Environmental Impact of Buildings*

- 65.2% of total U.S. electricity consumption
- > 36% of total U.S. primary energy use
- 30% of total U.S. greenhouse gas emissions
- 136 million tons of construction and demolition waste in the U.S. (approx. 2.8 lbs/person/day)
- 12% of potable water in the U.S.
- 40% (3 billion tons annually) of raw materials use globally

* Commercial and residential
Our Landfills Are Filling Up

- Most construction waste ends up in landfills.
- An average 2000 s.f. house sends 8000 pounds of waste to the dump.
- All 3 county landfills are estimated for closure between 2020 and 2040.
However, recycling efforts are beginning to pay off

- Intensive recycling of usable materials is extending the life of our landfills.
- Much of the construction waste can be recycled or donated to charity.
- Facilities need to gear up for more recycling.
Where do our utility costs go?

- There are many variations to the cost of utilities, but generally the average cost per month for a 2000 sq. foot house older than 10 years of age are as shown in the graph.

![Chart showing average cost per month for gas and electric.](chart.png)
Where do our utility costs go?

- A newer version of the same size house now includes installation of more efficient appliances and water using devices, such as low flow toilets, lavatories, showers and so forth.
Where do our utility costs go?

- Water usage has been affected dramatically in the last few years. Prior to requirements of low flow fixtures the average monthly use was about 7,670 gallons per month per dwelling (88 gpp/d) in Santa Cruz.
Where do our utility costs go?

- Today the average use for a single family dwelling is about 6,830 gallons per month (78 gpp/d). This is a reduction of nearly 10%. Individual new homes use even less.
So What Are Some of the New Requirements?

- Building codes are mandated by Federal, State and Local Governments.
- Code regulators have taken dramatic steps in recent years to not only make buildings safer in fires and earthquakes, and to improve accessibility, but be more efficient in the use of energy consuming products.
What is now mandated by the State to conserve energy?

- Mandatory requirements vary from state to state, however in California there are a variety of energy saving features which must be built into new homes and businesses.
What is now mandated by the State to conserve energy?

- All new homes and businesses now include:
  - Minimum insulation
  - Energy efficient heating and cooling.
  - High efficiency fenestration products.
✓ Special commercial lighting systems.

✓ High efficiency water heaters. (State buildings must derive at least 60% of water heating energy from solar.)
✓ Electronic igniters
✓ Severe restrictions on electric resistance heating.
✓ Caulked and gasketed building joints.
✓ Special duct installation methods.
✓ Sealed fireplace air intakes.
✓ Hot water piping insulation.
✓ Water conserving fixtures.
✓ Water pressure regulators.
✓ High efficiency lighting.

What now?
What about Green Building?

- The City Council recognized the value in creating a responsible Green Building Program.

The Planning Commission was directed to establish a working committee to develop a program for the city.
So, in 2002

The GREEN BUILDING WORKING GROUP was established
What is Green Building?

- A Green Building:
  - 1) Minimizes its impact on the environment.
  - 2) Effectively utilizes natural resources.
  - 3) Provides a safe, non-toxic work or live space, and
  - 4) Reduces the need for expensive services and utilities.
So, Who Are Some of The Players?

- U.S Green Building Council
- Forest Stewardship Council
  - Rainforest Alliance
- Sustainable Forest Initiative
- World Business Council for Sustainable Development
- Local, State and Federal
  - CA Energy Commission
Philosophy of Green Building
Optimize the Site’s Potential

- Min. development on open space.
- Improve erosion control methods
- Minimize habitat disturbance
- Restore degraded sites if possible
- Design for sustainable transportation.
Minimize Energy Consumption

- Reduce heating & cooling loads via climate responsive design.
- Use renewable high efficiency sources.
- Specify efficient HVAC and lighting.
- Optimize building performance.
- Monitor performance.
Protect and Conserve Water

- Reduce, control and treat surface runoff.
- Use water efficiently.
- Improve water quality.
- Recover non-sewage and gray water for onsite use.
- Use waste treatment and recycling programs.
Use Environmentally Preferable Products

- Renovate existing facilities, products and equipment.
- Evaluate environmental preferability using LCA
- Maximize recycled content of new materials
- Specify sustainable materials
- Limit construction debris
Optimize operational and maintenance practices

- Train occupants and maintenance staff in sustainability practices
- Buy cleaning products and supplies that are resource efficient and non-toxic
- Use automated monitors and controls
- Reduce waste through recycling
Enhance indoor environmental quality

- Make sound aesthetic decisions
- Provide thermal comfort
- Provide adequate ventilation & outside air
- Avoid materials high in polluting ingredients
- Control noise
- Design a high performance lighting system
<table>
<thead>
<tr>
<th>What do we build with?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
</tr>
<tr>
<td>Steel</td>
</tr>
<tr>
<td>Concrete</td>
</tr>
<tr>
<td>Roofing</td>
</tr>
<tr>
<td>Plastic</td>
</tr>
<tr>
<td>Ceramic Tiles</td>
</tr>
<tr>
<td>Glass</td>
</tr>
<tr>
<td>Paper</td>
</tr>
<tr>
<td>Composites</td>
</tr>
<tr>
<td>Copper</td>
</tr>
<tr>
<td>Brass</td>
</tr>
<tr>
<td>Aluminum</td>
</tr>
<tr>
<td>Paints/Stains</td>
</tr>
<tr>
<td>Insulation</td>
</tr>
<tr>
<td>Flooring</td>
</tr>
<tr>
<td>Stone</td>
</tr>
<tr>
<td>Brick</td>
</tr>
<tr>
<td>Asphalt</td>
</tr>
</tbody>
</table>
What Are Green Materials?

Green materials, products and systems have many of the following characteristics:
What Are Green Materials?

They are durable, Are low maintenance, and have low-embodied energy (energy required to acquire, transport, manufacture and install),
What Are Green Materials?

They are locally available,
Made from recycled or renewable resources,
Can be recycled or renewed,
What Are Green Materials?

They have low toxicity,
Produce little pollution or waste
and
Have minimal negative impacts
on the ecology.
How about alternate building methods?

- We are used to seeing standard building construction such as wood framed houses and steel framed commercial buildings.

- But there are other ways to build:
THERE ARE
OLD SCHOOL
METHODS
Straw bales houses were first built about 100 years ago by European settlers in the Sand Hills of Nebraska and later in Wyoming. Some still exist today and are in good shape.
And

There

Are

New

School

Methods
Solar Photovoltaic / Hot Water

- In addition to efficient construction systems, solar photovoltaic and hot water systems can also reduce the load on local utilities and on your pocket book.
Advanced Framing Techniques

- No headers in non-bearing wall
- Single top plate
- Single stud at rough opening
- No cripples under window opening
- Two stud corners
- Insulated header
- Header hangers instead of jack studs
- Point load transferred between studs by rim closure material acting as header. If rim closure material is non-structural, support will be required under point loads. Use solid blocking between joists.
The City of San Jose has embarked on a program called “Cool Streets”.
What path do we go down?
Leadership in Energy & Environmental Design

A leading-edge system for designing, constructing, and certifying the world’s greenest buildings.
The non-residential component is based on the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) standard, which awards points based on building performance. The calculations of performance for LEED are typically done by design professionals using specialized knowledge and forms. Thus the LEED system is typically used for larger projects in the non-residential (commercial) sector, where specialized professionals will typically be involved already.
The residential component is based on the Alameda County Waste Management Authority (ACWMA) Green Building Guidelines and awards points for specific measures rather than performance. The identification of the measures being utilized does not require specialized knowledge. Thus the ACWMA system is suitable for both small and large projects, not necessarily employing specialized professionals.
NOW, THEREFORE, BE IT ORDAINED
By The City Of Santa Cruz As Follows:
Section 1. Chapter 24.15 is hereby added to the Santa Cruz Municipal Code to read as follows:
“Chapter 24.15
Green Building Regulations

Sections:
- 24.15.010 Purpose and Findings
- 24.15.020 Definitions
- 24.15.030 Standards for Compliance
- 24.15.040 Exceptions
- 24.15.050 Maintenance of Document
- 24.15.060 Exceptional Design
City of Santa Cruz
Green Building Program:
Standards for Compliance
City of Santa Cruz Green Building Program:
Standards for Compliance

I. OVERVIEW:

- The City of Santa Cruz Green Building program distinguishes between two types of building projects: (a) non-residential projects, and (b) residential projects.
The basis for compliance consists of the checklists from these two programs, which set out the number of points earned for any one of the measures on the checklist. Compliance is measured in terms of the total number of points for the items to which the applicant commits at the time of building permit application.
Projects are required to implement items for which points have been awarded. Typically this will be enforced at intermediate or final building inspections.
If for some reason beyond the applicant’s control a measure cannot be implemented, then other green item(s) with an equivalent point total may be substituted, with prior approval from the Building Department.
The point systems are used to award the following actions:
Receipt of the building permit (mandatory)

A minimum number of points (as described below) is required to receive the building permit. This element of the program is mandatory. The only exceptions are relatively small projects; the threshold sizes for these exceptions are given below along with the point requirements.
- **Accelerated permit processing (optional, awarded for exceptional design)**
- If the project applicant commits to a larger number of points (as described below) accelerated Building Permit processing will be given.
Project Recognition and Green Building Award (optional)

Projects achieving a still larger number of points (as described below) will be recognized publicly through the Education and Outreach Program and will receive Green Building Awards.
II. STANDARDS FOR COMPLIANCE
FOR NON-RESIDENTIAL PROJECTS:
Leed Model

The LEED system recognizes six major categories of opportunities and uses the checklist in Appendix A. Points are awarded for performance that meets or exceeds defined metrics in each category. As a performance-based system, the table provides the flexibility to accommodate a variety of designs and materials. Design teams can develop their own solutions to achieve a given point, or build upon elements of previously successful projects. After completion, the USGBC awards certification levels, ranging from basic Certification to Platinum recognition, according to the total number of points earned for green elements incorporated into the final project.
The six categories addressed by LEED are:

- Sustainable Sites
- Materials and Resources
- Energy and Atmosphere
- Water Conservation and Management
- Indoor Air Quality
- Innovation and Design
Non-Residential Green Building Actions

A total of 75 points (Appendix A / Table 1) may earn actions at the building permit stage. (Projects are awarded points for each of the measures considered ‘prerequisites’ in the original LEED rating system.) The point totals required to receive these actions, whether for new construction, additions, or interior remodels, are summarized in Table 1 below.

The LEED system is performance based, so the point threshold for each of the actions is not dependent on project size.
**TABLE 1: NON-RESIDENTIAL ACTIONS AND POINT REQUIREMENTS**

- **Total points possible:** 75

- **Action Points required to receive action:**
  - C-1. Receipt of Building Permit*: 7
  - C-2. Accelerated building permit processing: 33
  - C-3. Green Building Award: 40

*Exceptions: These points are not required for non-residential additions and remodels totaling less than 1000 square feet, or interior-only non-residential remodels of any size
III. STANDARDS FOR COMPLIANCE FOR RESIDENTIAL PROJECTS
Alameda County Waste Management Authority Model

The Green Building Program for residential projects is based on the Residential Green Building Guidelines provided by the Alameda County Waste Management Association (ACWMA).
It utilizes a checklist (Appendix B) derived from the ACWMA checklists for new construction and additions/remodels. ACWMA defines residential construction as single-family or multi-family residences, less than or equal to three stories (above grade) in height.
Earning Residential Green Building Rating System Points

The ACWMA-based checklist awards points for specific measures. Where no explicit quantitative measure for receiving credit under a specific point item is given, the following guideline shall apply: If a point credit is claimed, that item shall be applied wherever the specific building element mentioned appears in the project, except where physical factors prevent its use.
For example: If credit is awarded for recycled low-VOC carpets (item N6) then wherever carpets are installed as part of the project, recycled low-VOC carpets shall be used. This would not preclude use of other types of flooring elsewhere.
As a second example, if credit is awarded for "Use Wood I-joists for floors and ceilings" (item C.3) but solid sawn lumber needs to be used for deck framing in order to taper the joists to create proper coping for drainage, then credit C.3 applies if Wood I-joists are used for all of the interior (non-deck) floors and ceilings.
Residential Green Building Sub-Categories and Size Dependence

The residential system distinguishes between new construction and additions/remodels. The two columns in Appendix A of this document (covering new and additions/remodels, respectively) differ slightly because certain elements are practical only for new construction, while certain other elements are important mainly for remodels which may not be subject to other standards that apply to new construction.
Construction of a detached unit on property with an existing dwelling is considered new construction.
Larger projects have more opportunities to incorporate specific measures than small projects. Therefore, larger buildings require more points than smaller buildings, to receive the same building permit action.

For the purpose of determining the required points, the size of the project is defined as heated square footage per dwelling unit.
New Residential Construction

For new residential construction, there are 460 points available for building permit actions.

No project will ever earn all of the points, in as much as some measures are mutually exclusive.
For multi-unit properties, points are calculated per dwelling unit. When many of these units are identical to each other, the points do not need to be reported separately for each unit, but all units of a type must incorporate the sustainable measures in order for the project to receive an action.

The point requirements to earn each of the actions are summarized below in Table 2.
Non-Residential Check List

CITY OF SANTA CRUZ
GREEN BUILDING PROGRAM

GREEN POINTS
CHECK LIST
FOR

NON-RESIDENTIAL BUILDINGS
NON-RESIDENTIAL GREEN BUILDING PROGRAM

Project Address: _________________ Square Footage: _______ (Total New Area)

Type of Project: (Check one) _______ NEW _______ ADDITION _______ REMODEL

POINTS REQUIRED FOR (Check which one you are applying for):

PERMIT ISSUANCE ___ ACCELERATED PLAN CHECK:___ GREEN BUILDING AWARD: ___

Total Points Required From (Table 1): ___________

POINTS BY CATEGORY:

Sustainable Sites: _______ Water Efficiency: _______

Energy and Atmosphere:_______ Materials and Resources:______

Indoor Environmental Quality: _____ Innovation and Design Process: ______

TOTAL POINTS FOR THIS PROJECT: _______ Verified By: ___________________
New Homes Check List

CITY OF SANTA CRUZ
GREEN BUILDING PROGRAM

NEW HOME GREEN POINTS CHECK LIST
FOR
RESIDENTIAL BUILDINGS
### TABLE 2: RESIDENTIAL NEW CONSTRUCTION ACTIONS AND POINT REQUIREMENTS

- **Total Points Available:** 460

<table>
<thead>
<tr>
<th>Action</th>
<th>Points required to receive action:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• <strong>First 350</strong></td>
</tr>
<tr>
<td></td>
<td>• <strong>Square Feet</strong></td>
</tr>
<tr>
<td><strong>R-N-1 Receipt of building Permit</strong></td>
<td>10</td>
</tr>
<tr>
<td><strong>R-N-2 Accelerated bldg permit</strong></td>
<td>35</td>
</tr>
<tr>
<td>process</td>
<td></td>
</tr>
<tr>
<td><strong>R-N-3 Green Building Award</strong></td>
<td>60</td>
</tr>
</tbody>
</table>
RESIDENTIAL COMPLIANCE SUMMARY

- Project Address: ___________________________ Square Footage: _______ (Include attached garage)
- Type of Project: (Check one)    ________ NEW           _______ADDITION           _______ REMODEL
- POINTS REQUIRED FOR (Check which one you are applying for):
  - PERMIT ISSUANCE ______  ACCELERATED PLAN CHECK:______  GREEN BUILDING AWARD: ______
- Base Points required from (Table 2 or 3): = ______
- B. Additional points required per 100 sq. ft.: Sq. Ft. /100  X  additional points factor (Table 2 or 3): = ______
- C. Total points required for permit issuance (= A + B): = ______

POINTS BY CATEGORY:
- Community Design Issues: ______  Site: ______
- Foundation: ______  Structural Frame: ______
- Exterior Finish: ______  Plumbing: ______
- Electrical: ______  Appliances: ______
- Insulation: ______  Windows: ______
- Heating, Ventilation & Air Conditioning:______  Renewable Energy and Roofing  ______
- Natural Heating and Cooling: ______  Indoor Air Quality & Finishes: ______
- Flooring: ______  Other: ______

TOTAL POINTS FOR THIS PROJECT: ____________ Verified By: _____________________________
Residential remodeling or additions

For residential remodeling or additions, 464 points are available. For multi-unit properties, points are calculated per dwelling unit. The point requirements to earn each of the actions are summarized below in Table 3.
TABLE 3: RESIDENTIAL REMODEL AND ADDITION ACTION POINT REQUIREMENTS

Total Points Available: 464

<table>
<thead>
<tr>
<th>Action</th>
<th>Points required to receive action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First 350 Square Feet</td>
</tr>
<tr>
<td>R-A/R-1 Receipt of Bldg Permit*</td>
<td>5</td>
</tr>
<tr>
<td>R-A/R-2 Accelerated bldg permit</td>
<td>25</td>
</tr>
<tr>
<td>R-A/R-3 Green Building Award</td>
<td>35</td>
</tr>
</tbody>
</table>

*Exception: These points are not required for additions and/or remodels of less than 350 square feet.
IV. PROGRAM IMPLEMENTATION AND PHASING
Phase 1 (First 12 months after enactment of the Ordinance)

Phase-in period. All projects first applying for a building permit within this period are required to complete the checklist for their category (residential or non-residential) indicating which measures are being implemented.

There is no mandatory requirement for a Building Permit.

Both higher-level actions are available to participants.

Outreach and Education Program activities begin.
Phase 2 (Thereafter)

- Same as Phase 1 except mandatory point requirements for receiving a Building Permit are in effect.