Energy Course Design Workshop

A Client-Focused, Project Based Approach

October 23rd 2019

Kurt Kornbluth, Alice Dien, & Magdalena Brum
Workshop Structure

9 am - Introductions (30 min)
- Who we are
- Group formation

9:30 am : Client Focused Approach

10:30 am : Break (30 min)

11:00 am - Part II (45 min)
- D-Lab Toolkit
- Build a course (Activities II-IV)

11:45 am - Lunch (1 hr)

12:45 am - Part III (1 hr)
- Activities V-VII

1:45 pm - Break (15 min)

2:00 pm – Elevator pitches and discussion
Today’s Deliverables

1-page course brief, Elevator Pitch

• Title
• Format
• Course Description: Skills, Tools, & Activities
• Course Objectives
• Resources: People, places, funds, potential Clients and Projects
• Evaluation Method
Introductions
Who are we?

Kurt Kornbluth, PhD  
Founder & Director  
Davis D-Lab

Magdalena Brum  
Energy Manager  
Sandford University

Alice Dien  
M.S. Student – Biological Systems Engineering
Group formation

1. Course framing (active listening)
   - Who are they? What are their skills?
   - Focus area?
   - What is their dream course? (5 keywords)

2. Elevator pitch to the class (Synthesis, Articulation)

3. Summary on a sticky note
Kurt Kornbluth
Likes design, cool technology
Wants a course to teach applied skills for RE evaluation

1. Energy
2. Modeling
3. Economics
4. Hands-on
5. Climate
6. Prototyping
D-Lab
Client-focused, project based learning

Development through
Dialogue
Design
Discovery
&
Dissemination
What motivates me?
Education Environment

- A place to meet
- Client focused
- Co-creation
- Interdisciplinary
- Multidisciplinary (Teachers and students)
- Design-think approach
- Bi-directional
- Guided & mentored
- Individual, group, & peer evaluation
A Place to Meet & Work
D-Lab student Innovation Space
Multidisciplinary
Interdisciplinary

- Environmental
  - Local impacts
  - Life cycle impacts

- Social
  - Key Stakeholders
  - Community ownership
  - Gender Issues

- Economic
  - Market segmentation
  - Costs & Benefits
  - Financing/Dissemination Strategy

- Technical
  - Performance
  - Resource Requirements
  - Capacity Requirements
Co-Creation/Primary research
Learning by Doing

“Sometimes you gotta get out of the library”
Client-focused...

The client or community partner brings the problem.

Mentors advise the team.

Student teams work as consultants.

Get Support

Learn

Address Real Needs

...produces intrinsic motivation (fear)
Global Outreach

- D-Lab Toolkit
- D-Lab Satellites
- Global Campus Partnerships
Scaling for impact

D-Lab Professional:
  Feasibility Studies
  Design Build & Test
  Art and Engineering
  Water and Sanitation Health

A Path to Zero Net Energy
A Path to Zero Waste
ABT 212 - PATH TO ZERO NET ENERGY
A Hands-On Approach
# 2019 ZNE Group Projects

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Client</th>
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<tbody>
<tr>
<td>Growth Chamber Efficiency</td>
<td>Controlled Environment Facility</td>
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<tr>
<td>Innovation Hub</td>
<td>Facilities Management</td>
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<tr>
<td>Efficient Lighting Retrofit</td>
<td>Fleet Services</td>
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<td>Ultra-Low Freezer Efficiency</td>
<td>Office of Sustainability</td>
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<td>Renewable Energy Design</td>
<td>McLaughlin Reserve</td>
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<td>Harvesting Daylighting</td>
<td>Energy Conservation Office</td>
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<td>Hop Kiln Energy Sourcing</td>
<td>Rühstaller Beer</td>
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NEW SEMINAR

A Path to Zero Waste
D-Lab Project Framing Seminar
FALL 2019

Looking for students interested in:
- Learning about sustainable waste management
- Facing challenges and designing solutions
- Participating in local and international waste management projects

Learn more about the role of managing waste on solving real world issues.

Guest Speakers & Case Studies
Students will work with clients to take action on pressing global issues through dialogue, design, and dissemination.
2019 PZW Projects

- Design of Smart Bins
- Composting and Carbon Policy for Yolo County Landfill
- FS for Almond Shell Plastic Composites
- Biogas Purification for the UC Davis Biodigester
- Economic Feasibility Study for Recycling System In Bukina faso
- Wood Waste Reduction at Yolo County Landfill
Thermal Storage Tank

Optimize TES charge and discharge schedules to minimize operational cost

- Davis, CA > 40 °C
- Cooling 365 days/year
- Energy & Climate Concerns

- $
- Client: UCD Facilities
- Team: ME, Econ, CD
Summer Chiller Operation and TES Charging Plot
(07/13/2011-07/14/2011)
Zero Net Energy

Recent Path to Zero Net Energy projects are described below. Please refer to the library for earlier projects.

Projects of Spring 2016:

- **Financing the conversion of steam district heating to hot water at UC Davis**

  This project contrasted the estimated cost of steam-to-hot water conversion to the business-as-usual case, considering maintenance and energy use. The conversion includes implementation of heat recovery chillers for cogeneration of cooling and heating. Over a 30-year analysis period and based on justifiable assumptions used in the financial model, the conversion has an NPV of $21M and MIR of 8%. Financing options include public-private joint venture, energy savings performance contracts, energy services agreements, student fees and revolving loan funds.

  Poster: Steam-to-Hot Water Conversion, Financing

- **Building level analysis of steam heating vs hot water heating**

  This project evaluated the potential energy savings at the building level due to conversion from steam to a hot water heating system. Two buildings were selected: Student Community Center (SCC) containing space heating and domestic hot water (DHW) loads and Robbins Hall containing space heating, DHW and process (laboratory) loads. Calculations suggest savings of 20% and 48% over the baseline for Robbins Hall and SCC, respectively, which are primarily due to lower distribution losses and virtually negligible condensate loss.

  Poster: Steam-to-Hot Water Conversion, Building Analysis

- **Commuting emissions of UC Davis Medical Center in Sacramento**

  This project evaluates the effectiveness of the Green Commuting Program on commuting emissions reductions implemented at the UC Sacramento Medical Center. The Program promotes commuting by ZGow, campus shuttles, bikes, walk and vehicle pooling. Fuel economy of personal transport was obtained from a sample of 200 vehicles at the UCDMC parking lots. MapQuest data was used to obtain driving distances from the UCDMC to zip codes of residences. Total commuting emissions reductions due to the program are calculated.

  Poster: Commuting Emissions, Green Commuting Program
### How do we do it?

<table>
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<th>Before: Course Set-Up</th>
<th>During: Course Execution</th>
<th>After: Follow-up</th>
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<tr>
<td>Client recruitment</td>
<td>Multidisciplinary Team formation</td>
<td>Project Continuity (Further Study, publications, implementation)</td>
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<td>Project Development</td>
<td>Problem Framing</td>
<td>Course Evaluation &amp; Improvement</td>
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<td>Student Outreach</td>
<td>Primary and Secondary Research</td>
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<tr>
<td>Identify Resources: Funding, speakers, literature, materials, site visits</td>
<td>Mentoring</td>
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<td>Presentation, feedback, Final Report, &amp; Evaluation</td>
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Course Framework

(Present, Participate, Mentor, Articulate, Document, and Evaluate)

- **Project Description and Selection**
- Team formation and Protocol
- Initial Research
- Client Communication and Consultation
- Project Framing & Scoping (4-lenses)
- Primary and Secondary Research
- **Project Framing Presentation (Client sign off)**
- Technical tools and concepts, project planning, renewable energy, economics, energy modeling, ...
  - Lectures
  - Guest Speakers
  - Experiential Learning (Hands-on Labs)
- Research, Analysis, and Synthesis
- **Final Presentation and Report**
Break (30 min)
Part II Course Design
How do we do it?

Before
- Course setup

During
- Course teaching
  - Feasibility studies
  - Design, build, test
  - A path to ZNE

After
- Course follow-up

Tools
- NORC
- Decision matrix
- Brainstorming
- Active listening
- Research methods
- Stakeholders Analysis
- Policy ID
- SWOT
- Evaluation matrix
- Team building
- Project Management (Gantt, Canvas Business Model,...)
Key Terms

• **Client:** The person or organization who provides the project

• **Project:** Need identified by the *client* and related to a specific topic (e.g. energy) for who the *team* does free consulting

• **Team:** Group of 3 students with different backgrounds

• **Mentors:** Professionals with relevant expertise that guide students

• **Reviewers:** Individuals with relevant expertise that provide feedback on the student’s work
**Draft Projects**
- Determine clients’ needs and availability
- Gather as much data as possible
- Draft one-page project briefs

**Final Details**
- Finalize project briefs
- Monitor enrollment
- Finalize schedule
- Organize curriculum materials

**Getting Started**
- Contact potential clients
- Compile curriculum
- Identify guest speakers

**Recruit Students**
- Design a flyer to advertise course
- Promote course on social media
- Share course info with administrators

**Course Begins**
- Teach the course!
Four Lenses of Sustainability

Technical
- Performance
- Available Materials
- Capacity
- Requirements

Environmental
- Local Pollutants
- GHG Emissions
- Water/Resource Use

Economic
- Cost/Benefit Analysis
- Business Model
- Return on Investment

Social
- Key Stakeholders
- Community
- Ownership
- Gender Equity
Let’s Build a course
Brainstorming Objectives

- Generate as many “course objectives” as possible
- Go for quantity
- Just write them down, without judging

Group Example
Activity II: Brainstorming Objectives

Brainstorm 10-20
Select your top 6-8 criteria
What makes a good course project?

• **Good client** (Must be communicative, motivated)

• **Project scope** (Achievable end-goal)

• **Theme** (Aligned, relevant, and interesting)

• **Alignment with skillset** (Appropriate for your students)

• **Required resources**

• **Scalability** (Potential to be replicated)
Finding Clients

1. Engage former clients
2. Outreach for new clients
3. Establish communication
4. Clients “apply” with a project proposal
Application

Project Title: *

Country/Community/Location: *

Brief Proposed Project Goals (250 words max): *
Please explain the what steps have already been taken to achieve this project, where you foresee this project in the future, and how D-Lab students can assist your project with either a feasibility study and/or concept design and testing.

Photo:

Choose File No file chosen

Lead contact—International Partner (email): *

Contact—Potential local project mentor(s) (Name, Phone, Email):
POTATO STORAGE FACILITY (FEASIBILITY STUDY)

Location: Kareti, Republic of Georgia

In-Country Partner Organization: Environment & Development

Project Background: Kareti is located in the Tkibuli Municipality of the Kvemo-Kartli Region. A 2017 market analysis report indicates that the average potato production in the Kvemo-Kartli Region is 10.83 tons per hectare whereas the average for developed countries is 50-60 tons per hectare. Because these are mostly subsistence farmers, progress is stifled by any risk of a negative impact to their operation. This lack of economic mobility means that few farmers are willing and able to shift their methods unless it has been proven to be successful in the region. This has led to the continuation of outdated farming methods resulting in reduced yields thus continuing a cycle of poverty within this already depressed area.

Project Problem Statement: The lack of an adequate storage facility and potential for post-harvest loss has a large financial impact. Local farmers in Kareti and the surrounding villages continue to use dilapidated and ineffective storage facilities, which results in post-harvest loss. The farmers have seen firsthand the perpetuating loss in yield due to seed degradation. Because of freezing temperatures during storage months, the storage facility must be constructed in a way which maximizes insulation and minimizes heat loss. The client estimates that the space should be 500 square meters and accommodate for 60-70 farmers in the community who will pay for storage. There is interest in utilizing the space as a training facility outfitted with windows. The project budget is currently pending a $90,000 grant from the Japanese Embassy in Georgia.

Project Goals and Objectives:

1. Feasibility Study
   a. Investigate existing potato storage facility designs

2. Conceptual Design
   a. Conduct peer art research on windows, insulation, layout, energy efficiency, and any other pertinent components
   b. Work with the client to determine design criteria

3. Make recommendations for D-Lab II Design, Build, Test (D-Lab II)
Activity III: Clients & Projects (10 min)

• Generate a List of 3-5 Potential “Clients” and describe:
  • What is their core business?
  • What are their needs?
  • Potential projects
Building the Curriculum

1. Deliverables
2. Case Studies
3. Site visits
4. Guest speakers
5. In-class activities
Course Framework
(Present, Participate, Mentor, Articulate, Document, and Evaluate)

• Project Description and Selection

• Team formation and Protocol

• Initial Research

• Client Communication and Consultation

• Project Framing & Scoping (4-lenses)

• Primary and Secondary Research

• Project Framing Presentation (Client sign off)

• Technical tools and concepts, project planning, renewable energy, economics, energy modeling,...
  o Lectures
  o Guest Speakers
  o Experiential Learning (Hands-on Labs)

• Research, Analysis, and Synthesis

• Final Presentation and Report
Activity IV:

Identify potential Case Studies, Site visits, Guest speakers, In-class activities (10 min)
Student Recruitment

• Who is your target?
• Advertising
• Application
  • Email
  • Name
  • Student ID
  • Grad/Undergrad
  • College
  • Major
  • ½ page essay “Why do you want to be in this course?”

ABT 212 - PATH TO ZERO NET ENERGY
A Hands-On Approach

Explore the principles and challenges of zero net energy
Apply your skills to help UC Davis reduce its carbon footprint
Work on real projects with UC Davis and community partners

Spring Quarter 2019
T/Th 2:10 - 4:00
Soc. Sci. & Hum., Room 90
CRN # 60538

Open to graduates and upper division undergrads, or with instructor consent.

For more information, please visit
http://pjet.ucdavis.edu
or contact
Lisa M. Slaughter at
lmslaughter@ucdavis.edu

Come to our info session featuring
FREE PIZZA
Learn about the course and meet the staff!
Thursday, Feb 28th
12:00 am – 1:30 pm
Bainer Hall, room 2045
Team Formation

• Groups of 3 students

• Important considerations:
  • Assign students in one of their three top project preferences
  • Mix students from different disciplines
  • Mix students from graduate and undergraduate
  • Level of expertise or skillset related to the project
Student Profile & Project Selection

• Deliverable 1:
  • Student profile
  • Top 3 preferences
  • Decision matrix
  • Justification essay
Lunch (1 hour)
Part III (1 hour)
Activity V: Evaluation Methods
(Discussion 10 min)

- Summative
- Formative
  - Mid-quarter & final presentations (group)
  - Individual Assignments
  - Final Report (group)
  - Peer Review
  - Course evaluation
Activity VI
Synthesis: Choose a title and generate a course description, (25 min)
Elevator Pitch
Elevator pitch should include:

• **Who**
  • You/Your group/Organization

• **What**
  • Problem you are trying to solve

• **How**
  • Your proposed solution

• **Why**
  • Why is it important
  • Key benefit of your solution
8 C’s of the Elevator Pitch

• **Concise.** Get to the purpose of the message quickly without any extra words

• **Clear.** Should be understood by your grandparents

• **Compelling.** Explain the problem of pain that you take away

• **Credible.** Tell your qualifications if they are relevant

• **Concrete.** Be very specific about who you are and what benefits you bring to the table

• **Customized.** You may have to change your message depending on who your audience is

• **Consistent.** Who you are, and the benefits have to be real and line up

• **Conversational.** Not rehearsed or phony.
Activity VII: Prepare elevator pitch

“You have 1-minute to convince me about your course idea”
Break (15 min)
Elevator pitches and Discussion

UC Davis D-Lab
Online Toolkit
Thank You!