

UC Berkeley Climate Action Course

Credit: 2 units of independent study with the faculty sponsor, or a professor within the student's department. This course is open to both graduate and undergraduate students. Telebears listing: Energy and Resources 299 P 001 IND, CCN 27508, pass/fail.

Time/Location: Mondays 4-6pm, Room 224 Wheeler

Faculty sponsor: Dan Kammen, Energy and Resources Group

Campus staff representative: Fahmida Ahmed, CalCAP Project Manager

Course Description

With the approval of the Cal Climate Action Partnership (CalCAP - <http://calcap.berkeley.edu>) proposal this past spring, Chancellor Birgeneau committed UC Berkeley to reduce campus greenhouse gas emissions to 1990 levels by 2014. The proposal was written by a team of authors guided by a steering committee composed of faculty, administrators, staff, and students and chaired by Vice Provost Cathy Koshland. It was built upon and extended a campus wide sustainability assessment completed in 2005 under the Chancellor's Advisory Committee on Sustainability (CACS) that represented the first attempt to inventory campus wide greenhouse gas emissions and resource consumption and make specific recommendations for reducing the ecological impact of campus activities.

This Climate Action Course will bring together interested students to study the projects currently being considered for implementation under CalCAP, identify new projects the campus might undertake, and to move them forward through action-oriented research. This course will provide motivated students an opportunity to contribute to significant reductions in campus greenhouse gas emissions and the realization of longer term sustainability goals.

Course sessions will engage CalCAP contributors, facilities management, research faculty, outside experts, and the UC administration in conversation on specific CalCAP projects and additional opportunities for emissions reductions on campus. Readings will include the 2005 Sustainability Assessment, the recently adopted CalCAP Proposal, documentation on similar commitments from campuses around the country, and peer reviewed literature on emissions reductions, behavior change, energy economics, building resource use, etc.

Course Requirements

- Students will be expected to write a research paper on a topic of their choice and prepare a presentation of their work for the CalCAP committee

- at the end of the semester. Topics must have practical applications and directly further CalCAP's goal to reduce campus emissions.
- In addition, each student will be expected to organize and run at least one class session and actively participate in classroom discussions.

Course Schedule with Readings

Note: Readings listed under each week must be read before class that day. Most sessions will start with a discussion of the readings followed by a conversation with guest speakers. Speakers and readings are subject to change.

8/27 Introduction

Course sign-up, overview, Q&A, readings assigned

9/3 Labor Day - No Class

9/10 CalCAP intro, campus emissions inventory, UC-wide goals

Discussion

Invited: Cathy Koshland, Fahmida Ahmed, Karl Brown, Matt St. Clair

Readings

- Ahmed, F. (2007). UC Berkeley Climate Action Partnership - Feasibility Study 2006- 2007 Final Report, UC Berkeley.
<http://sustainability.berkeley.edu/calcap/docs/CalCAP%20Report%20FINAL%20DRAFT%20June%202007.pdf>
- Dynes, R. C. (2007). University of California Policy on Sustainable Practices, University of California. <http://www.ucop.edu/facil/sustain/documents/ucregentgreenbldg.pdf>
- UC Regents (2007). Annual Report on Green Building, Clean Energy, and Sustainable Transportation Policy <http://www.universityofcalifornia.edu/regents/regmeet/jan07/113.pdf>
- Fitzgerald, G., et al. (2005). UC Berkeley Campus Sustainability Assessment, CACS. http://sustainability.berkeley.edu/assessment/pdf/CACS_UCB_Assessment_Full.pdf
- American College & University Presidents Climate Commitment <http://www.presidentsclimatecommitment.org/pdf/commitment.pdf>
- Dautremont-Smith, J., ACUPCC Implementation Guide (DRAFT) <http://www.presidentsclimatecommitment.org/pdf/ACUPCCdraftIG.pdf>

Assignment

Find a policy at another university related to climate change or emissions reductions, and email an analysis (~250 words) of its strengths and weakness to merrian_fuller@mba.berkeley.edu **by 5pm September 9th**. These will be shared with the class. Some links to get started:

http://www.williams.edu/admin/president/letters/070124_CAC.php
<http://www.greencampus.harvard.edu/about/principles.php>
<http://www.yale.edu/sustainability/>
<http://environment.stanford.edu/>

9/17 Projects under consideration, measuring/monitoring emissions

Discussion

Invited: Dan Kammen, Arpad Horvath, Chris Jones, Scott Zimmermann

Readings

- Gershon, David (2006). Low Carbon Diet: A 30 Day Program to Lose 5000 Pounds.
- Junnila, S., A. Horvath, et al. (2006). "Life-Cycle Assessment of Office Buildings in Europe and the United States." Journal of Infrastructure Systems 12: 10.
- Lovins (1996). "Negawatts - Twelve transitions, eight improvements and one distraction." Energy policy 24(4): 331.
- Monbiot, George (2007). Heat: How to Stop the Planet from Burning. (excerpts given in class)

Assignment

Write a preliminary description of the research you would be most interested in doing to further the CalCAP goals on campus (~250 words), and email to merrian_fuller@mba.berkeley.edu **by 5pm September 16th.**

9/24 Green buildings, building envelope, HVAC and mechanical systems

Discussion

Invited: Judy Chess, Gail Brager, Ed Arens

Readings

- Brager, G. S. and R. de Dear (2000). "A standard for natural ventilation." ASHRAE Journal 42(10): 21-28.
- World Business Council for Sustainable Development (2007). Facts & Trends: Energy Efficiency in Buildings. <http://www.wbcsd.org/includes/getTarget.asp?type=d&id=MjU5MTI>
- USGBC (2005). LEED NC: Green Building Rating System for New Construction & Major Renovations, US Green Building Council. pp 8-9, Energy and Atmosphere 31-44
- Torcellini, P., S. Pless, M. Deru, B. Griffith, N. Long, R. Judkoff (2006). Lessons Learned from Case Studies of Six High-Performance Buildings, NREL. Read: Executive Summary and Section 4 (Conclusions), skim Appendix A
- Schendler, A., and Udall, R. (2005). "Leed is Broken. Let's Fix It." skim

Optional Readings

- Diamond, R., Opitz M, Hicks T, Vonneida B, and Herrera S. (2006). Evaluating the site energy performance of the first generation of LEED-certified commercial buildings. Summer Study on Energy Efficiency in Buildings, Washington DC, American Council for an Energy Efficient Economy. http://epb.lbl.gov/homepages/Rick_Diamond/LBNL59853-LEED.pdf
- Langdon, D (2007). Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption <http://www.dladamson.com/upload/images/publications/USA/The%20Cost%20of%20Green%20Revisited.pdf>
- Kats, G. H. (2003). "Green Building Costs and Financial Benefits." Published in USA for Massachusetts Technology Collaborative. <http://www.cap-e.com/ewebeditpro/items/O59F3481.pdf>
- Griffith, B., P. Torcellini, et al. (2006). Assessment of the Technical Potential for Achieving Zero-Energy Commercial Buildings: Preprint. <http://www.nrel.gov/docs/fy06osti/39830.pdf>
- Lee, E., S. Selkowitz, et al. (2002). High-performance commercial building facades, LBNL 50502, Ernest Orlando Lawrence Berkeley National Laboratory, Berkeley, CA (US). (excerpts – read pages 6-25, skim case studies pages 95-109) <http://repositories.cdlib.org/cgi/viewcontent.cgi?article=2490&context=lbnl>
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10/1 Existing building retrofits, operations, controls, commissioning

Discussion

Paul Black, Charlie Huizenga

Readings

- Beard, D. P. (2007). Green the Capitol Initiative Final Report – Executive Summary, US

- House of Representatives. <http://cao.house.gov/greencapitol/green-the-capitol-final-report.pdf>
- Mills, E., et. al (2004). The Cost-Effectiveness of Commercial-Buildings Commissioning, LBNL: 60.
- USGBC (2005). LEED NC: Green Building Rating System for New Construction & Major Renovations, US Green Building Council.
<https://www.usgbc.org/ShowFile.aspx?DocumentID=1095>

10/8 Renewables and co-generation, CHP, smart grid

Discussion

Chris Marnay, Daniel Prull

Readings

- Santa Barbara County energy blueprint (2007) chapters 5-6
<http://www.communityenvironmentalcouncil.org/EnergyBlueprint/preblueprint.cfm>
- Marnay and Firestone (2007), "Microgrids: an emerging paradigm"
<http://eetd.lbl.gov/EA/EMP/reports/62572.pdf>
- <http://www.epa.gov/chp/>
- Marnay, et al (2007), "Optimal Technology Selection and Operation of Microgrids in Commercial Buildings."
<http://eetd.lbl.gov/EA/EMP/reports/62315.pdf>

Optional

- Russo, Christopher. "Using Real-Time and Historical Data Through the Internet and on the Desktop"
<http://cogen.mit.edu/publications.cfm>
- Bailey, et al (2002), "An Engineering-Economic Analysis of CHP Technologies in a Microgrid Application"
<http://repositories.cdlib.org/cgi/viewcontent.cgi?article=1610&context=lbln>
- Educogen (2001), "A Guide to Cogeneration"
http://www.cogen.org/Downloadables/Projects/EDUCOGEN_Cogen_Guide.pdf
- Marnay and Venkataramanan (2006), "Microgrids in the Evolving Energy Generation and Delivery Infrastructure"
http://der.lbl.gov/new_site/pubs/GiriMarnay_LBNL59544_16Feb2006.pdf
- Federal Energy Management Program Guide, "Using Distributed Energy Resources"
<http://www.nrel.gov/docs/fy02osti/31570.pdf>

10/15 Research topics selection/discussion

10/22 Energy economics and financing

Discussion

Nathan Brostrom

Readings

- Short version of budget/decision roadmap:
<http://www.cp.berkeley.edu/ProcessPage2.html>
- Long version of approval process roadmap:
http://www.cp.berkeley.edu/FS_Info/pa-betaweb/main.htm
- Wikipedia article on NPV
http://en.wikipedia.org/wiki/Net_present_value

- Wikipedia article on IRR
http://en.wikipedia.org/wiki/Internal_rate_of_return

10/29 Labs, plug loads, electronics/appliance efficiency

Discussion

Paul Matthew

Readings

- Mathew, P., D. Sartor, et al. (2004). "Rating energy efficiency and sustainability in laboratories: Results and lessons from the Labs21 program." Conference: ACEEE 2004 Summer Study in Buildings, Pacific Grove, CA (US), 08/22/2004--08/27/2004.

11/5 Work Session

11/12 No class (holiday)

11/19 Energy use and behavior, conservation, feedback systems

Discussion

Kameron Kitajima, Michael Murray

Readings

- Darby, S. (2001). Making it obvious: designing feedback into energy consumption, Environmental Change Institute, University of Oxford.
- Darby, S. (2006). "THE EFFECTIVENESS OF FEEDBACK ON ENERGY CONSUMPTION." A Review for DEFRA of the Literature on Metering, Billing and direct Displays, April.
- Lutzenhiser, L. (1993). "Social and Behavioural Aspects of Energy Use." Annual Review of Energy and the Environment 18: 247-289.
- Petersen, J. E., V. Shunturov, et al. (2007). "Dormitory residents reduce electricity consumption when exposed to real-time visual feedback and incentives The Authors." International Journal of Sustainability in Higher Education 8(1): 16-33.

11/26 Work Session

12/3 Final Presentation Practice

12/10 Final presentations