

PROJECT NAME: Introduction to Sustainable Energy & Transportation

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Learning Outcomes

- Describe proposed course in one sentence; including campus sustainability element
 - Introduce students to power generation systems and energy management applications, including chilled water distribution, electricity use data analysis, and solar photovoltaic systems.
- What specific skills will students learn? What knowledge will they gain?
 - Demonstrate comprehension of HVAC systems: chillers, boilers, condensers, controls, distribution systems, pumps, cooling towers, piping, heat exchangers, VSD/VFDs, mixing valves, refrigeration cycle
 - Use MS Excel skills to effectively communicate campus energy trends: peak energy demand, total campus usage, load factor, monthly cooling, plant average efficiency, central plant contribution to campus peak
 - Solar PV power system components design and operation: solar array, mounting, cabling, tracker, inverter, battery, monitoring and metering
- What Sustainability Outcomes does your team want the students to achieve?
 - 1) Increase energy efficiency of CSU buildings/facilities, 2) Identify energy efficiency improvement measures, 3) Create awareness of sustainability objectives to campus community, 4) Increase on-site, renewable power

Connecting to CALL

- How does this proposed course align with CALL program objectives?
 - Course redesign will tie elements of sustainability into opportunities for student learning using the campus environment, including 1) comprehension of central plant operations, 2) analysis of campus energy usage data, and 3) evaluation of solar photovoltaic system performance.
- Which activities can CALL program support?
 - 1) Video camera equipment for campus facilities tours, 2) Supporting access to primary data of campus energy usage, and 3) Technical support with removal and replacement of solar PV systems.
- What is the team's vision for the next year as part of the CALL redesign program?
 - 1) Reevaluate successes and opportunities for improvement, 2) Continue campus tours, student summaries of mechanical systems and revise video content if necessary, 3) Analyze energy performance at the building level rather than overall campus, and 4) Assess opportunities for further upgrades to PV system and opportunity to compare performance before and after the upgrade using online data.

Overcoming Obstacles

- Are there mismatches between desired learning outcomes and sustainability outcomes?
 - There is great alignment between learning and sustainability outcomes. Potential mismatches include an inability of students to propose effective energy efficiency improvement measures or to significantly reduce campus GHG emissions. However, there is little doubt that the students will not increase their awareness of sustainability objectives to campus community.
- Do you need to modify existing outcomes?
 - Yes, existing outcomes need to be modified to include specific skills listed under the Learning Outcomes section.

Tracking Success

- How will you know if students achieved Sustainability Outcomes?
 - Complete course activities: 1) tour and create video of central plant and other campus facilities, 2) analyze energy use trends and produce graphic visualizations to interpret data, and 3)
- How will you know if this redesigned course is an improvement over the current version? How will you measure?
 - Complete course activities: 1) tour and create video of central plant and other campus facilities, 2) analyze energy use trends and produce graphic visualizations to interpret data, and 3)

Taking Action

- What tasks/activities will the students perform?
 - 1) Multiple tours with facilities staff to review various components of central plant, 2) Create videos to effectively communicate the operations of central plant and chilled water distribution system, 3) Collect, review and analyze campus energy data, 4) Present energy usage report with graphical depictions of trends and recommend efficiency improvements, and 5) Observe and help of campus electricians remove and replace rooftop solar modules.
- What role will facilities/sustainability officer have in redesign process and course delivery?
 - Facilities will arrange student tours of central plant with Building Systems Engineers (BSEs), provide access to campus energy data for students to review and analyze, and coordinate removal of rooftop PV system with attention to safety issues.

Future Tasks

Designing the assignments

- Two of the three course segments will involve group projects: 1) video describing campus HVAC system and 2) energy data modeling presentations. A final assessment survey will evaluate comprehension, application, analysis, synthesis and evaluation of reviewed energy concepts.
- Sequencing of assignments: 1) Central plant and facilities tours, 2) Video presentations, 3) Energy data collection and analysis, 4) Energy modeling presentations, 5) Review and dismantling of PV system, and 6) Assessment of course material
- Assessments will include: pre-course survey, evaluations of HVAC video and energy modeling presentations, and post-course survey
- Background info needed to achieve goals of this course: effective understanding of campus chilled water distribution system, key terms related to energy data analysis, and the operation and performance of rooftop PV systems

Defining Criteria for Success

- Course outcomes are relevant to the learners and their personal goals if they are interested in issues of sustainability, and for their career goals if they decide to pursue an energy systems-related professional track.

CALL OBJECTIVE

The 'Campus as a Living Lab' Grant Program is a unique opportunity to partner faculty and facilities management staff in using the campus as a forum for the exploration of sustainability concepts and theories.