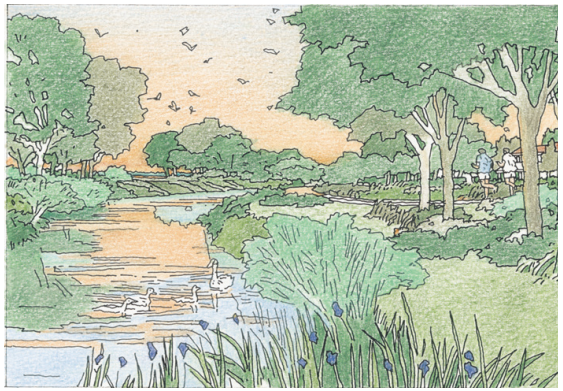
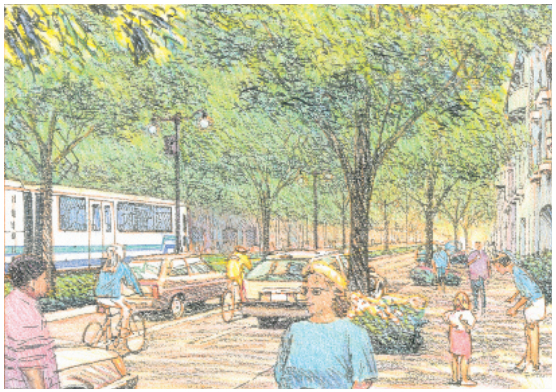
MUELLER GREEN RESOURCES GUIDE





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DISCLAIMER

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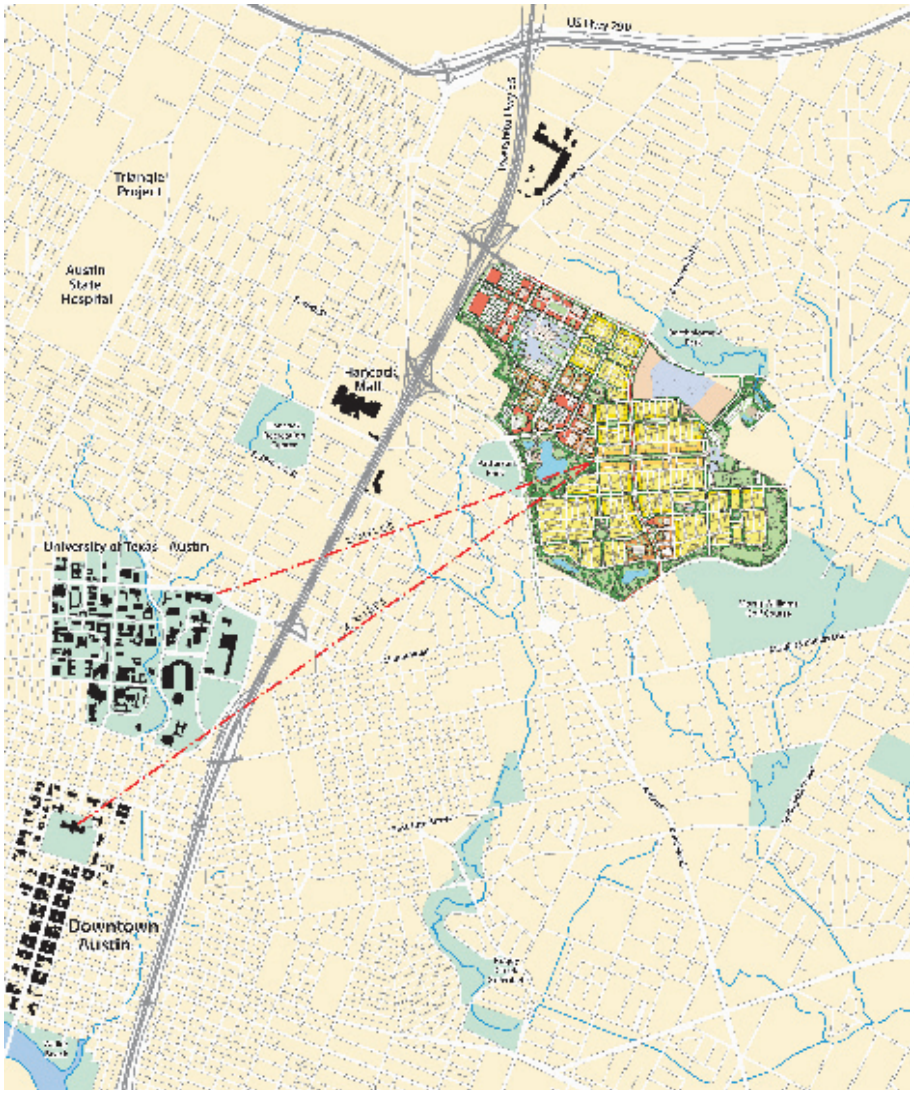


MUELLER CONTEXT MAP. IMAGE COURTESY OF ROMA DESIGN GROUP.

CHAPTER 1 - INTRODUCTION

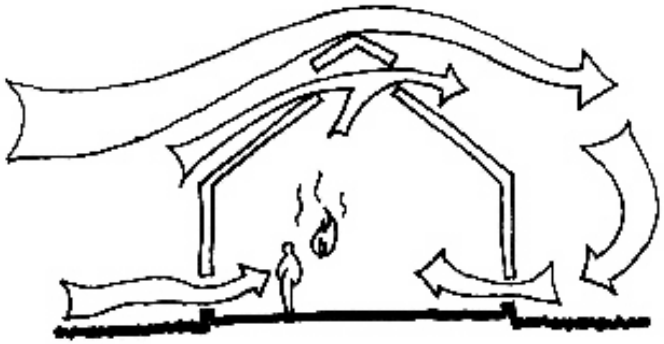


IMAGE COURTESY OF CITY OF AUSTIN

TEN BASIC APPROACHES TO GREEN BUILDING

1) Select and develop sites to promote livable communities
2) Develop flexible designs to enhance building longevity
3) Use natural strategies to protect and restore water resources
4) Improve energy efficiency while ensuring thermal comfort
5) Reduce environmental impacts related to energy use
6) Promote occupant health and well-being in the indoor environment
7) Conserve water and consider water reuse systems
8) Use environmentally preferable building materials
9) Use appropriate plant materials
10) Plan for recycling during construction, demolition, and occupancy

Source: HOK Guidebook

The Mueller Green Resources Guide is a reference document to support green building practices at Mueller. Green building incorporates healthy, environmentally sensitive, socially responsible, and cost-effective strategies into the design, construction and operation of buildings. Today, green buildings are recognized as good for the environment, for people, and for the bottom line.

WHY GREEN BUILDING?

Over the last three decades, there has been heightened awareness about the effects buildings have on the environment and human health. Buildings on a national basis are responsible for:

- ☐ 30% of all energy use
- ☐ 17% of water use
- ☐ 40% of raw stone, gravel, sand and steel use
- ☐ 25% of virgin wood use

In addition, buildings generate about 30% of carbon dioxide emissions (a greenhouse gas associated with global warming) and 35% of municipal solid waste. Extracting, processing, and transporting these materials can disturb sensitive ecological systems, and result in particulate and chemical emissions that can pollute the air, land and water. Furthermore, because people spend about 90% of every day indoors, it is essential that buildings have a healthy indoor environment.

By integrating climatic design principles with environmentally-sensitive construction practices, healthy building materials, native landscaping, and energy- and water-efficient mechanical and plumbing equipment, green buildings have lower operating costs, higher return on investment and appreciation, and enhanced occupant health and productivity. Based on recent studies, green buildings on average have a first cost premium of about two percent, which is generally recouped from lower operating costs. Moreover, with the prospect of escalating energy costs, green buildings are recognized as a smart business decision in addition to a demonstration of community and environmental stewardship.

Focus on CLIMATE CHANGE

In February 2005, 141 countries adopted the Kyoto Protocol as a response to climate change resulting from greenhouse gas emissions.

While the U.S. did not ratify the protocol, local governments, cities and organizations around the country have united to address the challenge.

The U.S. Mayor's Climate Protection Agreement calls for the nation's mayors to take leadership in creating policies and programs to reduce greenhouse gas emissions within their communities. As of June 2008, over 800 mayors have signed the agreement, including Austin's Mayor Will Wynn. Goals include:

1. Strive to meet or beat the Kyoto Protocol targets in their own communities, through actions ranging from anti-sprawl land-use policies to urban forest restoration projects to public information campaigns;

2. Urge state governments and the federal government to enact policies and programs to meet or beat the greenhouse gas emission reduction target suggested for the United States in the Kyoto Protocol -- 7% reduction from 1990 levels by 2012; and,

3. Urge the U.S. Congress to pass the bipartisan greenhouse gas reduction legislation, which would establish a national emissions trading system.

Source: Seattle Mayor's Office, http://www.seattle.gov/mayor/climate

AUSTIN CLIMATE PROTECTION PLAN

IN FEBRUARY 2007, AUSTIN MAYOR WILL WYNN ANNOUNCED THE AUSTIN CLIMATE PROTECTION PLAN, HIGHLIGHTING GOALS TO MAKE AUSTIN THE LEADING CITY IN THE U.S. IN REDUCING GREENHOUSE GASES.

Included in the Austin Climate Protection Plan:

Homes and Building Plan:
- Make all new single-family homes zero net-energy capable by 2015.
- Increase energy efficiency in all other new construction by 75% by 2015.
- Require disclosure of historic energy use, facilitate and require energy efficiency improvements in existing homes and buildings at point of sale.
- Enhance incentives and requirements for Green Building program; develop "carbon neutral" certification.

A Net-Zero Energy Capable Home achieves an efficiency level approximately 65% higher than homes built to the City of Austin Energy Code in effect in November 2006. This enables these homes to achieve annual net zero energy use with the provision of on-site energy generation. Because all homes in Austin will have to be built to this standard at point of sale in 2015, homes at Mueller can take the opportunity to build as close to zero-energy capable as they can now to avoid possible upgrades/retrofits that may be required in the future. Homes can benefit from guidance in the Mueller Green Resources Guide to put them on track to become Zero-Energy capable.

LEED FOR NEIGHBORHOOD DEVELOPMENT

In 2007, Mueller was selected as one of 238 development projects around the world to participate in the LEED for Neighborhood Development* Pilot Program. As a result, Mueller will be actively exploring an array of Green Urbanism Strategies at the development scale. These include:

- ☐ LEED Certified Green Buildings
- ☐ Energy Efficieny in Buildings
- ☐ Reduced Water Use
- ☐ Heat Island Reduction
- ☐ On-Site Energy Generation
- ☐ Proximity to Water and Wastewater Infrastructure
- ☐ Brownfield Redevelopment
- ☐ Building Reuse
- ☐ Reduced Automobile Dependence
- ☐ School Proximity
- ☐ Design for Habitat or Wetland Conservation
- ☐ Reduced Parking Footprint
- ☐ Walkable Streets
- ☐ Local Food Production

The Pilot spans an 18-month period during the active construction phase at Mueller. The entire 711 acre Mueller development will pursue LEED-ND certification and will be certified when the site is fully built out over the next decade.

*LEED for Neighborhood Development is developed through a partnership of the Congress for New Urbanism, Natural Resources Defense Council, and U.S. Green Building Council.

ARCHITECTURE 2030 °CHALLENGE

Architecture 2030 is a non-profit organization established in 2002 by architect Edward Mazria. Its goal is "to achieve a dramatic reduction in the global-warming-causing greenhouse gas (GHG) emissions of the Building Sector by changing the way buildings and developments are planned, designed and constructed." (from www.architecture2030.org).

Targets:

- At a minimum, an amount of existing building area equal to that of new construction be renovated annually to meet a fossil fuel, greenhouse gas (GHG) emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type.

- The fossil fuel reduction standard for all new buildings be increased to:
  - o 60% in 2010
  - o 70% in 2015
  - o 80% in 2020
  - o 90% in 2025
  - o Carbon-neutral by 2030 (zero fossil-fuel, GHG emitting energy to operate).

Achieving the targets may be accomplished through innovative design strategies, application of renewable technologies and/or the purchase (maximum 20%) of renewable energy. More information, energy charts, an incentive database, resources, and links are available at www.architecture2030.org.

Austin Mayor Will Wynn expressed support for the 2030 °Challenge with the unanimous passage of Resolution #50 by the US Conference of Mayors in November 2006. The 2030 °Challenge is also supported by the American Institute of Architects, the U.S. Green Building Council, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, the U.S. Environmental Protection Agency, and the American Solar Energy Society.

GREEN BUILDING GUIDELINES

Mueller has adopted green building guidelines from two established programs:

- ☐ U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) Green Building Rating System, a national green building rating system
- ☐ Austin Energy's Green Building Program (GBP)

These rating systems provide strategies and best practices guidelines for creating green buildings.

LEED® FOR NEW CONSTRUCTION

OVERVIEW - LEED is divided into six categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, Innovation and Design Process.
ELIGIBILITY - Commercial projects, Multi-family residential projects three stories or greater.
MUELLER REQUIREMENT - Certified
FEES - Registration and Certification fees apply. Fees based on USGBC membership status.

AUSTIN ENERGY'S GBP - COMMERCIAL

OVERVIEW - Austin Energy's Commercial GBP is divided into Basic Requirements and Voluntary Measures. Voluntary Measures are organized into eight categories: Team, Site, Energy, Water, Indoor Environmental Quality, Materials and Resources, Education, and Innovation.
ELIGIBILITY - All commercial projects or multi-family/ mixed-use buildings 7 stories or more. Multi-family and mixed-use buildings 4-6 stories have the option of using the Commercial or Multi-Family tool.
MUELLER REQUIREMENT - Two-Star Rating
FEES - None

AUSTIN ENERGY'S GBP - MULTI-FAMILY RESIDENTIAL

OVERVIEW - Austin Energy's Multi-Family Residential GBP is divided into Basic Requirements and Voluntary Measures. Voluntary Measures are organized into six categories: Site, Energy, Water, Indoor Environmental Quality, Materials and Resources, Innovation.
ELIGIBILITY - All multi-family residential projects of three stories or less and residential buildings where residences are stacked. Residential and mixed-use buildings of 4-6 stories have the option to use the Multi-Family or Commercial rating.
MUELLER REQUIREMENT - Two-Star Rating
FEES - None

AUSTIN ENERGY'S GBP - SINGLE-FAMILY HOME RATING

OVERVIEW - Austin Energy's Single-Family Home Rating is divided into Basic Requirements and Choice Measures. Choice Measures are organized into twelve categories: Planning Process, Site Selection, Design, Material Efficiency and Construction Waste, Integrated Pest Management, Thermal Envelope and Moisture Control, Plumbing and Appliances, Mechanical, Electrical, Interior Construction and Finishes, Sitework and Landscaping, Additions and Innovations.
ELIGIBILITY - All single-family residential projects.
MUELLER REQUIREMENT - Three-Star Rating
FEES - None

RESOURCES

U.S. Green Building Council
www.usgbc.org

Austin Energy
Green Building Program
www.ci.austin.tx.us/ greenbuilder

GREEN URBANISM

Mueller's master plan is based on sound urban planning principles that emphasize a walkable, pedestrian-friendly streetscape and mixed-use development pattern; transportation options including auto, bicycle and pedestrian connectivity; clustering of development to provide parks and open space; and, a series of wet ponds that remove pollutants from stormwater. Because these planning principles reinforce the sustainability and green building goals of the project, Mueller's site design and development exemplify "green urbanism."

GREEN URBANISM SIGNATURE THEMES

Four Green Urbanism Signature Themes underlie design and construction at Mueller. Together, these create a development that embodies both the goals of Mueller and the Austin community to benefit generations to come. Chapter Three describes the Signature Themes in more detail.

Each Signature Theme is divided into the following sections:

- ☐ Overview
- ☐ Punch List – summarizes key strategies
- ☐ Strategies – provides guidance for implementation
- ☐ Terminology

PROTECTING AIR QUALITY addresses both exterior and interior air quality issues. The section is organized into Design, Construction, and Operations.

MITIGATING URBAN HEAT ISLAND EFFECTS provides strategies to help lessen a site's contribution to elevated air temperatures in urban areas. The strategies outlined in this section are organized into Footprint, Shade, and Materials.

PROTECTING THE NIGHT SKY responds to the effect that light pollution has on nocturnal habitat. The strategies outlined in this section are divided into Design, Energy Efficiency, and Operations.

CREATING GREEN BUILDINGS offers strategies organized into Climatic Design, Materials Selection, Energy & Atmosphere, Water, Construction & Operations.

CASE STUDIES

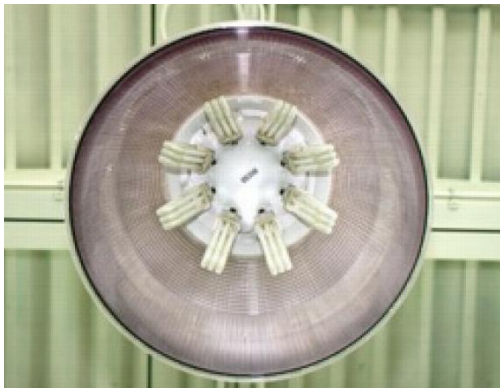
Chapter Four includes eight case studies featuring office, residential, multi-family, retail, and public sector projects located at Mueller and elsewhere in Austin that demonstrate successful green building measures and approaches implemented at several building scales.

REBATES & RESOURCES

The City of Austin, the State of Texas and the Federal Government offer programs, incentives and rebates to support green building strategies. Chapter Five provides a summary of these programs.

To implement a project's green building goals, it is helpful to draw on regional resources including green building professionals, public sector programs, incentives, and rebates. Chapter Six provides a list of print and online resources for regional materials, green building professionals, and further technical support.

CHAPTER 2 - USGBC'S LEED® GREEN BUILDING RATING SYSTEM & AUSTIN ENERGY'S GREEN BUILDING PROGRAM



LEED® for New Construction

DELL CHILDREN'S MEDICAL CENTER OF CENTRAL TEXAS, LOCATED AT MUELLER, IS PURSUING LEED for NEW CONSTRUCTION v2.2 CERTIFICATION. IMAGE COURTESY OF CATELLUS

TABLE 1 – Mueller Green Building Minimum Requirements

Building Type	USGBC LEED Certification		Austin Energy GBP
Office Single Tenant Retail Institutional Buildings	LEED-NC Certified	and/ or	Two-Star Rating
Multi-Family Residential*	LEED-NC Certified	and/ or	Two-Star Rating
Single-Family and Duplex Residential	N/A		Three-Star Rating

Note: Builders and Developers are encouraged to exceed these standards

* Multi-family at Mueller is defined as having three or more units. However, the LEED-NC standard is only applicable for buildings of three stories or greater.

PREVIOUS PAGE IMAGES - "LIVING MACHINE" AT OBERLIN COLLEGE (ROBB WILLIAMSON), OPEN GRID PAVEMENT (ANDY KARVONEN), COMPACT FLUORESCENT LIGHTING CONTROLLED BY AN ENERGY MANAGEMENT SYSTEM (JIM YOST, BIG HORN IMPROVEMENT CENTER, US EERE BUILDINGS DATABASE)

All projects at Mueller greater than 25,000 square feet are required to follow either the U.S. Green Building Council's LEED-NC (New Construction) green building rating system or Austin Energy's Green Building Program (Commercial, Multi-Family Residential, or Single-Family Homes). In general, the two standards are similar in layout: both outline multiple green building strategies, some of which are mandatory for certification and others that can be pursued at the discretion of the project delivery team, with a requirement to achieve a minimum point total associated with the required certification level.

Table 1 summarizes the green building requirements for each building type at Mueller. Either program can be used for most building types; however, only the Austin Energy Green Building Program is available for single-family and duplex residential buildings. These are minimum standards; building teams are encouraged to exceed them.

USGBC'S LEED® GREEN BUILDING RATING SYSTEM

The U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) Green Building Rating System is a voluntary, consensus-based national standard for creating high-performance, sustainable buildings. The USGBC, a national non-profit organization, has rapidly become the most widely recognized green building organization in the U.S. There are currently ten LEED standards launched, in public comment or pilot and one LEED rating system under development. Each corresponds to a distinct market sector (see Table 2). Commercial and multi-family projects at Mueller can choose to follow the LEED-NC rating system, the most highly developed and widely used LEED green building rating system.

MUELLER REQUIREMENT - LEED FOR NEW CONSTRUCTION AND MAJOR RENOVATIONS

ELIGIBILITY - Commercial, office and retail, multi-family residential projects three stories or greater

MUELLER REQUIREMENT - Certified

Higher certification levels are encouraged

FEES - Registration and Certification fees apply. Fee structure based on USGBC membership status.

OVERVIEW

LEED for New Construction is currently in Version 2.2. LEED 2009, currently in public comment phase, will be released in 2009.) See Table 3 for current fees.

The LEED-NC rating system is organized into five major categories:

- ☐ Sustainable Sites
- ☐ Water Efficiency
- ☐ Energy & Atmosphere
- ☐ Materials and Resources
- ☐ Indoor Environmental Quality

A sixth category, Innovation and Design Process, addresses exemplary performance and strategies not covered under the existing credits. This final category is important because it promotes novel approaches to green building and site specific elements while recognizing the participation of a LEED Accredited Professional on the design team.

STRUCTURE

Each of the LEED categories is divided into prerequisites and credits (see Table 6). Prerequisites are required of all projects seeking LEED certification. Each project delivery team has the option of choosing which Credits to pursue based on the particular goals and opportunities provided by their project, with a minimum number of points required to achieve LEED certification.

TABLE 2 – LEED Standards Available or In Development

TABLE 3 – LEED New Construction Fees (as of June 2008)

Registration	Fixed-Rate		
Members	$450		
Non-Members	$600		
Certification (design & construction)	Less than 50,000 SF	50,000 to 500,000 SF	More than 500,000 SF
Members	$1,750	$0.035 per SF	$17,500
Non-Members	$2,250	$0.045 per SF	$22,500

Note: These costs are valid as of June 2008 and are subject to change. See www.usgbc.org for current information.

PHOTOVOLTAIC SHADING ON PUBLIC PARKING GARAGE.
IMAGE COURTESY OF AUSTIN ENERGY

DECIDING BETWEEN LEED CERTIFICATION, GBP CERTIFICATION, OR BOTH

Commercial projects at Mueller have the option of achieving either LEED or GBP certification. Projects may also choose to pursue both green building certifications.

Project teams that aim for broader exposure and recognition for the green features of their buildings often pursue LEED certification because the program provides national recognition. It is also an attractive option to national firms familiar with the LEED process and with an established methodology for achieving green building certification.

Projects interested in local exposure or less familiar with green building practices may decide to pursue GBP certification. Because of its local nature, the GBP commercial tool is more specifically tailored to building projects in Austin and GBP representatives are available for consultation.

Pursuing both GBP and LEED is also a feasible option, and is advantageous because it rewards the project at both the local and national level. In many cases the rating systems complement one another. However, the rating systems do not have identical requirements, thus, it is important for project teams that opt to pursue both to have a thorough understanding of their similarities and differences. For the strategies that are similar, the project delivery team is encouraged to pursue the more stringent standard.

FURTHER INFORMATION

For information on LEED registration, certification, and educational and technical resources, visit www.usgbc.org.

For a more in-depth discussion of design strategies and interpretations of each LEED prerequisite and credit, the LEED V2.2 Reference Guide provides detailed information, resources, and case studies. Table 5 summarizes some of the USGBC resources applicable to projects at Mueller.

TABLE 5 – USGBC Resources

Description	Cost
LEED Version 2.2 Green Building Rating System	Free download
LEED Version 2.2 Reference Guide	Price Varies (see www.usgbc.org)
LEED Version 2.2 Letter Templates	Free to registered LEED projects
LEED Version 2.2 Documentation Requirements	Free download

TABLE 6 – LEED for New Construction v2.2 Prerequisites and Credits

Mueller Green Urbanism Signature Themes

				AIR QUALITY	HEAT ISLAND	NIGHT SKY	GREEN BLDGS
SUSTAINABLE SITES		14					
Prerequisite 1	Construction Activity Pollution Prevention	Required		X			X
Credit 1	Site Selection	1					X
Credit 2	Development Density and Community Connectivity	1		X			X
Credit 3	Brownfield Redevelopment	1		X			X
Credit 4	Alternative Transportation	4		X			X
Credit 5	Site Development	2		X	X		X
Credit 6	Stormwater Design	2			X		X
Credit 7	Heat Island Effect	2		X	X		X
Credit 8	Light Pollution Reduction	1				X	X
WATER EFFICIENCY		5					
Credit 1	Water Efficient Landscaping	2			X		X
Credit 2	Innovative Wastewater Technologies	1					X
Credit 3	Water Use Reduction	2					X
ENERGY & ATMOSPHERE		17					
Prerequisite 1	Fundamental Commissioning of Building Energy Systems	Required		X		X	X
Prerequisite 2	Minimum Energy Performance	Required		X			X
Prerequisite 3	Fundamental Refrigerant Management	Required					X
Credit 1	Optimize Energy Performance*	2 Required of 10		X			X
Credit 2	On-Site Renewable Energy	3		X			X
Credit 3	Enhanced Commissioning	1		X		X	X
Credit 4	Enhanced Refrigerant Management	1		X			X
Credit 5	Measurement & Verification	1		X			X
MATERIALS & RESOURCES		13					
Prerequisite 1	Storage & Collection of Recyclables	Required					X
Credit 1	Building Reuse	3			X		X
Credit 2	Construction Waste Management	2					X
Credit 3	Materials Reuse	2		X			X
Credit 4	Recycled Content	2					X
Credit 5	Regional Materials	2		X			X
Credit 6	Rapidly Renewable Materials	1					X
Credit 7	Certified Wood	1					X
INDOOR ENVIRONMENTAL QUALITY		15					
Prerequisite 1	Minimum IAQ Performance	Required		X			X
Prerequisite 2	Environmental Tobacco Smoke Control	Required		X			X
Credit 1	Outdoor Air Delivery Monitoring	1		X			X
Credit 2	Increased Ventilation	1		X			X
Credit 3	Construction IAQ Management Plan	2		X			X
Credit 4	Low-Emitting Materials	4		X			X
Credit 5	Indoor Chemical & Pollutant Source Control	1		X			X
Credit 6	Controllability of Systems	2					X
Credit 7	Thermal Comfort	2					X
Credit 8	Daylight & Views	2					X
INNOVATION & DESIGN PROCESS		5					
Credit 1	Innovation in Design	4					X
Credit 2	LEED Accredited Professional	1					X
		TOTAL	69				

AUSTIN ENERGY GBP

The Austin Energy Green Building Program (GBP) is a locally-based program that assists building design and construction teams to create sustainable buildings. The program provides an array of technical resources to address commercial retail and office buildings and single-family and multi-family residential buildings.

MUELLER REQUIREMENT - GBP COMMERCIAL

ELIGIBILITY - Commercial projects, multi-family projects of 4 or more stories.
MUELLER REQUIREMENT - Two-Star Rating
Higher certification levels are encouraged
FEES - None

AUSTIN RESOURCE CENTER FOR THE HOMELESS,
5-STAR GBP RATED, LEED SILVER CERTIFICATION
IMAGE COURTESY OF AUSTIN ENERGY

OVERVIEW

The GBP Commercial Rating Tool is organized around a checklist of green building measures for the projects' design and construction phases. The checklist includes Basic Requirements that must be fulfilled as well as Voluntary Measures that earn points towards star ratings ranging from One-Star to Five-Stars. Certification levels for the GBP Commercial Tool are summarized in Table 7. To access the current AEGBP Commercial Rating Tool go to www.austinenergy.com or call 512/482-5300.

Eight Basic Requirements must be completed for the building project. Voluntary Measures are organized into eight major sections: Team, Site, Energy, Water, Indoor Environmental Quality, Materials & Resources, Education and Innovation.

REGISTRATION & CERTIFICATION

The first step is to contact the Green Building Program. The GBP representative assigned to the project will provide technical assistance on the rating tool and how to implement the targeted green building strategies.

Once the project is completed, the project delivery team submits documentation to the GBP representative who performs a site inspection and reviews the submitted documentation to confirm compliance with all Basic Requirements and pursued Voluntary Measures. Once confirmed, the project is awarded a GBP star rating based on the number of points achieved. The required points for each certification level are summarized in Tables 7-9.

MUELLER REQUIREMENT - GBP MULTI-FAMILY

ELIGIBILITY - Multi-family residential projects of 3 stories or less
MUELLER REQUIREMENT - Two-Star Rating
Higher certification levels are encouraged
FEES - None

OVERVIEW

Multi-family residential projects at Mueller of 3 stories or less (excluding town houses, which must use GBP Single-family tool) have the option to use the GBP Multi-Family Residential Tool. This tool is similar to the GBP Commercial Tool but has different Basic Requirements and Voluntary Measures specific to multi-family projects. The certification levels for the GBP Multi-Family Residential Tool are summarized in Table 8. To access the current AEGBP Multi-Family Rating Tool, go to www.austinenergy.com or call 512/482-5300.

MUELLER REQUIREMENT - GBP SINGLE-FAMILY HOMES

ELIGIBILITY - Single-family and duplex residential projects
MUELLER REQUIREMENT - Three-Star Rating
Higher certification levels are encouraged
FEES - None

OVERVIEW

Single-family and duplex residential projects of 2 stories or less and townhouses at Mueller are required to follow the GBP Single-Family Homes Tool. This tool is similar to the GBP Commercial and Multi-Family Residential tools but has different Basic Requirements and Voluntary Measures for Points specific to single-family projects. Certification levels for the GBP Single-Family Tool are summarized in Table 9. To access the current AEGBP Single-Family Rating Tool, go to www.austinenergy.com or call 512/482-5300.

TABLE 7 – GBP Commercial Tool Certification Levels

Star Rating	Points Required
One-Star	Basic Requirements
Two-Star	30 to 36
Three-Star	37 to 43
Four-Star	44 to 58
Five-Star	59 or more

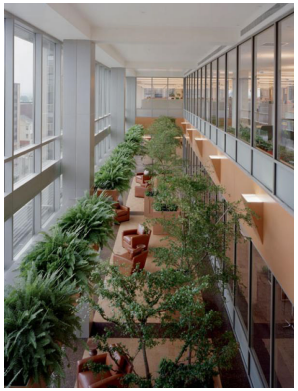
TABLE 8 – GBP Multi-Family Tool Certification Levels

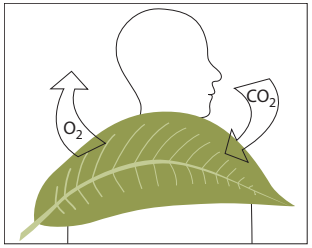
Star Rating	Points Required
One-Star	Basic Requirements
Two-Star	29 to 35
Three-Star	36 to 42
Four-Star	43 to 56
Five-Star	57 or more

TABLE 9 – GBP Single-Family Tool Certification Levels

Star Rating	Points Required
One-Star	0 to 49
Two-Star	50 to 74
Three-Star	75 to 99
Four-Star	100 to 124
Five-Star	125 or more

CHAPTER 3 - GREEN URBANISM SIGNATURE THEMES





PROTECTING AIR QUALITY

Air quality is a leading indicator of human and environmental health. According to the US EPA, Americans spend about 90% of each day indoors. This suggests that the quality of indoor air is intimately related to human health. Recent studies have linked health problems stemming from impaired indoor air quality in the U.S., and estimated direct medical costs at $15 billion per year, while indirect costs could be as high as $60 billion. Clearly, air quality is an economic, public health and social concern.

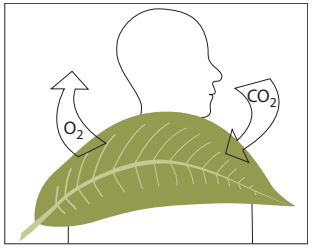
Fortunately, the past few decades have seen significant policy improvements related to air quality, including regulations that prohibit building occupants from smoking tobacco and legislation to outlaw harmful products such as lead-based paint. Air-borne particulates and volatile organic compounds (VOCs) have also received attention due to their direct burden on human health. Increased use of coatings, sealants, and other chemicals in buildings has prompted research on indoor air quality with a particular focus on how it effects human health and environmental quality.

In June 2007 the U.S. Environmental Protection Agency (EPA) proposed stricter ground level ozone standards. These were approved in March 2008. Austin's ground level ozone levels currently exceed these standards. If air quality levels are not improved, the EPA will classify Austin as a non-attainment zone and implement a mandatory air quality improvement plan. Mueller has the opportunity to make significant gains in protecting outdoor air quality by designing energy efficient buildings, implementing low-emitting construction practices, and taking advantage of diverse transportation options to reduce automobile travel and associated air emissions.

Mueller's New Urbanism design includes street connectivity, transit corridors and hubs, sidewalks, and bike lanes to promote walking, bicycling, and mass transit.

IMAGE COURTESY OF MUELLER DESIGN BOOK

PUNCH LIST



DESIGN

- [ ] Breathable building skin
- [ ] Proper HVAC system filtration
- [ ] Natural ventilation
- [ ] Occupant control over airflow, temperature, and lighting
- [ ] Entryway system pollutant control
- [ ] Separate ventilation for equipment and chemical mixing rooms
- [ ] Low-VOC paint, sealants/adhesives, carpet, furniture, ceiling tiles

CONSTRUCTION

- [ ] SMACNA Construction IAQ Guidelines
- [ ] Building Flush-Out/IAQ testing prior to move-in
- [ ] Reduce pollution on site during construction: dust, exhaust, fuel, idling; write low emission equipment standards into landscape and construction contracts
- [ ] Construction Air Quality Manager

OPERATIONS

- [ ] IAQ Facilities Manager
- [ ] Low VOC materials for building interior and exterior maintenance
- [ ] Low emitting lawncare equipment
- [ ] Integrated Pest Management

IMAGE COURTESY OF AUSTIN ENERGY

*Note: Refer to Chapter 2 for tables showing the overlap between Green Urbanism Themes in LEED and Austin Energy GBP rating systems.

DESIGN STRATEGIES

The first line of defense in protecting air quality lies in a project's design. Effective building design strategies coupled with specifications that require low-emitting materials and responsible construction practices can help reduce or even eliminate many health problems experienced by building occupants during and after the project's completion.

MOLDS AND FUNGI

ELIMINATE SOURCES OF PERSISTENT MOISTURE

Molds and fungi grow on moist surfaces and cause a multitude of health problems. Central Texas is particularly susceptible to this type of contamination due to its humid climate. Molds and fungi are some of the most difficult air contaminants to address because they grow in moist conditions that are often hard to avoid.

Action Items

- ☐ Control moisture
- ☐ Choose building materials that are inherently mold and mildew resistant
- ☐ Avoid materials particularly susceptible to mold and mildew growth: e.g., ceiling tiles made from man-made mineral fiber, vinyl wall covering, kraft-paper backed gypsum wallboard
- ☐ Select and use healthy, low-emitting materials and products
- ☐ Ensure that the building skin (roofs, walls, joints) sheds precipitation and does not trap moisture

Common design flaws that encourage growth of molds and fungi include inadequate drainage of exterior building surfaces and poorly designed vapor barriers.

MOLD GROWING ON THE BACK OF WALLPAPER.
IMAGE COURTESY OF US EPA

AIR CONDITIONING SYSTEM

DESIGN HVAC SYSTEM TO PROVIDE APPROPRIATE FILTRATION AND VENTILATION.

Air conditioning systems have the potential to distribute contaminants throughout the building if they are improperly sealed.

Filtration Techniques

- ☐ Mechanical filters - Remove particulates from the airstream
- ☐ Electrostatic precipitation devices - Remove fine particulates

MAKE SURE SUFFICIENT AMOUNT OF OUTDOOR AIR IS INTRODUCED INTO MECHANICAL SYSTEM.
IMAGE COURTESY OF US EPA

- ☐ Absorptive Materials - Remove gaseous contaminants such as VOCs, methane, formaldehyde and carbon monoxide

While filtration improves air quality and protects human health, the practice is also effective at keeping air handlers and ducts clean, prolonging the life of mechanical equipment, preventing fires and mold growth. Filters have limitations because they only function when the air handling system is in operation and only remove the particles based on the MERV rating. This enables small particles to pass through the filter media, in some cases.

Natural Ventilation

Natural ventilation, a key green building strategy, is common in residential buildings where operable windows are customary. However, it is becoming increasingly common for commercial buildings to be designed with natural ventilation strategies or a combination of natural and mechanical ventilation strategies.

Occupant Control

Occupant control for airflow, temperature, and lighting helps to avoid complaints of discomfort and irritation associated with indoor conditions. Providing occupany control can lead to higher productivity, lower absenteeism, and a more desirable workplace.

PHYSICAL SEPARATION

USE AN ENTRYWAY SYSTEM TO TRAP CONTAMINANTS BEFORE THEY ENTER THE BUILDING.

Many contaminants are tracked into buildings on the bottom of shoes. Physical barriers such as grills and grates in entryways and high traffic areas are an easy way to reduce contaminants in the building.

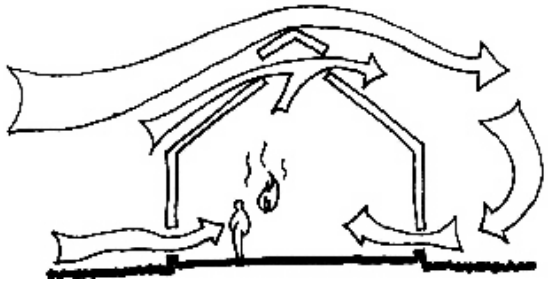
EQUIPMENT

PROVIDE SEPARATE VENTILATION FOR EQUIPMENT WITH OPEN COMBUSTION SYSTEMS.

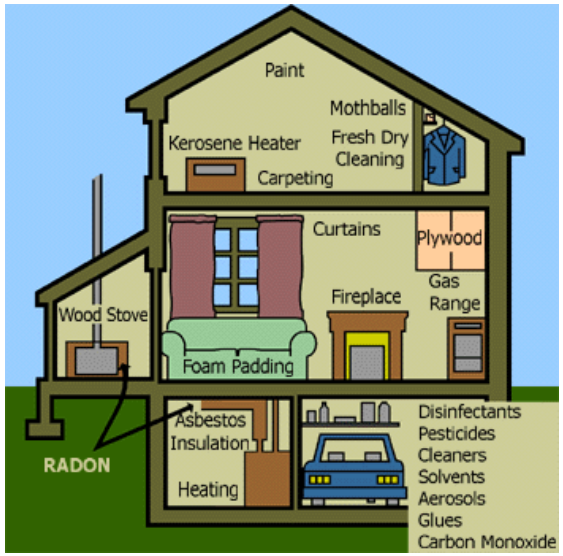
Combustion creates carbon monoxide and other gases detrimental to human health. Ensure that areas with combustion activities are separately ventilated to avoid contamination of interior spaces. This is a particular problem in residential buildings where gas ranges and fireplaces are common. If gas ranges are used, install kitchen range fans that exhaust the contaminants to the outside.

Open Combustion Sources

- ☐ Water heater
- ☐ Furnace
- ☐ Fireplace
- ☐ Woodstove
- ☐ Gas range



NATURAL VENTILATION - CONVECTION COOLING
IMAGE COURTESY OF DAN OVERBEY



RESIDENTIAL SOURCES OF INDOOR AIR POLLUTION IMAGE COURTESY OF US EPA, "THE INSIDE STORY: A GUIDE TO INDOOR AIR QUALITY," 1988.

CHEMICAL STORAGE

PROVIDE SEPARATE VENTILATION AND PLUMBING FOR CHEMICAL MIXING AREAS, WHERE APPLICABLE, AND ADOPT A GREEN HOUSEKEEPING PROTOCOL.

☐ Adopt a green housekeeping protocol that eliminates toxic, high emitting cleaning chemicals.

☐ Design areas used for mixing chemicals with separate HVAC systems to minimize impaired air quality in occupied areas.

LOW EMITTING MATERIALS

SPECIFY LOW AND NO VOC OPTIONS FOR ALL PAINTS, ADHESIVES, SEALANTS, CARPET, UPHOLSTERY, FURNISHINGS, AND ENGINEERED WOOD.

Volatile Organic Compounds (VOCs) originate from both natural sources and manufactured products. They are of particular concern in building interiors because of their negative effect on indoor air quality and occupant health. However, high-emitting exterior materials should also be avoided due to their ability to contribute to pollution and ozone depletion. In the building industry, VOCs are generally measured in grams per liter of product. High concentrations of VOCs and long exposure can cause skin or lung irritation, asthma, toxic reaction, and even carcinogenic triggers for building occupants.

Low-emitting Materials

☐ Water-based products

☐ Low-VOC paints & coatings (see Table 9)

☐ CRI Green Label Plus Certified carpet (see Table 10)

☐ Low, no-VOC adhesive and sealants (See Tables 12, 13, 14 and 15, pp 27-28).

☐ Formaldehyde-free engineered composite wood and insulation

☐ Low-VOC furniture, cubicle walls, and other upholstered items

LOW VOC CARPET

Carpet can be a significant source of VOCs in buildings. Carpet also serves as a sink for contaminants and has the potential to encourage mold and fungi growth when exposed to moisture. It also offers desirable sound-attentuation properties. Many new buildings are designed with flooring materials other than carpet. These materials include hardwood, tile, slate, linoleum, cork, bamboo, and concrete. Of course, these alternatives should also be assessed for their VOC content, including the adhesives, sealants, and varnishes used to install and finish them, and the cleaning agents used to maintain them during occupancy. When carpet is the preferred option, products are available with no or very low VOCs. It is also important to use low- and no-VOC carpet adhesives or better yet, opt for adhesive-free carpet installation options. Please refer to the Carpet and Rug Institute Green Label Products.
website: http://www.carpet-rug.com

IMAGE COURTESY OF AUSTIN ENERGY

Table 9 Low Emitting Materials - Paints & Coatings

Paints and Primers	VOC Limit (g/L)
Interior Flat	50
Interior Non-Flat	150
Exterior Flat	100
Exterior Non-Flat	200
Note: Verify Green Seal compliance at the time of order as product formulations are subject to change. Please see www.GreenSeal.org for more information.	

Table 10 Low Emitting Materials - Carpet

Chemical Emission	Maximum Emission Factor
Total Volatile Organic Compounds	0.5
4-PC (4-Phenylcyclohexene)	0.05
Formaldehyde (proves none is used)	0.05
Styrene	0.4
Note: To identify carpets and rugs that comply, look for the CRI Green Label logo:	

CONSTRUCTION

Construction practices can affect both outdoor and indoor air quality, resulting in health consequences for both construction workers, future builidng occupants, and the broader community.

CONSTRUCTION AIR QUALITY

REDUCE POLLUTION ON-SITE DURING CONSTRUCTION.

Construction activities have a significant impact on outdoor air quality. Diesel exhaust from construction equipment affects not only construction workers on-site but also nearby residents and the broader community by introducing VOCs and particulate matter into the atmosphere.

Action Items

☐ Adopt a construction environmental management plan.

☐ Prohibit equipment idling on the job site.

☐ Require newer, cleaner-burning diesel equipment for construction activities.

☐ Require that construction equipment use cleaner-burning diesel fuels, such as biofuel.

☐ Arrange for on-site fuel tanks to be filled with biofuel in lieu of petroleum-based diesel fuel.

☐ Adopt standards for low-noise construction equipment to minimize noise pollution.

CONSTRUCTION INDOOR AIR QUALITY

(IAQ) FOLLOW SMACNA GUIDELINES FOR CONSTRUCTION INDOOR AIR QUALITY AND SEQUENCE MATERIAL INSTALLATION PROPERLY.

The most comprehensive construction-related IAQ standards come from the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA). See Table 11 (page 25) for an outline of the SMACNA Guidelines for Construction Indoor Air Quality.

Moisture

Protect building materials from moisture and job site contaminants to avoid moisture build-up and compromised indoor air quality during construction. Building envelope and HVAC systems are priority areas.

☐ Store building materials in dry locations prior to installation.

☐ Cap HVAC ducts during construction using vacuum-fitted drywall.

☐ Seal the building from precipitation and other moisture sources.

☐ Erect temporary moisture barriers until the permanent building shell is complete.

☐ Do not start construction on the interior until the shell is watertight.

Sequencing

1. Finish constructing the shell.
2. Allow high-emitting materials to off-gas outside the building.
3. Allow high-emitting materials to fully cure before installing porous materials.

Volatile Organic Compound "Sinks"

"Sinks" absorb volatile organic compounds (VOCs) and slowly re-emit them over time. Install the following porous, absorptive materials after high-emitting materials have been installed and had a period of time to off-gas volatile chemicals:

☐ Ceiling Tile
☐ Insulation
☐ Carpet
☐ Drywall
☐ Upholstered furniture

BUILDING FLUSH-OUT

FLUSH OUT CONTAMINANTS BEFORE BUILDING OCCUPANCY.

A two-week flush-out period ventilates the building and allows high-emitting materials to off-gas.

Table 11
Construction Indoor Air Quality (IAQ) Management Plan

Sheet Metal & Air Conditioning Contractors' National Association (SMACNA) IAQ Management Plan
☐ HVAC Protection Shut down the return side of the HVAC system whenever possible during heavy construction or demolition. If the ventilation system must be operated during construction, it should be fitted with temporary filters that can be replaced with clean media (MERV 13) just prior to completion and occupancy.
☐ Source Control Specify finish materials (e.g., paints, carpet, composite wood, adhesives, sealants) that are non-toxic and low or non-emitting.
☐ Pathway Interruption During construction, isolate work areas to prevent contamination of clean or occupied spaces.
☐ Housekeeping Establish cleaning protocols that concentrate on HVAC and building spaces to remove contaminants from the building prior to occupancy. Building materials should be protected from weather and stored in a clean area prior to unpacking for installation. All coils, air filters, and fans should be cleaned before performing testing and balancing procedures and especially before conducting baseline air quality tests.
☐ Scheduling Specify construction sequencing to reduce absorption of VOCs by porous materials. Complete applications of wet and odorous materials such as paints, sealants, and coatings BEFORE installing absorbent "sink" materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings.

BIODIESEL

Biodiesel is a renewable fuel created when natural plant oils react with methanol. Normally blended with regular diesel fuel, the amount of biodiesel present is indicated in the blend's name. For example, the most common blend, B20, is composed of 20% biodiesel and 80% petroleum diesel. The displacement of the petroleum diesel can reduce emissions, lesson our dependence on foreign oil sources and provide and economic stimulus to rural communities.

When burned in its pure form (B100), biodiesel substantially reduces particulate matter, greenhouse gases and toxic emissions to air. Nitrogen oxides (NOx) (a precursor emission of ground-level ozone) can increase by upwards of 10% when using B100 biodiesel in internal combustion engines. However, in certain applications there may be no net increase in NOx.

Third-party certifications have verified the following emission figures compared to using petroleum diesel:

	B100	B20
HydroCarbons	-67%	-20%
Carbon Monoxide	-48%	-12%
Particulate Matter	-47%	-12%
NOx	+ 10%	+2% to -

The debate over the energy balance of biodiesel is ongoing. Transitioning fully to biofuels could require immense tracts of land if traditional food crops are used (although non-food crops can be utilized). The problem would be especially severe for nations with large economies, because energy consumption scales with economic output.

On December, 21 2008 the Texas Council on Environmental Quality (TCEQ) approved use of B5 (5% biodiesel) to be compatible with their Texas Low Emission Diesel formulation requirements for Texas. Biodiesel is cost competitive with petroleum diesel on both a wholesale and retail level in the Austin market. On-road fleets throughout the country, including the City of Dallas, are beginning to use B20. The City of Austin uses B20 in most of their diesel-powered engines. Caterpillar, a manufacturer of heavy industrial equipment, has indicated that B20 is compatible with its diesel construction engines and it will not void the engine warranty. Potential users should check with manufacturers regarding the highest allowed blend for their equipment and warranty-related information.

Source: Scott Johnson

For further informotion, see National Biodiesel Board: http://www.biodiesel.org/resources/fuelfactsheets/default.shtm

OPERATIONS

IMAGE COURTESY OF AUSTIN ENERGY

After constructing a building that creates conditions for healthy indoor and exterior air quality, equally high standards should be maintained once the building is occupied. Exterior air quality is a health concern in Austin resulting from high levels of ground-level ozone and particulate matter.

O&M AIR QUALITY

ESTABLISH AN OPERATIONS AND MAINTENANCE REGIMEN THAT MAINTAINS HEALTHY AIR QUALITY ESTABLISHED DURING CONSTRUCTION.

- ☐ Adopt a green housekeeping protocol that avoids toxic cleaners and surface treatments.
- ☐ Establish a regular cleaning schedule to remove contaminants tracked in by occupants.
- ☐ Install an air monitoring system to test for contaminants (e.g., carbon monoxide, carbon dioxide) in the ventilation system and occupied areas.
- ☐ Specify low-VOC paints, adhesives, and sealants for interior and exterior use.
- ☐ Adopt integrated pest management.

LANDSCAPING EQUIPMENT

MITIGATE POLLUTION BY PURCHASING LOW EMISSION LAWN EQUIPMENT.

Lawn mowers, leaf blowers, and line trimmers are significant sources of air pollution resulting from gas-powered engines. As a result, they can pose health risks to landscape workers, passers-by and the broader community. Emission standards for lawn equipment have improved significantly in the last few years, while electric powered alternatives are increasingly available.

Action Items

- ☐ Write low emission equipment standards into landscape contracts to require equipment to exceed current air quality standards.
- ☐ Provide electrical outlets in convenient outdoor locations to encourage use of electric landscaping equipment.
- ☐ Avoid sculpting individual shrubs planted en masse to reduce weeds, maintenance costs, and energy use.

TERMINOLOGY

INDOOR AIR QUALITY (IAQ)

A DESIGNATION OF POLLUTANT LEVELS INSIDE A BUILDING.

Studies conducted by the U.S. EPA have found that air pollution levels inside buildings may be two to five times higher than outdoor levels. These findings are of particular concern because Americans on average spend 90% of their time indoors.

Proper indoor air quality may be maintained by:

- ☐ Controlling the level of airborne contaminants circulating in the building.
- ☐ Regulating the introduction and distribution of an adequate amount of outdoor air.
- ☐ Maintaining thermal comfort levels.
- ☐ Maintaining proper relative humidity levels.

Typical symptoms of poor indoor air quality include:

- ☐ Headaches
- ☐ Unusual fatigue
- ☐ Itching or burning eyes
- ☐ Skin irritation
- ☐ Nasal congestion
- ☐ Dry or irritated throats
- ☐ Other respiratory irritations

Prolonged exposure to poor indoor air quality can lead to health problems such as asthma and allergies. Healthy indoor air quality has been shown to improve productivity and occupant well-being and reduce absenteeism in workplaces and schools.

PARTICULATE MATTER (PM)

AIRBORNE SOLID PARTICLES THAT CAUSE IRRITATION WHEN INHALED OR IN CONTACT WITH THE EYES.

Particulate Matter are criteria air pollutants that include dust, soot, and other fine bits of solid materials that are released into and move around in the air. Exposure to particulates can result in eye, nose and throat irritation and other health problems.

Particulates are produced by many sources, including:

- ☐ Diesel fuel combustion
- ☐ Incineration
- ☐ Road construction
- ☐ Industrial and mining operations
- ☐ Wood burning

Table 12
Low EmittingMaterials South Coast Air Quality Management District (SCAQMD) Rule #1168: Sealant Primers

Sealant Primer	VOC Limit (g/L)
Architectural (non-porous)	250
Architectural (porous)	775
Other	750

Table 13
Low EmittingMaterials South Coast Air Quality Management District (SCAQMD) Rule #1168: Sealants

Sealant	VOC Limit (g/L)
Architectural	250
Nonmembrane Roof	300
Roadway	250
Single-Ply Roof Membrane	450
Other	420

Table 14
Low Emitting Materials South Coast Air Quality Management District (SCAQMD) Rule #1168: Adhesives

Substrate Specific Applications	VOC Limit (g/L)
Metal to metal	30
Plastic foams	50
Porous material (except wood)	50
Wood	30
Fiberglass	80

Table 15
Low Emitting Materials South Coast Air Quality Management District (SCAQMD) Rule #1168: Adhesives

Architectural and Specialty Applications	VOC Limit (g/L)
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Wood flooring Adhesives	100
Rubber Floor Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT & Asphalt Adhesives	50
Drywall & Panel Adhesives	50
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
PVC Welding	510
CPVC Welding	490
ABS Welding	325
Plastic Cement Welding	250
Adhesive Primer for Plastic	550
Contact Adhesive	80
Special Purpose Contact Adhesive	250
Structural Wood Member Adhesive	140
Sheet Applied Rubber Lining Operations	850
Top & Trim Adhesive	250

SICK BUILDING SYNDROME (SBS)

NEGATIVE HEALTH IMPACTS ON BUILDING OCCUPANTS STEMMING FROM MODERN CONSTRUCTION PRACTICES.

The term sick building syndrome addresses a wide range of occupant health problems related to indoor environments, ranging from headaches and irritated eyes to nausea, fatigue, dizziness, and throat irritation. The World Health Organization estimates that up to 30% of the world's buildings suffer from sick building syndrome.

Occupants react differently to varying concentrations and combinations of chemicals in the air, making sick building syndrome difficult to diagnose. Contaminants of concern for indoor air quality include:

- ☐ Volatile Organic Compounds (VOCs)
- ☐ Chlorinated compounds
- ☐ Biological agents
- ☐ Formaldehyde
- ☐ Radon
- ☐ Second-hand tobacco smoke

VOLATILE ORGANIC COMPOUNDS (VOCs)

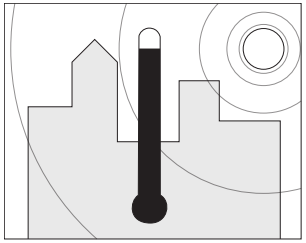
MOLECULES CONTAINING CARBON THAT ARE GENERALLY IN A GASEOUS STATE AT ROOM TEMPERATURE.

Some VOCs contain known or suspected carcinogens. Many synthetic materials such as paint, carpet, engineered wood products, adhesives and sealants emit dangerous VOCs, compromising air quality and human health.

VOCs are linked to a range of health problems, from short-term nose and throat discomfort to known carcinogens.

Volatile organic compounds are present in many of the following materials:

- ☐ Solvents
- ☐ Pesticides
- ☐ Cleaning supplies
- ☐ Office equipment
- ☐ Formaldehyde
- ☐ Paints and coatings
- ☐ Adhesives and sealants
- ☐ Carpet



URBAN HEAT ISLAND EFFECT

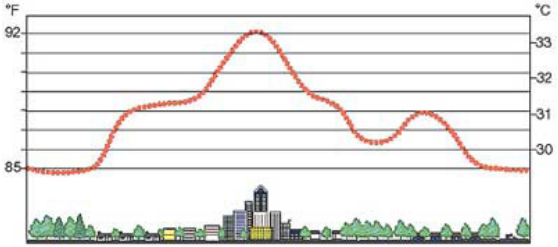
On summer days, the air temperature in urban areas can be as much as 6 - 8°F higher than in surrounding areas. This phenomenon, commonly referred to as the urban heat island effect, occurs when dark, impervious constructed surfaces absorb the sun's energy instead of reflecting it back into the atmosphere. The urban heat island effect is of particular concern in large cities located in warm climates such as Austin, Phoenix, Los Angeles, and Houston.

Buildings influenced by the urban heat island effect require additional energy to meet their cooling loads in the summer months. In Los Angeles, this phenomenon results in an estimated additional $100 million per year in energy costs.

The higher temperatures in these cities also alter the regions' microclimate and create adverse conditions for native wildlife and plant habitat.

Studies conducted at Lawrence Berkeley National Laboratory's Heat Island Group found that photochemical reactions of certain airborne pollutants intensify as ground level temperatures rise, resulting in increased ozone, a contributor to smog formation. For example, studies in Los Angeles have found that for every degree Fahrenheit increase in temperature above 70ºF, the incidence of smog increases by 3%.

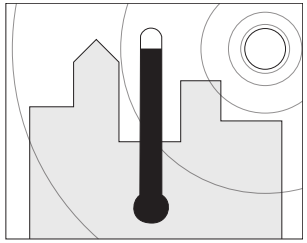
Researchers are still studying if and how the localized nature of urban heat islands contributes to global warming. At present, the only direct linkage established between the two phenomena is the impact of increased air conditioning load resulting in increased fossil fuel combustion and associated increased carbon dioxide releases.



URBAN HEAT ISLAND GRAPH
IMAGE COURTESY OF US EPA

IMAGE COURTESY OF AUSTIN ENERGY

PUNCH LIST



FOOTPRINT

- [ ] Compact building footprint
- [ ] Minimum parking required by code
- [ ] Stack building over parking or utilize underground parking

SHADE

- [ ] Plant vegetation strategically to shade structures and pavement
- [ ] Install vegetated roofs and walls

MATERIALS

- [ ] High SRI (Solar Reflectance Index) materials
- [ ] Light colored roof and paving materials
- [ ] Porous and Pervious paving

IMAGE COURTESY OF ROMA DESIGN GROUP

IMAGE COURTESY OF ROMA DESIGN GROUP

*Note: Refer to Chapter 2 for tables showing the overlap between Green Urbanism Themes and the LEED and Austin Energy GBP rating systems.

STRATEGIES

MINIMIZE BUILT SURFACE AREA

COMPACT FOOTPRINT. MINIMIZE ON-SITE PARKING.

An effective way to reduce a project's impact on the urban heat island effect is to reduce the site's built surface area.

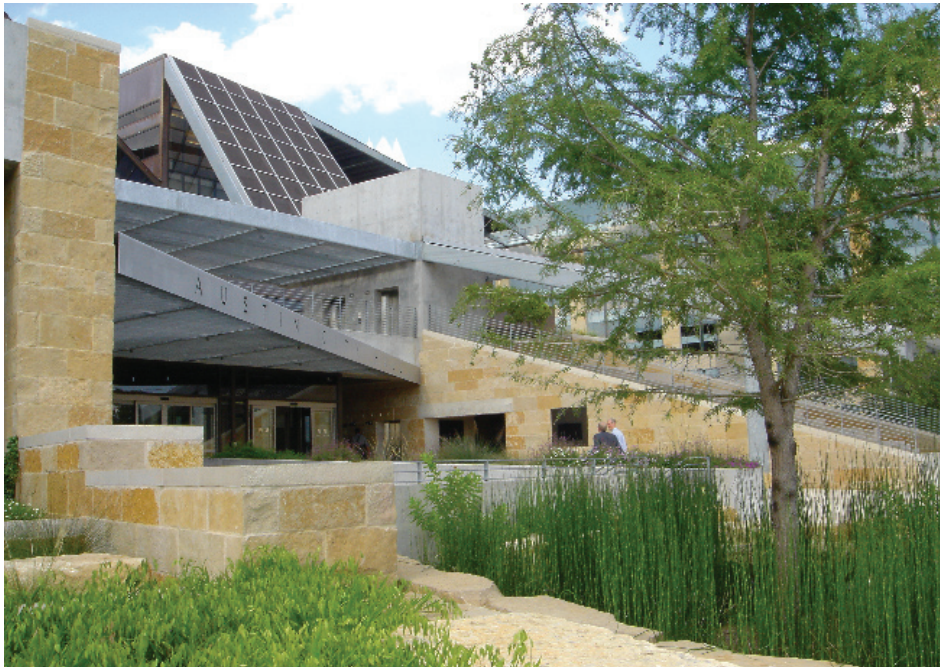
Action Items

- ☐ Reduce building footprint.
- ☐ Do not exceed the minimum parking required by local building codes.
- ☐ Stack the building and parking programs.
- ☐ Reduce coverage of sidewalks, driveways and other built surfaces surrounding the building.
- ☐ Establish formal construction area boundaries to minimize disturbance of the existing ground surface.

SHADE PLANTS

USE VEGETATION TO SHADE BUILDINGS.

Shading from trees blocks the sun's energy from striking and being absorbed by dark colored (low albedo) surfaces. Proper placement of vegetation on the building site can cool the air through evapotranspiration. Vegetation also provides an aesthetic benefit by enhancing a site's attractiveness.



AUSTIN CITY HALL - EXTERIOR WALKWAY

IMAGE COURTESY OF KAY OWENS

Action Items

- ☐ Plant deciduous trees on the building's south and west sides to protect it from the summer sun. In the winter months, these trees lose their leaves and allow sunlight to provide passive heating and daylight.
- ☐ Plant shade trees to protect roof surfaces, sidewalks, driveways, parking lots and exterior walls from direct solar heat gain, especially in the summer months.

GREEN ROOF

REDUCE STORMWATER RUNOFF AND BUILDING HEAT GAIN BY INSTALLING A GREEN ROOF.

Green roofs can reduce the urban heat island effect. They also can reduce stormwater runoff volume, improve the building's energy performance and sound attenuation, provide wildlife habitat and extend the life of a roof.

Intensive vs. Extensive

Green roofs are generally composed of a waterproof membrane covered by a drainage layer, growing medium, and vegetation. Some green roofs employ modular units that can facilitate maintenance and promote flexibility over time.

Green roofs have been used in Northern Europe for centuries. Their growing medium, and that of the "intensive" modern green roofs they have inspired, is generally 8 inches to several feet deep. The added weight can require structural reinforcement.

Over the past two decades, thinner "extensive" green roofs have become more common. These roofs have a decreased depth of growing medium, around 4 to 6 inches, reducing the need for added structural reinforcement.

Tests to determine optimal soil composition, proven green roof plant species, and how to satisfy water needs of green roofs in Austin's climate are underway by the Lady Bird Johnson Wildflower Center of the University of Texas and the City of Austin.

Pricing

Store-bought green roof pricing starts around $8 per square foot as compared with $1.25 per square foot for conventional roofs and $1.50 per square foot for high reflectance roofs. Self-designed green roofs may have lower cost.

ESCARPMENT VILLAGE GREEN ROOF
IMAGE COURTESY OF: PHILIP HAWKINS

THE ESCARPMENT VILLAGE GREEN ROOF

The 8,000 sq. ft. green roof at Escarpment Village on Slaughter Lane in Southwest Austin, designed by the Lady Bird Johnson Wildflower Center, is Austin's first extensive green roof. Plants grow in multiple 2' x 4' trays filled with 8" of a super absorbent growing medium. The roof, which can be seen from the Starbucks second floor, features only native plants, including prairie grasses, rock rose, agarita, Virginia creeper and crossvine. This green roof costs about double that of a typical roofing system but is expected to increase insulation, reducing heating and air conditioning costs. A green roof is also expected to extend roof life. Environmental benefits include stormwater runoff control, water filtration and a natural habitat for wildlife.

HIGH SRI MATERIALS

SPECIFY LIGHT COLORED AND REFLECTIVE MATERIALS.

Specify roof and pavement surfaces with high albedo and high emissivity values. (See Terminology on page 34) In general, white or light colored surfaces reflect the sun's energy better than darker materials.

Action Items

- ☐ Specify an Energy Star® or SRI-qualified roof (www.energystar.gov)
- ☐ Specify a light colored pavement. Standard concrete complies with the LEED for New Construction Sustainable Sites Credit 7.1 requiring high albedo paving.
- ☐ Specify light-colored exterior walls for non-shaded areas.

PERVIOUS & POROUS PAVEMENT

MINIMIZE PAVED SURFACES. INSTALL PERVIOUS PAVEMENT FOR DRIVES, WALKWAYS, PARKING.

Pervious Pavement - Also referred to as open grid pavement, pervious pavement is manufactured with voids that allow stormwater to filter into the subsurface while providing structural support for foot and vehicle traffic.

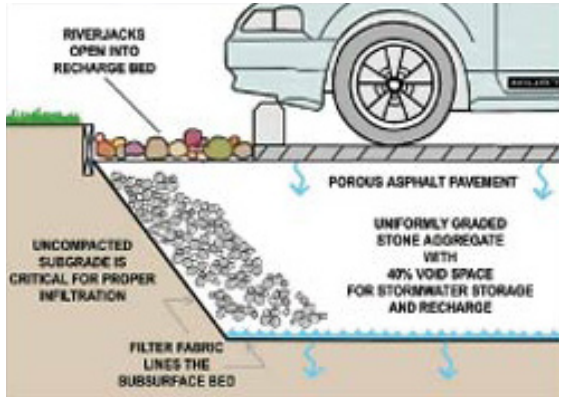
Pervious pavement absorbs less solar heat than non-pervious pavement because the voids allow evaporation and, in some cases, support vegetation. These products are generally manufactured as modular units (e.g., blocks, grids or rolls), and can be used for low-traffic surfaces such as sidewalks, parking spaces, and driveways. Modular units are typically not specified for high-volume vehicle traffic areas because their modularity and honeycomb structure reduces structural performance.

Porous Pavement - Porous paving systems, first developed by the Franklin Institute in Philadelphia in the 1970's, include porous asphalt and concrete, as well as unstabilized systems such as decomposed granite.

While these materials are effective for stormwater infiltration, their ability to mitigate the urban heat island effect varies based on their albedo and emissivity values.

In some cases, the City of Austin allows the use of porous pavement for pedestrian use (i.e., interior sidewalks) to offset a site's total impervious area limits. The use of porous pavement can also reduce the site's overall water quality pond sizing. Additionally, LEED and Austin Energy's GBP allow for both pervious and porous pavements to contribute to their respective heat island-related credits.

PERVIOUS PAVEMENT
IMAGE COURTESY OF US EPA



POROUS PAVEMENT
IMAGE COURTESY OF US EPA, STACIE JOHNSON, ASPHALT PAVING ASSOCIATION OF IOWA

TERMINOLOGY

LIGHT COLORED CONCRETE GENERALLY HAS A HIGH ALBEDO RATING.
IMAGE COURTESY OF AUSTIN ENERGY

Table 16 Albedo Values for Roof Surfaces

Roof Type	Albedo Range
Tar and Gravel	0.03 to 0.18
Red or Brown Tile	0.10 to 0.35
Corrugated	0.10 to 0.15
Colored Paint	0.15 to 0.35
White Paint	0.50 to 0.90
Highly Reflective Roof	0.60 to 0.70
Source: U.S. EPA Heat Island Effect website	

ALBEDO

THE HIGHER THE ALBEDO VALUE, THE BETTER

Albedo describes a material's ability to reflect solar energy.

Unconstructed surfaces tend to have high albedo values, meaning that they reflect most of the sun's energy. For example, fresh snow has one of the highest albedo values (0.90 or greater) because it reflects the majority of the sun's light back into the atmosphere. Conversely, dark colored constructed areas such as rooftops and paved surfaces usually have low albedo values and consequently absorb solar energy instead of reflecting it. Table 16 shows typical albedo ratings for roofing materials.

EMISSIVITY

THE HIGHER THE EMISSIVITY VALUE, THE BETTER.

Emissivity is the ability of a surface to radiate solar energy back into the atmosphere.

Unconstructed surfaces tend to have high emissivity values because they radiate most of the solar energy they capture during the day back into the atmosphere. Constructed surfaces tend to have low emissivity values and do not radiate solar energy as readily, resulting in higher ground temperatures than in the surrounding unbuilt areas.

SOLAR REFLECTANCE INDEX (SRI)

THE HIGHER THE SRI VALUE, THE BETTER

The surface properties of albedo and emissivity in combination are referred to as the Solar Reflectance Index. The SRI represents the solar characteristics of a given material.

SRI is expressed as a percentage ranging from a standard black surface (SRI = 0%) to a standard white surface (SRI = 100%).

A high SRI value means that a surface has a high degree of albedo and emissivity and is well suited to mitigate urban heat island effects.

PROTECTING THE NIGHT SKY

Light pollution is a symptom of wasted energy use. In the U.S., an estimated $2 billion is spent annually on ineffective lighting, resulting in the release of an estimated 19 million tons of carbon dioxide and other air pollutants. And, the need for more efficient and effective exterior lighting continues to grow in response to rising energy costs.

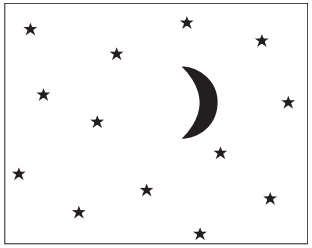
Astronomers first raised concerns about light pollution, finding the skyglow above towns and cities increasingly disruptive to their research. Brighter urban areas result from urban growth and the proliferation of exterior lighting. In recent years, light pollution has been broadly recognized by the general population as an aesthetic and wildlife habitat concern and an indicator of wasteful energy use.

Interest in the effects of light pollution has intensified in recent years as the importance of dark conditions for animals, plants, insects, and humans has better understood. Increased nocturnal light levels adversely impact foraging, breeding, and sleeping patterns of all living organisms, particularly those that function best in the dark. For example, Austin's beloved bat colonies, a significant tourist attraction and a natural form of insect control, depend on dark skies to forage. Bats are negatively impacted by higher ambient light levels in the Austin metro area.

Nighttime lighting is required in urban areas for safety, navigation, advertising, and aesthetic applications. Effective strategies to protect the night sky can be more effective, economical, and environmentally friendly than conventional exterior lighting design.

The intent of controlling light pollution is not to eliminate exterior lighting but to provide effective and uniform exterior illumination while avoiding the light pollution problems of glare, light trespass, and uplighting.

PUNCH LIST



DESIGN

- [ ] Design for uniform lighting -- more lights, lower overall illumination
- [ ] Create a lighting plan -- zone light levels based on an area's function
- [ ] Conform with neighborhood exterior lighting context
- [ ] Specify full cut-off fixtures
- [ ] Plant vegetative cover to minimize light trespass
- [ ] Top-light signs and buildings -- prohibit uplighting

RESOURCE EFFICIENCY

- [ ] Specify energy-efficient lamps
- [ ] Specify long-lasting, low-mercury fluorescent lamps or mercury-free lamp alternatives such as LEDs (low-emitting diodes)

OPERATIONS

- [ ] Adjust light fixture angle during scheduled maintenance
- [ ] Install a mechanical or astrological timer
- [ ] Install motion sensors where appropriate
- [ ] Have safe collection areas for recycling used lamps, especially fluorescent and other lamps containing mercury

NIGHT SKY FREE FROM LIGHT POLLUTION
IMAGE COURTESY OF INTERNATIONAL DARK SKY ASSOCIATION

*Note: Refer to Chapter 2 for tables showing the overlap between Green Urbanism Themes and the LEED and Austin Energy GBP rating systems.

STRATEGIES
DESIGN

UNIFORM LIGHT
INSTALL MORE LIGHTING FIXTURES TO PROVIDE MORE EVEN COVERAGE; SPECIFY LOWER OVER-ALL LIGHT LEVELS.

To minimize glare, lighting designers provide uniform light levels to reduce the difference between illuminated levels in adjacent areas. This strategy provides adequate illumination for safety and navigation while avoiding light pollution problems such as glare.

NEIGHBORHOOD CONTEXT
VARY LIGHTING LEVELS BASED ON AN AREA'S FUNCTION AND LOCATION

Design a property's lighting levels within the context of the surrounding neighborhood. For example, illumination levels at Mueller's commercial areas and the Town Center, which will host much of the development's nighttime activity, will require higher lighting levels than residential areas. See Table 17 for lighting levels identified in LEED for New Construction v2.2.

Commercial Lighting Levels - Safety and navigation lighting using full cut-off fixtures.

Residential Lighting Levels - Targeted safety lighting using full cut-off fixtures.

PLANNING STRATEGIES
INCORPORATE FULL CUT-OFF STREET LIGHTING, VEGETATIVE COVER, AND TOP-LIT SIGNS AND BUILDINGS.

Vegetative cover can be used to reduce the reflective properties of paved surfaces. These site-wide strategies will create uniform but lower illumination levels for the area overall.

Action Items

- ☐ Specify full cut-off fixtures.
- ☐ Top-light signs and buildings.
- ☐ Install vegetative cover to minimize reflective glare.

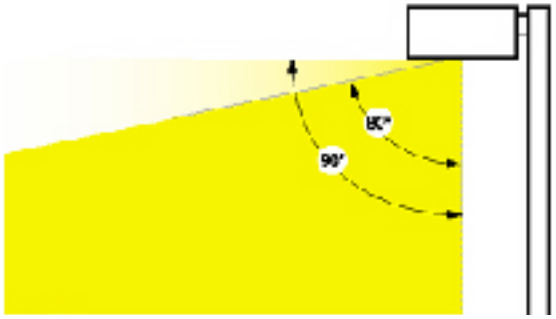
Table 17 – Lighting for Exterior Environments

Environmental Zone Description	Recommended Max Illuminance Levels (fc)
E1: Intrinsically Dark Parks & residential areas where controlling light pollution is a high priority	0.1
E2: Low Ambient Brightness Outer urban & rural residential areas	0.1
E2: Medium Ambient Brightness Urban residential areas	0.2
E3: High Ambient Brightness Urban areas having both residential and commercial use and experiencing high levels of nighttime activity	0.6
Adapted from IESNA RP-33-99	

LIGHT TRESPASS
IMAGE COURTESY OF RAB LIGHTING, WWW.RABWEB.COM

PROPERLY ADJUSTED EXTERIOR LIGHTING
IMAGE COURTESY OF RAB LIGHTING, WWW.RABWEB.COM

ALDRICH STREET WILL MINIMIZE LIGHT POLLUTION
IMAGE COURTESY OF ROMA DESIGN GROUP



FULL CUT-OFF FIXTURE

If the target of a lighting fixture is straight down (0 degrees), a light fixture that illuminates above an angle of 90 degrees fails to light its intended target and the light is wasted. Additionally, illumination between 80 and 90 degrees is too far away to reach the surface. Instead, light directed at angles between 80 and 90 degrees tends to result in glare and unsafe conditions.

IMAGE COURTESY OF ACUITY BRANDS LIGHTING
WWW.ACUITYBRANDSLIGHTING.COM

ENERGY-EFFICIENT LIGHTING

Select energy-efficient, full cut-off lamps that provide appropriate illumination. These lamps can provide adequate light levels while avoiding problems of over-illumination, glare, and uplighting.

ENERGY-EFFICIENT FIXTURES

- ☐ Low-pressure sodium lamps: 18, 35, or 55-watts.
- ☐ Supplement with metal halide or fluorescent lamps to improve color rendering characteristic; LED lamps are increasingly available.

Action Items

- ☐ Specify full cut-off light fixtures.
- ☐ Adjust fixtures during installation and maintenance to direct light towards the intended target.
- ☐ Specify light fixtures with the highest level of energy efficiency.

OPERATIONS

TIMERS & MOTION SENSORS

TIMERS AND MOTION SENSORS CONSERVE ENERGY.

Exterior lighting can be controlled through manual or automatic control. Specify timers or infrared sensors to illuminate particular areas for specific time periods or when movement is detected.

ALIGN LIGHTING FIXTURES

CORRECTLY ALIGN LIGHTING FIXTURES DURING MAINTENANCE FOR PROPER ILLUMINATION.

Re-align lighting fixtures during regular maintenance to accurately target the illumination and avoid glare and light trespass.

LIGHT POLLUTION TERMINOLOGY

LIGHT POLLUTION

OVER-ILLUMINATION OR POORLY CONTROLLED ILLUMINATION OF THE BUILT ENVIRONMENT.

Light pollution results in unsafe conditions, unnecessary energy use, and undesirable brightening of the night sky.

Sources Of Light Pollution

- ☐ Poorly designed and installed streetlights.
- ☐ Outdoor security lights.
- ☐ Uplighted signage.

LIGHT TRESPASS

LIGHT THAT SPILLS BEYOND THE SURFACE FOR WHICH IT IS INTENDED.

Light trespass is also referred to as spill light; it results from poorly designed or inadequately directed lighting fixtures.

Examples Of Light Trespass

- ☐ Streetlighting that illuminates rooftops and the night sky in addition to sidewalks and streets.
- ☐ Security lights that shine into buildings and onto adjacent properties instead of illuminating exteriors or paved areas.

FOOTCANDLES

THE UNIT OF MEASURE OF LIGHT FALLING ON A GIVEN SURFACE, EQUAL TO ONE LUMEN/SF.

Footcandle levels can be dramatically reduced when careful attention is paid to control glare and provide uniform lighting levels.

Tips for Reducing Footcandles

- ☐ Install two light fixtures with lower footcandle levels and good glare control instead of a single light fixture with higher footcandle levels.
- ☐ Design for the lowest lighting levels consistent with the project goals.

FULL CUT-OFF FIXTURE

A FIXTURE WHERE ZERO CANDELA INTENSITY OCCURS AT OR ABOVE A 90° ANGLE.

Additionally, the candela per 1000 lamp lumens does not numerically exceed 100 (10 percent) at or above a vertical angle of 80° above nadir. This applies to all lateral angles around the luminaires.

IMAGE COURTESY OF AUSTIN ENERGY

MERCURY VAPOR

The mercury vapor yard light is a common example of a poorly designed lighting fixture. Almost all of these fixtures are multi-directional and illuminate unintended as well as intended surfaces, resulting in wasted energy and light pollution. These fixtures are typically operated with a photocell sensor to turn them on at dusk and off at dawn. The long nightly operating period results in annual energy costs that are on average double the first cost of the fixture.

The Illuminating Engineering Society of North America (IESNA) recommends installing full cut-off fixtures to minimize light pollution. LEED for New Construction Light Pollution Reduction credit (SSc8) references the IESNA full cut-off standard.

FULLY SHIELDED FIXTURE

A FIXTURE WHERE ZERO LUMINOUS FLUX OCCURS ABOVE THE HORIZONTAL PLANE.

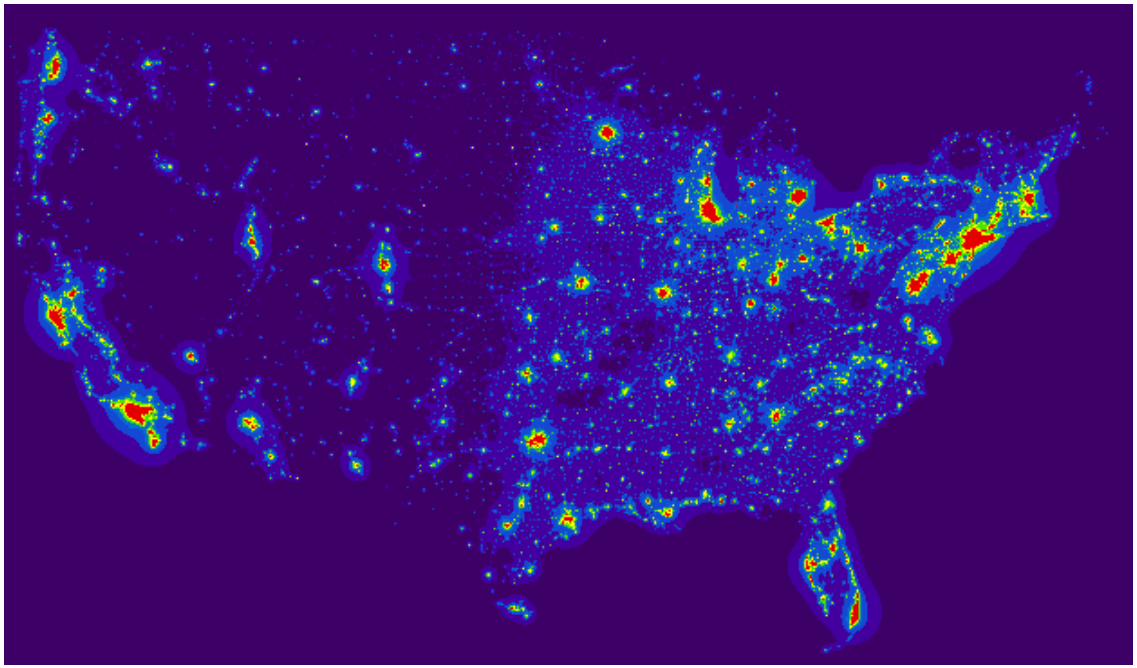
This standard does not regulate incidental reflections from the fixture's supporting pole, brackets, or arms. The International Dark Sky Association administers a Fixture Seal of Approval Program that recommends "fully shielded" fixtures.

GLARE

SIGNIFICANT DIFFERENCE IN LIGHT LEVEL BETWEEN LIGHT SOURCE AND SURROUNDINGS.

This difference in light levels causes discomfort, annoyance, and loss of visibility for drivers and pedestrians. The human eye experiences a process called "transient adaptation" to adjust to extreme differences in light levels. During the period of adjustment, the eye temporarily experiences poor visibility until it acclimates to the new light conditions.

Everyone has experienced glare while driving a car or walking towards a light source when they are temporarily blinded. Glare is not only an annoyance, it creates unsafe conditions for people and makes buildings less secure. Uneven light sources create shadows that can obscure undesirable activities.



DIGITAL IMAGE MODELING LIGHT POLLUTION IN THE U.S., BASED ON 1990 CENSUS DATA.
IMAGE COURTESY OF STEVE ALBERS, NATIONAL OCEANIC & ATMOSPHERIC ASSOCIATION (NOAA), LOCAL ANALYSIS AND PREDICTION SECTION, HTTP://LAPS.FSL.NOAA.GOV/ALBERS/SLIDES/AST/PLACES.HTML

UPLIGHT

ILLUMINATES THE NIGHT SKY RATHER THAN A SURFACE.

The most common form of uplight comes from light fixtures without full cut-off devices. For instance, globe lights illuminate in all directions, wasting the light they emit above the horizontal plane.

Common Targets of Uplighting

- ☐ Signage
- ☐ Building façades
- ☐ Advertising searchlights

CREATING GREEN BUILDINGS

Green building is an integrated, systems design approach that has its roots in the energy crisis of the 1970s. Energy performance was the single defining factor of environmentally responsive buildings during those years. By the late 1980s and early 1990s, the green building community had expanded the practice to include a much broader range of design considerations including water, materials, environmental quality, and human health.

Today, the term 'green building' is synonymous with 'sustainable' and 'high performance' building. The approach incorporates healthy, environmental, socially responsible, and cost effective strategies into building design, construction, and operations.

Green building professionals often combine high-tech with low-tech strategies, such as coupling photovoltaic panels with natural ventilation to create a comfortable and energy efficient indoor environment. Similarly, a rainwater harvesting system enhances the effectiveness of a low-water landscape design, reducing or eliminating the use of potable water.

In this way, 'green building' or 'high performance building' refers to thoughtful, innovative and integrated design strategies that work with nature to maximize building performance and enhance human health and well being.

Mueller offers numerous opportunities to pursue green building. The previous three Green Urbanism signature themes -- Air Quality, Urban Heat Island, and Night Sky -- addressed site and community issues.

The Creating Green Buildings signature theme is divided into five general strategies for designing, constructing, and operating green buildings:

- ☐ Climatic Design
- ☐ Materials Selection
- ☐ Energy & Atmosphere
- ☐ Water
- ☐ Construction & Operations

PUNCH LIST

CLIMATIC DESIGN

- [ ] Building orientation
- [ ] Appropriate shading
- [ ] Natural daylighting
- [ ] Rainwater harvesting

MATERIALS

- [ ] Low-emitting materials
- [ ] Low embodied energy/Carbon-neutral materials
- [ ] Rapidly renewable materials
- [ ] Recycled content materials
- [ ] Salvaged/Refurbished materials
- [ ] Chemical-free termite control

ENERGY & ATMOSPHERE

- [ ] Renewable energy
- [ ] Non-ozone-depleting HVAC refrigerants and fire suppression
- [ ] Combined Heat and Power

WATER

- [ ] Low-flow toilets, faucets, showerheads
- [ ] Reclaimed water
- [ ] Irrigation
- [ ] Xeriscaping and Adaptive Landscaping

CONSTRUCTION & OPERATIONS

- [ ] Construction air quality
- [ ] Construction waste management
- [ ] Tree protection
- [ ] Operations manual
- [ ] Green housekeeping and landscaping
- [ ] Integrated Pest Management
- [ ] Maintenance schedule

IMAGE COURTESY OF AUSTIN ENERGY

*Note: Refer to Chapter 2 for tables showing the overlap between Green Urbanism Themes and the LEED and Austin Energy GBP rating systems.

CLIMATIC DESIGN

By taking advantage of site resources such as solar energy, shade, breeze and rain, a building's heating and cooling loads can be reduced. For example, daylighting can offset electrical lighting costs, and collected rainwater can fulfill some or all of a building's water needs.

BUILDING ORIENTATION

OPTIMAL ORIENTATION ENABLES A BUILDING TO TAKE ADVANTAGE OF SUN, BREEZE AND SHADE.

Summer is the dominant climatic condition in Central Texas. As a result, climatic design in Austin focuses on minimizing solar gain during summer months and maximizing natural ventilation, daylight and shade. Orienting buildings along the east-west axis takes advantage of indirect northern light and the passive solar heating provided by southern light in the winter, while minimizing exposure in summer months to the hot eastern and western sun.

Action Items

- ☐ Orient the building so the sun can provide natural light and heat during winter months.
- ☐ Orient the building so shade cools the building and prevents direct solar gain from entering the in summer months.
- ☐ Orient the building so breezes provide natural ventilation and moderate temperatures during summer months.

See page 44 for a description of the Texas dogtrot design, which takes advantage of Central Texas breezes.

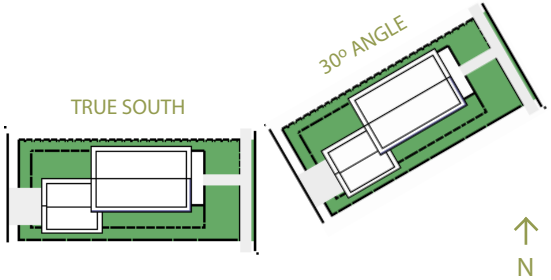
SHADE

PLACE SHADE ON THE BUILDING'S EAST, SOUTH AND WEST FACADES.

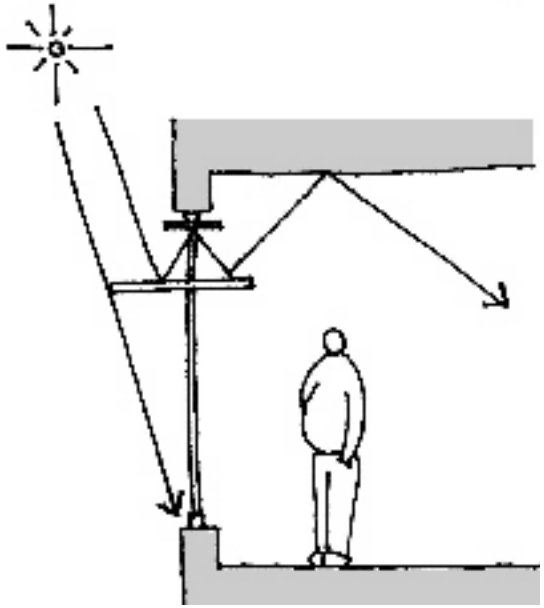
Shade is one of the most effective strategies to temper the hot summer sun.

Action Items

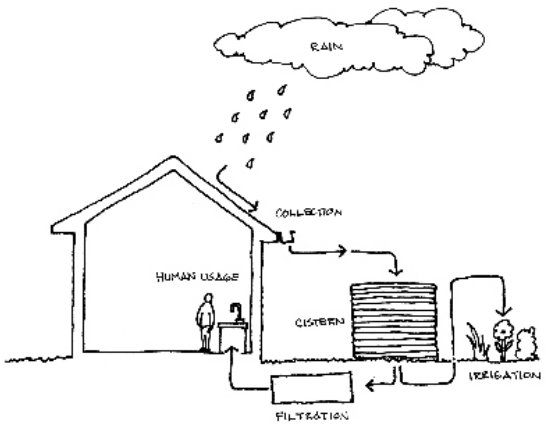
- ☐ Arcades and trellises.
- ☐ Landscape plants and trees.
- ☐ Interior and exterior shade devices.
- ☐ Building overhangs.



TO MAXIMIZE BREEZE, DAYLIGHTING, AND PHOTOVOLTAIC COLLECTION, AND TO MINIMIZE HEAT GAIN, A DETACHED DWELLING SHOULD BE ORIENTED WITHIN 30 DEGREES OF TRUE SOUTH.
IMAGE COURTESY OF RICH MACMATH



PROPERLY DESIGNED DAYLIGHTING REDUCES GLARE AND HEAT GAIN WHILE PROJECTING DIFFUSE DAYLIGHT DEEP INTO A BUILDING'S INTERIOR.
IMAGE COURTESY OF DAN OVERBEY



RAINWATER HARVESTING LIFECYLE.
IMAGE COURTESY OF DAN OVERBEY.

THE DOGTROT THAT SEPARATES THE OFFICE SPACE FROM THE RESIDENTIAL SIDE OF THE UT/CMPBS SOLAR DECATHLON BUILDING COOLS BOTH SIDES OF THE BUILDING.
IMAGE COURTESY OF THE CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS

TEXAS DOGTROT

Designed to take advantage of prevailing breezes, the classic Texas Dogtrot floorplan provides for an open breezeway or 'dogtrot' in the center of the building for the air to pass through, providing cooling breezes to the building's interior spaces.

DAYLIGHTING

DAYLIGHTING USES SUNLIGHT TO ILLUMINATE INTERIOR SPACES.

Properly designed natural daylighting systems reduce energy use and heat gain from electric lighting fixtures.

Action Items

- ☐ Maximize north-facing windows.
- ☐ Design room for daylight to enter from at least two sides.
- ☐ Position glazing high on the wall to minimize heat gain and glare.
- ☐ Install interior and exterior light shelves to bounce light deep into interior spaces.
- ☐ Have light-colored interior walls and ceilings to reflect light.

RAINWATER HARVESTING

CAPTURE AND STORE RAINWATER ON-SITE TO OFFSET RELIANCE ON MUNICIPALLY-TREATED POTABLE WATER.

The Austin area receives on average 32 inches of rain per year. Capturing rainwater for exterior and indoor uses is an historic practice in Central Texas that has gained popularity in recent years.

Rainwater may be captured in barrels or cisterns, underground storage tanks, or detention ponds. When used as 'graywater' for non-potable uses such as irrigation, clothes washing, and toilet flushing, the captured rainwater passes through a particulate filter prior to use. Further filtration and purification is advised for rainwater that needs to meet potable water standards, such as for drinking and cooking.

Action Items

- ☐ Determine the available collection area (typically a roof or parking surface).
- ☐ Multiply the collection area by Austin's average annual rainfall (32 in.) to determine storage requirements.
- ☐ Determine annual water demand to right-size the storage containers.

Rules of Thumb

- ☐ One square foot of roof area results in 100 gallons of water collected per inch of rain.
- ☐ One gallon of storage costs about $1 of system cost.

MATERIALS

Look for a combination of the following attributes when specifying green building materials:

- ☐ Non-toxic, low-emitting
- ☐ Low embodied energy
- ☐ Renewable resources
- ☐ Sustainably harvested wood
- ☐ High recycled content
- ☐ Recyclable, reusable, biodegradable
- ☐ Long-lasting
- ☐ Regionally sourced/manufactured
- ☐ Low-maintenance
- ☐ Avoid toxic chemicals

LOW-EMITTING

SPECIFY LOW-EMITTING MATERIALS TO IMPROVE AIR QUALITY.

Specifying low-emitting materials with no or low VOCs (volatile organic compounds) creates conditions for healthy indoor and outdoor air, and can also reduce formation of ground level ozone (smog). See Low Emitting Materials tables on page 27 for further information.

RAPIDLY RENEWABLE

SPECIFY MATERIALS WITH A MAXIMUM 10 YEAR GROWTH-HARVEST CYCLE.

Rapidly renewable materials such as cork, bamboo, cotton, straw, and natural linoleum have regeneration cycles that can limit some impacts associated with growth and harvesting practices. Rapidly renewable materials are biodegradable, and often require less energy to manufacture than non-rapidly renewable materials.

Strawbale construction takes advantage of a rapidly renewable material readily available in Texas. Straw, a by-product of grain production, is insulative (R-value) and appropriate for both structural and non-structural applications. Other uses of straw-based materials, including as a replacement for engineered wood products, are cost-competitive and meet or exceed typical performance requirements.

Table 18
Examples of Rapidly Renewable Materials

Building Material	Example
Flooring	Bamboo Natural linoleum Cork Wool carpeting Natural fiber rugs
Panels and Partitions	Sunflower seed Bamboo Straw
Cabinetry and Casework	Wheatboard Strawboard Soybean composite Bamboo
Insulation	Strawbale Cotton Soy-based foam

LOW EMBODIED ENERGY

AVOID MATERIALS REQUIRING ENERGY-INTENSIVE MANUFACTURING PRACTICES AND THAT ARE TRANSPORTED LONG DISTANCES.

Materials with high embodied energy are associated with significant CO_2 releases, a consequence of burning fossil fuels such as coal and natural gas to generate electricity for manufacturing. CO_2 releases are significant contributors to global climate change. Similarly, reducing transportation distances reduces CO_2 and other air emissions.

FLY ASH CEMENT - LOW EMBODIED ENERGY

The process of manufacturing Portland cement – a key ingredient in standard concrete mixes typically representing from 10% to 15% of raw materials – is energy intensive responsible for about 3% to 6% of global carbon dioxide (CO_2) emissions, a precursor of global warming. Substituting fly ash (a by-product from coal-burning power plants) for a portion of the cement content lowers embodied energy and CO_2 generation, while utilizing an abundant waste product. Many ready-mix concrete suppliers in Austin provide high volume fly ash concrete mixes, in the range of 25% to 40% and even higher.

In addition to specifying materials with low-embodied energy, some green projects offset CO_2 emissions associated with materials manufacturing, transportation, and building construction through operations practices -- such as on-site renewable energy sources, planting trees, green roofs, and passive heating and cooling.

Table 19 – Local Certified Wood Suppliers

Company	City/Phone	Products	Required Notification	Other Information
Austin Lumber Company	Austin 512/476-5534 www.austinlumbercompany.com	Lumber, MDF/HDF/LDF, Panel Products, Plywood		Deposit Required
Brazos Forest Products	Austin 512/443-0777 www.brazosforestproducts.com	Industrial hardwood lumber; plywood	Free next day delivery, orders must be in by 3 pm	$300 minimum
Dixie Plywood	San Antonio 210/662-6220	Douglas Fir; majority of wood sourced in Oregon	Variable (4-8 weeks)	Wholesale only, must have an account with company
Home Depot	Austin various locations www.homedepot.com	Varies by store	Next day delivery, orders must be in by 3pm	$49 per delivery within 15 mile radius of the store
Texas Redwood, Inc.	Austin 512/385-5334 lumbermax.com	Plywood in stock, access to lumber with advanced order	Next day delivery	$50 delivery fee to Austin area
Roddis Lumber & Veneer Co.	San Antonio 210/226-1426	Framing Lumber; Construction grade plywood; all sizes of dimensional lumber	Delivers to Austin; 6-8 weeks lead time	

FSC CERTIFIED WOOD

SUPPORT SUSTAINABLY MANAGED FORESTS BY SPECIFYING FSC CERTIFIED WOOD.

Forest Stewardship Council (FSC) is an international network that promotes environmentally appropriate, socially beneficial, and economically viable management of the world's forests.

Both LEED and AEGBP recognize FSC as the reference standard for wood-related credits. While FSC does not certify forest operations or manufacturers, it accredits certification organizations aligned with FSC's policies and standards.

An FSC Chain of Custody certificate ensures compliance with FSC standards, from extraction of raw materials from the forest through to final product manufacture. See Table 19 for certified wood sources in the Austin area.

THE COPPER USED TO WRAP THE AUSTIN CITY HALL AND CREATE THE "STINGER" HAS 82% RECYCLED CONTENT.

IMAGE COURTESY OF JODY HORTON, CITY OF AUSTIN

RECYCLED CONTENT

CONSERVE NATURAL RESOURCES AND SPECIFY MATERIALS WITH HIGH RECYCLED CONTENT.

Recycled-content paper, glass, rubber, plastic, wood, and other materials are increasingly available in a variety of building products. Target products with high post-consumer recycled content. These materials have been reclaimed from the consumer waste stream rather than from the factory floor (referred to as post-industrial or pre-consumer recycled content).

Table 20 – Examples of Recycled-Content Building Products

Building Product	Recycled Content
Road base	Glass, concrete, asphalt
Cement	Fly ash
Fiberglass insulation	Glass
Cellulose insulation	Newsprint
Cotton insulation	Cotton, denim
Carpet	Plastic, nylon fiber
Steel framing	Steel
Plastic lumber	Plastic, recycled wood
Clay brick	Bottom ash, fly ash, brick
Composite panels	Wood fiber
Gypsum Wallboard	Synthetic Gypsum, recycled kraft paper backing

SALVAGED/REFURBISHED

CONSERVE NATURAL RESOURCES AND SAVE MONEY BY REUSING EXISTING PRODUCTS AND MATERIALS.

While it is tempting to outfit new buildings with brand new furniture and fixtures, an increasing number of suppliers offer lightly used products at substantially discounted prices. This is particularly true for office furniture such as chairs, desks, cubicles, tables, and shelving. Using salvaged or refurbished building products diverts these items from the waste stream and lowers the demand for new building products.

Table 21 – Salvaged Materials Resources

Recycling Service Provider	Materials Collected
Austin Habitat for Humanity Re-Store 478-2165 310 Comal Street Austin, Texas 78702 www.re-store.com	Lumber, Tiles, Hardware, Stoves, Toilets, etc.
Used Building Materials Association 877-221-8262 www.ubma.org	Various Note: Membership organization

ENERGY & ATMOSPHERE

Mechanical equipment represents one of the most complex systems within a building. Innovative mechanical design can be an additional challenge in hot, humid climates such as Austin. Designers are encouraged to combine climatic design principles with tools such as energy modeling software to estimate cooling and heating loads and to properly size mechanical equipment. Buildings consume 48% of energy produced and account for half of greenhouse gas emissions in the U.S. Concerns about climate change have led to a sense of urgency to create energy efficient and carbon neutral buildings.

ENERGY EFFICIENCY

COMPLY WITH ASHRAE STANDARD 90.1-2004 AS A FIRST STEP TO CONSERVE ENERGY.

LEED requires compliance with the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Energy Standard 90.1-2004. For projects registered after June 26, 2007, LEED requires a minimum of two points for EA credit 1, equivalent to a 14% energy reduction in new buildings. Austin Energy's GBP requires a 15% improvement over the same standard.

Action Items

- ☐ Minimize HVAC load by optimizing the building envelope performance.
- ☐ Use ASHRAE 90.1-2004 lighting tables to guide lamp purchasing.
- ☐ Consider daylighting strategies and daylighting controls, and target accent lighting.
- ☐ Right-size HVAC equipment to correspond to building size.
- ☐ Pursue applicable local, state, and federal rebates (see Chapter 5).

IMAGE COURTESY OF AUSTIN ENERGY.

Table 22
Energy Performance Modeling Tools

	Tool	Website/Information
☐	E-Quest	freeware located on http://doe2.com
☐	Energy-10 v.1.7	www.psic.org/store/e10_reqsup.htm
☐	Trane/Trace 700	www.trane.com/Commercial/DNA/View.aspx?i=1136
☐	DOE-2	use database or numerous graphical interfaces (http://doe2.com)

INSTALLING PHOTOVOLTAIC PANELS
IMAGE COURTESY OF AUSTIN ENERGY

ENERGY STAR®

The highest energy users in residential buildings are the furnace, water heater, and air conditioning units. The U.S. Environmental Protection Agency's Energy Star program provides guidance for selecting appropriate equipment. Energy Star rated equipment carries a yellow Energy Guide label that provides a comparison between similar products. Other energy consuming appliances are also labeled with the Energy Star logo including refrigerators, dishwashers, ovens, washing machines and dryers, office equipment, and entertainment equipment. Selecting products with the Energy Star label and choosing those with the best energy performance based on the Energy Star label information is a simple way for homeowners to save on utility costs over the lifetime of these appliances.

ENERGY STAR - www.energystar.gov

RENEWABLE ENERGY

LOWER DEPENDENCE ON ENERGY FROM THE GRID BY INSTALLING RENEWABLE ENERGY INFRASTRUCTURE.

Incorporate renewable energy sources such as photovoltaics and solar water heating systems into the building design. Austin Energy, the leading solar energy utility in the nation, offers rebates for incorporating both strategies into commercial and residential projects. See Chapter 5 for available rebates and incentives.

Solar Water Heaters

With about 300 sunny days per year, Austin is well-suited for solar water heater technology. Depending on the size and type of unit installed, some units can effectively fulfill all of a building's hot water needs.

Install a passive system with integrated roof-mounted tanks that either provides pre-heated water or bypasses supplemental gas or electric water heaters. Integrated units that combine collection area and storage tank are low maintenance models and should not require drain-down for freeze protection in Austin's moderate climate. See Chapter 5 for information on available rebates and incentives.

OCCUPANCY SENSORS

OCCUPANCY SENSORS TURN LIGHTS OFF AFTER A DESIGNATED TIME INTERVAL WHEN A SPACE IS UNOCCUPIED.

Occupancy (motion) sensors are inexpensive devices that can easily be installed for indoor and outdoor applications. A study by the California Energy Commission estimated that typical energy savings from installed occupancy sensors range from 35-45%.

Consider calibrating the occupancy sensors with daylight sensors to dim and brighten lights in response to available daylight.

Recommended Rooms for Occupancy Sensor Installations

- ☐ Conference rooms
- ☐ Bathrooms
- ☐ Closets/storage
- ☐ Private offices

IMAGE COURTESY OF AUSTIN ENERGY

AUSTIN ENERGY'S GREENCHOICE®

Austin Energy (AE) customers can choose electricity generated from clean, renewable sources. The green power that flows into the AE grid reduces pollution and curbs reliance on non-renewable fuels that can experience volatile price swings. GreenChoice is one of the most successful utility-sponsored green power programs in the nation with over 665 million kWh in subscriptions as of June, 2008.

PROGRAM DETAILS - AE receives green power from wind turbines located on King Mountain in west Texas and from Sweetwater near Abilene in north central Texas. AE also receives electricity from several solar installations and three landfill gas projects in Austin and San Antonio.

SUBSCRIPTION INFORMATION - As of June 2008, the program is available for new subscribers. Renewable energy is available for the fixed rate of 5.5 cents per kWh. For the average residential customer consuming 1,000 kWhs per month, this would increase utility bills by about $18.50/month.

CONTACT INFORMATION -
http://www.austinenergy.com/Energy Efficiency/Programs/Green Choice/

(512) 974-7548
E-MAIL - green.choice@austinenergy.com

RENEWABLE ENERGY CREDITS

OFFSET CO_2 EMISSIONS BY PURCHASING RENEWABLE ENERGY CREDITS.

Consumers without access to utility-provided green energy can purchase renewable energy credits by signing up with a renewable energy provider. Each credit purchased ensures 100 kWhs of green energy will be added to the electrical grid. While the renewable energy purchased will not directly power the individual's energy demand, the renewable energy credits offset CO_2 releases, increase consumer demand and encourage development of more renewable energy sources.

Table 23
Texas Renewable Energy Credit Providers

Provider	Website/Information	Rate
Green Mountain Energy	www.greenmountainenergy.com/carbon_offsets.shtml Calculate your carbon footprint to offset your carbon emissions.	$14.00 per metric ton of CO2.
Sterling Planet	www.sterlingplanet.com sign up online, minimum credits: 1,000 kWh ($16/month. Opportunity to pick renewable source but not location.	1.6 cents per kWh

NON-OZONE DEPLETING REFRIGERANTS/ FIRE SUPPRESSANTS

MITIGATE OZONE DEPLETION BY AVOIDING CFC/HCFC REFRIGERANTS.

Some chemicals used for refrigerants and fire suppression contribute to stratospheric ozone depletion. These include CFCs, HCFCs, and Halons. Ozone-friendly alternative products are available for most HVAC and fire suppression applications. Substitute CFCs with non-ozone depleting HFCs. Substitutions for halons are carbon dioxide, water, powders, and foams.

Table 24 – Relative Atmospheric Impacts of Common Refrigerants and Fire Suppressing Chemicals

Chemical Type	Ozone Depletion Potential	Global Warming Potential
CFCs	Moderate	Very High
HCFCs	Low	Low to Moderate
HFCs	Low	Low to Moderate
Halons	Very High	Low

Source: Thomas, Randall, ed. (1999) Environmental Design: An Introduction for Architects and Engineers, second edition, New York: E & FN Spon, 2006.

IMAGE COURTESY OF AUSTIN ENERGY

Table 25
1992 National Energy Policy Act Fixture Ratings

Fixture	EPACT Maximum Flow Requirement
Water Closets (GPF)	1.6
Urinals (GPF)	1.0
Showerheads (GPM)	2.5
Faucets (GPF)	2.5
Replacement Aerators (GPM)	2.5
Metering Faucets (cal/CY)	0.25

WATER

Curbing reliance on potable water relieves demand on water treatment plants, keeping water rates in check and saving money, energy and natural resources.

LOW-FLOW PLUMBING FIXTURES

CONSERVE WATER AND SAVE MONEY BY INSTALLING LOW-FLOW PLUMBING FIXTURES.

Commercial and multi-family projects seeking Austin Energy's GBP certification are required to reduce water consumption by 15% over the federal standards displayed in Table 25.

Low-flow water closets, faucets, showerheads, and urinals are now standard for commercial and residential buildings. See Rebate Section in Chapter 5 for information on free low-flow fixtures from the City of Austin.

GRAYWATER REUSE

ELIMINATE CITY WATER USE IN CERTAIN APPLICATIONS BY REQUESTING A PERMIT FROM TRAVIS COUNTY FOR GRAYWATER REUSE.

Graywater systems are approved for use in Texas in residential, commercial, and industrial applications as a result of House Bill 2661. This bill amended the Texas Water Code and went into effect January 6, 2005.

A permit is not required for domestic graywater systems that do not exceed 400 gallons of graywater use per day, subject to the following criteria:

- ☐ The graywater comes from a private residence.
- ☐ The graywater is used on-site for gardening, composting, waste treatment and disposal system.
- ☐ The graywater is stored in clearly marked tanks identified as non-potable water.
- ☐ The graywater runs through pipes clearly labeled as non-potable water.
- ☐ The graywater does not result in forming ponds or pools.

For More Information: See Texas Commission on Environmental Quality Chapter 285 - On-Site Sewage Facilities:
www.tceq.state.tx.us/assets/public/legal/rules/rules/pdflib/285h.pdf

Contacts
City of Austin Water Conservation Program
www.ci.austin.tx.us/watercon, 974-2199

IMAGE COURTESY OF AUSTIN ENERGY

EFFICIENT IRRIGATION

CONSERVE WATER AND SAVE MONEY BY INSTALLING EFFICIENT IRRIGATION SYSTEMS.

In Austin, outdoor irrigation systems represent about 50% of daytime water use and 35% of total annual water use. Efficient and well-planned irrigation systems reduce run-off and erosion, and prevent water contaminated by pollutants on the roads from entering streams and aquifer recharge zones.

Action Items

- ☐ Follow City of Austin Watering Restrictions
- ☐ Utilize irrigation system evaluations (see Chapter 5 for info on City of Austin free irrigation audits)
- ☐ Ensure irrigation system is designed to only water landscape, not sidewalks or roads.

XERISCAPING AND NATIVE AND ADAPTED LANDSCAPING

REDUCE IRRIGATION NEEDS BY PLANTING NATIVE AND ADAPTED PLANTS.

Landscapes at Mueller designed with native and adapted plant species, appropriate for Austin's climate and rainfall pattern, can reduce irrigation needs. For a list of non-invasive, native and adapted plant species, please see the Accepted Plant List in the Mueller Design Book.

For irrigation related rebates available from the City of Austin, refer to Chapter 5.

Table 26
Restricted Invasive Species

Plant Name:	
Running Bamboo	Chinese Photinia
Cats Claw Vine	Common Privet
Chinaberry	Pyracantha
Chinese Parasol Tree	Russian Olive
Chinese Pistache	Salt Cedar Tamarisk
Chinese Tallow	Tree of Heaven
Giant Cane	Vitex (agnus-castus)
Paper Mulberry	Elephant Ear
Kudzu	English Ivy
Wax Leaf Ligustrum	Holly Fern
Japanese Ligustrum	Japanese Honeysuckle
Mimosa (Non-Native)	Wisteria
Nandina (berrying varieties)	Vinca (perennial varieties)
White Mulberry	

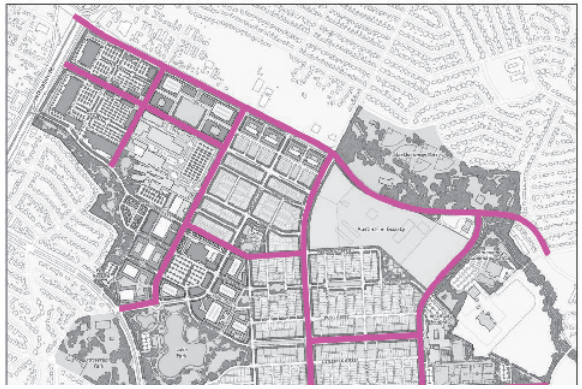
Source: City of Austin Native and Adapted Plant Guide
http://www.ci.austin.tx.us/growgreen/pg_pdfs.htm

WATER CONSERVATION TASK FORCE

On May 3, 2007 the Austin City Council unanimously approved the recommendations put forward by the Water Conservation Task Force. The Recommendations are structured to reduce current water use by 1% for each of the next 10 years, resulting in a projected water savings of 32 million gallons of water per day by 2017.

CITY OF AUSTIN WATER CONSERVATION TASK FORCE RECOMMENDATIONS:

- ☐ Expand Water Use Management Ordinance to limit frequency, timing and method of outdoor watering.
- ☐ Require new residential irrigation systems to meet design standards and permitting requirements.
- ☐ Create additional design requirements for commercial irrigation systems and landscapes.
- ☐ Establish soil-depth requirements for new landscapes.
- ☐ Require homebuilders to offer a WaterWise landscape option.
- ☐ Require regular analysis of automatic irrigation systems for properties of 1 acre or more.
- ☐ Require water audits for high-volume residential customers.



RECLAIMED WATER (PURPLE PIPE) SYSTEM
MAP OF THE PURPLE PIPE SYSTEM THAT RUNS THROUGH MUELLER.
SOURCE: AUSTIN ENERGY

RECLAIMED WATER (PURPLE PIPE)

To conserve water resources by lessening dependence on municipally-treated potable water for non-potable uses, the Austin Water Utility is designing and constructing a "purple pipe" reclaimed water system, with networks distributed throughout the City. Mueller is one of the first areas to receive reclaimed water service. Mains have been installed along 51st Street and in the commercial and multifamily areas in Mueller's Northwest Quadrant and Town Center. Eventually, mains will be installed in all of Mueller's major roads. The reclaimed water system will serve as the primary source of irrigation water for Mueller's public open spaces and streetscapes, and potentially for residential and commercial uses throughout the development.

CONTACT - Austin Water Utility, 972-0074
MORE INFORMATION - www.ci.austin.tx.us/wri/waterreuse.htm

CHP SYSTEM
MAP OF THE AREAS AT MUELLER THAT WILL HAVE ACCESS TO CHP CHILLED WATER CONNECTIONS. THE DARK SQUARE, DELL CHILDREN'S HOSPITAL, WILL ALSO HAVE ACCESS TO PREMIUM POWER AND HOT WATER.
SOURCE: AUSTIN ENERGY

CENTRALIZED COMBINED HEAT AND POWER SYSTEM (CCHP)

Austin Energy has constructed an efficient on-site energy system located adjacent to the Dell Children's Medical Center of Central Texas. This CCHP plant produces electricity, steam and chilled water to meet the needs of the hospital, and provides extra chilled water capacity to meet the air conditioning and de-humidification needs of commercial and multi-family developments in Mueller's Northwest Quadrant and the Town Center. Chilled water is distributed via underground pipes installed along Barbara Jordan Boulevard and Mueller Boulevard.

By operating at more than 60 percent efficiency, the Centralized Combined Heat and Power system substantial reduces greenhouse gas emissions (i.e., carbon dioxide) and other chemical and particulate emissions associated with fossil fuel combustion, and provides price stability in a volatile energy market. For buildings connected to the system, this positive environmental impact contributes to achieving LEED and Austin Energy Green Building points. The CCHP plant provides superior reliability when compared to conventional energy systems and is monitored on a continuous basis. Connection to the CCHP will allow new construction projects to downsize mechanical infrastructure by eliminating the building specific installed mechanical equipment.

CONTACT - Austin Energy District Energy Services, 322-6559

CONSTRUCTION & OPERATIONS

The long-term success of green buildings relies on diligent construction and operations procedures. A building designed with green features will realize long-term performance benefits only if it is properly built and operated.

During construction, implement strategies to maintain a safe and healthy building site:

- ☐ Air quality monitoring and protection program.
- ☐ Tree protection program.
- ☐ Construction recycling program.
- ☐ Site boundary restrictions.

CONSTRUCTION WASTE MANAGEMENT

DIVERT WASTE FROM LANDFILLS BY RECYCLING CONSTRUCTION DEBRIS

Diverting construction waste from landfills conserves natural resources, extends landfill life and can reduce costs.

Recycle Construction Debris:

- ☐ Concrete
- ☐ Cardboard
- ☐ Clean wood
- ☐ Gypsum wallboard
- ☐ Steel
- ☐ Aluminum
- ☐ Paint

Construction Waste Recycling Plan

- ☐ Establish clear goals early in project.
- ☐ AEGBP requires a minimum 50% construction recycling by weight for Commercial Projects and 40% by weight for Residential Projects. Examples of greater than 80% construction recycling have been achieved in Austin.
- ☐ Establish a relationship with recycling service providers and/or markets for recyclables.
- ☐ Establish a clearly marked area for recycling containers.
- ☐ Train construction workers on which materials to recycle and how to sort them.
- ☐ Contact City of Austin Waste Reduction Assistance Program (WRAP) at 974-9727.

Table 27 – Construction Site Recycling Services in the Austin Area

Site Recycling Manager	Contact Information
A & R Demolition Dell Valle, TX	243-0512
Texas Disposal Systems www.texasdisposal.com Creedmoor, TX	421-1300 tdscorporate@texasdisposal.com
TRIAD Building Maintenance	Adrian Neely 385-1189, triadbm@aol.com
The Institution Recycling Network (IRN) www.ir-network.com	J.D. Porter 626-8512 or 708-9872 jporter@ir-network.com
River City Roll-Offs	David Rodwald 453-4646 darconstruction@austin.rr.com
Timberlake Excavation San Marcos, TX	Danny Davis 393-3478 or 801-7720 dannydavis74@yahoo.com
Tri-Recycling www.trirecycling.com	Gerry Acuña 329-0172, trirecycle@aol.com
Waste Management	Russell Salmon 272-6214

ZERO WASTE

ON WORLD ENVIRONMENT DAY 2005 IN SAN FRANCISCO, AUSTIN MAYOR WILL WYNN SIGNED ONTO THE URBAN ENVIRONMENTAL ACCORDS, COMMITTING TO ACTIONS TO BECOME A SUSTAINABLE CITY. THE ACCORDS INCLUDE A FOCUS ON A GLOBAL ZERO WASTE INITIATIVE, DIRECTING CITIES TO TAKE SEVERAL ACTIONS, INCLUDING THE FOLLOWING:

☐ Action 4: Establish a policy to achieve zero waste to landfill and incinerators by 2040.

☐ Action 5: Adopt a citywide law that reduces the use of a disposable, toxic, or non-renewable product category by at least 50% in seven years.

☐ Action 6: Implement "user-friendly" recycling and composting programs, with the goal of reducing solid waste disposal to landfill and incineration by 20% per capita in seven years.

The City of Austin is in the process of finalizing a study commissioned by Gary Liss & Associates providing recommendations for a Zero Waste Master Plan to fulfill the City's commitment to the Environmental Accords Zero Waste Goals.

OPERATIONS MANUAL

PROVIDE A ROADMAP TO OPERATE A GREEN BUILDING.

Often, the team that designs and constructs the building is not the ultimate building occupant or owner. While the design team may understand how the building is intended to be operated, the owner and occupants may not. To assist in the handoff, it is essential for the project delivery team to create a manual that describes building features and provides instructions on how to operate and maintain the building over time.

CHEMICAL-FREE TERMITE CONTROL

USE CHEMICAL-FREE TERMITE CONTROL TO AVOID CONTAMINATING THE BUILDING SITE.

Chemical-free termite control is a proven technology, available in Austin, that eliminates reliance on some of the most toxic chemicals applied to a building site. One chemical-free method employs a fine-mesh stainless steel barrier effective at deterring subterranean termites from entering a building and damaging wood and other materials vulnerable to termite infestations. Such barrier methods come with a multi-year warranty, and should eliminate the need to pre-treat a site or to apply termiticides during the building's operation. As a healthy and effective

Table 28 – Storage Space Required for a Recycling Program (Commercial Buildings)

Commercial Office Building Square Footage (sf)	Minimum Recycling Area (sf)
0 to 5,000	1 lb/100 sf/day
5,001 to 15,000	7 lbs/100 sf/day
50,001 to 100,000	2 lbs/100 sf/day
100,001 to 200,000	3 lbs/100 sf/day
	1.5 lbs/meal

Source: LEED-NC Version 2.1 Reference Guide, US Green Building Council

Table 29
Recycling Services in the Austin Area

Recycling Service Provider	Materials Collected
TRI Recycling Gerry Acuña 329-0172 www.trirecycling.com	Paper, Cardboard, Aluminum, Metals, Glass, Plastic
Balcones Recycling 2416 East 6th Street Austin, TX 472-6200 www.balconesresources.com	Cardboard, Mixed Office Paper

TERMINOLOGY

CLIMATE CHANGE

The burning of fossil fuels over the last 100 years has altered atmospheric composition. These changes have increased global temperature and led to the melting of polar ice caps and rising sea levels, threatening ecosystems, wildlife and future human generations.

CARBON NEUTRAL

Buildings that use zero energy derived from energy sources that emit greenhouse gases. Such buildings rely on passive solar and thermally-effective envelopes, and on renewable energy, non-fossil fuel based sources.

CLIMATIC DESIGN

The optimization of building orientation, envelope, thermal and comfort strategies to take advantage of local climate and site conditions. Climatic design offsets reliance on energy and water resources, reduces utility costs, and creates healthier environments.

EMBODIED ENERGY

The amount of energy used to extract, manufacture, transport, and construct a building material. Cement and aluminum are commonly used building materials that can have high embodied energy. Strip mining, Portland cement manufacture and virgin aluminum ore processing are energy intensive. Recycled aluminum in products such as curtain walls reduces the embodied energy of the end product by an average of 80%.

RECYCLED CONTENT

Post-Consumer - Contains content that was recycled after passing through the consumer market, such as: aluminum cans converted into aluminum siding; old newsprint converted into cellulose insulation.

Pre-Consumer - Products with content that was recycled after passing through the manufacturing process: such as, wood chips converted into medium density fiberboard and plywood.

RENEWABLE ENERGY

Sustainable energy sources such as solar, wind, biomass, and hydro power that reduce dependence on fossil fuels and reduce associated emissions.

PERSISTENT BIOACCUMULATIVE TOXIC CHEMICALS (PBTs)

TOXIC CHEMICALS THAT DO NOT BREAK DOWN AND ACCUMULATE IN ORGANISMS HIGH IN THE FOOD CHAIN.

The U.S. EPA identifies PBTs as chemicals of concern because they are highly toxic, do not break down easily in the environment, and accumulate in living tissues. Among the PBTs most closely associated with building materials are lead (e.g., used as a stabilizer in some PVC products, roof flashing, and in some solders); dioxin (e.g., released as a by-product of vinyl chloride monomer manufacture — a feedstock of PVC — and released as a consequence of accidental or intentional combustion of PVC and other halogenated compounds); and mercury (e.g., used in electrical switches, thermostats and relays and fluorescent lamps). EPA's concern about PBTs is echoed by the Stockholm Convention on Persistent Organic Pollutants (POPs), a global treaty signed by 151 nations including the U.S. protecting human health and the environment from persistent organic pollutants. Because of the significant and prolonged environmental and human health burdens, PBTs represent priority chemicals to avoid in building materials, when more benign alternatives of equal or better performance are available and competitively priced.

CHAPTER 4 - GREEN BUILDING CASE STUDIES

LEED OFFICE

MUELLER VISITOR CENTER

AUSTIN, TEXAS

The Mueller Visitor Center is a striking example of the aesthetic and environmental attributes of green building. In addition to creating an energy efficient building constructed with a rich palette of recycled and re-used materials, the master developer, Catellus Development Group, and the City of Austin were committed to ensure that the Mueller Vistor Center exemplify environmental stewardship by reusing 80% of the building from the Signature Freight building at the former Mueller airport. The building team restored an on-site natural habitat through native and adapted landscaping and brownfield remediation. The site also encourages alternate transportation methods, supporting bicyclists by providing a changing and shower room and offering parking designated for alternative-fuel vehicles.

MUELLER VISITOR CENTER -- EXTERIOR
IMAGE COURTESY OF ANDY MATTERN

RATING: LEED Gold Certified; LEED-NC version 2.1
Four-Star Austin Energy Commercial Green Building Program

PROJECT TEAM

PRINCIPAL ARCHITECT: Milton Hime, Studio 8 Architects
MECHANICAL ENGINEER: Bay and Associates
LANDSCAPE ARCHITECT: Coleman and Associates
CIVIL ENGINEER: Bury and Partners
LEED CONSULTANT: Studio 8 Architects

GREEN BUILDING- The design team implemented methods to mitigate urban heat island effects and light pollution. A light, reflective roof prevents solar heat absorption and helps keep the building cool. The building's sidewalks and drives are concrete, a more reflective material than asphalt, reducing heat absorption into the ground and mitigating the heat island effect. Trees and outdoor shading on hard surfaces cool outdoor spaces. The design team used no uplighting on the property. Shielding devices on all exterior light fixtures in the parking lot protect the night sky, and controlled downlights keep all pathways safely lit. By using low-flow fixtures, dual-flush toilets and 1/8 pint per flush urinals, the building boasts a 60% water reduction compared to Code. Reclaimed water from the Purple Pipe is used for irrigation and in toilets.

MATERIALS - Keeping a strong focus on conserving natural resources and supporting the regional economy, 65% of materials (Divisions 2-10, based on cost) were sourced and manufactured within 500 miles of the site, and 30% contained recycled content. The limestone used for exterior cladding and interior accent was sourced in Texas. The building features FSC-certified wood soffits and bamboo, a rapidly renewable material, for many surfaces and veneers. The design team utilized carpets and rubber flooring made with recycled content; all materials used are low-VOC and urea-formaldehyde free, ensuring a healthy indoor environment. Sixty-four percent of waste (by weight) was recycled and diverted from landfills.

ENERGY EFFICIENCY - Mueller Visitor Center is 22% more energy efficient than a standard building of its type. It features a gearless elevator that is 60% more efficient than a typical elevator, and works without a pump. The gearless elevator runs on momentum and uses an electric motor located in the elevator shaft (as opposed to a separate engine room). This saves space, reducing building footprint while running more efficiently and without oil. The DDC (direct digital control) allows the mechanical system to be controlled digitally to monitor and maximize performance of the heating and cooling systems. Energy-efficient lighting is also employed, exceeding average lighting efficiency by 10% as compared to Code. Reduced lighting needs in the offices offset the higher lighting levels in the lobby space. All regularly occupied spaces benefit from natural daylighting and views to the outside.

MUELLER VISITOR CENTER -- INTERIOR
IMAGE COURTESY OF ANDY MATTERN

TABLE 30 -
MUELLER VISITOR CENTER STRATEGIES AS THEY RELATE TO MUELLER GREEN URBANISM THEMES

STRATEGY	PROTECTING AIR QUALITY	MITIGATING URBAN HEAT ISLAND EFFECTS	PROTECTING THE NIGHT SKY	CREATING GREEN BUILDINGS
Water	X			X
Materials	X	X		X
Energy Efficiency	X	X		X
Landscaping	X	X	X	X

FOR MORE INFORMATION

Steven Meyers — Studio 8 Architects — 473-8989

USGBC'S LEED CHECKLIST

MUELLER VISITOR CENTER

GOLD - LEED for NEW CONSTRUCTION version 2.1

	Description	Possible Points	Achieved Points
SUSTAINABLE SITES			**11**
Prereq 1	Erosion & Sedimentation Control	Y	Y
Credit 1	Site Selection	1	1
Credit 2	Urban Redevelopment	1	
Credit 3	Brownfield Redevelopment	1	1
Credit 4	Alternative Transportation	4	3
Credit 5	Reduced Site Disturbance	2	1
Credit 6	Stormwater Management	2	2
Credit 7	Heat Island Effect	2	2
Credit 8	Light Pollution Reduction	1	1
WATER EFFICIENCY			**5**
Credit 1	Water Efficient Landscaping	2	2
Credit 2	Innovative Wastetwater Technologies	1	1
Credit 3	Water Use Reduction	2	2
ENERGY & ATMOSPHERE			**6**
Prereq 1	Fundamental Bldg Sys Commissioning	Y	Y
Prereq 2	Minimum Energy Performance	Y	Y
Prereq 3	CFC Reduction in HVAC&R Equipment	Y	Y
Credit 1	Optimize Energy Performance	10	5
Credit 2	Renewable Energy	3	
Credit 3	Additional Commissioning	1	
Credit 4	Ozone Depletion	1	1
Credit 5	Measurement & Verification	1	
Credit 6	Green Power	1	

	Description	Possible Points	Achieved Points
MATERIALS & RESOURCES			**7**
Prereq 1	Storage & Collection of Recyclables	Y	Y
Credit 1	Building Reuse	3	1
Credit 2	Construction Waste Management	2	1
Credit 3	Resource Reuse	2	
Credit 4	Recycled Content	2	2
Credit 5	Local/Regional Materials	2	2
Credit 6	Rapidly Renewable Materials	1	
Credit 7	Certified Wood	1	1
INDOOR ENVIRONMENTAL QUALITY			**7**
Prereq 1	Minimum IAQ Performance	Y	Y
Prereq 2	Environmental Tobacco Smoke Control	Y	Y
Credit 1	Carbon Dioxide Monitoring	1	
Credit 2	Ventilation Effectiveness	1	1
Credit 3	Construction IAQ Management Plan	2	
Credit 4	Low-Emitting Materials	4	2
Credit 5	Indoor Chemical & Pollutant Source Control	1	
Credit 6	Controllability of Systems	2	1
Credit 7	Thermal Comfort	2	2
Credit 8	Daylight & Views	2	1
INNOVATION & DESIGN PROCESS			**5**
Credit 1	Innovation in Design	4	4
Credit 2	LEED Accredited Professional	1	1
	TOTAL	69	41

GBP RETAIL

H-E-B STORE #28

5800 WEST SLAUGHTER LANE
AUSTIN, TX 78749

H-E-B STORE #28
IMAGE COURTESY OF AUSTIN ENERGY

RATING: Four-Star Austin Energy Commercial Green Building Program

PROJECT TEAM

SENIOR ARCHITECT: Christopher Sutton
CONSULTING ARCHITECT: Selser Schaefer Architects
CONSULTING ENGINEERS: Clive Samuels and Associates
SUSTAINABILITY DESIGN TEAM LEADER: Sheila W. Morales
GREEN CONSULTANT: The Green Team, Inc.

The location of H-E-B's 4-Star Austin Energy Green Building rated store in Escarpment Village, off Slaughter Lane in southwest Austin, pursued many strategies necessary to make it environmentally sensitive. Required to comply with a stringent set of green building Restrictive Covenants associated with the project's location on an environmentally sensitive site, the design team was especially conscious of impact on the surrounding land and watershed.

The H-E-B team was able to create an energy-efficient building that conserves water and other natural resources. The developers, Stratus Properties with Trammel Crow, completed an Environmental Site Assessment, and kept site disturbance within 40 feet of the building's perimeter. In addition, designers created a stormwater management plan created to control flow rate and pollution levels by collecting and filtering stormwater run-off. The result is a building that exceeds code in many areas and responds to the environmentally sensitive site.

H-E-B STORE #28 INTERIOR
IMAGE COURTESY OF AUSTIN ENERGY

TABLE 31 -
H-E-B STORE #28 STRATEGIES AS THEY RELATE TO MUELLER GREEN URBANISM THEMES

STRATEGY	PROTECTING AIR QUALITY	MITIGATING URBAN HEAT ISLAND EFFECTS	PROTECTING THE NIGHT SKY	CREATING GREEN BUILDINGS
Water		X		X
Energy Efficiency	X	X		X
Materials Selection	X	X		X
Waste Minimization	X			X

FOR MORE INFORMATION
Sheila Morales H-E-B Architect (210) 938-8668

APPROACH - The key to this successful, green H-E-B was an integrative planning process. The design team was open to explore strategies to enhance performance, protect the environment, seek out appropriate materials and spend more time and resources at the front end of the design process to reap long-term savings over the life of the building.

GREEN BUILDING - The H-E-B team developed numerous innovative green building approaches. Ninety-two percent of the roof is reflective, EPA Energy Star-compliant single-ply roofing, exceeding Austin Energy GBP's credit threshold. Reflective roofing helps mitigate urban heat islands and reduce absorption of energy into the building, keeping the interior cooler and reducing air conditioning loads. The designers also implemented an innovative system that captures wasted heat escaping from the refrigerator compressor, using it to heat water and offset 65-75% of fuel that would otherwise be needed to heat water. To ensure effective use of the building's green features and provide information on site-specific environmental issues, H-E-B created an in-store education program to inform employees and customers.

ENERGY AND WATER- H-E-B is the 4th largest subscriber to Austin Energy's GreenChoice program. Efficient energy systems result in 9% annual electrical savings compared to similarly sized H-E-B stores. All office spaces have views to the outside, providing ample natural daylight. Sensors installed in the building dim the lighting once sufficient daylight fills the store. The design team chose a high-efficiency HVAC system and ensured that one-third of the site's impervious cover is shaded, tempering outdoor and indoor temperatures. Energy modeling demonstrates that the building performs 45% better than a building designed to code without green features. Outdoor water use was reduced 60% by incorporating native plants in the landscaping and installing a high efficiency irrigation system using reclaimed 'purple pipe' water. Indoor pllumbing fixtures are low-flow, further reducing water use and associated wastewater.

MATERIALS - The H-E-B design team focused on using regional, recycled-content, and low-VOC materials. The composite wood and insulation materials contain no added urea-formaldehyde. All adhesives, sealants and flooring are low-VOC, enhancing indoor air quality. More than half of the total materials (by cost) used in construction were manufactured in Texas, and 66% were manufactured within 500 miles of the site. In addition, by employing well-planned construction practices, 80% of construction debris was diverted from landfills.

AUSTIN ENERGY GBP'S CHECKLIST

H-E-B STORE #28

FOUR-STAR GBP COMMERCIAL RATING

	Description	Possible Points	Achieved Points
TEAM			**3**
Credit 1	Integrated Design Team	1	1
Credit 2	Goal Setting	2	2
SUSTAINABLE SITES			**7**
Credit 1	Site Selection	3	
Credit 2	Urban Development	3	
Credit 3	Brownfield Redevelopment	1	
Credit 4	Environmental Site Assessment	1	1
Credit 5	Alternative Transportation	4	
Credit 6	Reduced Site Disturbance	3	2
Credit 7	Site Impervious Surfaces to Reduce Heat Island	1	1
Credit 8	Light Pollution Reduction	1	1
Credit 9	Integrated Pest Management	1	1
Credit 10	Outdoor Environmental Quality	1	1
ENERGY			**13**
Credit 1	Additional Energy Use Efficiency	10	10
Credit 2	Green Energy	1	1
Credit 3	Renewables	2	
Credit 4	Additional Commissioning	2	2
Credit 5	District Cooling	1	
WATER EFFICIENCY			**4**
Credit 1	Irrigation Water Minimization	3	1
Credit 2	Indoor Potable Water Use Reduction	4	2
Credit 3	Stormwater Management	1	1

	Description	Possible Points	Achieved Points
INDOOR ENVIRONMENTAL QUALITY			**11**
Credit 1	Indoor Air Quality Monitoring	1	1
Credit 2	Indoor Chemical and Pollutant Sources	1	
Credit 3	Daylighting	1	1
Credit 4	Views to Outside	1	1
Credit 5	Thermal Comfort	1	1
Credit 6	Individual Controllability	1	
Credit 7	Low-Emitting Materials	4	4
Credit 8	Moisture Prevention	1	1
Credit 9	Acoustic Quality	1	
Credit 10	Outdoor Pollutant Sources	1	1
MATERIALS & RESOURCES			**7**
Credit 1	Additional Construction Waste Managment	1	1
Credit 2	Building Reuse	3	
Credit 3	Salvaged Materials	2	
Credit 4	Recycled Content	2	2
Credit 5	Rapidly Renewable Materials	1	
Credit 6	Regionally Sourced Materials	2	2
Credit 7	Certified Wood	1	
Credit 8	Low VOC Exterior Materials	2	2
INNOVATION			**10**
	TOTAL	74	55

GBP RETAIL

CHIPOTLE MEXICAN GRILL

801 CONGRESS AVENUE
AUSTIN, TX 78701

The Chipotle Mexican Grill restaurant received a Four-Star rating from Austin Energy's Commercial Green Building Program for their store at 801 Congress Avenue. The company's motivation for green building is an extension of their overall mission of providing "food with integrity." Chipotle is committed to providing their customers with healthy food and encouraging their suppliers to follow sustainable business practices. The company continues to develop and add to their green building approach with each new store. While they recognize the marketing opportunities associated with these measures, they maintain a low profile with their green building strategies and focus on the long-term economic benefits, improved construction process, and enhanced performance that their efforts create.

CHIPOTLE EXTERIOR
IMAGE COURTESY OF ANDY KARVONEN

RATING: Four-Star
Austin Energy Commercial Green Building Program

PROJECT TEAM

ARCHITECT: Stephan Sahayda, Project Manager -- Glavan Feher Architects
MECHANICAL ENGINEER: Richard T. Jones, PE – National Engineering
DESIGNER: Scott L. Shippey - Chipotle Mexican Grill
CONTRACTOR: James Farrier – Ridgeway Construction

CHIPOTLE: INTERIOR
IMAGE COURTESY OF ANDY KARVONEN

TABLE 32 -
CHIPOTLE STRATEGIES AS THEY RELATE TO MUELLER GREEN URBANISM THEMES

STRATEGY	PROTECTING AIR QUALITY	MITIGATING URBAN HEAT ISLAND EFFECTS	PROTECTING THE NIGHT SKY	CREATING GREEN BUILDINGS
Building Reuse		X		X
Energy Efficiency	X			X
Waste Minimization	X			X

FOR MORE INFORMATION

Scott L. Shippey
Manager, Research & Development
Chipotle Mexican Grill
sshippey@chipotle.com
512-358-9647

APPROACH - The Chipotle approach to green building is focused on lowering life cycle costs for store operations and creating a dining atmosphere that is healthy and enjoyable for both customers and employees.

BUILDING RE-USE - For the Congress Avenue store, the most significant strategy adopted by the design team was to reuse a historic downtown commercial space. The location is beneficial because of the high volume of pedestrian traffic in the area, and encourages increased activity in the revitalized downtown district. Building reuse also avoids the appropriation of undeveloped land for new construction and produces less construction waste.

ENERGY EFFICIENCY - The store includes high efficiency lamps and fixtures that exceed the energy code requirements by 30%. A high-efficiency water heater was specified to exceed energy code requirements by 20%. The high-efficiency HVAC system exceeds energy code requirements by 15%. These energy efficient strategies have resulted in an estimated monthly savings of $3,000 on utility bills. The additional capital cost for these items will be recouped with operational savings in less than three years. The restaurant is enrolled in Austin Energy's GreenChoice program that sources electricity from renewable sources such as wind, biogas, and solar energy facilities. While subscribers to this program pay slightly higher rates for electricity, their rates are locked in for 10 years.

WASTE MINIMIZATION - Waste minimization was a strategy pursued by the design and construction teams. The design team specified a low-finish interior to reduce the demand for new construction materials and minimize maintenance needs. The design team substituted conventional dropped ceilings and carpeted floors with an exposed ceiling and durable counters and work surfaces. They also restored the original tile floor, a move which kept an estimated 30 cubic yards of material from the landfill. Other low-maintenance, recycled-content finishes used in the project include stainless steel, galvanized steel, and corrugated metal. During the construction process, the construction team implemented a construction recycling program that diverted 100 cubic yards of solid waste from disposal in a landfill.

AUSTIN COMMERCIAL GBP CHECKLIST

CHIPOTLE MEXICAN GRILL

FOUR-STAR GBP COMMERCIAL RATING

		Points Available	Points Awarded
I	**Pre-Design:**		
	General Objectives for Team	10	10
	General Objectives for Building	6	6
	Objectives for Site Selection	20	12
	Objectives for Site	12	3
	Objectives for Energy	22	20
	Objectives for Water	15	0
	Objectives for Materials	4	4
	Objectives for Solid Waste	6	6
II	**Schematic Design:**		
	Objectives for Team	17	17
	Objectives for Building	9	6
	Objectives for Site	13	5
	Objectives for Energy	92	85
	Objectives for Water Conservation	10	3
	Objectives for Material Selection	4	4
	Objectives for Waste Management	4	4

NOTE: THE AUSTIN COMMERCIAL GBP CHECKLIST WAS UPDATED AFTER THE CHIPOTLE STORE ACHIEVED A FOUR-STAR RATING. SEE APPENDIX 1 FOR CURRENT CHECKLIST.

		Points Available	Points Awarded
III	**Design Development:**		
	General Objectives for Team	26	26
	Objectives for Building	21	18
	Objectives for Site	20	20
	Objectives for Energy	44	37
	Objectives for Indoor Environmental Quality	22	21
	Objectives for Water	15	5
	Objectives for Materials Specification	30	30
	Objectives for Waste Management	9	9
IV	**Construction Management:**		
	General Objectives for Team	11	9
	Objectives for Indoor Environmental Quality	1	0
	Objectives for Site	8	0
	Objectives for Commissioning	11	11
	Objectives for Water	1	1
	Objectives for Solid Waste	9	5
	TOTAL	472	377

GBP RETAIL

AUSTIN FEDERAL CREDIT UNION

1900 WOODWARD STREET
AUSTIN, TX 78741

AUSTIN FEDERAL CREDIT UNION -- FACADE
IMAGE COURTESY OF ANDY KARVONEN

RATING: Two-Star
Austin Commercial Green Building Program

PROJECT TEAM

ARCHITECT: Clark Mente Architects
MECHANICAL ENGINEER: KWR Services
LANDSCAPE ARCHITECT: Tom Brown
CONTRACTOR: Austin Canyon Corporation

The Austin Federal Credit Union received a Two-Star rating from the City of Austin's Commercial Green Building Program for their retail/office building at 1900 Woodward Street in Southeast Austin. The 6,450 square foot building, completed in 2003, provides office space for 16 employees and a retail service area for walk-up and drive-through credit union members.

Credit Union Vice President Phil Mitchell characterizes the company's priorities when designing the new building. "Our building provides an excellent working environment for our staff. It's energy efficient and incorporates a considerable amount of natural lighting and energy conservation measures. The natural lighting was extremely important to us as we were coming from a working environment without windows."

APPROACH - The owner was interested in incorporating sustainable strategies in the building to take advantage of long-term operational savings that could be passed along to credit union members, to attract new members by adopting the values of Austin's environmentally-conscious population, and to increase employee productivity through a more pleasant work environment.

CLIMATIC DESIGN - The principal green building strategy pursued by the design team was climatic design. The building design follows an east-west orientation to minimize heat gain during the hot Austin summer. The building shell has minimal glazing areas on the east and west facades to reduce heat gain due to low sun angles in the morning and afternoon. Large overhangs and a clerestory were incorporated into the design to allow natural light into the building while avoiding solar gain. The roof is a white reflective membrane that reduces solar gain, extends the roof lifetime, and reduces urban heat island effects.

ENERGY - After focusing on solar design, the team selected energy-efficient building equipment to further enhance energy performance. The mechanical engineer specified high-efficiency HVAC equipment to improve energy performance by 15% and on-demand water heaters that reduce water heating costs by 10%.

The architect supplemented the natural lighting design with high-efficiency lighting fixtures and a continuous variable dimming system to automatically adjust interior lighting levels. The dimming system maintains consistent light levels throughout the day and provides a pleasant interior space for employees and customers alike. Overall, the team's energy efficiency measures resulted in a building design that exceeds Texas Energy Code requirements by an estimated 38%.

GREEN BUILDING - In addition to the focus on energy efficiency, the project delivery team implemented a number of other green building strategies. These include a landscape design that utilizes native plants to eliminate the need for irrigation, the use of recycled-content building materials, and implementation of a waste recycling program during construction to reduce the volume of solid waste going to the landfill.

AUSTIN FEDERAL CREDIT UNION: INTERIOR
IMAGE COURTESY OF ANDY KARVONEN

TABLE 33 -
AUSTIN FEDERAL CREDIT UNION STRATEGIES AS THEY RELATE TO MUELLER GREEN URBANISM THEMES

STRATEGY	PROTECTING AIR QUALITY	MITIGATING URBAN HEAT ISLAND EFFECTS	PROTECTING THE NIGHT SKY	CREATING GREEN BUILDINGS
Climatic Design	X	X		X
Energy Efficiency	X			X
Low-Water Landscaping				X
Recycled Content Materials				X
Waste Minimization	X			X

FOR MORE INFORMATION

Clark Mente
Ibby Sowell

Clark Mente Architects, Inc.

804-0609

AUSTIN COMMERCIAL GBP CHECKLIST

AUSTIN FEDERAL CREDIT UNION

TWO-STAR GBP COMMERCIAL RATING

		Points Available	Points Awarded
I	**Pre-Design:**		
	General Objectives for Team	10	9
	General Objectives for Building	6	5
	Objectives for Site Selection	16	16
	Objectives for Site	12	12
	Objectives for Energy	20	13
	Objectives for Water	13	9
	Objectives for Materials	4	4
	Objectives for Solid Waste	6	6
II	**Schematic Design:**		
	Objectives for Team	17	13
	Objectives for Building	9	3
	Objectives for Site	9	6
	Objectives for Energy	92	64
	Objectives for Water Conservation	7	4
	Objectives for Material Selection	4	4
	Objectives for Waste Management	4	4

NOTE: THE AUSTIN COMMERCIAL GBP CHECKLIST WAS UPDATED AFTER THE CHIPOTLE STORE ACHIEVED A FOUR-STAR RATING. SEE APPENDIX 1 FOR CURRENT CHECKLIST.

		Points Available	Points Awarded
III	**Design Development:**		
	General Objectives for Team	26	20
	Objectives for Building	21	12
	Objectives for Site	20	11
	Objectives for Energy	44	36
	Objectives for Indoor Environmental Quality	22	22
	Objectives for Water	11	7
	Objectives for Materials Specification	30	15
	Objectives for Waste Management	9	9
IV	**Construction Management:**		
	General Objectives for Team	11	11
	Objectives for Site	8	8
	Objectives for Commissioning	11	11
	Objectives for Water	1	1
	Objectives for Solid Waste	4	4
	TOTAL	447	339

LEED COMMERCIAL

FAR SOUTHEAST EMS STATION #28

5905 NUCKOLS CROSSING ROAD
AUSTIN, TEXAS

In August 2005, the Far Southeast Emergency Response Station #28 in Austin, Texas achieved LEED for New Construction v2.1 Gold certification from the U.S. Green Building Council. The facility, one of the busiest emergency response stations in the region, is owned and operated by the City of Austin. The City adopted sustainable design strategies for the project to provide an optimal working environment to the emergency response teams, to reflect the community's commitment to environmental protection, and to reduce operating costs over the building's lifetime.

FAR SOUTHEAST EMS STATION #28
IMAGE COURTESY OF © PETER TATA

RATING: LEED Gold
LEED-NC version 2.1

PROJECT TEAM

ARCHITECT: Betty Trent, AIA, Architecture Plus
MECHANICAL ENGINEER: Tom Green & Co. Engineers
LANDSCAPE ARCHITECT: Winterowd Associates, Inc.
CIVIL ENGINEER: Raymond Chan & Associates
INTERIORS: Laurie Smith Design Associates
LEED CONSULTANT: Center for Maximum Potential Building Systems

FAR SOUTHEAST EMS STATION #28
IMAGE COURTESY OF © PETER TATA

TABLE 34 -
FAR SOUTHEAST EMS STATION #28 STRATEGIES AS THEY RELATE TO MUELLER GREEN URBANISM THEMES

STRATEGY	PROTECTING AIR QUALITY	MITIGATING URBAN HEAT ISLAND EFFECTS	PROTECTING THE NIGHT SKY	CREATING GREEN BUILDINGS
Indoor Air Quality	X			X
Materials	X	X		X
Energy and Water	X		X	X

FOR MORE INFORMATION

Betty Trent — Architecture + Plus — 478-0970

APPROACH - To optimize the indoor environment for the emergency response teams, the project delivery team created a design that provides all occupied rooms with optimal daylight and views. Mechanical systems allow for occupant control of temperature, ventilation, and lighting to suit their preferences.

INDOOR AIR QUALITY - Superior indoor air quality was achieved by specifying all carpet, paints, adhesives, and sealants to contain low or no VOCs. In addition, all composite wood products used in the project were specified to contain no added urea-formaldehyde. Finally, a carbon dioxide monitoring system was installed to ensure adequate ventilation at all times. To maintain enhanced indoor air quality, the maintenance staff has adopted green housekeeping procedures that eliminate the use of toxic cleaning chemicals.

MATERIALS - The design team minimized the building's environmental burdens by specifying building materials that included recycled content or rapidly renewable feedstocks. In addition, an estimated 31% of all building materials were manufactured within 500 miles of the site. To reduce urban heat island effects, the roof surface was covered with a white, reflective Energy Star-compliant roofing membrane and high-albedo concrete was specified for sidewalks, parking lots, and driveways.

ENERGY & WATER -An exterior lighting plan was followed to avoid light trespass beyond the property boundaries while high-efficiency fixtures provide adequate outdoor illumination and avoid illuminating the night sky. The mechanical engineer designed a rainwater harvesting system to direct stormwater runoff from the roof for use in landscape irrigation. This strategy not only reduces water bills for irrigation but also minimizes stormwater volumes leaving the site. The building was designed to emphasize cost savings over the long-term. The architect specified highly efficient wall and roof insulation, high performance glazing, and energy efficient lighting and HVAC equipment. In total, these efforts resulted in building energy performance that exceeds ASHRAE/IESNA Standard 90.1-1999 by 41%. All mechanical systems were also commissioned to ensure that they will operate as designed. Finally, a 30% reduction in water use was achieved by specifying Energy Star-rated dishwashers and clothes washers as well as low-flow lavatories and showers.

USGBC'S LEED CHECKLIST

FAR SOUTHEAST EMS STATION #28

GOLD - LEED-NC version 2.1

	Description	Possible Points	Achieved Points
SUSTAINABLE SITES			**9**
Prereq 1	Erosion & Sedimentation Control	Y	Y
Credit 1	Site Selection	1	1
Credit 2	Urban Redevelopment	1	
Credit 3	Brownfield Redevelopment	1	
Credit 4	Alternative Transportation	4	4
Credit 5	Reduced Site Disturbance	2	
Credit 6	Stormwater Management	2	2
Credit 7	Heat Island Effect	2	1
Credit 8	Light Pollution Reduction	1	1
WATER EFFICIENCY			**4**
Credit 1	Water Efficient Landscaping	2	2
Credit 2	Innovative Wastetwater Technologies	1	
Credit 3	Water Use Reduction	2	2
ENERGY & ATMOSPHERE			**7**
Prereq 1	Fundamental Bldg Systems Commissioning	Y	Y
Prereq 2	Minimum Energy Performance	Y	Y
Prereq 3	CFC Reduction in HVAC&R Equipment	Y	Y
Credit 1	Optimize Energy Performance	10	6
Credit 2	Renewable Energy	3	
Credit 3	Additional Commissioning	1	
Credit 4	Ozone Depletion	1	1
Credit 5	Measurement & Verification	1	
Credit 6	Green Power	1	

	Description	Possible Points	Achieved Points
MATERIALS & RESOURCES			**4**
Prereq 1	Storage & Collection of Recyclables	Y	Y
Credit 1	Building Reuse	3	
Credit 2	Construction Waste Management	2	
Credit 3	Resource Reuse	2	
Credit 4	Recycled Content	2	2
Credit 5	Local/Regional Materials	2	2
Credit 6	Rapidly Renewable Materials	1	
Credit 7	Certified Wood	1	
INDOOR ENVIRONMENTAL QUALITY			**12**
Prereq 1	Minimum IAQ Performance	Y	Y
Prereq 2	Environmental Tobacco Smoke Control	Y	Y
Credit 1	Carbon Dioxide Monitoring	1	1
Credit 2	Ventilation Effectiveness	1	
Credit 3	Construction IAQ Management Plan	2	
Credit 4	Low-Emitting Materials	4	4
Credit 5	Indoor Chemical & Pollutant Source Control	1	1
Credit 6	Controllability of Systems	2	2
Credit 7	Thermal Comfort	2	2
Credit 8	Daylight & Views	2	2
INNOVATION & DESIGN PROCESS			**3**
Credit 1	Innovation in Design	4	2
Credit 2	LEED Accredited Professional	1	1
	TOTAL	69	39

GBP MIXED-USE

SALTILLO LOFTS: EXTERIOR
IMAGE COURTESY OF AUSTIN ENERGY

THE SALTILLO LOFTS

1601 E. 5th St.
Austin, TX 78702

The Saltillo Lofts received a Three-Star rating from Austin Energy's Green Building Multi-Famly residential program. With 29 loft units and floor space for eight commercial offices, the building design provides in-fill housing to families and individuals seeking to live close to downtown and near multiple bus routes and a future rail line. By redeveloping a site previously containing a warehouse, the Saltillo Lofts create housing and business opportunities in a close-in urban neighborhood, preserving land and resources by not contributing to urban sprawl.

RATING: Three-Star
Austin Energy Multi-Family Residential Green Building Program

PROJECT TEAM

ARCHITECT: Hailey | Johnson Architects, LLP
MECHANICAL-ELECTRICAL-PLUMBING ENGINEER: Encotech Engineering Consultants, Inc.
BUILDING OWNER: Constructive Ventures, Inc.
CONTRACTOR: Bailey Elliot Construction

APPROACH - The Saltillo Lofts provide affordable, environmentally friendly and healthy housing in a prime urban location. Energy efficiency complements affordability by lowering utility and electricity bills, while the central location reduces reliance on cars. By selecting appropriate materials, the Lofts achieve enhanced indoor air quality, creating a healthy indoor environment. As a high-density urban in-fill project replete with a community garden, the Saltillo Lofts create walkable neighborhood ambiance on a redeveloped urban lot.

MATERIALS - The designers of Saltillo Lofts promoted healthy living and enhanced indoor air quality by avoiding materials with volatile organic compounds (VOCs). By specifying all hard surfaces for finished flooring, the Lofts offer durable, low-maintenance floors that resist moisture and mildew. The wood flooring was installed with no-VOC adhesives. The building's developers also employed a chemical-free termite control method rather than the more customary initial and periodic applications of toxic termiticides.

ENERGY EFFICIENCY - The Saltillo Lofts' design promotes energy efficiency by reducing heat loss and maximizing opportunities for natural cooling. To minimize heat loss, all ductwork was set inside the thermal envelope. Overhangs provide shade around the building; well-insulated windows with low-E glass were installed. In addition, the designers employed reflective roofs and light colored fiber cement exterior walls with a stucco finish to maximize cool surfaces. All installed appliances are U.S. EPA Energy Star rated; a minimum of two light fixtures use fluorescent lamps, helping residents reduce electricity costs and curbing CO_2 emissions that contribute to global warming.

WASTE AND MATERIAL MINIMIZATION - To prevent waste, the Saltillo Lofts' designers engaged in multiple material reuse and recycling opportunities. Excess construction materials were sold or given to salvage. The Lofts received innovation credits from the Austin Energy Green Building Program for the reuse of old billboard signs for floor protection instead of using new materials. Designers also reused vintage Austin Common Bricks that originally were made from clay excavated from Town Lake. Material reduction strategies included using the structural floor as the finish floor and leaving much of the structure exposed. The Saltillo Lofts also has a recycling center available to all residents.

SALTILLO LOFTS: INTERIOR
IMAGE COURTESY OF VERISTUDIO

TABLE 35 -
SALTILLO LOFTS STRATEGIES AS THEY RELATE TO MUELLER GREEN URBANISM THEMES

STRATEGY	PROTECTING AIR QUALITY	MITIGATING URBAN HEAT ISLAND EFFECTS	PROTECTING THE NIGHT SKY	CREATING GREEN BUILDINGS
Materials	X			X
Waste Minimization	X	X		X
Energy Efficiency	X	X		X
Infill Project	X			X

FOR MORE INFORMATION

Kit Johnson Hailey | Johnson Architects 472-0650

AUSTIN ENERGY GBP'S CHECKLIST

THE SALTILLO LOFTS
THREE-STAR GBP MULTI-FAMILY RATING

Description	Possible Points	Achieved Points
ENERGY		**32**
Design	33	13
Thermal Envelope	19	6
Heating Cooling, Water Heating	39	6
Lighting, Appliances	11	4
Additions		3
MATERIALS		**17**
Design, Structure	13	2
Finish Materials	16	11
Excess Jobsite Resources	12	4
WATER		**10**
Indoor	6	1
Outdoor	27	7
Additions		2

Description	Possible Points	Achieved Points
HEALTH, SAFETY		**14**
Air Distribution & Ventilation	16	3
Chemical Outgassing	16	3
Combustion Gases	5	
Integrated Pest Management	11	8
COMMUNITY		**10**
General	29	10
SITES		**9**
General	21	9
TOTAL	274	92

NOTE: THE AUSTIN MULTI-FAMILY GBP CHECKLIST WAS UPDATED AFTER THE SALTILLO LOFTS ACHIEVED A THREE-STAR RATING. SEE APPENDIX 3 FOR CURRENT CHECKLIST.

GBP HOME

STREETMAN RESIDENCE

2300 TOM MILLER STREET
AUSTIN, TEXAS

Streetman Homes is one of six builders participating in Mueller's first phase of residential development. The Austin-based homebuilder will design and construct 36 houses for this project phase; all are designed to achieve a 5-Star rating under the Austin Energy Residential Green Building Program.

One of the first Streetman houses at Mueller is the 3,510-square foot, 4-bedroom residence at 2300 Tom Miller Street. The project includes innovative design features to reduce long-term maintenance costs while providing a superior living environment for its future occupants.

STREETMANHOME - EXTERIOR
IMAGE COURTESY OF ANDY KARVONEN

RATING: 5-Star
Austin Energy Single-Family Green Building Program

PROJECT TEAM

ARCHITECT: Texas Four
BUILDER/CONTRACTOR: Streetman Homes
ARCHITECT/DESIGNER: Texas Four
MECHANICAL CONTRACTOR: Big Tex HVAC

STREETMAN HOME - LANDSCAPE
IMAGE COURTESY OF ANDY KARVONEN

TABLE 36 -
STREETMAN HOME STRATEGIES AS THEY RELATE TO MUELLER GREEN URBANISM THEMES

STRATEGY	PROTECTING AIR QUALITY	MITIGATING URBAN HEAT ISLAND EFFECTS	PROTECTING THE NIGHT SKY	CREATING GREEN BUILDINGS
Energy Efficiency		X		X
Indoor Air Quality	X			X
Green Site Design	X	X	X	X

FOR MORE INFORMATION

Natalie Roberts, Marketing Manager roberts@streetmanhomes.com 512/329-9966

APPROACH: In the design and construction of their Austin Energy Green Building Single-Family Residential Five-Star houses, Streetman Homes has adopted multiple green building strategies to enhance long-term performance and livability. The following paragraphs summarize some of these strategies related to energy efficiency, indoor air quality, and green site design.

ENERGY EFFICIENCY: The house is designed from the ground up to be energy efficient. An open floorplan creates attractive daylit spaces while taking advantage of passive airflow through cross ventilation and the stack effect. The mechanical system includes two high-efficiency (SEER 14) air conditioning units, a tankless gas water heater, and a 1.7 kW roof-mounted photovoltaic system. The contractor used spray foam insulation and low E2 argon-filled windows to create a tight building envelope and reduce interior conditioning loads. And finally, the house is outfitted with ceiling fans in every room, Energy Star-rated electrical fixtures and appliances, and compact fluorescent lightbulbs.

INDOOR AIR QUALITY: The house was designed and constructed to enhance indoor air quality for its residents. Building materials and finishes were selected with minimal off-gassing characteristics, such as the previously mentioned spray foam insulation as well as low-VOC paints (30 grams/liter VOCs). Hard surface wood flooring was installed throughout the house to prevent buildup of contaminants over time and allow for easy cleaning. And the HVAC system includes a six-inch pleated filter to purify indoor air as it is recirculated through the house.

GREEN SITE DESIGN: The attractive, low-maintenance landscape was carefully designed with drought-tolerant native and non-invasive adapted species well-suited to the Central Texas climate. Streetman followed the City of Austin's Grow Green Plant Guide (available from www.ci.austin.tx.us/growgreen) to guide plant selection. Plants include Texas Sage, Purple Coneflower, Yellow Bells, Twistleaf Yucca, and Mexican Feathergrass. Turf areas were minimized; a Bermuda grass variety was selected to reduce watering and maintenance requirements. Finally, trees were planted on the Boulevard that will eventually grow into a lush street tree canopy to shade the house and reduce the urban heat island effect.

AUSTIN ENERGY GBP'S CHECKLIST

STREETMAN HOME

FIVE-STAR GBP SINGLE-FAMILY RATING 7.2

Required and Choice Measures	Points Available	Points Awarded
Site Selection	19	11
Home Design	76	35
Construction Waste Management	12	3
Building Structure and Enclosure	40	8
Thermal and Moisture Control	34	17
Plumbing and Appliances	33	13

	Points Available	Points Awarded
Mechanical	49	24
Third Party Performance Testing	10	10
Electrical	23	18
Interior Construction and Finishes	30	8
Sitework and Landscaping	35	17
Additions and Innovations	--	1
TOTAL		165

GBP HOME

BENAVIDES RESIDENCE

UNIVERSITY HILLS
AUSTIN, TEXAS

BENAVIDES HOME - EXTERIOR
IMAGE COURTESY OF AUSTIN ENERGY

The Benavides Family wanted to create a home for their children and an elderly relative living with them that excelled in energy efficiency and durability. To accomplish these goals, they worked with Z Works Design Build to create an urban infill home, located in University Hills, that would accommodate a two-bedroom, two-bath house with a one-bedroom, one-bath separate apartment arranged around an interior courtyard.

The 2,000 sq ft. residence, located near public transportation routes, parks and commercial amenities, cost around $145/sq. ft., and includes a home office with a separate entrance, a small studio and a covered porch.

RATING: 5-Star
Austin Energy Single-Family Residential Green Building Program

PROJECT TEAM

ARCHITECT: Z Works Design Build
SOLAR ENERGY SYSTEM: Meridian Energy Systems
SUBCONTRACTOR FOR ICF WALL SYSTEM: PWPS Construction
SUBCONTRACTOR FOR HVAC SYSTEM: Minyard Services
SUBCONTRACTOR FOR SOLAR WATER HEATER: TechSun Solar Water Systems

WATER - The Benavides family conserves water by installing low flush toilets. The family also opted to use xeriscaping methods in their landscape by preserving existing plants, planting native and adapted species and avoiding turf grass. Xeriscaping dramatically reduces irrigation needs. Thinking ahead, they designed a roof with a collection area capable of maintaining a 2,000-3,000 gallon rainwater harvesting system which they plan to install in the future to fulfill the home's irrigation needs.

ENERGY EFFICIENCY - The Benavides home was designed to utilize passive heating/cooling strategies. The house is south facing with a v-shaped courtyard that maximizes breezes through the backyard. Roof overhangs, covered outdoor space and trees saved on-site shade windows and the courtyard. These design strategies reduce load on the efficient 15 SEER HVAC system, located inside the thermal envelope along with all duct work. With insulation in exterior walls and structural insulated panels (SIPs) on the roof, the home's envelope has a high insulation value. In combination, these factors retain cooled air inside the house during summer months and heated air in the house during winter months. The house design also maximizes natural light entering each room while utilizing double-pane, low-E windows to ensure rooms do not heat up from infiltrating sunlight during summer months. Fluorescent lamps, Energy Star-rated appliances and a programmable thermostat ensure the family optimizes energy use. In addition to being exceptionally efficient, the home includes a 3kW solar photovoltaic system on the roof designed to contribute to electrical demand. In addition, the home features a solar water heater that fulfills 100% of the home's hot water needs. The system is projected to pay for itself within five years.

MATERIALS - The design team reduced the use of wood and other natural resources by limiting solid lumber larger than 2x10's and re-using or recycling lumber, and by using concrete and stone rubble, metal scraps, and corrugated cardboard. They also utilized MDF (medium density fiberboard), an engineered wood product designed to reduce reliance on virgin wood resources, for all cabinet faces. The house features concrete countertops and shower walls as well as stained concrete floors, making all surfaces durable and reducing maintenance requirements. The home's exterior walls were built with 10-inch thick insulated concrete forms (ICF), manufactured with 86% recycled content. Interior paints used were low VOC, promoting indoor air quality.

BENAVIDES HOME - INTERIOR
IMAGE COURTESY OF AUSTIN ENERGY

TABLE 37 -
BENAVIDES HOME STRATEGIES AS THEY RELATE TO MUELLER GREEN URBANISM THEMES

STRATEGY	PROTECTING AIR QUALITY	MITIGATING URBAN HEAT ISLAND EFFECTS	PROTECTING THE NIGHT SKY	CREATING GREEN BUILDINGS
Water	X			X
Materials	X			X
Energy	X		X	X

FOR MORE INFORMATION

Zaman, Z Works Design/Build www.zworksdb.com 264-0587

AUSTIN ENERGY GBP'S CHECKLIST

BENAVIDES RESIDENCE

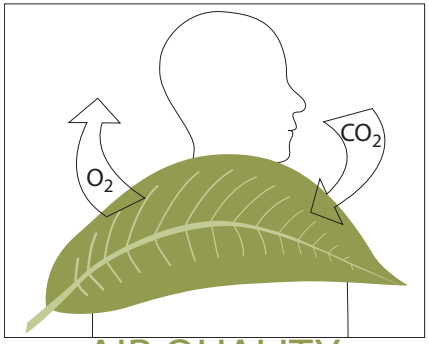
FIVE-STAR GBP SINGLE-FAMILY RATING 7.2

Description	Possible Points	Achieved Points
ENERGY		**99**
Design	44	35
Thermal Envelope	25	18
Heating, Cooling, Water Heating	34	24
Power, Lighting, Appliances	14	14
Additions		8
TESTING		**14**
General	14	14
MATERIALS		**38**
Design, Structure	27	12
Finishes	17	13
Efficient Use and Recycling	9	8
Additions		5
WATER		**21**
Indoor	11	6
Outdoor	26	15

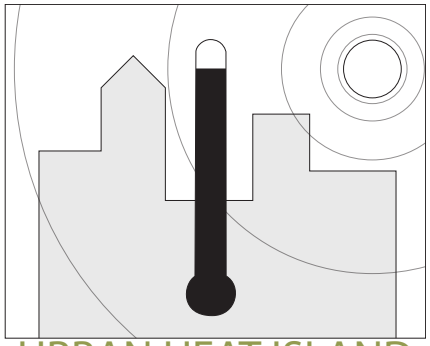
Description	Possible Points	Achieved Points
HEALTH, SAFETY		**41**
Molds, Mites and Fibers	8	8
Humidity & Ventilation	6	2
Mechanical	8	4
Chemical	15	13
Combustion Gases	7	3
Integrated Pest Management	8	8
Age-In-Place, Bath Safety	3	3
COMMUNITY		**28**
Dwelling Unit	11	5
Site or Lot	18	6
Neighborhood	11	11
Additions		6
TOTAL	337	241

NOTE: THE AUSTIN SINGLE-FAMILY GBP CHECKLIST WAS UPDATED AFTER THE BENAVIDES HOME ACHIEVED A FIVE-STAR RATING. SEE APPENDIX 3 FOR CURRENT GBP RATING.

CHAPTER 5 - CITY, STATE AND FEDERAL PROGRAMS, INCENTIVES, AND REBATES



AIR QUALITY



URBAN HEAT ISLAND

NIGHT SKY

GREEN BUILDING

AUSTIN ENERGY

RESIDENTIAL
SINGLE AND MULTI-FAMILY

GENERAL CONTACTS AND INFORMATION

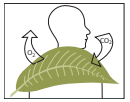
Conservation Information Center - 482-5346

RESIDENTIAL
www.austinenergy.com

COMMERCIAL
Bill Sparks. 505-3663, f: 479-8417

EACH REBATE OR INCENTIVE PROGRAM IS CODED TO A GREEN URBANISM SIGNATURE THEME. REFER TO THE SIGNATURE THEME SECTION FOR MORE INFORMATION ABOUT HOW THE REBATES FIT INTO THE MUELLER GREEN URBANISM THEMES. INCENTIVES ARE GEARED TOWARDS NEW CONSTRUCTION, BUT SOME MAY ALSO BE RELEVANT TO OWNERS OF EXISTING BUILDINGS.

THE REBATE INFORMATION PUBLISHED IN THIS GUIDE IS CURRENT AS OF JUNE 2008. PLEASE CONTACT THE DEPARTMENTS REFERENCED IN EACH SECTION TO VERIFY CURRENT REBATE INFORMATION.

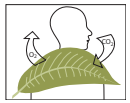


AIR CONDITIONER REBATE

High efficiency air conditioning and heating equipment.

- ☐ Central Split Systems, Packaged Air Conditioners and Heat Pumps (14 SEER/11.5 EER or greater)
- ☐ Window Air Conditioners
- ☐ Solar Water Heaters
- ☐ Heat Pump Water Heaters (all-electric homes only)
- ☐ Heat Recovery Water Heaters (all-electric homes only)

CONTACT - www.austinenergy.com or 482-5346
www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Residential/Air%20Conditioner/index.htm
email: custinfo@austinenergy.com

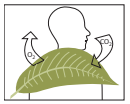


HOME PERFORMANCE WITH ENERGY STAR

Homes more than 10 years old can receive rebates on suggested improvements worth up to $1,575 after a home energy analysis. Rebates on improvements include:

- ☐ Air conditioner or heat pump (14 SEER/11.5 EER or greater)
- ☐ Duct repair and sealing
- ☐ Additional attic insulation
- ☐ Solar screens, window film, and low-E glass
- ☐ Caulking and weather stripping
- ☐ Attic radiant barrier/reflective material

CONTACT - www.austinenergy.com or http://austinenergy.com/Energy%20Efficiency/Tools%20and%20Tips/participatingCompanies.htm for participating companies



SOLAR REBATE PROGRAM

Austin Energy offers $4.50 per watt to offset the cost of a solar photovoltaic electric system. This rebate pays for 45%-75% of the cost of installing a system for a typical residential customer.

CONTACT - Conservation Information Center, 482-5346 or www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Solar%20Rebates/index.htm

COMMERCIAL

COMMERCIAL ENERGY REBATE

Austin Energy offers assistance to businesses wishing to identify and install energy conservation improvements that will reduce peak demand. Rebates are offered in the following technology categories: Air Conditioning, Chillers, Custom Technologies, Energy Recovery Ventilator, Lighting, Motors, New Construction, Reflective Roof, Solar Photolvoltaics, Solar Water Heater, Variable Frequency Drives (VFD), and Window Treatments.

CONTACT - Bill Sparks, 505-3663 or www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Commercial%20Energy/index.htm

SMALL BUSINESS LIGHTING DISCOUNT

Austin Energy offers discounts to retrofit interior lighting systems with high-efficiency fixtures. Use AE's contractor for purchasing and installation. Eligible Austin Energy commercial customers are in two rate classes:

- ☐ E02 (General Service Non-Demand)
- ☐ E06 (General Service, Demand) whose monthly peak demand does not exceed 100kW

CONTACT - Bill Sparks, 505-3663 or www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Small%20Business%20Lighting%20Discount/index.htm

SOLAR REBATE PROGRAM

Austin Energy offers $4.50 per watt to offset the cost of a solar photovoltaic electric system. The solar rebate for a commercial installation is capped at 80% of the invoiced cost up to $100,000.

CONTACT - Conservation Information Center, 482-5346 or www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Solar%20Rebates/index.htm

SOLAR WATER HEATER REBATES

All current Austin Energy residential, commercial and municipal customers are eligible for rebates of $1,500 - $2,000 on purchase/installation of a new Solar Water Heater. Solar water heaters must be SRCC (Solar Rating Certification Corporation) certified and sized for a minimum of a family of four.

Systems that provide 50% of the on-site hot water qualify for a 30% Federal Tax Credit. See Federal Tax Credit info on page 90.

CONTACT - Austin Energy, 482-5346 or www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/Solar%20Rebates/Solar%20Water%20Heater/index.htm

MULTI-FAMILY ENERGY EFFICIENCY REBATE

Owners, developers and property managers of multi-family properties with four or more residential units are eligible for energy efficiency rebates up to $100,000. The buildings must be air-conditioned.

CONTACT - Bill Sparks, 505-3663, http://austinenergy.com/Energy%20Efficiency/Programs/Rebates/Commercial/Multi-Family%20Properties/index.htm
Conservation Information Center, 482-5346

COA WATER

RESIDENTIAL
SINGLE AND MULTI-FAMILY

GENERAL CONTACTS AND INFORMATION

CITY OF AUSTIN WATER CONSERVATION - 974-2199, http://www.ci.austin.tx.us/watercon

AUSTIN ENERGY - 974-7827, http://www.austinenergy.com/Energy%20Efficiency/Programs/Rebates/index.htm

EACH REBATE OR INCENTIVE PROGRAM IS CODED TO A GREEN URBANISM SIGNATURE THEME. REFER TO THE SIGNATURE THEME SECTION FOR MORE INFORMATION ABOUT HOW THE REBATES FIT INTO THE MUELLER GREEN URBANISM THEMES. INCENTIVES ARE GEARED TOWARDS NEW CONSTRUCTION, BUT SOME MAY ALSO BE RELEVANT TO OWNERS OF EXISTING BUILDINGS.

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CLOTHES WASHER "WASHWISE" PROGRAM

The City offers rebates on the purchase of high efficiency clothes washers. The $100 rebate is made up of two parts: a $50 water rebate and a $50 energy rebate. Eligibility for the $50 energy rebate requires connection to Austin Energy for electric water heaters or to Texas Gas Service for gas water heaters and must be within Austin city limits (rate code: Austin I/S Res, see p. 87 for contact information).
Propane water heaters are not eligible for the energy rebate.

CONTACT - 974-2199 or www.ci.austin.tx.us/watercon/sfwasher.htm

RAIN BARREL & RAINWATER HARVESTING REBATE

City of Austin Water Conservation Department periodically offers 75 gallon rainbarrels for sale at a discounted price of $60 per barrel. Customers are limited to 4 barrels per sale. Rebates of $30 per barrel are also offered for rainbarrels purchased from other vendors. In addition, rebates up to $500 are offered on the cost of a rainwater harvesting system with a capacity of 300 gallons or greater.

CONTACT - 974-2199 or www.ci.austin.tx.us/watercon/rainwater.htm; www.ci.austin.tx.us/watercon/rainwaterharvesting.htm

NOTE - Buildings with access to city reclaimed water ("purple pipe") are not eligible for COA rainwater harvesting rebates. To learn if your building is in a location with access to the purple pipe reclaimed water, see map on page 53.

RAINWATER COLLECTION TANKS. PEDERNALES LOFTS.
IMAGE COURTESY OF ANDY KARVONEN

FREE SHOWERHEADS & FAUCET AERATORS

City of Austin customers can pick up free water-efficient showerheads and faucet aerators during business hours at COA Water and Wastewater offices.

CONTACT - 974-2199 COA - 625 E. 10th St., Suite 615
www.ci.austin.tx.us/watercon/showerheads

WATERWISE LANDSCAPE REBATE

Rebates are available to qualifying customers who replace large areas of turfgrass with drought-tolerant native plants. Applicants must apply before June 1st and be approved before purchasing plants or beginning any landscaping projects. There is a maximum rebate of $400 per home.

CONTACT - 974-2978 or 974-2199
www.ci.austin.tx.us/watercon/landscape.htm;
www.ci.austin.tx.us/watercon/waterwiseland.htm

RESIDENTIAL IRRIGATION AUDIT

Free irrigation audits are available to City of Austin water customers who have an underground sprinkler system and use more than 25,000 gallons per month in the summer. A City water auditor will check the system and determine an efficient watering schedule, with potential to reduce summer water bills by 20% to 50%. After irrigation audit, customers may be eligible for up to $375 of rebates on recommended system improvements.

CONTACT - 974-2199
http://www.ci.austin.tx.us/watercon/irrigation.htm

COMMERCIAL

CLOTHES WASHER "WASHWISE" PROGRAM

Rebates of up to $250 per machine for water- and energy-saving coin-operated machines selected from list of approved models. The $250 rebate is separated into a water and energy component. $100 of the rebate is available only to customers with gas water heat, supplied by Texas Gas Service, and qualifying rate code. Customers must receive water from Austin Water Utility or eligible MUD to receive the $150 water-related rebate. No rebate will be given to replace existing front-loading machines. Current rebate levels, eligibility requirements, and online applications are available via the internet.

CONTACT - 974-2199 or www.ci.austin.tx.us/watercon/cwasher.htm, and Texas Gas Service, 800 700-2443 or 512 477-5852
www.texasgasservice.com/bu/bu_gc_austin.jsp

RAINWATER HARVESTING REBATE PROGRAM

City of Austin Water Conservation offers a rebate of up to $500 on the cost of installing a large capacity rainwater harvesting system of more than 300 gallons.

CONTACT - 974-2199 or www.ci.austin.tx.us/watercon/rwrebates.htm

NOTE - Buildings with access to city reclaimed water ("purple pipe") are not eligible for COA rainwater harvesting rebates. To learn if your building is located within reach of purple pipe, see map on page 53.

IRRIGATION AUDIT REBATE

The City of Austin offers free irrigation evaluations that can help commercial properties correct equipment problems and reduce overall landscape watering demands. Customers who participate in irrigation audits may be eligible for rebates of up to $1000 per account when making recommended upgrades to existing systems.

CONTACT - 974-2199 or www.ci.austin.tx.us/watercon/cirrigation.htm

COA WATER COMMERCIAL
CONTINUED

WHOLE SYSTEM WATER CONSERVATION AUDITS

Water Conservation auditors are available to evaluate a building's water consumption to assess water use patterns. Auditors will suggest opportunities for reducing water consumption and discuss eligibility for special commercial rebates.

CONTACT - 974-2893 or www.ci.austin.tx.us/watercon/systemaudits.htm

WATERWISE RESTAURANTS REBATE

This program offers rebates to restaurants that upgrade certain kitchen equipment to reduce water use.

CONTACT - 974-2199 or www.ci.austin.tx.us/watercon/restaurants.htm

SPECIAL COMMERCIAL REBATE

Water Conservation offers rebates of up to $40,000 to industrial, commercial, and institutional customers for installing new equipment and processes that conserve water at existing facilities.

CONTACT - 974-2893 or www.ci.austin.tx.us/watercon/systemaudits.htm

FREE SHOWERHEADS & FAUCET AERATORS

City of Austin customers can pick up free water-efficient showerheads and faucet aerators during business hours at COA Water and Wastewater offices.

CONTACT - 974-2199 or www.ci.austin.tx.us/watercon/showerheads.htm. COA - 625 E. 10th St, Suite 615.

TEXAS SALES TAX EXEMPTION FOR WATER CONSERVATION

Water conservation strategies and associated equipment, supplies and services are exempt from sales tax if used solely for the purpose described below:

- ☐ Rainwater harvesting: rain barrels; gutters used solely to route the water into rain barrels or rainwater collection systems; tanks and cisterns; roof washers used in rain harvesting systems; screens and filters for the gutters, barrels, tanks, cisterns and roof washers; and a collection surface area that is not used as a roof of a structure or storage area.
- ☐ Water recycling and reuse: chemicals, tanks & cisterns, and water recycling systems for washing machines.
- ☐ Reduction or elimination of water use: water dams for toilets, timers attached to sprinkler systems, water displacement devices for toilet tanks, and faucet sensors that shut off water flow.
- ☐ Desalination of surface water or groundwater: cleaning and pickling valves, filters, membranes, pre-filter pumps, product flow meters, salinity meters, and high-pressure control valves.
- ☐ Brush control designed to increase the availability of water: spray equipment & calibration of equipment, herbicides, tractors, bulldozers and chain saws.
- ☐ Precipitation enhancement: end-burning cloud-base flares; acetone solution wing-tip generators; pressure transducers; spectrometer probes; calibration equipment.
- ☐ Water or wastewater system: equipment, services, and supplies to construct or operate a system certified by the Texas Commission on Environmental Quality (TCEQ) as a regional system.

VETERANS

RESIDENTIAL

GENERAL CONTACTS AND INFORMATION

TEXAS GENERAL LAND OFFICE - 800 998-4GLO (4456), 463-5001, http://www.glo.state.tx.us/

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HOUSING ASSISTANCE PROGRAM

The Veterans Land Board (VLB) offers Land Loans up to $60,000 (minimum one-acre tracts). New construction housing must meet the U.S. Environmental Protection Agency's ENERGY STAR® rating as an energy-efficient home.

The Veterans Housing Assistance Program (VHAP) provides qualified Texas veterans with financing up to $325,000 toward the purchase of a home. Loans for $45,000 or less are originated through the Texas Veterans Land Board's (VLB) direct loan program. Loans over $45,000 must be originated by a participating lender. The VHAP must be originated in conjunction with Federal Housing Administration (FHA), Veterans Administration (VA), or approved private lenders.

CONTACT - 800 252-VETS (8387) or 463-5060 or www.glo.state.tx.us/vlb/index.html; ENERGY STAR® Home www.energystar.gov/index.cfm?c=new_homes.hm_index

IMAGES COURTESY OF AUSTIN ENERGY

NATURAL GAS

RESIDENTIAL

SINGLE AND MULTI-FAMILY

GENERAL CONTACTS AND INFORMATION

TEXAS GAS SERVICE CONSERVATION PROGRAMS - 800-700-2443, 407-1842, fax 465-1186
RESIDENTIAL - www.texasgasservice.com/rs/rs_gc_austin.jsp
COMMERCIAL - www.texasgasservice.com/bu/bu_gc_austin.jsp

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RESIDENTIAL HYDRONIC HEATING REBATE

Texas Gas Service offers an incentive to residential customers of $125 per living unit.

CONTACT - 370-8243 or www.texasgasservice.com/rs/rs_gc_austin.jsp

NATURAL GAS VEHICLE REBATE PROGRAM

Texas Gas Service offers an incentive ranging from $1,000 to $2,000 for participants (either residential or commercial) who convert a gasoline-powered vehicle to natural gas, or who purchase a natural gas vehicle. The program includes the conversions of light and heavy-duty vehicles and forklifts.

CONTACT - 370-8243, http://www.texasgasservice.com/rs/rs_gc_austin.jsp

COMMERCIAL

COMMERCIAL HYDRONIC HEATING REBATE

Texas Gas Service offers commercial customers an incentive of $500 per unit.

CONTACT - 800 700-2443 or 407-1842 or www.texasgasservice.com/rs/rs_gc_austin.jsp

FOOD SERVICE EQUIPMENT REBATE

Texas Gas Service provides a rebate for the installation of high efficiency natural gas cooking equipment, such as water heaters, booster heaters, food service equipment.

CONTACT - 800 700-2443 or 407-1842 or www.texasgasservice.com/bu/bu_gc_austin.jsp#food

COMMERCIAL WATER HEATING REBATE

Texas Gas Service offers incentives to help make the installation of new, high-efficient, energy-saving gas water heating systems financially rewarding. Texas Gas Service offers up to 20% of equipment cost.

CONTACT - 800 700-2443, 407-1842 or www.texasgasservice.com/rs/rs_gc_austin.jsp

FEDERAL TAX CREDITS

GENERAL CONTACTS AND INFORMATION

2005 FEDERAL ENERGY TAX CREDIT - See the Kentucky Office of Energy Policy website for links to tax credit resources, http://www.energy.ky.gov/2005federalenergybill.htm

EACH REBATE OR INCENTIVE PROGRAM IS CODED TO A GREEN URBANISM SIGNATURE THEME. REFER TO THE SIGNATURE THEME SECTION FOR MORE INFORMATION ABOUT HOW THE REBATES FIT INTO THE MUELLER GREEN URBANISM THEMES. INCENTIVES ARE GEARED TOWARDS NEW CONSTRUCTION, BUT SOME MAY ALSO BE RELEVANT TO OWNERS OF EXISTING BUILDINGS.

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IMAGE COURTESY OF AUSTIN ENERGY

RESIDENTIAL

ENERGY EFFICIENT HOME IMPROVEMENTS

- ☐ 20% of the cost of improvements such as doors, windows, skylights
- ☐ 10% of the cost of improvements up to a $500 limit per homeowner for:
  - Insulation and envelope improvements meeting IECC specifications
  - $200 cap: Windows meeting IECC specification
  - $300 cap: Central air conditioners or heat pumps meeting 2006 Consortium for Energy Efficiency specifications (expected to be 15 SEER and 13 EER)
  - $150 cap: Furnaces and boilers with Annual Fuel Utilization Efficiency of 95 or better
  - $300 cap: Water heaters with min. Energy Factor of 0.80
  - $300 cap: Heat pump water heaters with min. Energy Factor of 2.0
  - $300 cap: Ground source heat pumps meeting specified performance levels

SOLAR ENERGY TAX CREDIT

- ☐ 15-30% of the cost of mechanical and water heating systems. Credit does not extend to hot tubs or pools.

HYBRID VEHICLE TAX CREDIT

- ☐ $2,000-$2,4000 tax deduction based on fuel economy

COMMERCIAL

ENERGY EFFICIENT HVAC

- ☐ Tax credit for energy-saving upgrades
- ☐ Tax credit for efficient furnaces or water heaters

ENERGY EFFICIENT HOUSING

Builders receive tax credits for energy efficient new homes.

- ☐ $2,000 tax credit for exceeding 50% less than International Energy Conservation Code (IECC)
- ☐ $1,000 for meeting ENERGYSTAR® criteria

ENERGY EFFICIENT COMMERCIAL BUILDINGS

- ☐ $1.80 per square foot for buildings exceeding ASHRAE 90.1-2001 by 50%. Prorated deductions available for individual systems.

ENERGY EFFICIENT APPLIANCES

- ☐ $175 cap: Manufacturer credit for high-efficiency appliances.
- ☐ $75 million cap per manufacturer over the credit period.

The Securing America's Energy Independence Act H.R. 550, S. 590

The tax credit information provided on in this guide is based on information contained in the Energy Policy Act of 2005, which expires in December of 2008. The passage of the H.R. 550 and S 590 would extend the current bill 8 years and allow the following changes:

- ☐ Modifies the residential and commercial tax credit for photovoltaics to $1,500 per half kilowatt.
- ☐ Removes the 30% cap for commercial photovoltaic installations and the $2,000 cap on residential photovoltaic installations.
- ☐ Provides AMT relief for fuel cells and solar.
- ☐ Provides 3-year accelerated depreciation for commercial solar and fuel cell projects.

For updated information, see The U.S. Department of Energy, http://www.energy.gov/taxbreaks.htm

CHAPTER 6 - RESOURCES

IMAGE COURTESY OF ANDY KARVONEN

GREEN PROFESSIONALS

LEED Accredited Professionals, http://www.usgbc.org
Austin Energy's Green Building Program, Professionals, http://www.ci.austin.tx.us/greenbuilder/gbpmembers.htm
American Institute of Architects Committee on the Environment, Austin Chapter, http://www.aiaaustin.org
Sustainable Sources Directory, http://www.greenbuilder.com

LINKS TO MATERIALS, PRODUCTS, SYSTEMS

Austin Energy Sustainable Building Sourcebook, http://www.greenbuilder.com
GreenSpec (paid membership required), http://www.buildinggreen.com
Healthy Building Network, http://www.healthybuilding.net
Oikos Green Building Source, http://www.oikos.com
Sustainable Sources Directory, http://www.greenbuilder.com

RELATED INFORMATION & ORGANIZATIONAL WEBSITES

Alpine, TX, Outdoor Lighting Ordinance, http://users.wirelessfrontier.net/~bbastro/archives/alpine_light_ord.html
American Water Works Association, 800-926-7337, http://www.waterwiser.org
American Wind Energy Association, 202-383-2500, http://www.awea.org
Austin Energy Green Building Program, http://www.austinenergy.com
Bay Area Air Quality Management District, Reg. 8, Rule 51, http://www.baaqmd.gov
BuildingGreen, Inc., 802-257-7300, http://www.buildinggreen.com
Cahill Associates, http://www.thcahill.com
Carpet and Rug Institute Green Label Air Quality Test Program, http://www.carpet-rug.com
Center for Maximum Potential Building Systems, 928-4786, http://www.cmpbs.org
City of Austin Air Quality Program, http://www.ci.austin.tx.us/airquality/defaul
City of Austin Tree/Plant List, www.ci.austin.tx.us/watershed/plantlist.htm
City of Austin Xeriscape Plant List, www.ci.austin.tx.us/watercon/downloads/CommercialPlantList.pdf
Cool Roof Rating Council, www.coolroofs.org/ratedproductsdirectory.html
DOE Office of Energy Efficiency and Renewable Energy, http://www.eere.energy.gov
EcoWise, http://www.ecowise.com
Florida Concrete & Products Association, http://www.fcpa.org (Portland Cement Pervious Pavement Manual)
Forest Certification Resource Center, http://www.certifiedwood.org
GreenGuard Environmental Institute, http://www.greenguard.org
Green Roofs, http://www.greenroofs.com
Green Seal, http://www.greenseal.org
Illuminating Engineering Society of North America, http://www.iesna.org
International Dark Sky Association, Fixture Seal of Approval Program, 520-293-3198, http://www.darksky.org
Lady Bird Johnson Wildflower Center at the University of Texas, 512-992-4100, http://www.wildflower.org

Lawrence Berkeley National Laboratory Heat Island Group, http://eetd.lbl.gov/heatisland/

Lighting Research Center, http://www.lrc.rpi.edu

National Asphalt Pavement Association, http://www.hotmix.org

North American Native Plant Society, 416-631-4438, http://www.nanps.org

SMACNA 2000 IAQ Guidelines for Occupied Buildings Under Construction, http://www.smacna.org

South Coast Air Quality Management District, Rule 1168, http://www.aqmd.gov

Straw Bale Association of Texas, http://www.greenbuilder.com/sbat/

Texas Solar Energy Society, 800-465-5049, http://www.txses.org

U.S. EPA Energy Star Roofs, www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products

U.S. EPA Indoor Air Quality, http://www.epa.gov/iaq

U.S. EPA Heat Island Program, http://www.epa.gov/heatisland/

U.S. Green Building Council, http://www.usgbc.org

U.S. Green Building Council Central Texas Balcones Chapter, http://www.usgbc.org/chapters/centraltexas/

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