Campus Sustainability Goals

The Hawaii Clean Energy Initiative sets the goal of 70% clean energy by 2030 with 30% from efficiency measures and 40% coming from locally generated renewable sources.

The University of Hawaii Manoa Building Design, Performance, and Sustainability Guidelines state UH Energy Goals:

- 30% energy reduction by 2012
- 50% energy reduction by 2015
- **Energy and water self-sufficient by 2050**
- LEED Silver required for new construction

The University of Hawaii Manoa Building Design, Performance, and Sustainability Guidelines also includes UH Building Performance Goals:

- Increased comfort
- Energy savings
- Healthy working environment assurance
Commercial Building Partnership Program

PROGRAM GOAL
DOE aims to reduce energy use in the commercial building sector by demonstrating high performance design, construction, and operations measures that can be widely deployed throughout the commercial building sector.

LOW ENERGY COMMITMENT
CBP partners with design projects that commit to advanced low energy design goals.

FUNDING
DOE provides funding for technical assistance and analysis to meet the project energy goals using National Lab researchers and outside Technical Experts and M&V (measurement & verification) Contractors.

MEASURED PERFORMANCE
Energy monitoring done before and after the improvements have been made to assess the actual performance and energy savings for each Energy Conservation Measure (ECM) implemented.
DOE CBP Technical Assistance Overview

COST TRACKING
Energy Conservation Measure (ECM) costs are tracked through each stage of design, at project completion business case studies provided to determine the business case for ECMs, their energy cost savings, life cycle and payback analysis.

TECHNICAL AND BUSINESS CASE STUDIES
ECM technical case studies are provided to demonstrate the technical performance of ECMs, developing a technical report and business case model for ECM’s implemented.

DEPLOYMENT PLAN
Provide assistance with a deployment plan for proven ECMs throughout the Partner’s (UH Manoa’s) portfolio.

OUTREACH
Opportunities for increased outreach, public relations, collaboration with other higher education institutions and commercial real estate sector.
LBNL CBP Pilot Projects

UH Manoa Kuykendall Hall one of only 3 CBP Pilot projects at LBNL:

NASA AMES, Moffet Field, CA
Net zero ‘Sustainability Base’ new building
New York Times, New York, NY
Advanced low energy shading, lighting and HVAC
UH Manoa, Kuykendall Hall, HI
Retrofit towards net zero, bioclimatic natural ventilation emphasis
Existing Conditions: Classroom Bldg Exterior

Ewa/Makai view from Legacy Path

Diamond Head/Mauka view from Correa Road

KUYKENDALL RENOVATION
CFPB PRESENTATION  April 7, 2011
modified for RFSOQ, March 23,2012

Benjamin Woo Architects
Lawrence Berkeley National Laboratories
Existing Conditions: Office Bldg Interior

Corner Office

Corridor

KUYKENDALL RENOVATION
CFPB PRESENTATION  April 7, 2011
modified for RFSOQ, March 23, 2012

Benjamin Woo Architects
Lawrence Berkeley National Laboratories
3/23/2012 notes
*The boundary doesn’t include Correa Road.
*The Design has been modified.
Sustainability Courtyard Improvement

Improvement around existing stage area

KUYKENDALL RENOVATION
CFPB PRESENTATION April 7, 2011
modified for RFSOQ, March 23, 2012

Benjamin Woo Architects
Lawrence Berkeley National Laboratories
Ground level Circulation Improvement

KUYKENDALL RENOVATION
CFPB PRESENTATION  April 7, 2011
modified for RFSOQ, March 23, 2012

3/23/2012 notes
* The Plan has been modified.

New Main Entry from Correa Road

Staff Entry

BOH service entry

Staff entry  Preventing passing through traffic
Vertical Circulation Improvement

- Student gathering area with Electrical receptacles for laptop charging
- New accessible elevator
- New electric closets
- New telecom closets

3/23/2012 notes
* The elevator location has been modified.
Breezeway & Lobby seating area Improvement

3/23/2012 notes
* The design has been further developed and modified.
The design has been further developed and modified.
Corridor Improvement

Widen corridor and built-in seating area with electric receptacles for laptops
Create the separation between the classroom doors to prevent the accident
• Light shelf to bring more natural light into the interior space (not shown in image)
• Pendant direct & indirect light fixtures for better lighting condition
Natural lighting & improvement on lighting condition

- Light shelf to bring more natural light into the interior space (not shown in image)
- Pendant direct & indirect light fixtures for better lighting condition

3/23/2012 notes
* No light shelf is incorporated into the design.
PV & wind turbines

PV system on roof
PV system on awnings

Wind turbines on north edge of roof

3/23/2012 notes
* No wind turbine is incorporated into the design.

3/23/2012 notes
• The PV design has been further developed and became more complicated.
  1. Steel frame canopy with PV's is at both roof tops.
  2. PV's are integrated with acoustical chambers
  3. Glass Awnings with integrated PV films at ground level
  4. PV film integrated curtain wall system on west façade.
Design goals

1. Design for “Net-Zero” energy building

2. Substantially reduce the energy use cost effectively
   • Identify and implement climate appropriate low energy design solutions
   • Improve current indoor environmental conditions, set a new climate appropriate
     thermal comfort standard
   • Identify new methods and opportunities for adoption of low energy design practices
   • Capacity building within student body, faculty, staff and State

3. Participant in Commercial Building Partnership Program

4. Kuykendall Hall will be a model for future sustainability building design projects on the
   university campus, set a world class standard for low energy design

5. Modernize Kuykendall Hall into a “State of Art” teaching and learning center

6. Redesign Kuykendall Hall into a major node on campus sensitive to its environment

7. LEED Platinum (3/23/2012 note)
Acoustical consideration

Noise measurements taken 30" outside of the exterior window of each room. $I_{eq}$ based on hourly average.

67 dBA = Outside Noise Design Parameter

Date & Time of Measurement

Kuykendall Hall Sound Measurements - All Rooms (Exterior)

February 2011 11-04 APD
Date Project No. Drawn By

KUYKENDALL RENOVATION
CFPB PRESENTATION April 7, 2011
modified for RFSOQ, March 23, 2012

Benjamin Woo Architects
Lawrence Berkeley National Laboratories
Thermal Comfort Criteria
Appropriate for Climate and for Low Energy Design

- Variables that influence our comfort:
  - Environmental: Temperature, humidity, air velocity, mean radiant temperature
  - Personal: Activity level, clothing

- Fully Sealed and Air Conditioned Design
  - In practice has heavily emphasized temperature and humidity control to achieve comfort
  - Traditional ASHRAE Std. 55 comfort zone
  - Has narrowest band of acceptable interior temperatures
  - Can allow for higher indoor air temperature with elevated air speeds from ceiling fans
  - Most energy intensive approach

- Natural Ventilation Emphasized Design
  - Emphasizes air velocity for thermal comfort, which has correlating cooling affect on the person (e.g. moisture evaporation cools the body)
  - Natural ventilation ASHRAE Std. 55 comfort zone
  - Has wider band of acceptable interior temperatures, varies depending on exterior conditions
  - Allows for higher indoor air temperatures with elevated air speeds (e.g. ceiling fans)
  - Least energy intensive approach
Additional Thermal Comfort Considerations

- Natural Ventilation Emphasized Design (cont’d)
  - Corridors and other transitional spaces between outdoors and naturally ventilated spaces:
    - Opportunity to remove moisture (and partially cool) warmed up occupants at higher metabolism rates before they enter a sedentary classroom
    - Use elevated air speeds to improve air movement during warm conditions
    - Mechanical cooling should be minimized and controlled to reduce condensation opportunities
    - Dehumidify without lowering temperature to reduce risk of developing mold

- Mixed-mode Design (not considered. 3/23/2012 note)
  - Follows natural ventilation or mechanical cooling depending on the operating mode
  - Thermal comfort criteria are the same as the naturally ventilated and fully sealed A/C modes
72% of classroom tower is naturally ventilated. 
2nd, 3rd & 4th corridor functions as a “transitional space”.

3/23/2012 notes
• The plan has been modified. Currently 74.5% of Classroom building is naturally ventilated
Natural Ventilation Model: Classroom Wing

3/23/2012 notes
* The design has been further developed and modified.
* The design has been further developed and modified.

Air velocity sensor installed in the cross duct.

New PV roof canopy is not shown.

Integrating PV panels on south.

The chamber design has been modified. No acoustical louver. Two chambers design with control damper with actuator at the bottom air intake.
Natural Ventilation Model: Classroom Corridor / Transitional Space

Dehumidified Air will be supplied over the newly created seating area in corridor. The entire corridor will function as “a transitional area” prior entering classrooms.

Dehumidification at night to minimize the mold growth cycle.

3/23/2012 notes
• The design has been further developed and modified.
• The inside of cross duct & acoustic chambers are dehumidified at night.
• All offices will be naturally ventilated.
• Office user will have individual control to operate windows.
• Each office has a ceiling fan with individual controls.
• When wind is not available, enthalpy sensor will trigger the mechanical exhaust system.

• The corridor is not envisioned to be designed the same as the transitional space in the classroom building

• The entire building will be automatically sealed, and dehumidification system will be turned on between 1 AM & 5 AM to interrupt the mold growth cycle.

3/23/2012 notes
• The design has been further developed and modified.
• Each office has an occupancy sensor to control lighting & plug load.
3/23/2012 notes
• The design has been further developed and modified.

1. Acoustical chambers (different design from classroom building) are designed and have integrate PV’s on south.
2. The sunshade design has been modified.
3. The corridor ceiling design has been further developed in consideration of both natural air flow & acoustics.
4. The louvers at the end of corridor are equipped with actuators.
3/23/2012 notes
1. The air intake can be through either windows or acoustic chamber (not shown in this sketch).
3/23/2012 notes

1. The design has been further developed and modified.

2. Windows are equipped with actuators so that they will be automatically closed during night time dehumidification. The acoustic chambers have control dampers with actuators at the bottom.

3. The return path has been modified.
Comparison with campus energy performance goals

The University of Hawaii Manoa Building Design, Performance, and Sustainability Guidelines state UH Energy Goals:

- **30% energy reduction by 2012; 50% energy reduction by 2015**
- **Energy and water self-sufficient by 2050**

<table>
<thead>
<tr>
<th></th>
<th>Existing Building</th>
<th>Naturally Ventilated Option</th>
<th>Mixed Mode Option</th>
<th>Fully Air Conditioned Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% Energy Reduction possible <strong>without</strong> PV?</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Energy Self-Sufficiency Possible with PV?</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Energy Self-Sufficiency Possible with energy produced only at Kuyk?</td>
<td>NO</td>
<td>Possibly – with plug load reduction, minimized dehumidification and deeper lighting savings</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>
* The design has been further developed and modified.