U.S. EPA's Pacific Southwest Regional Office collaborated with green building experts across the United States as part of a "Building Healthy Hospitals" project. Under this initiative, the project team surveyed architects, designers, engineers, and healthcare professionals to identify the "Top 5 Green Building Strategies for Healthcare" that support JHACO environment of care objectives and best combine: (a) enhanced community reputation, (b) benefits to the environment, patients and staff, and (c) cost competitiveness.

The project team conducted a literature review of green building publications, articles, factsheets, and websites; solicited input from the Building Healthy Hospitals Technical Advisory Group (TAG) convened for this project; collected information from conferences on Green Building and Green Healthcare; conducted interviews with leading practitioners in green building; and reviewed healthcare case studies and selected the following Top 5 Green Building Strategies for Healthcare:

#1: Energy Efficiency—Integrated Design and HVAC Systems

#2: Process Water Efficiency

#3: Sustainable Flooring Material Selection

#4: Indoor Air Quality: Materials Selection

#5: Lighting Efficiency—Optimizing Artificial and Natural Lighting

Case Studies Facilities:
- Emory University
- University of Florida
- Kaiser Permanente
- Discovery Health Center

The following table summarizes the benefits and case study results for each of the five green building strategies.
## Case Studies Overview
### HEALTHCARE - TOP 5 GREEN BUILDING STRATEGIES

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Community Reputation</th>
<th>Environmental/Staff/Patient Benefit</th>
<th>Cost Competitive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>If promoted as part of an environmental outreach program, can <strong>enhance the reputation of the organization</strong> including public’s increasing concern with global warming.</td>
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<tr>
<td></td>
<td>Energy efficiency counteracts <strong>continually increasing energy costs</strong>; HVAC energy efficiency projects can improve the facility’s overall operational efficiency.</td>
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<td></td>
<td><strong>Integrated design lowers HVAC size and rating</strong> and results in less intrusive indoor environment for patient and staff.</td>
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<td>Emory University:</td>
<td>Installed <strong>Low-Emissivity (Low-E), high performance windows.</strong> Realized a 42% reduction in energy consumption for space cooling from <strong>high efficiency chillers</strong> and a 48% savings in cooling tower energy.</td>
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<td>University of Florida:</td>
<td>Heat from the building is captured through the chiller system, minimizing boiler operation; a <strong>ventilated “attic” space, high performance glass</strong>, and brick façade reduce the building’s heat gain.</td>
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<td>Discovery Health Center:</td>
<td>Designed non-combustion, all electric building supplied by wind power. Focused on <strong>building envelope design</strong> because it had the largest effect on the building’s overall energy efficiency. Installed an efficient <strong>geothermal radiant floor heating system</strong> dramatically improving the efficiency of the facility’s HVAC system. Encountered challenges with the air exchange system requirements and energy use.</td>
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<td>Process water represents the largest component of facility water use; water efficiency <strong>improves long-term facility operational efficiency</strong>; proven technologies available and well-tested.</td>
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<td>Emory University:</td>
<td>Installed <strong>condensate water recovery</strong> equipment on air handling unit cooling coils and used it as make-up water for the cooling towers, saving 900,000 gallons annually.</td>
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<td>Emory University:</td>
<td>Reused water from the <strong>chilled water loop serving air handling units to cool compressors</strong> used to chill 9 70-100 square foot walk-in refrigerators in laboratories, saving 11.8 million gallons annually with a payback of 7.5 months.</td>
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HEALTHCARE - TOP 5 GREEN BUILDING STRATEGIES

Benefits

- Community Reputation
- Environmental/Staff/Patient Benefit
- Cost Competitive

- Sustainable flooring reduces impact to the environment and building occupants of purchasing new or replacement flooring material.
- Some environmentally preferable flooring materials may offer reduced slip-trip-and-fall incidents or easier lifetime maintenance, improving employee satisfaction and reducing long-term costs associated with its use.
- If promoted as part of an environmental outreach program, can enhance the reputation of the organization.

Case Studies

- Emory University: Installed recyclable carpet tiles.
- University of Florida: Purchased low-emitting carpets and linoleum.
- Kaiser Permanente: Prepared extensive internal analysis of resilient flooring.
- Discovery Health Center: Used linoleum (low-VOC) and non-vinyl carpets (some cases used hog’s hair). Heated sidewalks reduce salt used in winter, preventing excessive wear on flooring materials as well as water pollution.

Benefits

- Community Reputation
- Environmental/Staff/Patient Benefit
- Cost Competitive

- Careful material selection can improve indoor air quality (IAQ) by reducing contaminants from materials and adhesives during and after construction.
- Use of environmentally preferable materials and unfinished surfaces can reduce need for cleaning chemicals.
- Improved IAQ promotes community awareness, and can be promoted to patients, workers, and visitors.
- If promoted as part of an environmental outreach program, can enhance the reputation of the organization.

Case Studies

- Emory University
- University of Florida
- Kaiser Permanente
- Discovery Health Center

- University of Florida, Emory University, and Discovery Health Center did extensive work to ensure all sealants, paints, carpets, and other finishes were low-emitting to minimize building effects on IAQ.
- Kaiser is developing specifications that eliminate harmful chemicals from entire categories of building materials including moldings and paints.
Case Studies Overview

HEALTHCARE - TOP 5 GREEN BUILDING STRATEGIES

Building Healthy Hospitals Project Objectives

- Community Reputation
- Environmental/ Staff/Patient Benefit
- Cost Competitive

- Lighting energy efficiency counteracts increasing energy costs and improves the facility’s overall operational efficiency.
- Maximizing natural light can improve patient and employee satisfaction.
- Studies suggest that patients can heal faster with access to natural light and vistas.
- Patient and staff control of local environment increases satisfaction and comfort.
- If promoted as part of an environmental outreach program, can enhance the reputation of the organization.

Case Studies

- Emory University
- University of Florida
- Kaiser Permanente
- Discovery Health Center

- Emory University: Increased interior windows (room-to-room) and used switches and occupancy sensors to increase lighting efficiency without increasing energy demands.
- University of Florida: Used ll fixtures with automatic shut-off controls and occupancy sensors; integrated daylighting extensively.
- Discovery Health Center and Boulder Foothills Community Hospital: Emphasized strong connection to environment and extensive use of natural light.