



UNIVERSITY  
of HAWAII®  
MĀNOA

*Office of Facilities and Grounds*

The Climate Registry 

# University of Hawaii at Mānoa Energy Status Report March 2010



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MĀNOA

March 2010

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## 2007 Energy Usage Reduction Plan

| Baseline Electrical Usage   | 2006               | 2007               | 2008               | 2009               | 2010              | 2011              | 2012              | 2013              | 2014              |
|-----------------------------|--------------------|--------------------|--------------------|--------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Baseline Annual kWh (2004)  | 121,350,873        | 121,350,873        | 121,350,873        | 121,350,873        | 121,350,873       | 121,350,873       | 121,350,873       | 121,350,873       | 121,350,873       |
| Energy Program Savings kWh  |                    |                    |                    |                    |                   |                   |                   |                   |                   |
| Mechanical Systems kWh      | 8,500,000          | 9,000,000          | 12,400,000         | 13,000,000         | 15,000,000        | 17,000,000        | 19,000,000        | 21,000,000        | 23,000,000        |
| Conservation kWh            |                    |                    |                    | 2,000,000          | 6,000,000         | 8,000,000         | 8,000,000         | 8,000,000         | 8,000,000         |
| Performance Contracting kWh |                    |                    |                    |                    | 2,000,000         | 8,000,000         | 12,000,000        | 16,000,000        | 20,000,000        |
| RCx kWh                     |                    |                    |                    | 200,000            | 800,000           | 2,000,000         | 2,000,000         | 2,000,000         | 2,000,000         |
| PV Systems kWh              |                    |                    |                    |                    | 1,000,000         | 2,000,000         | 2,000,000         | 2,000,000         | 4,000,000         |
| Total Program Savings kWh   | 8,500,000          | 9,000,000          | 12,400,000         | 15,200,000         | 24,800,000        | 37,000,000        | 43,000,000        | 49,000,000        | 57,000,000        |
| Net Requirement kWh         | <b>112,850,873</b> | <b>112,350,873</b> | <b>108,950,873</b> | <b>106,150,873</b> | <b>96,550,873</b> | <b>84,350,873</b> | <b>78,350,873</b> | <b>72,350,873</b> | <b>64,350,873</b> |
| Percent Reduction Targets   |                    |                    |                    |                    |                   |                   |                   |                   |                   |
| Mechanical Upgrades         |                    | 7.4%               | 10.2%              | 10.7%              | 12.4%             | 14.0%             | 15.7%             | 17.3%             | 19.0%             |
| Conservation                |                    | 0.0%               | 0.0%               | 1.6%               | 4.9%              | 6.6%              | 6.6%              | 6.6%              | 6.6%              |
| Performance Contracting     |                    | 0.0%               | 0.0%               | 0.0%               | 1.6%              | 6.6%              | 9.9%              | 13.2%             | 16.5%             |
| RCx                         |                    | 0.0%               | 0.0%               | 0.2%               | 0.7%              | 1.6%              | 1.6%              | 1.6%              | 1.6%              |
| PV Systems                  |                    | 0.0%               | 0.0%               | 0.0%               | 0.8%              | 1.6%              | 1.6%              | 1.6%              | 3.3%              |
| Total Reduction             | 7.0%               | 7.4%               | 10.2%              | 12.5%              | 20.4%             | 30.5%             | 35.4%             | 40.4%             | 47.0%             |



## FY2009 Performance

- Manoa Campus' net electrical usage for Fiscal Year 2009 declined by over 7% to 101,171,623 kWh from the prior year of 108,950,873 kWh.
- This reduction of 7,779,250 kWh is equivalent to approximately \$1.5 million in expense savings equivalent to the full-time annual tuition for 230 undergraduates or the fully loaded salaries of 15 faculty members per year.
- This is the fourth straight year in the decline of net energy usage from the campus peak usage of 121,350,873 kWh in FY2004 contributing \$9 million in cumulative savings



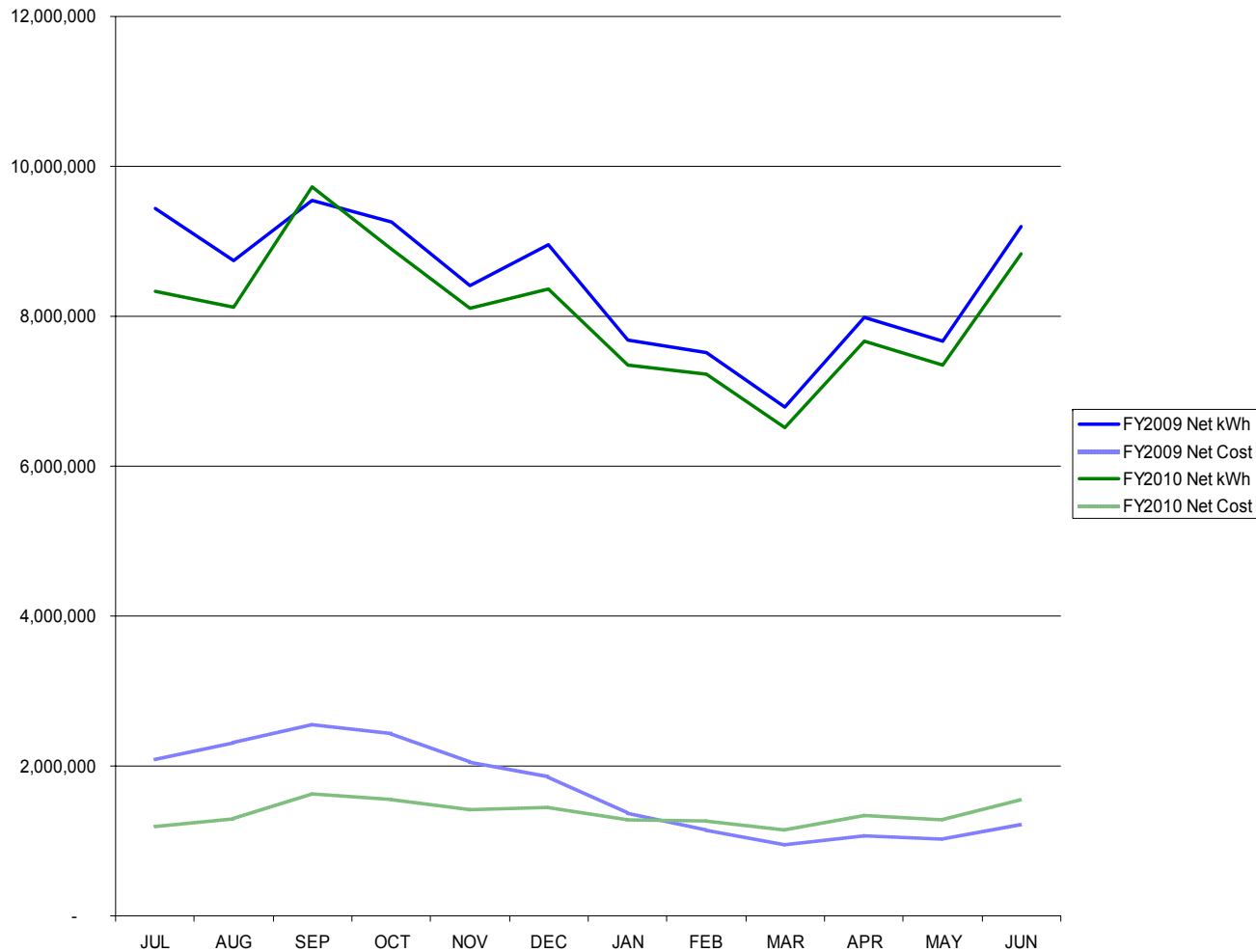
## FY2010 Performance

- In FY 2004 UHM consumed 121 million kWh
- In FY 2009 UHM consumed 101 million kWh -16%
- In FY 2010 UHM will consume 95 million kWh -20%
- FY2010 Savings of \$3.5 million
- Achieve or exceed FY2010 Goal
- Reinvest for FY2011

|                 | JUL          | AUG          | SEP          | OCT          | NOV          | DEC          | JAN          | FEB          | MAR          | APR          | MAY          | JUN          | TOTAL         |
|-----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|
| FY2009 Net kWh  | 9,439,875    | 8,740,202    | 9,538,908    | 9,255,010    | 8,406,202    | 8,950,639    | 7,682,634    | 7,521,655    | 6,789,159    | 7,990,181    | 7,660,117    | 9,197,041    | 101,171,623   |
| FY2009 Net Cost | \$ 2,093,612 | \$ 2,314,950 | \$ 2,554,068 | \$ 2,434,209 | \$ 2,055,118 | \$ 1,860,322 | \$ 1,380,825 | \$ 1,152,110 | \$ 958,326   | \$ 1,070,870 | \$ 1,026,398 | \$ 1,227,727 | \$ 20,128,535 |
| FY2010 Net kWh  | 8,332,216    | 8,119,950    | 9,723,818    | 8,901,461    | 8,102,553    | 8,368,679    | 7,344,269    | 7,220,789    | 6,517,593    | 7,670,574    | 7,353,712    | 8,829,159    | 96,484,773    |
| FY2010 Net Cost | \$ 1,199,788 | \$ 1,306,168 | \$ 1,631,647 | \$ 1,562,507 | \$ 1,421,497 | \$ 1,448,242 | \$ 1,292,152 | \$ 1,270,859 | \$ 1,147,096 | \$ 1,350,021 | \$ 1,294,253 | \$ 1,553,932 | \$ 16,478,163 |

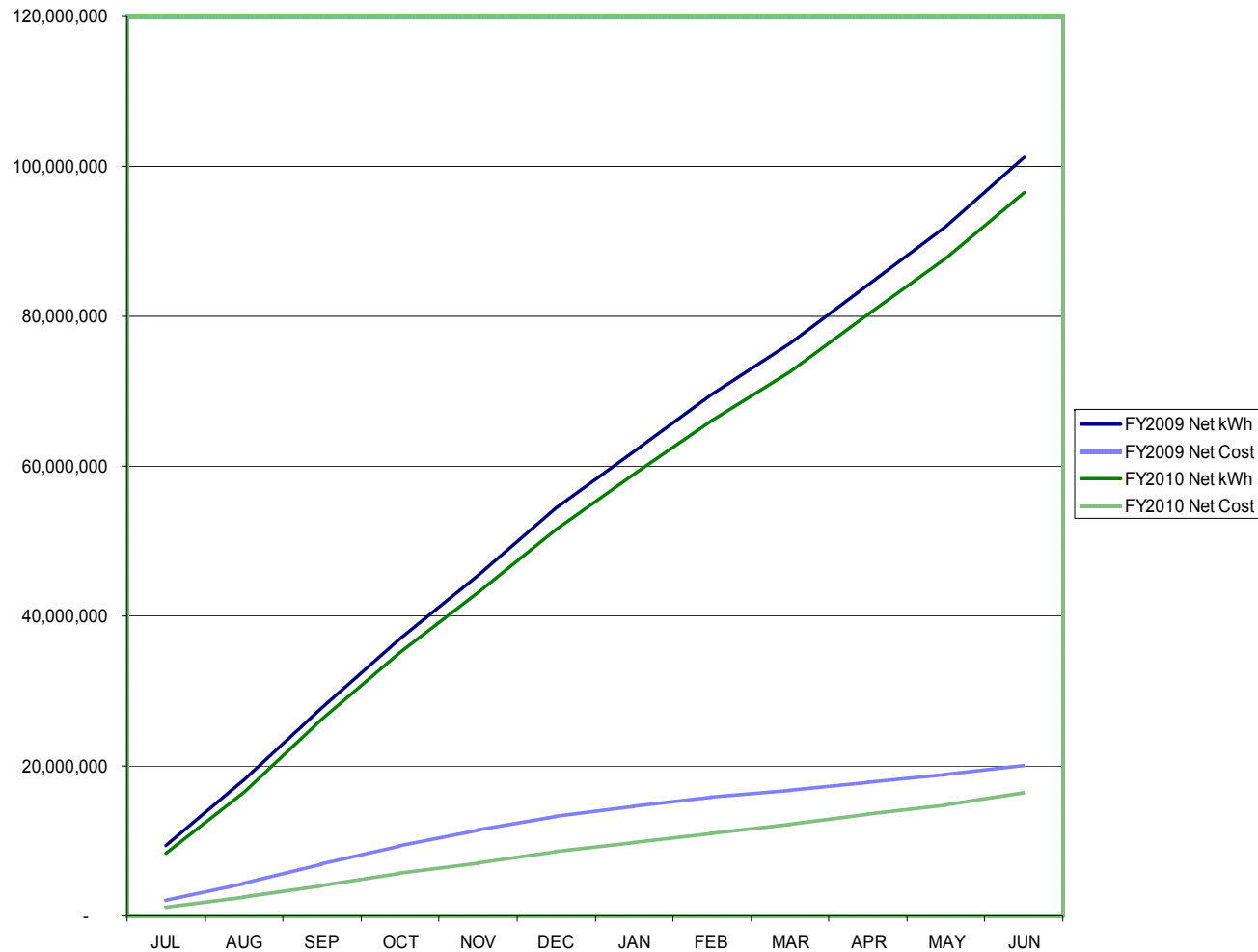


# UHM Monthly Net Energy Usage



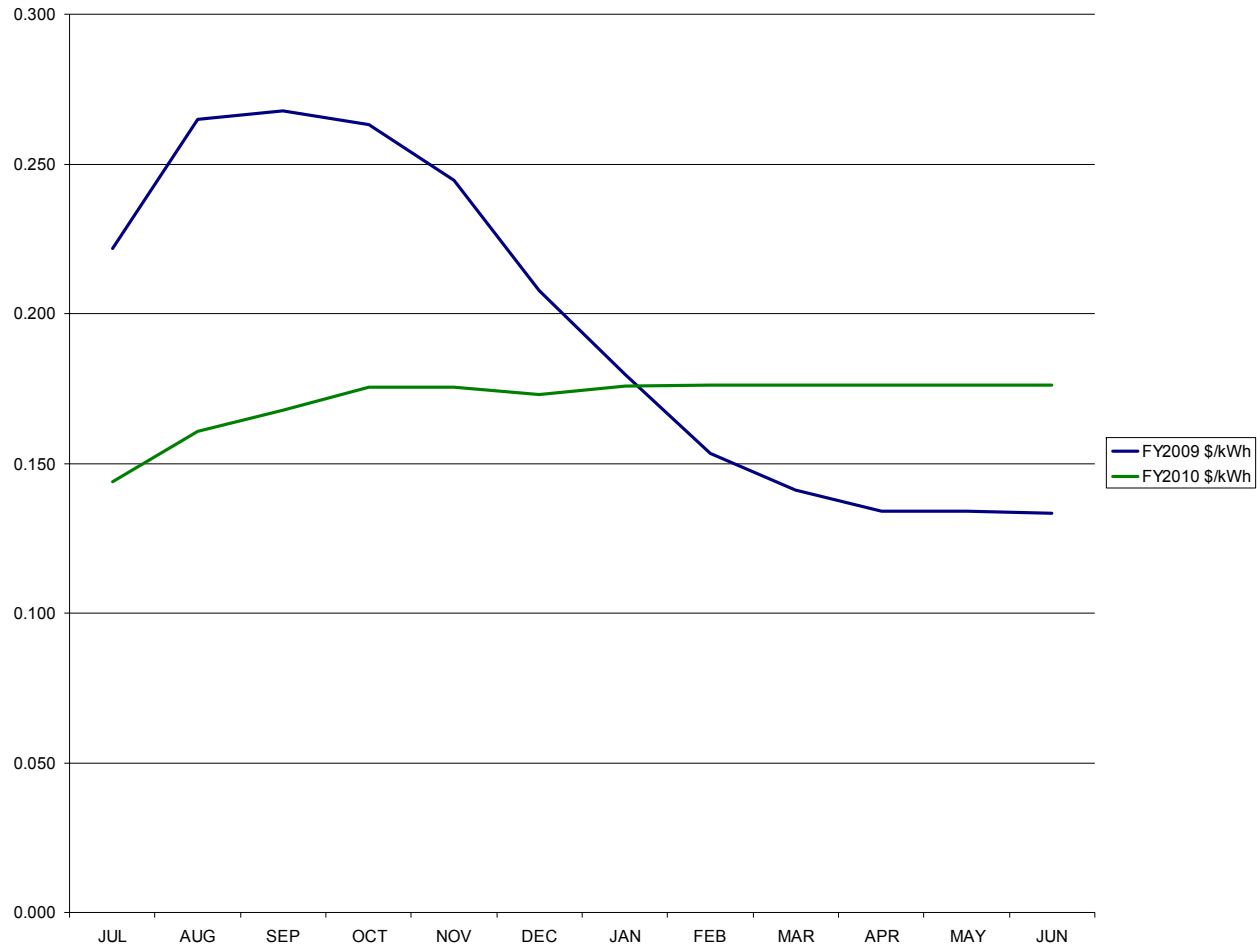


# UHM Monthly Cumulative Energy Usage





# Price per kWh





## Energy Program Drivers

- These results have been made possible by an established program of capital investments in HVAC mechanical upgrades and energy retrofits as part of the campus' biennium Campus Renewal and Deferred Maintenance program.
- 75% of all energy savings are the result of HVAC mechanical upgrades and retrofits.
- The Manoa campus commits 30% of its biennium capital program towards this purpose.
- Additional savings are created through soft projects such as the Manoa Green Days conservation efforts.
- The on-going CRDM HVAC mechanical upgrade and energy retrofit program, the expansion of the Manoa Green Days, and future re-lamping programs with the Center for Smart Buildings and Community Design, the campus is well positioned to achieve its goals
- Future initiatives include
  - the installation of intelligent metering technology;
  - the installation of photovoltaic roof-top systems to provide Distributed Generation capability;
  - intelligent building power distribution and control systems;
  - a new “Smart Grid” campus electrical substation;
  - and, time-of-day billing and demand response.



## Manoa Green Days

- A/C Shutdown during the Holidays (Thanksgiving, Christmas/New Year) and Spring Break
- To provide information on sustainable energy initiatives of campus buildings
- To drive collaboration between campus constituents - promote partnerships
- To communicate progress and energy conservation results of campus buildings

<http://www.manoa.hawaii.edu/facilities/mgd>



## Participating Buildings

### Phase 1 Participants

- **Architecture School**
- **Bachman Hall**
- **Crawford Hall**
- **George Hall**
- **Hamilton Library**
- **Hawaii Hall**
- **Kuykendall Hall**
- **Law Classroom/Office Building**
- **Queen Lili'uokalani Center for Student Services**
- **Saunders Hall**
- **University Health Services**
- **Webster Hall**

### Phase 2 Participants

- **Everly Hall**
- **Holmes Hall**
- **Center for Hawaiian Studies**
- **Kennedy Theatre**
- **Moore Hall**
- **Music Building/Orvis Auditorium**
- **Shidler College of Business**
- **UH Press**
- **Wist Hall**



# Examples



## Architecture School

Building Coordinator: Clark Llewellyn

Contact: Email: [clarklle@hawaii.edu](mailto:clarklle@hawaii.edu) Phone: 956-3469

Weekend Closure Start Date: July 2, 2009

Building News:

### A/C Schedule

Mon: 5:00am - 6:00pm

Tue-Fri: 6:00am - 6:00pm

Sat/Sun: Off



## Hawaii Hall

Building Coordinator: Michele Sonoda

Email: [mssonoda@hawaii.edu](mailto:mssonoda@hawaii.edu) Phone: 956-0810

Weekend Closure Start Date: July 2, 2009

Building News:

### A/C Schedule

Mon: 5:00am - 9:00pm

Tue-Fri: 6:00am - 9:00pm

Sat/Sun: Off

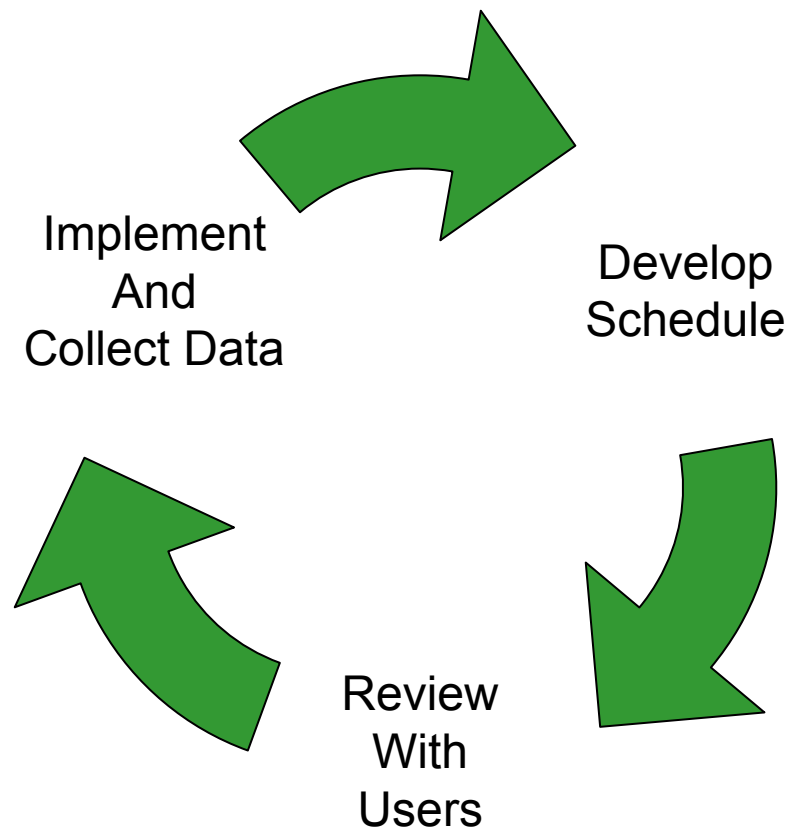


## AC Scheduling

- Scheduling versus Shutdown
  - Primary buildings systems remain active
- Each Building has its own plan fitted to user needs and building technology
  - Hours of Operation
  - Operating Parameters (Temp and RH)
  - Age of HVAC system
  - Constant Volume vs. Variable
  - Available Controls (EMCS)
    - Manual
    - Local Programmable
    - Remote Control



## Schedule Development Process





## Results from December-January

- Overall net energy usage reduction of approximately 1 M kWh for the two month period. (8.5 M kWh vs. 7.5 M kWh)
- Estimated savings of \$225,000
- MGD program directly accounted for 20% of these savings ( 0.2 M kWh)
  - Saturday 19 Dec through Sunday 3 Jan (16 Days)
  - \$40,000
- MGD “Indirect” secondary benefits



## *OFG – People Serving Pride, Joy, and Aloha*