Overview

1. Background
2. Scottsdale Green Buildings
3. Solar Energy Activity
4. Green Codes and Standards
Scottsdale
Environmental Initiatives

1. Indian Bend Multi-Use Wash
2. Environmentally Sensitive Lands Ord.
3. Natural Area Open Space
4. McDowell Mountain Preserve
5. Sensitive Design Principles
6. Green Building Program
Green Building Program

- Established in 1998 as a voluntary program
  - Green Building Advisory Committee (1998-2011)
    - Program development and outreach
- Regionally derived rating criteria
  - Sonoran Desert Character and Sustainability
  - Developed for single family, multifamily and commercial development
- Verification Process
  - Integration with city development process
    - Building plan review, permits and inspections
Green Building Incentives

- Expedited plan review and development process assistance
- Market differentiation for owners, developers, designers and builders
  - Directory of participants and construction site signs
- Promotional material, education and public outreach
Green Building Rating Checklist

Use this rating worksheet to qualify projects under the Green Building Program for one- and two-family dwellings and multiple single-family dwellings (townhouses and condominiums) not more than three stories in height with a separate means of egress (International Residential Code - IRC Section R101.2).

All building system components, materials, and equipment must be installed per code and manufacturer’s instructions.

<table>
<thead>
<tr>
<th>Entry Level</th>
<th>Advanced Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Meet all mandatory measures and adjust rating for house size (p. 2 – 7).</td>
<td></td>
</tr>
<tr>
<td>▲ Accumulate 50 - 99 points from the rating checklist (p. 8 – 26).</td>
<td>• Meet all mandatory measures and adjust rating for house size (p. 2 – 7).</td>
</tr>
</tbody>
</table>

Summary of Rating Categories

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Heating, Ventilation, &amp; Air Conditioning</td>
<td>10. Interior Finishes</td>
<td></td>
</tr>
</tbody>
</table>
How does Scottsdale Compare to other Green Building Programs?

<table>
<thead>
<tr>
<th>Program Measures</th>
<th>LEED for Homes</th>
<th>ICC 700/NAHB</th>
<th>City of Scottsdale Green Building Program</th>
<th>Pima County Regional Residential GB Program</th>
<th>Coconino County Sustainable Building Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry certification level</td>
<td>Certified</td>
<td>Bronze</td>
<td>Entry Green Building</td>
<td>Bronze</td>
<td>Entry Level</td>
</tr>
<tr>
<td>Consensus built</td>
<td>USGBC process</td>
<td>ANSI process</td>
<td>Scottsdale GB Advisory Committee &amp; Open Meeting Law process</td>
<td>Pima County GB Advisory Committee &amp; Open Meeting Law process</td>
<td>Coconino County Sustainable Building Advisory Committee</td>
</tr>
<tr>
<td>Third Party certification</td>
<td>Yes, and legally binding accountability form signed by Builder for unverifiable field items</td>
<td>Yes</td>
<td>Yes, field verifiable items done by bldg. inspectors; Certificate of Completion req’d for unverifiable field items (i.e., recycled content, zero VOC)</td>
<td>Yes, field verifiable items done by bldg. inspectors; Submittal req’d for unverifiable field items (i.e., recycled content, zero VOC)</td>
<td>Yes, certification done by selected Coconino County Sustainable Building Advisory Committee Members</td>
</tr>
<tr>
<td>Energy: Key Measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Energy Star or equivalent</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td>Mandatory (10/09)</td>
<td>Mandatory</td>
<td>Optional (points)</td>
</tr>
<tr>
<td>- 3rd party performance test</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td></td>
<td>Mandatory</td>
<td>Optional (points)</td>
</tr>
<tr>
<td>- Meet code</td>
<td>Yes</td>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Water: Key Measures</td>
<td>Indoor and outdoor Points only for total home compliance</td>
<td>Indoor and outdoor Points per fixture</td>
<td>Indoor and outdoor Points per fixture</td>
<td>Indoor and outdoor Points per fixture</td>
<td>Indoor and outdoor Some mandatory, some optional (points)</td>
</tr>
<tr>
<td>- Types of measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- High-efficiency water fixtures</td>
<td>Indoor and outdoor Points only for total home compliance</td>
<td>Indoor and outdoor Points per fixture</td>
<td>Indoor and outdoor Points per fixture</td>
<td>Indoor and outdoor Points per fixture</td>
<td>Indoor and outdoor Some mandatory, some optional (points)</td>
</tr>
<tr>
<td>IEG: Key Measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- MERV 8 filters</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td>N/A</td>
</tr>
<tr>
<td>- No unsealed/unventilated combustion appliances</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td>Optional (points)</td>
</tr>
<tr>
<td>- No air handling equip. in garage</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td>Optional (points)</td>
</tr>
<tr>
<td>Materials: Key Measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Construction waste mgmt plan</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td>Optional (points)</td>
<td>Optional (points)</td>
<td>Optional (points)</td>
</tr>
<tr>
<td>- Minimize excess lumber in framing</td>
<td>Max of 10% excess for home compliance</td>
<td>Points available per framing area</td>
<td>Optional (points)</td>
<td>Options (points) available per framing technique</td>
<td>Optional (points)</td>
</tr>
<tr>
<td>- Storage and collection of recyclables</td>
<td>N/A</td>
<td>N/A</td>
<td>Mandatory (recycling area in or near kitchen)</td>
<td>Optional (points)</td>
<td>Optional (points)</td>
</tr>
<tr>
<td>Site: Key Measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Erosion controls during constr.</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td>Optional (points)</td>
<td>Mandatory</td>
<td>Optional (points)</td>
</tr>
<tr>
<td>- Landscaping measures</td>
<td>Mandatory</td>
<td>Optional (points)</td>
<td></td>
<td>Mandatory</td>
<td>Optional (points)</td>
</tr>
<tr>
<td>- Protected entrances</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Fees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Single family home</td>
<td>Members: $375/unit</td>
<td>Members: $200/unit</td>
<td>No fees</td>
<td>No fees</td>
<td>No fees</td>
</tr>
<tr>
<td>- Production homes</td>
<td>Members: $107/unit</td>
<td>Members: $200/unit</td>
<td>No fees</td>
<td>No fees</td>
<td>No fees</td>
</tr>
<tr>
<td>Verification Fees</td>
<td>TBD by market</td>
<td>TBD by market</td>
<td>Other than city inspections, TBD by market</td>
<td>No fees if participating in utility energy program, or using prescriptive path</td>
<td>No fees</td>
</tr>
</tbody>
</table>
Scottsdale Green Building Outreach

- **Green Building Lectures**
  - 1st Thursday of each month
  - avg. attendance is 45

- **Solar Lectures**
  - 3rd Thursday of each month
  - avg. attendance is 25

www.scottsdaleaz.gov/greenbuilding
Green Single Family Permit Activity

Production Home Builders

Updated Rating Checklist

Source: Scottsdale CDS records
## Green Single Family Permit Activity (1998 - 2011)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Permits</th>
<th>Green Permits</th>
<th>Percentage of Total Permits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>2172</td>
<td>20</td>
<td>1%</td>
</tr>
<tr>
<td>1999</td>
<td>1554</td>
<td>36</td>
<td>2%</td>
</tr>
<tr>
<td>2000</td>
<td>1076</td>
<td>41</td>
<td>4%</td>
</tr>
<tr>
<td>2001</td>
<td>843</td>
<td>38</td>
<td>5%</td>
</tr>
<tr>
<td>2002</td>
<td>768</td>
<td>33</td>
<td>4%</td>
</tr>
<tr>
<td>2003</td>
<td>896</td>
<td>38</td>
<td>4%</td>
</tr>
<tr>
<td>2004</td>
<td>1137</td>
<td>247</td>
<td>22%</td>
</tr>
<tr>
<td>2005</td>
<td>852</td>
<td>439</td>
<td>52%</td>
</tr>
<tr>
<td>2006</td>
<td>685</td>
<td>177</td>
<td>26%</td>
</tr>
<tr>
<td>2007</td>
<td>573</td>
<td>106</td>
<td>19%</td>
</tr>
<tr>
<td>2008</td>
<td>200</td>
<td>35</td>
<td>18%</td>
</tr>
<tr>
<td>2009</td>
<td>121</td>
<td>30</td>
<td>25%</td>
</tr>
<tr>
<td>2010</td>
<td>149</td>
<td>28</td>
<td>19%</td>
</tr>
<tr>
<td>2011</td>
<td>155</td>
<td>15</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>11,181</td>
<td>1,283</td>
<td>12%</td>
</tr>
</tbody>
</table>

Source: Scottsdale CDS records
# Green TI and Condo Unit Build-outs (1998 - 2011)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Permits</th>
<th>Green Permits</th>
<th>Percentage of Total Permits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>1732</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1990</td>
<td>1789</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>1366</td>
<td>1</td>
<td>0.07</td>
</tr>
<tr>
<td>2001</td>
<td>1003</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2002</td>
<td>832</td>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>2003</td>
<td>1149</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2004</td>
<td>982</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>1121</td>
<td>181</td>
<td>16%</td>
</tr>
<tr>
<td>2006</td>
<td>1328</td>
<td>264</td>
<td>20%</td>
</tr>
<tr>
<td>2007</td>
<td>1019</td>
<td>265</td>
<td>26%</td>
</tr>
<tr>
<td>2008</td>
<td>638</td>
<td>41</td>
<td>6%</td>
</tr>
<tr>
<td>2009</td>
<td>193</td>
<td>13</td>
<td>7%</td>
</tr>
<tr>
<td>2010</td>
<td>354</td>
<td>37</td>
<td>11%</td>
</tr>
<tr>
<td>2011</td>
<td>227</td>
<td>61</td>
<td>27%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Scottsdale Building Trends 1998 – 2012

- **Energy Efficiency**
  - Cathedralized attics (insulation at roof deck)
  - All buildings constructed from 2006 to 2012 are 15% or more efficient than national energy code (2006 IECC)

- **Heat Island Mitigation**
  - Shaded building entrances, courtyards, outdoor living spaces and limited hardscape surfaces

- **Water Efficiency**
  - Low-water use landscaping and efficient irrigation systems
  - High efficiency plumbing fixtures
  - Efficient hot water delivery systems (recirculation pumps)

- **Passive and Active Solar Systems**
  - Significant increase in permits for photovoltaic (solar electric) and solar hot water systems
“A cynic is a man who knows the price of everything, and the value of nothing.”

Oscar Wilde
Green equates to Quality

- It’s not a question of whether one can afford green building, but whether how much one is able to afford
  - Health
  - Performance
  - Safety
  - Durability
  - Comfort
Costs are Relative

- Depends on how far you go
  - Standard Quality versus High Quality
- If a green product costs more, it is often
  - More durable
  - High performing
  - Multi-functional
  - Aesthetically valued
- You generally get what you pay for
Green Saturation into the Market

- Most environmentally responsible products are no more expensive than average costs
  - composite decking (recycled plastic/scrap wood) that is highly durable with low maintenance
  - comparable to higher grade cedar or redwood

- high efficiency toilets (1.28 gpf)
  - WaterSense label is the industry standard
Green Saturation into the Market

- **Engineered lumber products**
  - standard component of wood construction
- **Energy efficiency products**
  - highly competitive market
- **Recycled content materials**
  - economic benefit for most manufacturers
- **Regional and Indigenous materials**
  - economic advantage for locally recovered, harvested, extracted or manufactured building products
Foster Residence - 2004
AAC walls, Daylighting, Solar Power, Metal Framing - Edwards Design Group
Hovey Residence - 2004
Scottsdale’s first
Building Integrated Solar PV System
McDonnell Residence - 2005

Downtown in-fill development
Live-work remodel and addition

Daylighting, solar control
energy efficient building envelope
Strata International – 2005
Saebi Alternative Building System – Load bearing foam foundation, walls and roof
Beaulieu Residence - 2006

Earth sheltered, renewable energy, passive cooling, vegetated roofs, site integration, outdoor living, indoor natural ventilation, gray water recycling

Scottsdale’s Highest Rated Green Home
# Post Occupancy Energy Audit of Scottsdale Green Homes

<table>
<thead>
<tr>
<th>Project</th>
<th>Building Completion Date</th>
<th>Size (sq. ft.)</th>
<th>Governing Building Code (at time of permit)</th>
<th>Energy Audit, Performance Testing and Rating (8/09 to 5/10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Becker Residence</td>
<td>8/02</td>
<td>2,654</td>
<td>UBC 1997</td>
<td>HERS Index - 73 27% better than 2006 IECC</td>
</tr>
<tr>
<td>(exterior insulated masonry wall construction)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loloma 5 Town Homes</td>
<td>10/04</td>
<td>1,612</td>
<td>UBC 1997</td>
<td>HERS Index - 76 24% better than 2006 IECC</td>
</tr>
<tr>
<td>(exterior insulated masonry &amp; wood frame construction)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McDonnell Infill Office/Residence</td>
<td>12/04</td>
<td>2,241</td>
<td>UBC 1997</td>
<td>HERS Index - 61 39% better than 2006 IECC</td>
</tr>
<tr>
<td>(exterior insulated masonry wall construction)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Krahman/Wallenmeyer Residence</td>
<td>8/08</td>
<td>5,508</td>
<td>IRC 2003</td>
<td>HERS Index - 10 (65 w/o solar) 90% better than 2006 IECC</td>
</tr>
<tr>
<td>(exterior insulated wood frame wall construction)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moore Remodel</td>
<td>4/10</td>
<td>1,842</td>
<td>IRC 2003</td>
<td>HERS Index – 8 (55 w/o solar) 92% better than 2006 IECC</td>
</tr>
</tbody>
</table>
Post Occupancy Energy Audit of Green Homes

Becker Residence
Krahman/Wallenmeyer Residence
McDonnell Infill Office/Residence
Loloma 5 Town Homes
Scottsdale City Resolution
LEED Gold Certified City Buildings
March 2005

Granite Reef Senior Center
1st LEED Gold certified city facility - 2006

Gabor Lorant Architects

Solar partnership with SRP solar electric (PV) shade canopy roof mounted solar electric (PV)
Lost Dog Wash Trailhead Building - 2006

Weddle Gilmore Architects

B. Timmeman

Scottsdale certified

1st LEED Platinum certified city facility

Downtown Fire Station 2 - 2009

LEA Architects
Appaloosa Library - 2009

Gateway Access Trailhead Building - 2009

Arabian Library – 2008/2009 certification
McCormick-Stillman Model Railroad Building - 2011

Holly Street Studio Architects

LEED Gold
certified city facility

Fire Stations #1 and #8 - 2012

WLC Architects

LEED Platinum
pending
SkySong
ASU Scottsdale Innovation Center

SkySong - 2009
Phase I & II Office Buildings

Amanda Wills, Earth911.com
General Dynamics Facility
Certified Green under the new LEED Operations and Maintenance designation – EB/OM

- **2009** – General Dynamics became the first industrial site of its size to receive the LEED-EB/OM designation
- **2005** - General Dynamics received the first EB certification during the LEED pilot program

- Conversion of 250,000 square feet of lawn to a Xeriscape
- Diverted 575 tons of recyclable materials from local landfills
Optima Camelview Village

Largest Scottsdale Green Building Project  (Phase I-III, 2005-2012)
11 buildings - 700 residential units - 24,000 sq. ft. retail – 13 acre site
18 acres of vegetated terraces – Seeking LEED Silver certification
Hyatt Regency Scottsdale at Gainey Ranch

Largest Solar Hot Water System Installed in a Hotel

- Domestic hot water for
  - 492 guest rooms
  - main laundry services room
  - restaurants
- Designed to reduce the resort’s energy use by 50%
- Estimated 3-year payback on investment beginning in 2009
Solar Permits 2001 to 2011

Solar Demand Continues to Grows

Source: Scottsdale CDS permit records
## Solar Permits 2001 to 2011

**Solar Demand Continue to Grows**

### Solar Electric (PV)

<table>
<thead>
<tr>
<th>Year</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
<th>08</th>
<th>09</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Permits</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>13</td>
<td>10</td>
<td>20</td>
<td>28</td>
<td>47</td>
<td>237</td>
<td>251</td>
<td>300</td>
</tr>
</tbody>
</table>

### Solar Hot Water

<table>
<thead>
<tr>
<th>Year</th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
<th>05</th>
<th>06</th>
<th>07</th>
<th>08</th>
<th>09</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Permits</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>40</td>
<td>126</td>
<td>198</td>
<td>162</td>
</tr>
</tbody>
</table>

*Source: Scottsdale CDS permit records*
Without esthetic consideration of solar panel placement, panels requiring southern exposure could look like this lunar landing.
Solar System Submittal Guidelines

Residential Solar Plan Review
Quality Submittal Guidelines

This packet applies to roof-mounted solar photovoltaic and hot water systems only.

City of Scottsdale
One Stop Shop
7447 E. Indian School Road, Suite 105
480-312-2500

GREEN BUILDING PROGRAM

Solar Site Plan Checklist:
- Site plan must be legible, show entire lot, and be proportional in scale.
- Provide 2 copies of site plan.
- Provide Zoning
- Vicinity Map
- Parcel # (APN), lot & subdivision
- North Arrow
- Lot dimensions
- Identify street
- Identify easements (i.e. NAOS or drainage easement—represent on site plan with dashed lines)
- Show all ridge lines, and/or parapets
- Identify all vents, chimneys, or other apparatus that may affect placement of panels

Solar Elevation Example:
- South facing panels at 25 degree pitch
- Panels will not exceed 8" above adjacent roof line
- Roof line will not project above surface

September 2009
Solar PV Panel Placement Design Guidelines

- South Facing Pitched Roofs
- North and East/West Facing Pitched Roofs
- Flat Roofs

SOLAR PANEL PLACEMENT DESIGN GUIDELINES FOR SINGLE FAMILY HOMES

The following guidelines are to be used in the design and placement of solar panels (photovoltaic and solar thermal systems) on pitched and flat roofs of single-family dwellings for the purpose of compatible design. With a little foresight and planning, a solar system can be effectively integrated into the design of new and existing roofs. Those projects which comply with the design guidelines qualify for over the counter plan review. All other proposals will be required to be submitted for plan review.

A. South Facing Pitched Roofs (within 45° east or west of due south)
   1) Solar panels should be low profile and parallel with the plane of the pitched roof.
   2) Top of the panels should not exceed 8 inches above the adjacent finish roofing surface (e.g., - tile, shingles). Panels should not project above the roof ridge line.
   3) Placement of panels should be uniform. Consider the panels as part of the overall roof configuration. Match the shape and proportions of the array with the shape and proportions of the roof.
   4) Color of panel frames and support structure should be neutral and compatible with roof surface color (exposed frames and components should have a non-reflective surface).
Building Integrated PV Systems

SunPower SunTile is a roof-integrated solar tile for flat and S-Tile roofs.
Building Integrated PV Systems

Desert Mountain Residence, Scottsdale

Optima Biltmore Condo Project, Phoenix

Scottsdale Granite Reef Senior Center
Building Integrated PV Systems

Beaulieu Residence, Scottsdale
The Smart House

Xcel Energy's Smart Grid Consortium is imagining a future that would allow you to communicate your energy choices to the power grid and automatically receive electricity based on your personal needs.

The potential benefits:
- Lower cost of power
- Cleaner power
- A more efficient and resilient grid
- Improved system reliability
- Increased conservation and energy efficiency

Plug-in Hybrid Electric Car
Xcel Energy is studying how plug-in electric vehicles can store energy, act as backup generators for homes and supplement the grid during peak hours.

Smart Meter
Real-time pricing signals create increased options for consumers.

Smart Appliances
Smart appliances contain on-board intelligence that "talks" to the grid, senses grid conditions and automatically turns devices on and off as needed.

Smart Thermostat
Customers can opt to use a smart thermostat, which can communicate with the grid and adjust device settings to help optimize load management. Other "smart devices" could control your air conditioner or pool pump.

High-Speed Connections
Advanced sensors distributed throughout the grid and a high-speed communications network tie the entire system together.

Customer Choice
Customers may be offered an opportunity to choose the type and amount of energy they'd like to receive with just the click of a mouse on their computer. 100 percent green power? A mix of sources? The cheapest priced source? In Smart Grid City, it could be up to you.
Scottsdale’s IgCC Adoption
July 5, 2011 – Voluntary/Mandatory

- Site Development and Land Use
- Materials Resources
- Energy Efficiency
- Water Efficiency
- Indoor Environmental Quality
- Commissioning, Operation and Maintenance

Version 2.0 - November 2010
Gap between IgCC and LEED

Closing gap between minimum code requirements and criteria for LEED certification
Towards Regenerative Buildings

Living Building Challenge - 0.1%

Mass Market

LEED – 24.9%

IgCC – 75%

Market Leader

Pull

Push
Alignment of Tools and Instruments

- Green Rating Programs
- Government Policy
- Standards & Codes
- Market Supply & Demand
For More Information

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