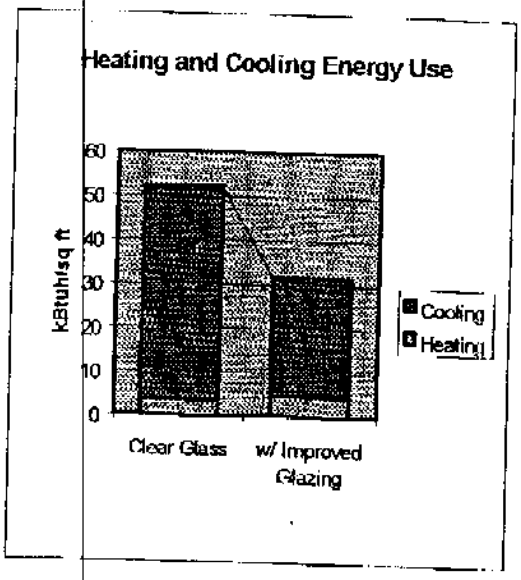
References and Documentation

1. EPA Energy Star Buildings Manual.
2. Lawrence Berkeley National Laboratory Building Technology Program.
3. For high albedo roof material: Lawrence Berkeley National Laboratory Cool Roofing Materials Database, http://eetd.lbl.gov/coolroof/.
4. National Fenestration Rating Council.
5. American Glass Manufacturers Association.
6. ASHRAE Standard 62.
7. ASHRAE Fundamentals Handbook, Fenestration 29.5.

Application

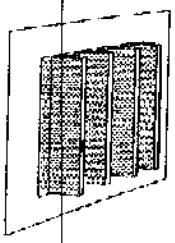
Energy Use

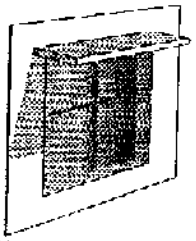
The following chart shows the heating and cooling energy for a typical high density building in Playa Vista with and without efficient glazing. Although there is a small increase in heating energy, the cooling energy is dramatically reduced.



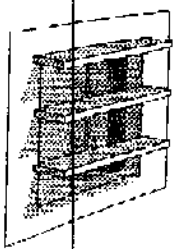
Shading

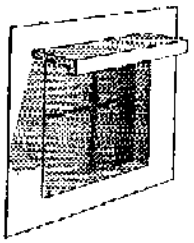
A variety of different shading devices can be used to minimize solar heat gain. The path of the sun through the sky makes vertical louvers or side fins effective on the east and west facades of buildings, while overhangs are more effective on the south façade.


Vertical Louvers


Horizontal Overhang

Variations on typical overhangs provide options to allow for space constraints or structural limitations that would prohibit a larger overhang.


Broken Overhang


Dropped Edge

Source: Lawrence Berkeley National Lab

5.2 Space Conditioning

Principles

Thirty-one percent of all the energy consumed by households in California is used to provide space heating and cooling.[1] Occupant comfort is affected by the quality (e.g. odors, stale air) and temperature (e.g. overheated air) of the air inside a space. Regulations control the minimum required ventilation of a space to prevent occupant health issues. Natural ventilation provides additional airflow through a space to help force out overheated or overcooled air and is a low energy consuming alternative that can reduce air conditioning and heating needs during many times of the year.

High density structures

Using a whole-building systems approach to design and select equipment can help optimize space conditioning systems and allows consideration for the sharing of equipment resources in high density buildings.

Using a single system that can provide both space heating and cooling, or space heating and water heating, can be more cost-effective than installing separate pieces of equipment to provide the same functions. A water source heat pump is such a dual device, and when considered using the whole-building design approach can lead to significant construction cost and energy use savings. See Heat Pumps, section 5.2.1, for details.

The high density base case system addresses a number of design requirements, including:

- Minimizing mechanical equipment space in units.
- No noise impact on balconies to encourage opening windows for natural ventilation.
- Eliminating "clutter" on balconies or roofs.
- Avoiding the impact of the salt air on DX unit condensing coils.

Low density housing

Low density housing lends itself to individual space conditioning units. High efficiency gas furnaces (forced air units or FAU) and high efficiency air conditioning systems are therefore recommended as the base case.

Guidelines

- Evaluate equipment cost at the whole-building level and compare to the cost of providing equipment at the unit level.
- Consider the cost-of-energy savings benefit to individual homeowners by providing equipment at the "whole building" level.
- Consider the economic benefit and payback of using equipment with higher energy efficiencies.
- Use natural ventilation to reduce the use of air conditioning and heating.
- Locate building openings and systems to allow cross-ventilation of a building's interior.

Mandatory Measures

- Provide medium efficiency (average of 25 to 30 percent per ASHRAE Test Standard 52) air filtration.
- For **high density** homes, do not locate any equipment on walls, balconies or patios.
- For any roof-mounted equipment, install enclosures that conform to the Architectural Guidelines' definition of roofs as "fifth walls."
- For any outside equipment, eliminate or minimize noise and provide corrosion protective coatings.
- For subterranean garages, naturally or mechanically ventilate using high-efficiency or two-speed fans where ventilation is required.
- For subterranean garages, incorporate carbon monoxide (CO) sensors to control operation of fans where ventilation is required.

Energy Base Case Measures

- For **high density** structures, install water source heat pump system or equivalent to supply heating and cooling at the unit level via a centralized tempered water distribution system.
- For **high density**, install high efficiency pulse boilers or equivalent to provide heated water for the centralized water source heat pump system.
- For **low density** homes, utilize high efficiency forced-air gas furnaces (AFUE > 80 percent) and air conditioners (SEER > 12), or use high efficiency air-to-air heat pumps for both heating and cooling.

Optional Measures

- Design in cross-ventilation for each dwelling unit to allow the opportunity for natural ventilation with operable openings other than doors.
- Use fans to assist natural ventilation in all units. Include the use of operable dampers and thermostatic controls.
- Install operable inlet air dampers for natural ventilation.
- Install at least 75 percent premium efficiency electric motors.
- Use direct-drive, variable-speed motors for at least 75 percent of pumps and fans.

Performance Metrics

- Heating efficiency expressed as **Annual Fuel Utilization Efficiency (AFUE)**, representing the efficiency of heat delivered over the year. An AFUE of 78 percent is a minimum requirement.
- Heating efficiency expressed as a **Heating Seasonal Performance Factor (HSPF)**, a measure of heating efficiency over the system. HSPF is useful for heat pumps; an HSPF of 7 or higher is typical.
- **Seasonal Energy Efficiency Ratio (SEER)** is a rating used for central air conditioning systems that might be used in low density dwellings. An Air Conditioning and Refrigeration Institute (ARI) rated SEER of 12 or higher for DX cooling is considered high efficiency.

- Added value of improved indoor environmental quality – comfort, acoustics and air quality.
- Total or "whole building" cost of equipment installation.
- Simple payback to measure how many years an energy savings measure will require to offset the initial investment.
- Added value of lower operations and maintenance costs.
- Added value of improved indoor environmental quality – comfort, acoustics and air quality.
- Reduced air conditioning and heating energy use.
- Improvement of indoor air quality and feeling of comfort.

References and Documentation

1. Household Energy Consumption and Expenditures, 1993. Supplement – State, U.S. Department of Energy, Energy Information Administration.
2. Non-Residential Manual for Compliance with the 1992 Energy Efficiency Standards, California Energy Commission.
3. Residential Central Air conditioner and Heat Pump Program, Consortium for Energy Efficiency, November 17, 1995.
4. Buildings for the 21st Century, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.
5. Energy Star Buildings Manual, U.S. Environmental Protection Agency.
6. Sustainable Building Technical Manual, U.S. Green Building Council.

5.2.1. Heat Pumps

Principles

Heat pumps offer an energy-efficient and cost-effective alternative to furnaces and air conditioners in high density buildings for climates with moderate space heating and cooling needs. Heat pumps absorb heat from one space and then transfer it to another. Air-cooling and water-cooling are two of the methods used by heat pumps for transferring heat. Of these two methods, water-cooled heat pumps offer high equipment efficiencies.

During the heating season, a water source heat pump absorbs heat from an external water heating distribution system and transfers the water's heat to an air-to-water heat exchanger. Cool air is drawn from a building's interior and across fins in the heat exchanger by an air fan. The cool air becomes warmed and is then sent back into the structure by the fan. Cooled water exiting the heat pump is recycled back into the distribution system water where it is reheated. The reheated water is then distributed back to the building for additional heating use by the heat pump.

During the cooling season the process is modified: the heat pump uses cool water from the external water distribution loop and circulates it through the air-to-water heat exchanger. Warm air is drawn from a building's interior and across the heat exchanger's fins by the air fan. The fan then recirculates the cooled air back into the structure. The heat pump transfers heat from the warmed water that exits the heat exchanger back into the external water distribution loop. The external water distribution loop re-cools the water then recycles it back into the distribution system for cooling use by the heat pump.

Because heat pumps move rather than generate heat, they can effectively produce three to ten times the amount of cooling energy they consume.

Guidelines

The installation of water source heat pumps can occur in two ways:

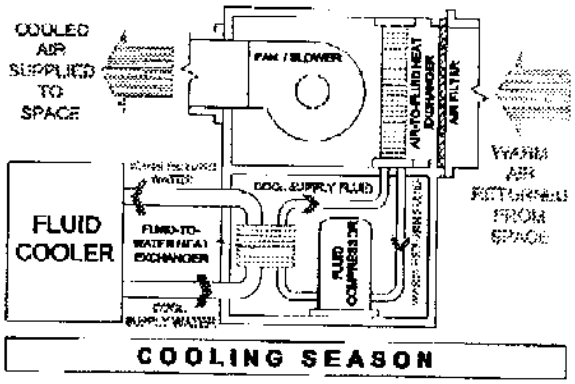
- **Vertical installation** used in closet or utility room installations. These units have small footprints, typically less than three feet square. Available sizes range from 1/2 to 5 tons or more.
- **Horizontal installation** used in concealed, above ceiling installations. These units have a low profile, typically less than two feet high. Available sizes range from 1/2 to 5 tons or more.

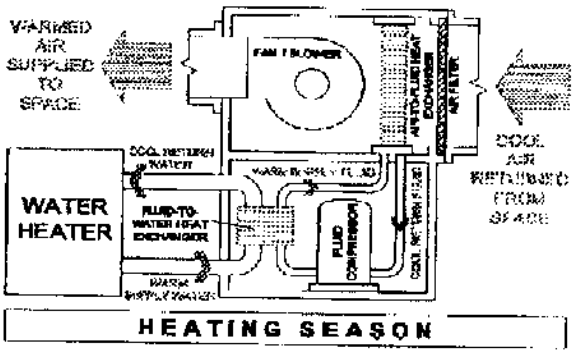
Performance Metrics

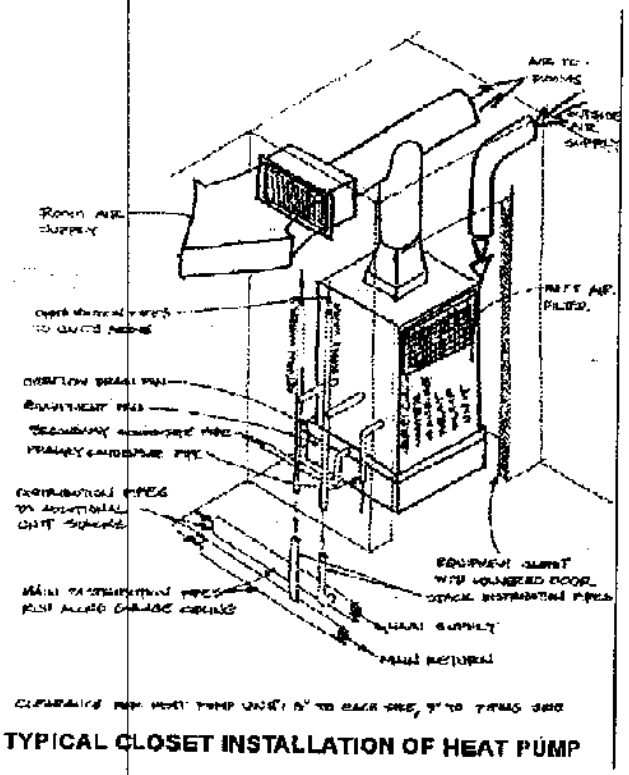
- Cooling efficiency expressed as **Coefficient of Performance (COP)**. A COP of three or more is typical.
- Heating efficiency expressed as **Energy Efficiency Ratio (EER)**, which is defined as heating or cooling energy transfer (btu) divided by electric energy input (in Watt-hours). An EER of 8 or higher is typical.
- **Seasonal Energy Efficiency Ratio (SEER)** is a rating used for central air conditioning systems for single family dwellings. A Air Conditioning and Refrigeration Institute (ARI) rated SEER rating of 14 or higher is considered high efficiency for water-source heat pumps.

References and Documentation

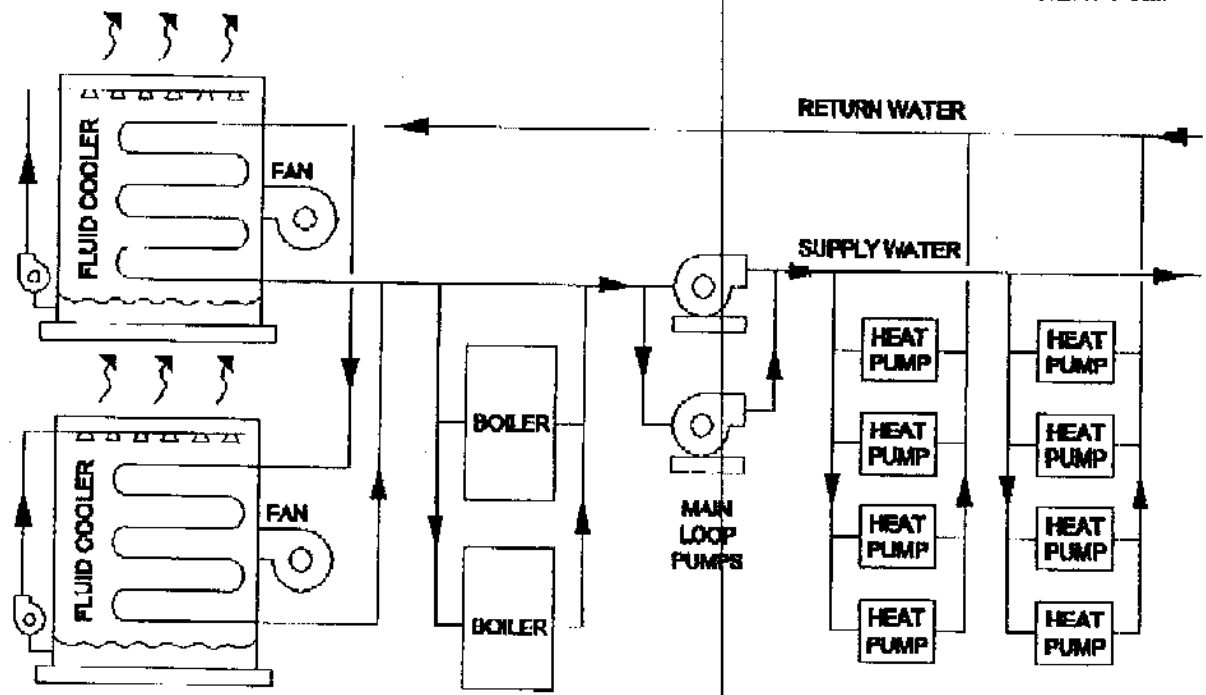
1. Buildings for the 21st Century, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.







TYPICAL CLOSET INSTALLATION OF HEAT PUMP



WATER SOURCE HEAT PUMP SYSTEM SCHEMATIC

5.2.2 Ventilation

Principles

Natural or mechanically assisted ventilation can help reduce air conditioning and heating costs and improve indoor air quality. The proper design of openings in a building's shell can allow the effective use of natural ventilation as a cooling and heating strategy. The increased air movement created by ventilation extends the upper limit of the temperature at which a person feels comfortable.

When outdoor air temperatures are below 80°F, windows can be opened or a building exhaust fan turned on to allow outside air to flow through and cool the occupants in a building. When the outdoor air temperature exceeds 82°F, the best strategy is to minimize infiltration during the day and ventilate at night when outdoor air is cooler.

For buildings where design, security or privacy constraints restrict the optimum placement of openings, mechanically assisted ventilation with whole house fans can be used. The proper placement and location of a fan can provide as effective a cooling and heating strategy as natural ventilation. Fans also assist in the natural ventilation of a building if properly located. They can operate when a homeowner is not home, or if the homeowner forgets or prefers not to open windows or doors. Fans are low energy devices that are much cheaper to operate than even the most efficient air conditioning system.

Ventilation fans should include automatic controls to turn the fan on based on interior and exterior thermostat values. If the building requires cooling and outdoor conditions discourage the use of the fan, then the air conditioning system is turned on.

High Density Housing

One of the major energy users for ventilation in high density housing will be the fan systems needed to exhaust the underground parking garages. One option is to design the garages so that they are "open" (at least 50 percent of the wall area) and thus do not require mechanical ventilation. Since this is prohibited by the Playa Vista Architectural Guidelines, the mechanical ventilation systems should be designed to include the following features, all of which are classified as "base case" for the Playa Vista project:

- High-efficiency fans.
- Two-speed motors on fans.
- Carbon monoxide (CO) sensors to control operation of fans.

An additional discretionary feature is the design of the ductwork for the garage ventilation system to minimize static pressure drop.

Guidelines

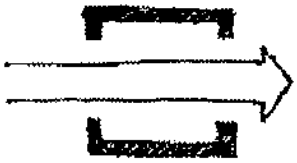
- Use natural ventilation to reduce the use of air conditioning and heating.
- Properly locate building openings to provide full cross-ventilation or vertical ventilation of a building's interior.
- Use a whole-house fan with operable dampers to ensure proper use of natural ventilation.
- Use stack ventilation with ventilation fans and operable dampers in buildings where properly located openings cannot be provided.
- Use automatic controls to operate a ventilation fan and air conditioning system properly.
- Consider control lock-outs on compressor use when natural ventilation conditions exist.

Performance Metrics

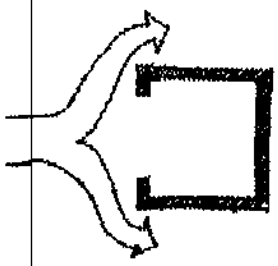
- Reduced air conditioning and heating system use.
- Improved indoor air quality as measured in cubic feet per minute (cfm) or air changes per hour (ACH).
- Improved perception of comfort indoors.

References and Documentation

1. Buildings for the 21st Century, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.
2. Sustainable Building Technical Manual, U.S. Green Building Council.
3. Climatic Building Design, Energy-Efficient Building Principles and Practice, Donald Watson and Kenneth Labs, McGraw-Hill.
4. Sun, Wind, and Light: Architectural Design Strategies, G.Z. Brown, John Wiley & Sons

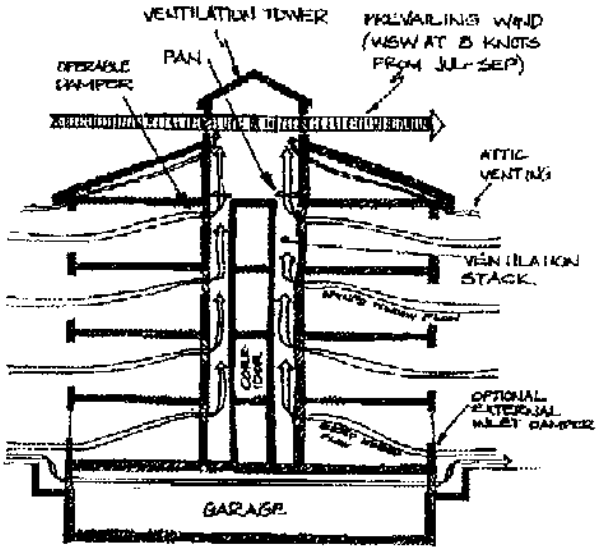


Air flow through the unit provides excellent ventilation opportunities. Overheated air and odors are flushed from inside the space.

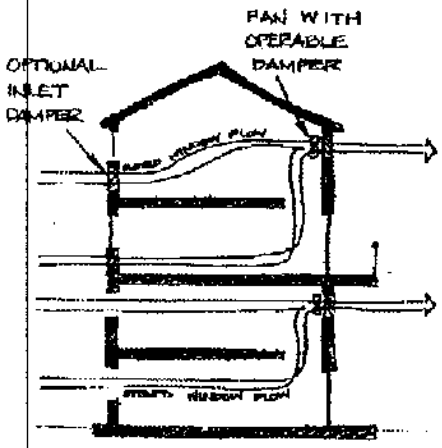


Air fails to adequately flow through the unit. Overheated air and odors tend to stay inside the space.

UNIT PLAN WITH GOOD CROSS VENTILATION



UNIT PLAN WITH POOR CROSS VENTILATION



DOUBLE LOADED CORRIDOR CROSS VENTILATION SCHEME

- Ventilation shafts and tower allow cross-ventilation of the unit.
- Operable dampers allow control of ventilation at each unit.
- Subterranean garage requires dedicated ventilation fan.
- Optional operable inlet dampers allow automatic cross ventilation of unit when windows are closed.

MULTI-STORY UNIT CROSS VENTILATION SCHEME

- Operable dampers allow control of ventilation at each unit.
- Optional operable inlet dampers allow automatic cross ventilation of unit when windows are closed.

5.3 Interior and Exterior Lighting

Principles

Interior lighting provides ambiance, safety and necessary illumination for performing a variety of tasks in the home. For these reasons, the quality and quantity of lighting in a home are essential. The efficiency of the lighting system is also an important consideration because lighting is one of the largest energy consumers in most homes.

The amount and type of permanently installed lighting in a home is an important feature, as this hard-wired system will be supplemented by portable fixtures (table lamps, torchieres and task lighting) that the occupant provides. These occupant-provided fixtures are usually incandescent, and can be 300 percent less efficient than other sources.

Guidelines

- **Quantity:** Illumination must conform to Illumination Engineering Society (I.E.S.) standards. In spaces where permanently attached lighting will be the main source of light – the kitchen, bathrooms and stairways, for example – the designer must be sure that sufficient illumination is provided, as occupants do not usually install extra fixtures in these types of spaces.
- **Quality:** Most people find the color temperature and rendering characteristics of incandescent lighting to be preferable to that of other light sources. However, modern fluorescent lamps can be selected that have similar qualities to incandescent lamps while being 300 percent more efficient and lasting 10 times as long.
- **Efficiency:** While incandescent lamps are inexpensive and readily available, they are the least efficient way to light a space. They also generate a significant amount of heat, increasing the need for air conditioning.

Mandatory Measures

- T8 lamps and electronic ballasts shall be used in all linear (straight tube) fluorescent fixtures.
- Porch and patio lighting shall be accomplished with hard-wired compact fluorescent fixtures with electronic ballasts.
- Hard-wired compact fluorescent (CF) lamps with electronic ballasts shall be used for all common area recessed can fixtures. Both the lamp and ballast must be replaceable, and the lamp cannot extend below the bottom of the fixture
- Include photocell controls shall be used on common-area exterior lighting fixtures.

Energy Base Case Measure

- Fluorescent or high intensity discharge (HID) lighting in common areas such as corridors, stairways and parking structures.

Optional Measures

- Hard-wire and use electronic ballasts for all compact fluorescent lamps in residential units.
- Provide photocell and motion controls on porch and patio light fixtures with user override.

Performance Metrics

- Exceed Title-24 lighting requirements by 20 percent or more.
- Meet or exceed I.E.S. illumination guidelines for all spaces.

References and Documentation

1. Illuminating Engineering Society (I.E.S.) Handbook, most current edition.
2. Electric Power Research Institute (EPRI) Guide to High Efficiency Lighting.

Application

Figure 1 depicts the components of a permanently installed compact fluorescent Fixture. Note that the lamps and ballast are each replaceable, the lamp does not extend below the bottom of the fixture and the fixture includes an integral reflector to diffuse the light and improve distribution.

The *efficacy* of different light sources is defined as the light output of the source divided by the amount of energy that must be input to the lamp. Efficacy is most often expressed in lumens per watt. Figure 2 shows the maximum efficacy for a variety of light sources. Note the wide difference in the efficacy of incandescent and fluorescent sources.

Fluorescent technology offers the advantages of high efficiency, good color rendering, long life and reasonable cost.

In the past, consumers have not embraced compact fluorescent technology because of the large first cost difference between a compact fluorescent and incandescent lamp. While it is true that the compact fluorescent lamps cost more per lamp, they are actually less expensive when one considers that a compact fluorescent lamp will burn for about 8,000 hours before replacement. An incandescent lamp must be replaced after about 800 hours. Over an 8,000 hour operating life the compact fluorescent system will cost about $36 to operate, while the incandescent system will cost about $90 to operate. In addition, during this period the homeowner will have replaced the incandescent lamp ten times, while the compact fluorescent will not have been replaced at all.

While screw-in compact fluorescent lamps are available that fit directly into a standard incandescent socket, they should not be used in new construction projects. This is because when the lamp finally burns out and requires replacement, many users will replace it with an incandescent lamp (either because this is what they have on hand or because they don't want to spend the extra money for the compact fluorescent lamp). A hard-wired fixture is therefore preferable because it will only accept a compact fluorescent replacement lamp.

In addition to ensuring that compact fluorescent lamps will continue to be used, a hard-wired fixture will typically use a higher quality electronic ballast, leading to better illumination quality, increased efficiency and no audible noise from the fixture.

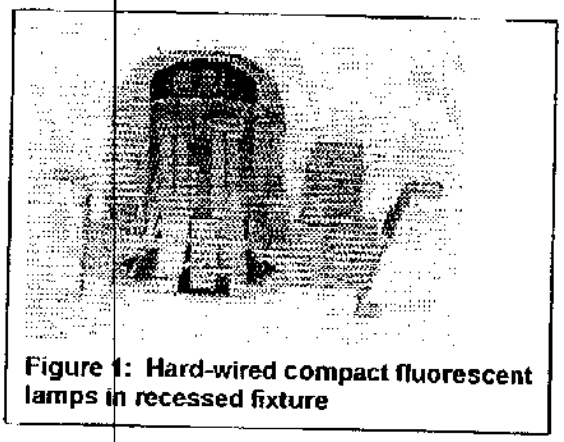
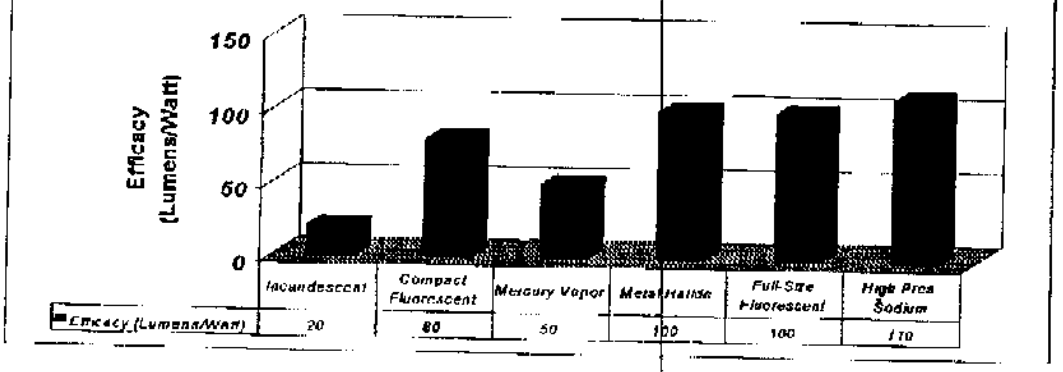


Figure 1: Hard-wired compact fluorescent lamps in recessed fixture

Source: Nora Lighting

Figure 2: Maximum Efficacy of Different Light Sources



5.4. Water Heating

Principles

Thirteen percent of all energy consumed by California's households is used to provide heated water.[1] Using a whole-building or systems approach to design and select domestic hot water equipment can help optimize a building's energy use, cost of operation, and cost of construction. Reduced energy consumption can be obtained through the use of more efficient equipment and a reduction in the size of the equipment used.

High density structures

A systems approach allows consideration for the sharing of equipment resources among many units in a high density building. A centralized system can also require less total floor space to install than individual water heaters. The reduced floor space requirements for the total building can save the homebuilder and homeowner construction cost.

Low density housing

For low density buildings, where the use of a centralized system may not be cost effective, individual tankless water heaters can be used in each dwelling unit. Tankless water heaters require very little space, freeing up the floor area typically used for storage-type water heaters for other purposes.

Guidelines

- For **high density** structures, evaluate equipment cost at the whole building level and compare to the cost of providing equipment at the unit level.
- For **high density** structures, consider the cost-of-energy savings benefit to individual homeowner's of providing equipment at the whole building level.
- For **low density** structures, consider using a tankless water heater for each unit.
- Consider the economic benefits of using equipment with higher energy efficiencies.

Energy Base Case Measures

- For **high density** structures, install a gas-fired central water heating distribution system to allow a building to share water-heating resources.
- In **high density** housing, install high energy-efficiency gas-fired pulse boilers or the equivalent. A system providing an equivalent energy benefit or better can be proposed.
- For **low density** housing, utilize efficient gas individual storage water heaters with an **Energy Factor (EF)** of 0.58 percent or better.
- Insulate the piping on hot water supply and return lines inside each dwelling unit.

Optional Measure

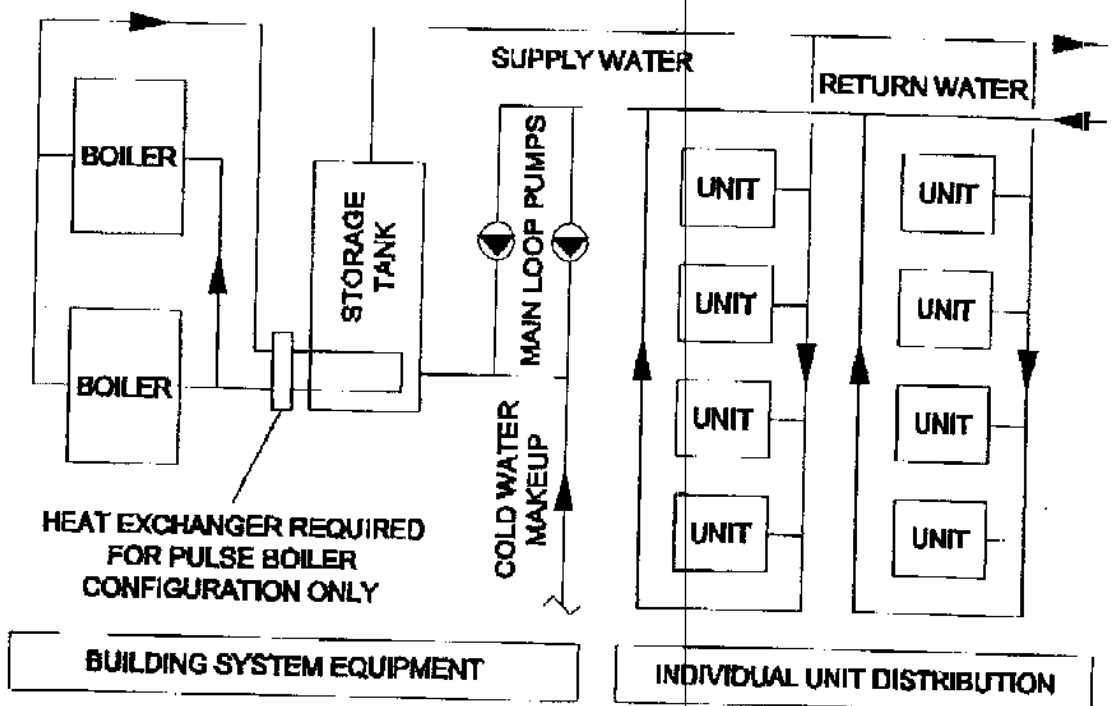
- For **low density** housing, utilize tankless instantaneous gas water heaters with an equivalent EF of .70 or better.

Performance Metrics

- Total cost of equipment installation.
- Added value of lower energy costs provided by higher efficiency equipment.
- Added value of lower operations and maintenance costs.
- Added value of improved unit comfort, acoustics, and indoor environmental quality.
- Added value of additional floor space in dwelling unit created by reducing the size requirement of equipment rooms or spaces.

References and Documentation

1. Household Energy Consumption and Expenditures, 1993. Supplement – State, U.S. Department of Energy, Energy Information Administration.
2. Buildings for the 21st Century, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.
3. International Performance Measurement and Verification Protocol, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.
4. Sustainable Building Technical Manual, U.S. Green Building Council.
5. Energy Design Update, Volume 17, No. 7; "An Energy Saving Product that's Actually Convenient?!



SHARED DOMESTIC HOT WATER SYSTEM SCHEMATIC

5.5 Renewable and Alternate Energy Sources

Principles

The on-site use of renewable energy is a key component of sustainable design. Both thermal (heat) and photovoltaic (electric) energy can be derived from the sun and used directly or stored.

Solar heating panels can supply heat to a domestic hot water storage tank, a swimming pool or spa.

Photovoltaic (PV) energy converts solar radiation to direct current (DC) electricity that, if stored and inverted, can provide electricity to meet standard alternating current (AC) needs. Costs are reduced if PV is considered early in the design phase.

The on-site production and utilization of energy from non-renewable sources should also be considered in sustainable design. Fuel cells or efficient micro-turbines can generate electric power and attain high system efficiencies if waste heat is recovered to assist in meeting thermal requirements. Recent innovations are making these options more economically attractive.

Guidelines

Solar heating is best accomplished using otherwise unused roof space. Generally, panels are purpose-built and oriented south at a 30°-45° off-horizontal pitch to capture the greatest percentage of incident solar radiation. An active, pumped-fluid loop transfers the heat to the desired storage tank or to the pool or spa.

Photovoltaic generated electricity, while installed on rooftops, is usually collected centrally at a battery bank and inverted from DC to AC to mesh with utility power. The host utility usually requires back-feed prevention circuitry.

Micro-turbines, typically less than 300 kW in total electric power output, can be located centrally to serve 100 to 200 households' average electricity needs and at the same time the reject heat can be used for heating a spa or swimming pool.
Fuel cells are typically larger in power output and size and have the benefit of modularity in sizing. Several technologies are vying for success in this promising market including phosphoric acid (PAFC), molten carbonate (MCFC), hybrid solid oxide (HSOFC) and proton exchange membrane (PEMFC). All have efficiencies upwards of 40 percent, though operating temperatures vary widely. MCFC and HSOFC require operating temperatures of 650°C and 1000°C respectively. Their high efficiency guarantees that lower cost fuel can be purchased.

Mandatory Measures

- Utilize solar heating for swimming pools and spas to provide 50 percent or more of their heating requirements 80 percent of the time.
- Make each building photovoltaic-ready:
  1. For **high density buildings**, install and cap a 1½" minimum diameter electric conduit from the roof to the electric panel that serves the common area load. It is assumed that the inverter will be placed on the roof and that any photovoltaic system will serve common area load. Provide the roof framing plan. Design and construct the roof to create as large an unobstructed area as possible and to group any rooftop equipment and vents towards the north end.
  2. For **low density buildings**, install and cap a 1¼" minimum diameter electric conduit from the largest south or southwest facing portion of the roof to the electric meter of each unit. Provide mounting space for an inverter near the meter either on the wall (3' by 3') or on the ground (1' by 3'). Provide the roof framing plan. Design and construct the south-facing roofs to create as large an unobstructed area as possible.

Optional Measures

- Provide an active solar hot water heating system for domestic hot water needs.
- Install photovoltaic-powered landscape lighting. Energy must be stored

centrally and used to power a substantial percentage (50%) of the landscape lighting.

- Install photovoltaics to serve in-building common area lighting loads. Building integrated photovoltaics should be considered.
- Install waste heat recovery for fuel cells or micro-cogeneration. Both fuel cells and micro-turbines with waste-heat recovery can provide high efficiency on-site energy. Swimming pools and spas make a suitable heat sink for either low- or high-temperature waste heat from on-site generation.

Performance Metrics

- Solar water heating systems can be measured in peak thermal recovery (e.g. kBtu/hr or gallons per hour at a given temperature rise).
- Photovoltaic systems are often sized in terms of peak watts (maximum power output in full sun). A battery's ability to store electricity is measured in amp-hours. Other common terms include energy density (kWh/kg) and power density (kW/kg).

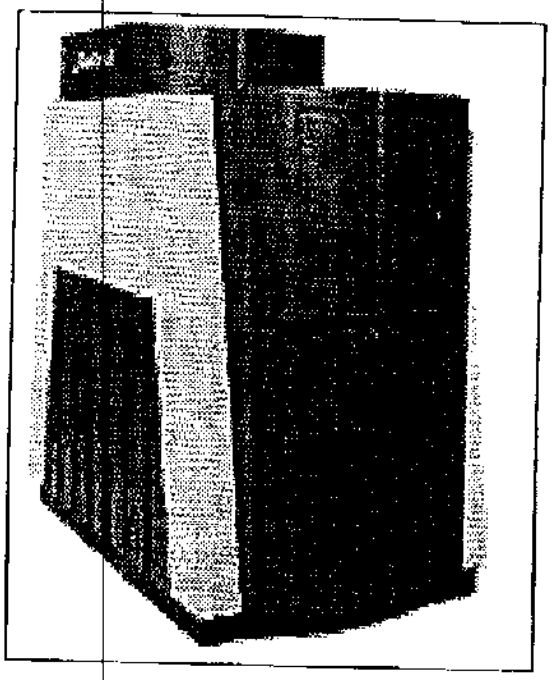
References and Documentation

1. Pint-size Producer of Power Unveiled," Sallie Gaines, Chicago Turbine.
2. Graphic of micro-turbine: Allied Signal.

Application

The are generally two forms of solar energy generation technologies: photovoltaic and solar concentration. The latter technology has not met with great success and is not likely to be used at Playa Vista. Solar panels, like those pictured, are used to directly generate on-site electricity. A typical photovoltaic array installation on a service building is shown.

One of earlier entrants into the micro-turbine market is AlliedSignal with a 75-kW unit, shown in the adjoining photograph. The 75-kW model is scheduled for Beta production during the fourth quarter of 1998, with high-volume production beginning sometime in 1999. Larger (350 to 400 kW) and smaller (40 to 50 kW) units are also under development and will be introduced later.



5.6 Controls and Feedback

Principles

One of the basic principles of energy management is that user feedback is essential to achieve conservation. Without knowing or being responsible for how much gas, electricity and water one uses, it is difficult to correct wasteful habits and lower utility costs.

Amazing advances in solid state technology in recent years have made possible intelligent, communicative building system controls that can be used to minimize energy consumption, report when problems occur and maximize comfort. While such systems can cost more than the basic pneumatic or electric control systems of the past, their capabilities far surpass these older technologies.

Guidelines

Even the most basic of modern HVAC thermostats usually includes energy saving features, such as nighttime temperature setback. There are other features, however, that are available at only minor additional cost that should be included at Playa Vista. These features include battery backup of a thermostat's programmed schedule, automatic adjustment for daylight savings time and the ability to "learn" what time the heater should come on in the morning so the space is warm when people wake up. All of these features are available in a wall-mounted unit that is nearly identical to the familiar thermostat in most homes.

Energy Base Case Measures

- Install enhanced feature setback thermostats. Title 24 already requires that builders provide setback thermostats. In addition to the ability to program in setpoints for use during unoccupied periods, the following features must also be included with HVAC thermostats:
  1. Battery backup (or non-volatile memory) of program schedule.
  2. Automatic adjustment for daylight savings time.
  3. Start/stop time optimization that will turn the HVAC system on as late as possible to achieve setpoint by the specified time and turn the system off as early as possible while still maintaining comfort until the shut-off time.
- Provide remotely readable utility metering for gas, water and electricity, serving both individual units as well as common areas.

Optional Measures

- Provide on-demand feedback on energy and water use via a touchscreen in residence.
- Provide digital control system for central systems (water source heat pump loop and domestic hot water system).

References and Documentation

1. Control Systems for Heating, Ventilating, and Air Conditioning Roger Haines; Van Nostrand Reinhold, 1987

Application

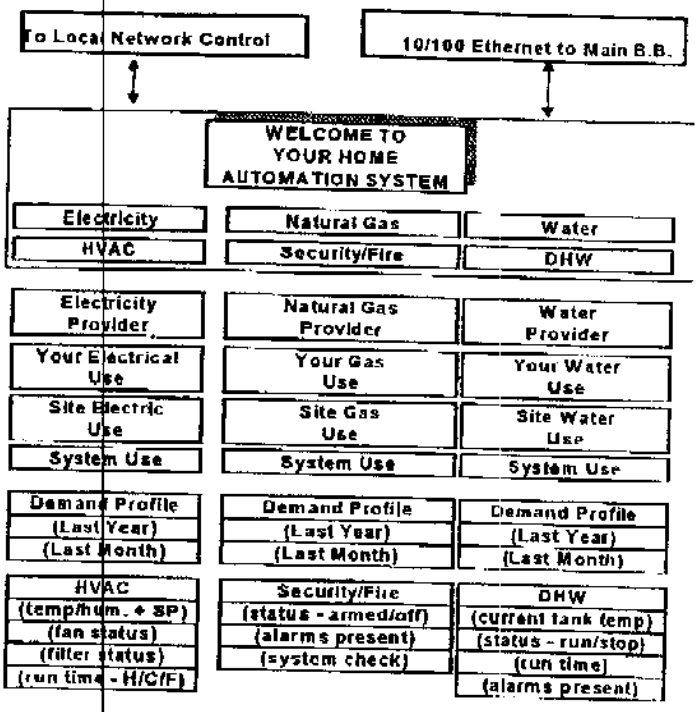
It is envisioned that Playa Vista residents will be able to get immediate and on-demand feedback on their energy and water consumption habits via a touchscreen built into the wall of their dwelling unit. From the touchscreen, a variety of menus will be available to show daily, weekly, monthly and annual energy and water consumption, and how current consumption compares to similar periods in the past. In addition, this screen will provide information as to when HVAC equipment maintenance should be performed in order to maximize its efficiency and reliability.

For example, when the weather cools down in the fall, the touchscreen would display a reminder to have the heating system air filter changed or cleaned. A similar message would be displayed at the beginning of the cooling season.

Another useful option would be for the user to input a maximum desired utility bill based on their monthly budget or a particular conservation goal. If their energy and water use increased in such a way that they would likely exceed their energy budget, they would be notified via the touchscreen of the impending problem and also be offered suggestions on how to get back on budget.

To achieve these objectives, the touchscreen will be integrated with the microprocessor that controls HVAC functions and the meters measuring gas, electricity and water consumption.

The uses for a connected touchscreen system go beyond energy conservation. Once the touchscreen and its related operating system is designed, it will be possible to connect each home at Playa Vista via a central network. Such a network could be used to disseminate local information of interest, query occupants about community-related issues, order pay-per-view movies or even order pizza. The key to making the touchscreen concept a reality is installing the necessary inter-dwelling unit and intra-building communication backbone (either fiber optic or coaxial cable). With this in place, it will be possible to make a variety of devices – including touchscreens, air conditioners, cable TV boxes and utility meters – communicate.



5.7 Appliances

Principles

Home appliances are very energy and water intensive. Because they are used daily and in many case, several times per day, appliances can have a substantial impact on utility costs. Studies indicate that appliances are responsible for about 20% of total residential energy use in the United States.

Generally, the higher initial cost of energy and water-efficient appliances will be recovered several times over during the life of the appliance through reduced utility bills.

Guidelines

Typically, a cooking range and dishwasher are provided in a new home or apartment, while the occupant provides their own washer/dryer and refrigerator. Builders often offer optional refrigerator and washer/dryer packages that can be included in the first cost of the home. These optional appliance packages present an excellent opportunity to promote energy and water conserving equipment, while allowing the homeowner to avoid the out-of-pocket expense of purchasing these new appliances.

Including the cost of efficient appliances in the mortgage can allow the homeowner to reduce monthly energy and water costs in a financially convenient way.

Mandatory Measures

- Provide low water consumption, energy efficient, front-loading and Energy Star compliant clothes washing machines in common areas and in-home laundry facilities.
- Provide a low water consumption, energy efficient and Energy Star compliant dishwasher in each dwelling unit.
- Provide energy efficient and Energy Star compliant clothes dryers in common area and in-home laundry facilities.
- Provide high efficiency, HFC (hydrofluorocarbon) and Energy Star compliant refrigerator-freezer in each dwelling unit.

Energy Base Case Measure

- Install a duct from the range exhaust to the outdoors, instead of using a less effective "ductless" system.

Optional Measures

- Provide make-up air for exhaust fans over 100 cfm (range hood and dryer).
- Install medium pressure gas lines to reduce pipe size.

Performance Metrics

- The Environmental Protection Agency (EPA) identifies efficient appliances (refrigerators, clothes washers, clothes dryers, dishwashers, and even computers) with an Energy Star label. Appliances must have an Energy Star to be considered efficient.
- The Energy Guide rating is another reference. These ratings were mandated by the Federal National Appliance Energy Conservation Act (NAECA) of 1987.
- For comparing one appliance to another, the following units are typically used:
  1. Clothes washers: ft^3/kWh/cycle
  2. Clothes dryers: lbs/kWh
  3. Dishwashers: cycles/kWh
  4. Refrigerators: kWh/year

References and Documentation

1. *Consumer Guide to Home Energy Savings (8th Edition)*, A. Wilson and J. Morrill, American Council for an Energy Efficient Economy (ACEEE), 1998.
2. *Consumer Reports*, The Consumers Union of the United States, Inc. ("Clothes Dryers" June 1998, "Dishwashers" October 1993, "A New Spin on Clothes Washers" July 1998, and "Refrigerators: The Kings of Cool" January 1998).

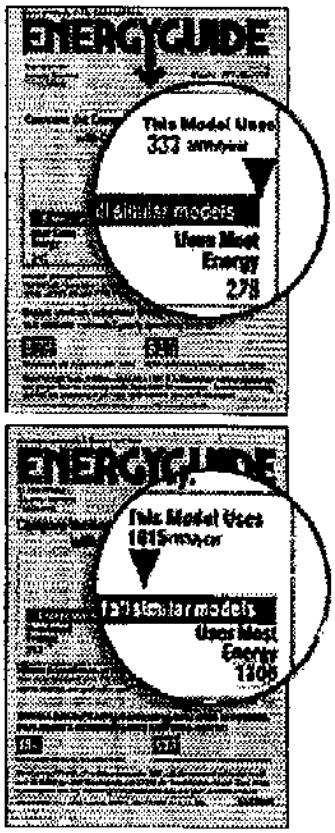
Application

The Energy Guide labeling system is used on all major appliances manufactured or sold in the United States. This bright yellow label provides information on the efficiency of an appliance and shows how it compares to other similar models, thereby allowing consumers to weigh the operating cost versus purchase price for different models and manufacturers.

Care must be exercised, however, in how the Energy Guide label is interpreted. The label compares energy consumption and operating cost for "similar models" which can sometimes lead to misleading comparisons (Consumer Reports Product Update, "A Misleading Energy Guide for Washers," September 1998).

For example, an energy-efficient, front-loading clothes washing machine (top) may appear to use more energy than a top loading model (bottom, the most common type) because of the relative position of the arrows on the operating cost bar. However, there are two different rating scales based on the type of machine. The front-loading washer in fact uses one third of the energy (333 versus 1015 kilowatt hours per year) and much less water.

In addition, the capacity of different models may not always be taken into account, also leading to misleading results. Usually, Energy Guide ratings are based on energy consumed for a fixed number of loads, regardless of load size. Obviously, a larger capacity washer will clean the same amount of clothing in fewer washes than a smaller capacity model and will therefore be penalized on the Energy Guide rating scale.



The Energy Star logo can provide quick and easy identification of efficient appliances.

6. Domestic Water

Principles

Water is a limited resource in Los Angeles and water conservation standards have been established to reduce waste. The City has established water use limits for many bath fixtures and appliances, and has developed reclaimed water sources for tertiary uses such as landscape irrigation.

Water conservation strategies are required. By promoting the responsible use of water, Playa Vista aims to have a low impact on the local environment and the city water system.

Guidelines

Playa Vista will conserve water by reducing domestic landscape water consumption. (See the Landscape, Section 10, for details on landscape measures.)

Playa Vista will conform to all local regulations requiring low flow appliances and fixtures. Low flow faucets, showerheads and toilets will be used in public facilities as well as in each dwelling unit. The use of low flow dishwashers and clothes washers will further reduce domestic water use. Low flow appliances which use less water than local regulations mandate should be used whenever economically feasible. These fixtures and appliances not only conserve water, but also lower energy costs by reducing the use of hot water. Because of these double benefits, low flow fixtures are required.

Water is also wasted in the home when a user waits for hot water to reach faucets, showerheads and hot water appliances. All of the tepid water in the supply line is wasted. Insulating hot water supply pipes and reducing the length of supply runs mitigates this problem. Running return lines from hot water fixtures reclaims the lukewarm water as new supply water for the hot water heater, thus eliminating all waste.

Residents must be conscious of their water use habits in order to conserve water on a daily basis. The installation of direct feedback water metering systems via a touchscreen in each unit raises occupant consciousness of water use practices and fosters water conserving habits.

Mandatory Measures

- Use reduced water consumption fixtures:
  1. Toilets 1.6 gallons per flush or less
  2. Kitchen faucets 1.6 gallons per minute.
  3. Bathroom faucets 1.0 gallons per minute or less.
  4. Showerheads 2.5 gallons per minute.
  5. Use all of the above low flow fixtures in public facilities plus 1.0 gallon per flush urinals.
- Use water conserving appliances (see 5.7 "Appliances").

Optional Measures

- Provide a "hot water demand system" that recirculates the hot water supply to a remote fixture (usually at the farthest fixture from the main hot water supply to the dwelling) when there is a demand for hot water at the fixture. It recirculates only when needed, thus saving significant energy. However, the largest savings is from the reduction in water use; such systems have been documented to save over 10,000 gallons per dwelling unit per year.
- Provide water use feedback to each resident via a direct response touchscreen.

Performance Metrics

- Specification and installation of approved fixtures.
- Approval of Plumbing Plan with return lines to hot water fixtures.
- Specification and installation of approved metering feedback equipment.

References and Documentation

1. City of Los Angeles Water Conservation Ordinance No. 166080.
2. City of Los Angeles Sustainable Building Reference Manual, Citywide Sustainable Design Task Force, updated June 1998.

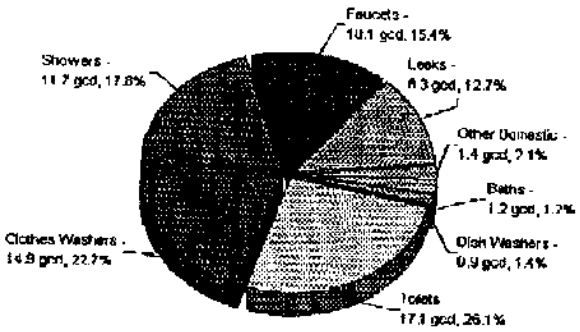
3. California Title 22.
4. Los Angeles Department of Water and Power.

Application

Low flow appliances

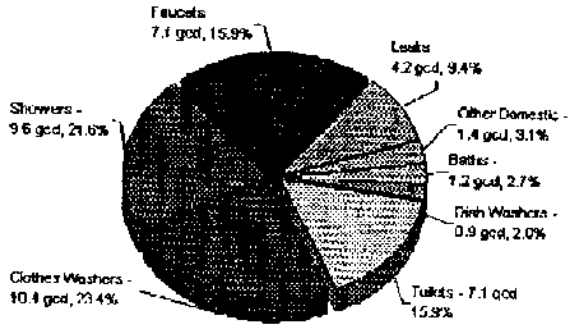
The use of low flow appliances in a home can greatly reduce the consumption of water per person in the household. The following graphs show the typical amount of water used in a household and then the lower amount used in a home with low flow appliances. The chart to the right shows the percentage savings of water consumption. Low flow appliances offer users as much comfort and control as conventional fixtures while not wasting water. On an individual level, each household pays lower water and energy bills due to lower hot water usage. On the scale of an entire development, large amounts of water are conserved, thus reducing the impact on the city water system and regional ecosystem.

Typical Single Family Home Water Use
Without Conservation -



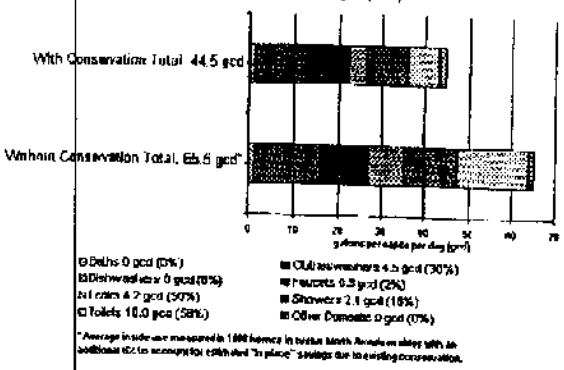
Total: 65.5 gallons per capita per day (gcd)

Typical Single Family Home Water Use
- With Conservation -



Total: 44.5 gallons per capita per day (gcd)

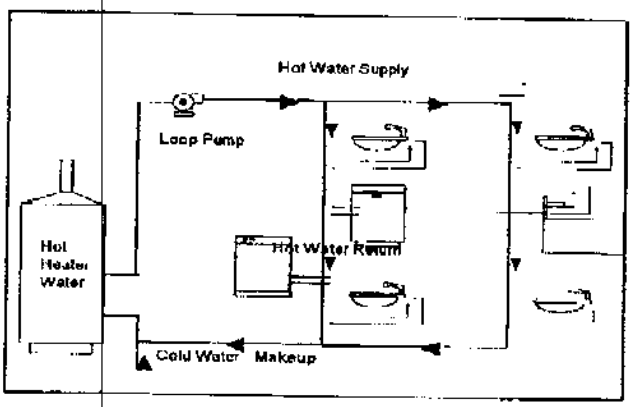
Comparison of End Use of Water Inside the Home
Total Potential Savings: 21.0 gcd (32%)



These calculations assumed 1.6 gallon per flush toilets, 2.2 gallon per minute faucets, 2.5 gallon per minute showerheads and a tumbler style washing machine. Playa Vista will utilize 1.6 gallon per minute or less faucets and water conserving dishwashers, so even greater water conservation will be achieved.

Return pipe from hot water fixtures

In a typical home, a lot of hot water is wasted while the user waits for hot water to arrive. Return lines from faucets, showers, dishwashers and clothes washing machines can recirculate the tepid water in the hot water supply piping back to the hot water tank instead of down the waste line. This supply/return loop enables hot water to reach the fixtures and appliances quickly, saving hot water. The loop pump can also be controlled by a timer so that hot water is only circulated during those times of day when occupants use hot water, such as the morning and evening.



7. Recycling & Solid Waste

Principles

Recycling and waste management is a mandated measure of Playa Vista's development. The goal is to correspond with the California mandate (AB 939) to reduce waste by 50 percent by the year 2000. The City of Los Angeles has additional waste reduction goals of 62 percent by 2010 and 70 percent by 2020.

State and local laws also require the proper disposal of household hazardous waste. It is therefore important to maximize the recovery of these materials as well.

Guidelines

Install dual-bin collection systems in all multi-family buildings that work with the City of Los Angeles' commingled recycling collection process.

Mandatory Measures

- Install a dual-bin kitchen system for recyclables and trash. One bin should be designated for recyclable material. Recyclables include all clean paper (if it tears, it can be recycled), glass and plastic bottles and cans. The other bin is for non-recyclable trash. Install instructional decals for the kitchen recycling and trash drawer (see diagram).
- For **high density** housing, install a dual-chute system for recyclables and trash. Install instructional decals on trash chutes explaining what materials should be placed in which chute. The decals should also instruct residents as to the proper disposal of household hazardous waste.
- For **low density** housing, locate three 60 gallon self-rolling containers (one each for recyclables, green waste and trash) in the garage or in a dedicated outside enclosed area.

Optional Measures

- Use recycled steel for the trash and recycling chutes, and recycled rubber baffles inside the chutes to comply with Playa Vista's goal of using sustainable building materials. The rubber baffles keep recyclables and broken glass from flaring out of the bin.
- In **low density** housing, install a trash compactor in each unit's kitchen. This action reduces the required size of the trash bin to a 35 gallon container.

Performance Metrics

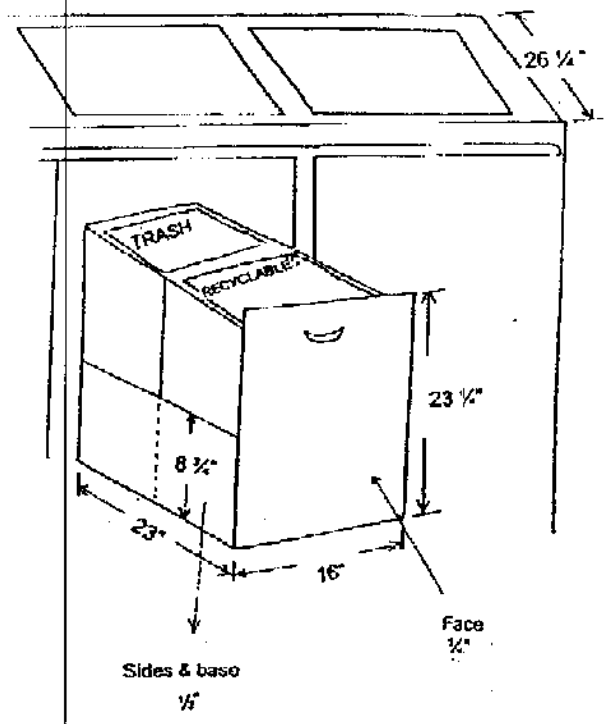
- Review and approval of the design of the recycling, waste and container collection and storage systems.

References and Documentation

1. City of Los Angeles Sustainable Building Reference Manual, Citywide Sustainable Design Task Force, updated June 1998.
2. City of Los Angeles Space Allocation for Recycling Ordinance No. 171687, Municipal Code Section 12.21, Subdivision 19, Subsection A.
3. Los Angeles City Municipal Code Section 711.5.
4. Los Angeles City Municipal Code Section 91.711.
5. Environmental Problem Solving Enterprises.

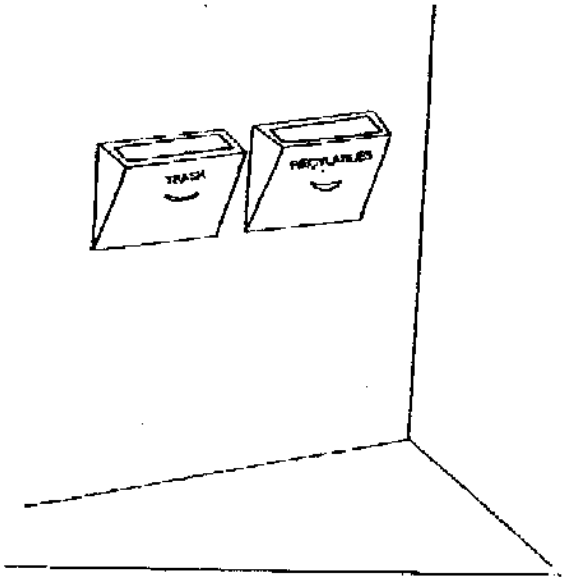
Application

Kitchen Dual-Bin System

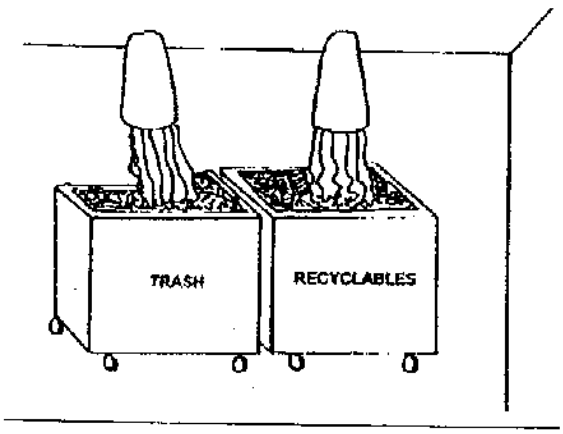


To optimize kitchen space, a pantry or other area can be used to enclose the recycling and trash containers.

Recycling / Trash Chutes
The City permits chute sizes up to 9 square feet. Recycling and trash chutes need to be the same size.



Centralized Recyclables & Trash Collection Area
Three cubic yard collection containers and exchange bins will be used in high density housing.



The following minimum recycling collection square footage is required by the City for high density residential buildings:

- For 20 or fewer dwelling units, 30 square feet.
- For 21 to 50 units, 60 square feet.
- For 51 or more units, 100 square feet.
- A minimum vertical clearance of 8 feet.

The recycling area or room shall be able to accommodate the collection of all recyclable material without overflowing or forcing significant amounts of recyclable materials to be discarded as general refuse. If not, the Department of Building and Safety shall require a larger space, even if the dedicated area exceeds the minimum requirements.

The state-of-the-art collection process has evolved since the City ordinance was written and adopted. These requirements are therefore a minimum that is subject to change based on commingled participation rates.

The trash area or room must be separated from the remainder of the building by an occupancy separation having the same fire resistance as required for the shaft enclosure, but not less than a one hour rating.

Openings into chute termination rooms shall not be located in exit corridors or stairways.

Hazardous Waste
Under State and local laws, the disposal of household hazardous waste is prohibited in the solid waste stream, in streets and in sewage systems. Per the mitigation requirements, Playa Vista will provide a site for the City of Los Angeles' mobile household hazardous drop-off program.

8. Power Signal and Control

Principles

Playa Vista will employ design features that encourage electronic access to the ever-expanding media and communications environment. Connection will allow access to educational, health and employment opportunities, as well as many conveniences such as lifestyle and operational choices not typically available to tenants and homeowners.

The market place is rapidly evolving, and one media or another, cable, telephonics, or fiber optics, will for a time become the most convenient means of connecting to the information available. To insure that the unit can readily be modified, it is important that the designers and builders of the residential buildings in Playa Vista provide for easy and serviceable connections for every residence. Engineering must also account for the reliability of these connections, and provide for power conditioning and interruption protection.

Lighting is only one of the connected loads served by the residential load center today. Increasing demand for home entertainment and home theater options, as well as other conveniences, suggest that greater planning is needed when determining circuit locations and service capacities. Playa Vista recommends that additional capacity be built into the service center and that lighting and utility circuits be separated. This will also allow for future lighting control if the occupants desire this convenience.

Control technologies currently include thermostat and security systems, but will in the future allow the owner operational decisions based on increasing information availability. The deregulation of electric utilities and the mergers of telecommunications companies and other service providers suggest that the owner of the Playa Vista residence will be capable of making purchasing decisions for services and operating actions that are not even defined today. It is important that design decisions do not limit the options of the future residences in fully utilizing the new digital environment.

Guidelines

Power: The high density of the residential units and the increasing connection of computers and digital controls will increase the need for clean and reliable power. Multiple computers have the tendency to build up harmonics on service lines that must be removed with active filters. Also, since many controls will be based on real time information, there must be power back-ups for all control circuits. Connection to photovoltaic systems and their potential to store energy may be one response. Gas or diesel powered generators could also be utilized to provide temporary power. Critical controls that need power include security, emergency lighting, elevators, computers and parking ventilation fans.

Signal: The keys to accommodating the future needs of the signal environment include two actions: install high quality wiring infrastructure in the units and provide chase and access space for future technologies. Utilize industry standards to determine the wiring capacities and qualities, meeting as a minimum the Playa Vista criteria for outlet and cable requirements.

Control: Control systems will include basics such as security, fire alarm and thermostat wiring, as well as pre-wiring of control wires from utility meters, doorbells and water heaters to the network hub. This

infrastructure will allow the future addition of smart devices.

Mandatory Measures

- Install fire detection and signal in each unit.
- Wire each unit to minimum connection standard per Playa Vista standards.
- Provide a seismic gas line shut-off valve.

Optional Measures

- Provide automatic call to fire department and building manager (if applicable) and link fire detection to ventilation operation.
- Provide visual fire alarm in each unit and in common spaces and provide unit enunciator indicating building or unit fire.
- Size power service for 25 percent expansion.
- Separate lighting circuits from convenience circuits.
- Install circuit capacity and conduit for electric vehicle charging in the garage.
- Provide mounting space for surge protection, power conditioning and battery backup for each unit. Space must include power and phone line access.

Performance Metrics

- Fire alarm installation check and tests.
- Network and wiring plan approval.
- Security system tests.

References and Documentation

1. Manufacturer's literature from AMP, Lucent Technologies, Greyfox, & Bell Atlantic

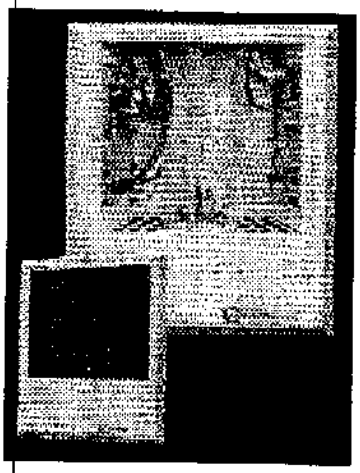
Application

The Home Entertainment Center

Advances in home entertainment and theaters make it possible for movies to be brought into the modern home. Playa Vista residents will have full access to the latest technologies.

The Local Network

The photograph below shows an example of the network hub hardware to be installed in each dwelling unit. This network hub connects the homes and apartments to security systems, fire alarms, building managers, control/feedback systems from utilities and other services. The hub contains the capacity to expand as future technology requires.



The Home Office

Occupants of Playa Vista will be able to work at home and even participate in educational courses from their homes. Playa Capital Company fully expects that as much as 40 percent of Playa Vista's population will work from their homes as a principle place of business. In order to meet this need, quality electrical and communication service must be increased to provide reliable service well into the 21st century. The picture below illustrates a home office as envisioned for Playa Vista, showing generic hardware and connections to various communication and power networks.

9. Adaptability

Principles

All of the residences within Playa Vista should meet the diverse accessibility needs of all citizens with disabilities. Designing units with the flexibility to change for disabled citizens results in better homes for all people. A kitchen with variable counter heights and sufficient room for a wheelchair to turn about is not only accessible for disabled persons, but also better meets the needs of a typical family.

Adaptability also increases the value of each unit by equipping the residence to meet the changing needs of the owner over time. As families grow and technology advances and lifestyles change, homes must be remodeled, upgraded and adapted to meet these future needs. With proper planning, homes can be constructed to flex easily with the changing needs of the occupant and with rapidly evolving home technologies. Technology upgrades and lifestyle adaptations can become simple changes instead of major remodeling efforts. In this way, planning for adaptability reduces future headaches and also reduces material waste. Homes at Playa Vista will be designed not only to meet present needs but also to accommodate future adaptations with ease.

Guidelines

All public buildings and multi-unit residences in Playa Vista will be designed and constructed to meet the accessibility requirements of disabled persons, or to be adapted to meet these needs easily.

Bathroom walls will be framed so that grab bars can be easily installed at a later date. As long as adequate framing exists at appropriate locations around showers and water closets, grab bars can be installed without completely remodeling the bathroom.

Likewise, all doors will either be 2'10" wide or be framed in such a way that wider doors can be easily installed. By keeping the rough doorway opening between king studs 3'1" wide, 2'10" doors can be installed without major remodeling. Smaller doors to closets and small rooms will swing outward so that they remain wheelchair accessible. Sliding doors and pocket doors are also a possibility in these circumstances.

Kitchens should be designed to be easily adapted to meet the necessary criterion of the user. This is accomplished by varying the working heights of standard cabinetry and appliances. Plumbing systems below the sink should be laid out in a manner so as not to obstruct the legroom of a wheelchair.

Homes in Playa Vista should meet all City of Los Angeles disability residential design standards, including door and hallway openings, egress systems, turn around space in kitchens and bathrooms and appropriate fixture and countertop heights. Other health and safety considerations, such as material finishes, ramped entrances and landscape design, will be sensitive to the needs of the elderly.

In order to accommodate lifestyle changes and evolving technology, all Playa Vista residences will be designed for ease of maintenance and flexibility in remodeling and upgrading systems.

All chases and conduits will be large enough to accept future technology upgrades. Furthermore, these conduits will be accessible from the building utility zone so that major spaces need not be remodeled for frequent technology upgrades. Within each dwelling unit, residents should have access for all maintenance and repairs of their home.

Complete documentation of systems and products should be provided to occupants and building managers. Both written and electronic documentation of construction and operation should be created to facilitate maintenance and future changes to the building or individual units.

Mandatory Measure

- Conform to all City of Los Angeles disability residential standards.

Optional Measures

- Reinforce bath walls for grab bars in all areas around showers and water closets.
- Provide accessible door sizes and swings by installing doors at 2'10" width or framing roughed to allow simple change, and installing out-swinging doors, sliding doors or pocket doors to small rooms.

- In high density housing, provide adequate access for service of all trunk lines located within common area corridors, including building supplied water, hot water, solar roof access and major power feed. Adequate access is measured by the ability to access all traps for cleaning, balance and clean ductwork, maintain filters in indoor air quality systems, and service bath and shower valves without demolition. Also needed is the identification of the specific paths of the supply and waste plumbing lines, the building hot water and/or heat pump loops, and electrical and communication services. Acceptable access includes doors, access panels, removable floor segments or access through ceilings. Acceptable documentation includes electronic and/or paper records in the possession of the resident or landlord.
- Provide electronic (disk, CD ROM or World Wide Web addresses) or written construction, product and system documentation to the building manager and all residents.
- Design kitchens to allow counter height adjustment for various users.

Performance Metrics

- City of Los Angeles Building Code approval.
- Technology upgrade specification and approval.
- Framing Plan approval.
- Construction and operation document approval.

References and Documentation

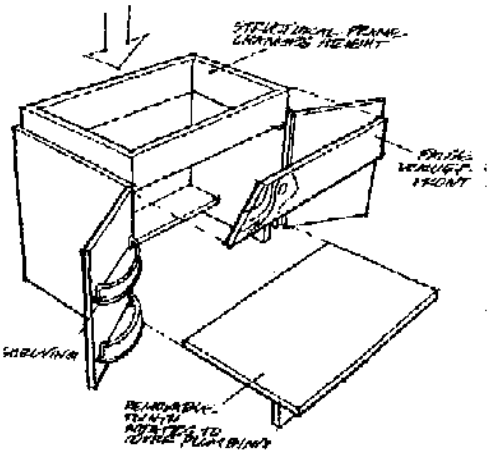
1. City of Los Angeles building code.
2. American Association of Retired Persons.
3. American Lung Association.
4. General Electric Appliances Real Life Design.
5. IBACOS demonstration kitchen.

Application

A better kitchen must strive to meet the needs of all users of all ages and sizes within today's broad housing market. A kitchen that is adaptable can be adjusted to the specific needs of the occupant(s).

As people grow older, they lose strength and endurance and have less dexterity, balance and vision capability. In a kitchen, these limitations translate to problems in seeing, reaching and moving food. A kitchen should include a flat work surface centrally located so that the user can reach many appliances from one location. Drawers and Lazy Susan cabinets should be designed to help bring storage to the users instead of them reaching for items. Combined with good lighting and color rendition, these attributes make a kitchen easy to use for the elderly and all homeowners.

A better kitchen will also be adaptable for people with limited mobility or those confined to a wheelchair. Standard cabinetry and



countertops should be adjustable in height while providing leg space for wheelchair accessibility. This change in height and improved leg space should be accommodated under the sink and food preparation areas.

The photo below shows a prototypical kitchen using standard builder grade cabinetry built by IBACOS to demonstrate adaptable design. Note the raised dishwasher to alleviate back strain and the lowered kitchen sink with open space below to allow access for wheelchairs.

10. Landscape

Principles

The landscape around a residential building helps determine the comfort of people indoors and outside and contributes to the attractiveness of the home and community. The selection of landscape materials has a significant impact on the quality of outdoor environments, landscape maintenance, and outdoor water consumption.

Shading paved areas and local cooling by transpiration creates pleasant environments for walking and gathering outside. These microclimates also affect the surrounding buildings, keeping them cool on hot days or providing wind protection on cool winter days. The planting scheme should therefore be integrated with the buildings' energy and comfort systems.

All plant materials require maintenance to control their growth. This maintenance produces organic waste material that can become an asset if decomposed and returned to the ground as topsoil. This can be accomplished in large composting centers or more simply by using mulching landscape equipment.

Landscaping also has a large impact on water consumption and the local environment. By using native, drought resistant plants, the use of excess water and energy is not needed to maintain the landscape. Moreover, native plants preserve the local ecosystem.

Controlled irrigation is another important strategy in reducing landscape water consumption. By using reclaimed water to irrigate plants at appropriate times and in proper amounts, the health of plants is maintained without wasting water. Together, these methods of native plant selection, appropriate irrigation and proper maintenance, form the main concepts of the City's Landscape Ordinance.

Guidelines

least 50 percent of plant materials be native or drought resistant. Playa Vista recommends that 75 percent be native or drought resistant.

In order to meet the City's Landscape Ordinance, one tree shall be planted for every four surface parking spaces and these trees shall shade 50 percent of ground level parking areas within ten years. Landscaping shall also provide shade for pathways and buildings to ensure comfort in outdoor environments. Western facades receive excess solar gains in the summer, and loads on the building envelope can be mitigated with shade trees. Likewise, vines can shade windows from summertime sun while losing their leaves and allowing winter sun to enter the building.

In order to minimize landscape waste, plants should be selected that produce little organic waste. Also, maintenance plans will be developed that utilize mulching lawn mowers and the composting of landscape waste.

The use of controlled, efficient irrigation systems operating solely on reclaimed water will eliminate potable water use for landscape purposes. Finally, the use of pervious pavements and rainwater collection systems will enable rainwater to be used for on-site needs.

Mandatory Measures

- Use at least 50 percent native or drought resistant plants.
- Use plants that require minimum maintenance and which produce little landscape waste.
- Plant at least one tree for every four surface parking spaces; at least 50 percent of surface parking areas must be shaded within ten years.
- Use reclaimed water for all landscape irrigation.
- Use drip or soaker-based irrigation to water plants slowly and reduce runoff, evaporation and water waste.
- Use automatic controls for irrigation systems, including rain sensors to avoid irrigating after rain and time controls to irrigate at night in specific amounts as plants require.
- Provide slopes to transport maintenance water to planting areas if surface landscaping flush with paved areas is installed.

Optional Measures

- Use native or drought tolerant plants for at least 75 percent of the landscape.
- Use deciduous trees and vines to shade buildings and windows.
- Slow storm water runoff with landscaped swales or retention areas, reduced pavement areas and permeable pavement.
- Use permeable pavement for 50 percent of sidewalks, driveways and patios.

Performance Metrics

- Approval of landscape and site plan.
- Specification and installation of plants and pavement materials.
- Appropriate connection to reclaimed water.
- Specification and installation of approved irrigation system.

References and Documentation

1. City Landscape Ordinance No. 170978.
2. City of Los Angeles Sustainable Building Reference Manual, Section III, Citywide Sustainable Task Force, updated June 1998.
3. Smart Planting for the New Urban Forest, TreePeople, 1992.
4. California Xeriscaping Foundation.
5. Las Pilitas Native Plants Nursery.
6. California Native Plant Society.

Application

Xeriscaping

Xeriscaping is a landscaping principle that utilizes native and other drought resistant plants in dry climates to conserve water and regional ecosystems. Water thirsty plants are often imported to beautify the landscape. With proper planning and skillful design, however, the landscape can be beautified using native and drought tolerant species.

In order for xeriscaping to succeed fully, efficient drip irrigation and appropriate maintenance must complement creative design and plant selection. Landscapes should only be irrigated to meet the needs of the chosen plants; over-irrigation wastes water. Information on the care of the landscape should be passed on to the homeowners and maintenance workers to ensure that the plants thrive.

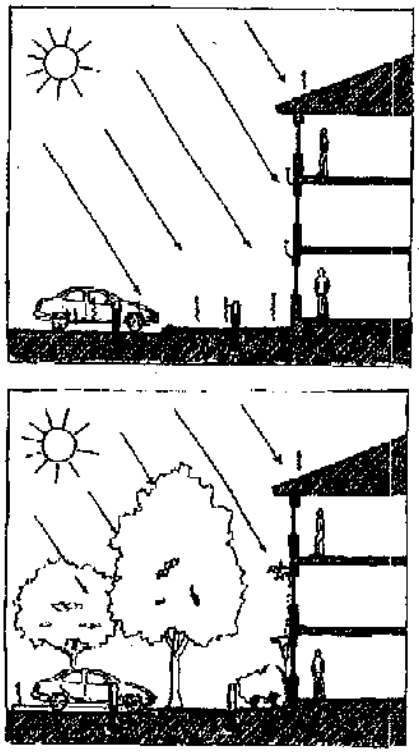
The Box Elder is a drought resistant plant providing ample shading and windbreaking for the home. For a more complete native plant list see the listed references.

The seven xeriscape principles that should be followed to conserve landscape water and preserve the local environment are:

1. Planning and design.
2. Soil improvement.
3. Appropriate plant selection.
4. Practical turf areas.
5. Efficient irrigation.
6. Use of mulches.
7. Appropriate maintenance.

Microclimates

Landscaping and pavement selections greatly affect the microclimates surrounding a building. Large, flat areas of exposed pavement become extremely hot on the sunny afternoons that abound in Los Angeles. This pavement creates heat islands (pictured above) which are uncomfortable even to walk through and which can strain building cooling systems. Trees and vegetation that shade parking areas, pavement and buildings alleviate this problem. Moreover, shade and transpiration (the natural evaporative cooling provided by plants) create comfortable outdoor environments. The drawing below illustrates the use of shade trees to cool parking areas and walkways, and the use of vines to shade windows.



Irrigation Systems

Drip irrigation slowly supplies water directly to the root systems of plants and vegetation. Very little water is wasted due to run-off or evaporation.

11. Transportation

Principles

One of the basic concepts of Playa Vista's mixed-use design is to minimize the need to drive. Walking and bike riding must therefore be made convenient and the project needs to be ready for a future that will include alternative fueled vehicles.

The fuel of choice for automobiles and other vehicles is beginning to change. The widespread use of alternative fuels is a key strategy for the South Coast Air Basin, which includes Los Angeles, to meet Federally mandated clean air goals.

Vehicles utilizing electricity, natural gas, propane, ethanol and methanol are now on the market. Electricity and natural gas are the short-term alternative fuels of choice. Hybrid vehicles, which combine electric drive trains and small engines are, by consensus, the most likely long-term future of ground transportation. It is unclear, however, what type of fuel hybrid engines will use. The choices include fuel cells (which could be powered by hydrogen, methanol or natural gas), gasoline, diesel or natural gas internal combustion engines, or natural gas turbines.

Guidelines

Playa Vista will provide opportunities for secure bicycle storage and refueling alternative fueled vehicles as appropriate. Electric vehicle charging will be provided in individual buildings. Natural gas fueling will most likely be provided at a centralized fueling station.

Optional Measures

- In **high density** or shared-garage housing, provide secure bicycle storage sufficient for one bike for every three residential units. Round to the nearest whole number.
- In high **density** housing, install a sufficient number of electric vehicle chargers to charge at least one vehicle for every ten residential units, up to a maximum of five. Round to the nearest whole number. For example, three chargers would be installed in a twenty-five unit building.

Performance Metrics

- Specification and installation of the required wiring and additional circuit capacity.
- Specification and installation of a sufficient number of electric vehicle chargers, either conductive or inductive chargers, depending on market demand.

References and Documentation

1. California Building Code Part 2, Title 24, C.C.R, Chapters 2 (Section 206 and 208), 3 (Section 311), and 12 (Section 1202 and 1206), effective August 19, 1996.
2. *Electric Vehicles Model City Starter Kit*, Southern California Economic Partnership, 1996.

Application

A vehicle charger, whether inductive or conductive, requires one circuit, single phase 208V/240V and an additional panel capacity of 400 Amps. For more than one vehicle, the house panel should be increased by the number of vehicles. For example, four vehicles would require 160A if all are expected to be charged simultaneously, which is a fair assumption as most residential charging will take place at night.

The main house panel or building circuit should have the required excess capacity to accommodate an added circuit breaker for the electric vehicle load to be connected at a later time.

Ford Motor Company conductive charger.

In a conductive system there is direct metal to metal contact between pins in the charge connector and the vehicle receptacle.

Two styles of conductive chargers are shown: floor (above) and wall mounted (above right). Charger electronics are typically on-board the vehicle.

Below is Toyota's example of an inductive charger. Japan has entered the market aggressively and may soon offer both vehicle and charger options within the United States. Inductive chargers create less of a shock hazard to the user and are more corrosion resistant.