UNIQUE INSIGHTS INTO LEADING-EDGE CLEANTECH INNOVATIONS

Brian Steel, Bev Alexander & Bill Shelander (B3)
C2M assesses low-carbon energy, green chemistry, and water technology innovations and identifies early-stage market opportunities

- 10th year!
- A Haas capstone course
- A partnership between students, entrepreneurs, researchers, and professionals
“There are few parts of the school that I bring up more often externally than C2M. You've left a lasting mark on our school and on so many students that, together, are going to have a lot of impact.”

— Rich Lyons, Dean, Berkeley Haas, June 2017
C2M Teaches About...

- Cleantech
- Technology assessment
- Market evaluation
- Interviewing techniques
- Presentations
- Interdisciplinary leadership & teamwork

+ Career focused guidance and networking
Berkeley Haas cited as the **#1 business school for careers in cleantech** in the United States with Cleantech to Market named as key factor.

—Business Because
Our Students Are Our Strength

• **Haas Students**
  – Accounting/Finance
  – Architecture
  – Business Development
  – Communications
  – Consulting
  – Economics
  – History
  – Information Systems
  – Marketing & Sales
  – Mathematics
  – Operations
  – Political Science
  – Project Management

• **Other Disciplines**
  – Biology
  – Chemistry
  – Computer Science
  – Energy & Resources
  – Environmental Science
  – Engineering
    • Chemical
    • Civil
    • Electrical
    • Environmental
    • Industrial & Operations
    • Mechanical
    • Nuclear
  – Law
  – Materials Science
  – Physics
  – Public Policy
C2M Team Pride

SunVapor

GrowPlastics

Packetized Energy

GreenBlu

MICROOrganic

eCalCharge
C2M Faculty

More than a century of combined post-graduate work experience. Yikes!

• Bev Alexander
  – PG&E officer (Utility Clean Energy, Customer Service, & other initiatives)
  – Environmental law & policy (National Law Journal “Top 40 Under 40”)
  – Haas Best Case Award
  – Berkeley Law

• Brian Steel
  – PG&E officer (Corporate Strategy & Development – renewable energy financing)
  – Three-time CEO + multiple advisory roles
  – Internet technology (22 boards, 3 IPOs)
  – Investment banking
  – Duke University

• Bill Shelander
  – Founder & CEO of multiple companies
  – LBL business development
  – Managing Director multiple VC funds
  – Product & line operations
  – White House OSTP
  – MBA/Engineering degrees
Cleantech—a Diverse Arena

Eight categories of cleantech

Clean energy
- Wind
- Solar
- Renewable fuels
- Marine
- Biomass
- Geothermal
- Fuel cells
- Waste-to-energy
- Nuclear
- Emerging
- Measurement & analytics

Energy storage
- Batteries
- Thermal storage
- Mechanical storage
- Super/ultracapacitors
- Hydrogen storage

Efficiency
- Smart grid
- Green building
- Cogeneration
- Data centers & devices
- Semiconductors
- Collaborative consumption systems

Transportation
- Vehicles
- Traffic management
- Fuelling/charging infrastructure

Air & environment
- Carbon sequestration
- Carbon trading/offsets
- Emissions control
- Bioremediation
- Recycling & waste
- Monitoring & compliance

Clean industry
- Materials innovation
- Design innovation
- Equipment innovation
- Production
- Monitoring & compliance
- Advanced packaging

Water
- Production
- Treatment
- Transmission
- Efficiency
- Monitoring & compliance

Agriculture
- Crop farming
- Controlled environment agriculture
- Sustainable forestry
- Animal farming
- Aquaculture

Source: Kachan & Co., 2012

Our proprietary taxonomy is our way of mapping the cleantech universe. This advanced tool allows you to get smart on one of our 18 primary sectors, and enhance your company discovery experience by exploring the startups for every tag. (Alternate view)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Sector</th>
<th>Sector</th>
<th>Sector</th>
<th>Sector</th>
<th>Sector</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>advanced materials</td>
<td>agriculture &amp; food</td>
<td>air</td>
<td>biofuels &amp; biochemicals</td>
<td>biomass generation</td>
<td>conventional fuels</td>
<td></td>
</tr>
<tr>
<td>energy efficiency</td>
<td>energy storage</td>
<td>fuel cells &amp; hydrogen</td>
<td>geothermal</td>
<td>hydro &amp; marine power</td>
<td>nuclear</td>
<td></td>
</tr>
<tr>
<td>recycling &amp; waste</td>
<td>smart grid</td>
<td>solar</td>
<td>transportation</td>
<td>water &amp; wastewater</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
“Climate Change” Tech Casts a Wide Net

Potential Climate Change Impacts

- **Climate Changes**
  - Temperature
  - Precipitation
  - Sea Level Rise

- **Health Impacts**
  - Weather-related Mortality
  - Infectious Diseases
  - Air Quality-Respiratory Illnesses

- **Agriculture Impacts**
  - Crop yields
  - Irrigation demands

- **Forest Impacts**
  - Change in forest composition
  - Shift geographic range of forests
  - Forest Health and Productivity

- **Water Resource Impacts**
  - Changes in water supply
  - Water quality
  - Increased Competition for water

- **Impacts on Coastal Areas**
  - Erosion of beaches
  - Inundate coastal lands
  - Costs to defend coastal communities

- **Species and Natural Areas**
  - Shift in ecological zones
  - Loss of habitat and species

*United States Environmental Protection Agency*
What Problems Does C2M Address?

Useful tech often stalls at pre-commercial gaps due to insufficient market research.
C2M’s Diverse Technology Sourcing

- C2M partners with high quality upstream partners to accept cleantech from a wide variety of sources and startups

Cyclotronroad

- C2M applies a structured commercialization process to provide them with valuable insights & recommendations
“Steady Stream of Successes”

- GreenBlu
- Grow Plastics
- MICROrganic
- Sunvapor
- Spark Thermionics
- CalWave
- Feasible
- Nelumbo
- Opus 12
- Synvitrobio
- Sepion
- Imprint Energy
- SiElectra
- Heliotrope
- Slice Energy
- CinderBio
- Point Source Power
- Connora Technologies
- Indoor Reality
Vital Niche in Innovation Ecosystem

• “C2M provides insights on the critical questions to address to move projects closer to commercial relevance, and in-depth market analyses that catalyze industry investments.

• Several startup companies have also emerged from C2M activities, so you are an economic driver of the region as well.

• C2M occupies a vital niche in the continuum from research to commercial products and services.”
Engaged Sponsors & Partners

“C2M is a key program for Dow at Berkeley, leading the way in identifying key clean technologies and providing smart and useful market analysis”.

Steve Hahn
Research Fellow
Dow Chemical Company
Satisfied Entrepreneurs

- My C2M team was extremely insightful, hard working, and capable - a gigantic value-add, and we're using their findings in grant applications and fundraising pitches." —Zachary Sun, CEO, Synvitrobio

- "We received an SBIR grant thanks in large part to the incredible work done by our C2M team!" —Jill Fuss, Co-Founder, Cinder Bio

- "We were thrilled with the progress, understanding, and relationships that developed in the C2M program, and we highly recommend it." —Liam Berryman, CEO, Nelumbo

- "The team did an amazing job of obtaining interviews with key people, which resulted in productive discussions and connections with potential investors." —Steve Yamamoto, CEO, Matrix Sensors

- "Top notch - great experience and really valuable market research for a startup like Greenblu. We plan to make full use of what you accomplished." —Howard Yuh, Founder, GreenBlu
“Best Class at Haas . . . Berkeley”

- "Tremendous learning, amazing professors, incredible network. One of the reasons I decided to go to Haas and it lived up to its expectations.”

- "If you're a Ph.D. thinking about options outside research, you can't NOT apply for this course."

- "One of the best reasons to attend Berkeley."

- "Fantastic experience and learning opportunity."

- "Very remarkable real-world applicability.”
...and Jobs!

SUNPOWER
APPLIED MATERIALS®
Illuminate Ventures
Pivotal
McKinsey & Company
Table Rock Infrastructure Partners
Capgemini
CONSULTING. TECHNOLOGY. OUTSOURCING
SAMSUNG
xcellbio
IMPRINT ENERGY
NAVIGANT
CISCO
Bloom Energy
RECURRENT ENERGY
OPower
vodafone
EDISON INTERNATIONAL
LUMILEDS
TERVIVA
Comfy
Asentria
GREENHOUSE CAPITAL PARTNERS
PG&E
Valeo
Trina Solar
Genentech
GOBEE
Tesla
GE
APPLE
WELLS FARGO
PLANT PV
Google

New Materials for Photovoltaic Cells
C2M Course Details

• **Fall Semester Course**
  – 40+ graduate students (2/3 Haas 2\textsuperscript{nd} years + 1/3 outside Haas)

• **Annual Four-Phase Program**
  – Project selection (January – March)
  – Team formation (April – May)
  – Program customization (June – July)
  – Technology & market analysis (August – December)

• **Rigorous, Structured Commercialization Support**
  – 40-point, deep market analysis
  – Builds on Haas innovation curriculum
  – Developed & proven over 10 years
Guided Innovation Process

Phase I
Aug 21 – Sept 6

Phase II
Sept 11 – Oct 4

Phase III
Oct 9 – Nov 1

Phase IV
Nov 6 – Dec 7

Observe & Understand
Diverge
Technology to Market Fit
Converge

I
II
III
IV

Final Incorp. of Feedback
Present & Report

Slides & Reports

Guided Innovation Process

C2M
Cleantech to Market
Start With Great Sources

C2M TOP 50 MARKET RESEARCH WEBSITES

GOVERNMENT – CLEANTECH
California Energy Commission http://www.energy.ca.gov/
California Public Utilities Commission http://www.cpuc.ca.gov/puc/
Clean Energy States Alliance http://www.cleanenergystates.org/
UC DOE http://energy.gov/
  • US DOE Energy Codes http://www.energycodes.gov/
  • US DOE Energy Frontier Research Center http://science.energy.gov/bes/efrc/
US DOE Laboratories http://science.energy.gov/laboratories/
  • Lawrence Berkeley National Laboratory http://www.lbl.gov/
  • LBNL Carbon Cycle 2.0 http://carboncycle2.lbl.gov/
  • National Energy Technology Laboratory http://www.netl.doe.gov/
  • National Renewable Energy Laboratory http://www.nrel.gov/
  • Sandia Laboratory http://www.sandia.gov/
White House Office of Science & Technology Policy
## Conduct Informational Interviews

### Berkeley Energy Network

<table>
<thead>
<tr>
<th>First</th>
<th>Last</th>
<th>Email</th>
<th>Phone</th>
<th>Entity (1)</th>
<th>Sub-Entity (2)</th>
<th>Subject</th>
<th>Sub Subject</th>
<th>Background</th>
<th>Current Organization/Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adam</td>
<td>Arkin</td>
<td><a href="mailto:aparkin@lbl.gov">aparkin@lbl.gov</a></td>
<td>254-932-4567</td>
<td>Faculty</td>
<td>UCB</td>
<td>Biofuels</td>
<td></td>
<td>His research centers on uncovering the evolutionary design principles of cellular networks and exploiting them for applications. He and colleagues are developing a framework to facilitate applications in health, the environment, and bioenergy by combining comparative functional genomics, quantitative measurement of cellular dynamics, biophysical modeling of cellular networks, and cellular circuit design.</td>
<td>Bioengineering</td>
</tr>
<tr>
<td>Ben</td>
<td>Wu</td>
<td><a href="mailto:bcowu@sandia.gov">bcowu@sandia.gov</a></td>
<td>(925) 294-2015</td>
<td>DOE Lab</td>
<td>Sandia National Lab</td>
<td>Biofuels</td>
<td>Biomass</td>
<td>Biofuel cells, nanophotonic materials, microfluidics, nanofluidics, desalination, biomirreralization and enzyme engineering. Most recently, he has been studying enzymes isolated from extremophile organisms that could be applied to the deconstruction of lignocellulosic biomass into biofuel material.</td>
<td>Sandia National Laboratories</td>
</tr>
<tr>
<td>Blake</td>
<td>Simmons</td>
<td>besimmo@san</td>
<td>DOE Lab</td>
<td>LBL</td>
<td>Biofuels</td>
<td>Cellulosic</td>
<td></td>
<td>The research program in my lab is largely directed toward understanding how plant cell wall polysaccharides are synthesized, how the structures relate to the functions of the cell wall, and how the system is regulated. I envision that knowledge of cell wall structure and function will facilitate the development of plants with improved utility as sources.</td>
<td>Physical Biosciences Division</td>
</tr>
<tr>
<td>Bret</td>
<td>Strogen</td>
<td><a href="mailto:bret@berkeley.edu">bret@berkeley.edu</a></td>
<td>Student</td>
<td>UCB</td>
<td>Biofuels</td>
<td></td>
<td></td>
<td></td>
<td>UCB</td>
</tr>
</tbody>
</table>
Leverage Haas Core Courses

APPENDIX B - Haas First-Year Core Course Lessons Relevant to Cleantech to Market

**OB&L** = Organizational Behavior & Leadership

**MM&S** = Marketing Management & Strategy

**OM** = Operations Management

**DDS** = Data, Decisions, Statistics

**F** = Finance

**M&ME** = Macro & Micro Economics

**LC** = Leadership Communications

**PFPS** = Problem Finding, Problem Solving
Go Deep on C2M Core’s Analysis

- **Technology Characteristics & Value Proposition / Customer Segments**
  - What characteristics define this technology?
  - What are the key cost and performance metrics?
  - What problems or customer pain does it solve?
  - What solutions, benefits or opportunities could it offer?
  - What degree of improvement might it offer?
  - Are there manufacturing or other issues that might impact the transition from lab scale to commercial scale?
  - Is it more likely to become a company, a product, or a feature?
  - How will you protect the intellectual property?

- **Market Selection, Market Sizing**
  - What is your most promising first market, and who might be your early adopters?
  - Are you creating a new market or re-segmentation an existing market?
  - How do you define the size and expected growth of your customer segments?
  - Who are your buyers, decision makers, users, influencers, recommenders, and saboteurs?
  - How will you get, keep and grow your customers?
  - How will broader societal, technical, economic, regulatory, and political trends impact you?
  - How will global and capital markets, commodities, and existing infrastructure impact you?
Support With Teaching & Coaching

Learn About Clean Tech Industry

Coach You “In Action”
# Team/Leadership Coaching

## TEAMS

<table>
<thead>
<tr>
<th></th>
<th>Adherence to Schedules</th>
<th>Efficiency Quality</th>
<th>Relationship Quality</th>
<th>Creativity</th>
<th>Learning Management</th>
<th>Client Management</th>
<th>Problem Framing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>6.00</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5.60</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>5.60</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5.60</td>
</tr>
<tr>
<td></td>
<td>6.00</td>
<td>6.00</td>
<td>5.50</td>
<td>6.00</td>
<td>6.33</td>
<td>6.17</td>
<td>5.50</td>
</tr>
</tbody>
</table>

47.0 Two significant strengths; no significant weaknesses.

<table>
<thead>
<tr>
<th></th>
<th>Adherence to Schedules</th>
<th>Efficiency Quality</th>
<th>Relationship Quality</th>
<th>Creativity</th>
<th>Learning Management</th>
<th>Client Management</th>
<th>Problem Framing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>6.00</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td></td>
<td>6.75</td>
<td>6.75</td>
<td>5.50</td>
<td>5.50</td>
<td>5.25</td>
<td>5.75</td>
<td>5.75</td>
</tr>
</tbody>
</table>

46.3 Two significant strengths; one significant weaknesses (creativity)

<table>
<thead>
<tr>
<th></th>
<th>Adherence to Schedules</th>
<th>Efficiency Quality</th>
<th>Relationship Quality</th>
<th>Creativity</th>
<th>Learning Management</th>
<th>Client Management</th>
<th>Problem Framing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6.00</td>
</tr>
<tr>
<td></td>
<td>5.60</td>
<td>5.60</td>
<td>5.20</td>
<td>6.20</td>
<td>6.20</td>
<td>6.00</td>
<td>5.40</td>
</tr>
</tbody>
</table>

46.2 Two significant strengths; no significant weaknesses.

<table>
<thead>
<tr>
<th></th>
<th>Adherence to Schedules</th>
<th>Efficiency Quality</th>
<th>Relationship Quality</th>
<th>Creativity</th>
<th>Learning Management</th>
<th>Client Management</th>
<th>Problem Framing</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>5.40</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>5.40</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>5.40</td>
</tr>
<tr>
<td></td>
<td>6.00</td>
<td>6.40</td>
<td>5.40</td>
<td>5.60</td>
<td>6.20</td>
<td>6.20</td>
<td>5.40</td>
</tr>
</tbody>
</table>

45.6 One significant strength; one significant weaknesses (client mgmt.)

<table>
<thead>
<tr>
<th></th>
<th>Adherence to Schedules</th>
<th>Efficiency Quality</th>
<th>Relationship Quality</th>
<th>Creativity</th>
<th>Learning Management</th>
<th>Client Management</th>
<th>Problem Framing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>5.40</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>5.40</td>
</tr>
<tr>
<td></td>
<td>5.60</td>
<td>5.00</td>
<td>5.40</td>
<td>5.40</td>
<td>5.80</td>
<td>6.00</td>
<td>5.60</td>
</tr>
</tbody>
</table>

44.8 One significant strength; two sign. weaknesses (adher. to sched. & rel. quality)

<table>
<thead>
<tr>
<th></th>
<th>Adherence to Schedules</th>
<th>Efficiency Quality</th>
<th>Relationship Quality</th>
<th>Creativity</th>
<th>Learning Management</th>
<th>Client Management</th>
<th>Problem Framing</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>5.60</td>
</tr>
<tr>
<td></td>
<td>6.00</td>
<td>5.80</td>
<td>5.40</td>
<td>5.80</td>
<td>5.80</td>
<td>5.20</td>
<td>5.60</td>
</tr>
</tbody>
</table>

44.6 No significant strengths. One significant weakness: Learning.

## AVG.

<table>
<thead>
<tr>
<th>Adherence to Schedules</th>
<th>Efficiency Quality</th>
<th>Relationship Quality</th>
<th>Creativity</th>
<th>Learning Management</th>
<th>Client Management</th>
<th>Problem Framing</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.69</td>
<td>5.93</td>
<td>5.40</td>
<td>5.75</td>
<td>5.86</td>
<td>5.89</td>
<td>5.64</td>
</tr>
</tbody>
</table>

## StDev (SD)

<table>
<thead>
<tr>
<th>Adherence to Schedules</th>
<th>Efficiency Quality</th>
<th>Relationship Quality</th>
<th>Creativity</th>
<th>Learning Management</th>
<th>Client Management</th>
<th>Problem Framing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.16</td>
<td>0.61</td>
<td>0.11</td>
<td>0.31</td>
<td>0.38</td>
<td>0.37</td>
<td>0.33</td>
</tr>
</tbody>
</table>

| Add 1 SD | 0.85 | 6.54 | 5.51 | 6.06 | 6.24 | 6.26 | 5.97 | 5.81 | 5.89 |
| Add 1 SD | 5.53 | 5.31 | 5.29 | 5.44 | 5.48 | 5.51 | 5.31 | 5.36 | 5.34 |
Symposium Feedback

• **Fantastic slides**, great combination of metrics & pics; persuasive & fun.

• **High energy**; strong delivery, great timing, coordinated appearance, obvious teamwork on stage; and many tactics to engage the audience.

• **Great flow** on the history and context; good description of pain points.

• Excellent **description of technology**; good graphics & animation.

• Excellent work on **market analysis**, however 4-year payback is long (you could feel the audience retreat).

• Very nice **summary of economics**.

• Good **comparison to competitors**, including effective use of the video.

• Overall **good market assessment**, but needed a more in-depth discussion of the markets with a **sample business** case like some of the other teams (**more numbers & financials**).
Sandwich Core
Expanded Bioplastics

Market Reports

C2M
Cleantech to Market

Technical Lead
Michael Wiegner, Grow Plastics

C2M Student Team
Sofia Ramos, Team Lead, MBA 2018
Shane Bune, MBA 2018
Johnny Truong, Ph.D. Chemistry 2019
Stephen Meckler, Ph.D. Chemistry 2018
Tannara Sparks, Ph.D Chemistry 2018

December 2017
Cleantech to Market
Haas School of Business
University of California, Berkeley

SUNVAPOR
RENEWABLE PROCESS HEAT

Berkeley

C2M Student Team
Beryl Xia, Chemistry PhD 2019
David Starnak, MBA 2018
Francois-Jerome Selwaste, MBA 2018
Kurt Karonbracker, JD 2019
Matias Martinez Alarcon, MBA 2018
Natalie Gerson, Chemistry PhD 2018

Research Team
Philip Glickman, CEO
Sue Glickman, Manager
Nicolas Perdea, Lead Structural Engineer

December 2017
Cleantech to Market
Haas School of Business
University of California, Berkeley

DISTRIBUTED OPTIMAL
POWER FLOW ALGORITHM
The smarts you need to manage the smart grid

C2M Student Team
James Alire, MBA 2015
Ashley Nan Lin, JD 2016
Jonathan Mather, Mechanical Engineering PhD 2017
Ross Trenary, MBA 2015
Bari Wilsen, MBA 2015
Evan Williams, MBA 2015
Market Report Feedback

• **Beautifully written** - energetic, clear, focused on path to market, contained the right information, easy to understand, a pleasure to read.

• **Great executive summary** - hit all the right points at the right level.

• **Excellent introduction**, table of contents and “signage.”

• Nice balance of **positive but including warnings** (IP, competitors, etc.).

• **Smart market selection** – thoughtful and actionable recommendations.

• **Great emphasis on key points** – caught reader’s attention at right places.

• **Well organized** - good balance of materials in the report v appendices. However, it got a bit choppy in places.

• **Good bibliography**, glossary of terms and interview notes.

• Could have included **more metrics** in your competitor analysis.

• Best **techno-economic model** in the class - well done!

• Nice **interview list and notes**.
Grading – Team & Individual

• **70% Team**
  – Market report – 45%
  – Symposium slides – 25%

• **30% Individual**
  – Peer feedback surveys – 15%
  – Instructor observations – 10%
  – Symposium oral delivery – 5%
Team Formation Process

1. Get Info
   – C2M website, faculty, C2M alumni

2. Bid / Apply
   – Team leads (Haas): Apply! – April 6 deadline, interviews April 9-10
     • TLs are guaranteed enrollment & Haas allocates 3/13th (230) of their bid points
     • TLs also receive 1 unit of extra credit via an independent study course
   – Team members (Haas): Bid! – Week of April 23
   – Team members (outside Haas): Apply! – April 30 deadline (‘green button’ takes you to an on-line application from the C2M website)

3. Rank Top 5 Preferences (stack-rack + 100-pt allocation)
   – We consider your top 5 preferences & CVs in forming teams

4. Get Drafted
   – Team leads “draft” team members on May 4 (with B3 oversight)
   – Teams start meeting / communicating before summer

* Haas provides 1,000 points for 13 units; C2M = 3 units; 3/13 of 1,000 = 230
Lots of Information is Available Online

Energy Institute at Haas

Cleantech to Market

Dynamic Partnership

Cleantech to Market (C2M) is a partnership between graduate students, entrepreneurs, researchers, and industry professionals to help accelerate the commercialization of emerging cleantech. In the process, C2M also develops the next generation of innovative cleantech leaders.

- **Entrepreneurs & Researchers**
  C2M first identifies promising cleantech from (1) existing startups, (2) top-tier universities such as UC Berkeley, Stanford, Caltech, Princeton & MIT, (3) accelerators & incubators such as Cyclotron Road and the Cleantech Open, and (4) government sponsored programs such as the Department of Energy, ARPA-E, and the Lawrence Berkeley National Laboratory.

- **Graduate Students**
  C2M then handpicks graduate student commercialization teams from over 20 UC Berkeley disciplines, including business, engineering, science, law, policy, and the Energy and Resources Group. C2M matches their academic and work experience with each project.

- **Cleantech Professionals**
  C2M supports the teams with leading cleantech professionals who bring deep subject matter expertise (e.g., energy generation, efficiency, storage, and transportation, green chemistry, water purification, grid operations, economics, early stage venture, and much more). They help guide the students as speakers, mentors, and contacts.
C2M 2018 Technology Finalists

**Dauntless** — Ultra-fast, adaptive machine learning and control

**EnZinc** — Zinc batteries that are cleaner, safer and more affordable.

**HelioBioSys** — Cyanobacteria using air, seawater, sunlight for sustainable biomaterials

**Lucent Optics** — Daylight-harvesting materials to redirect sunlight into buildings

**Mosaic Materials** — Molecular structures for environmental gas separation

**Opcondys** — High-power switching using light to surpass semiconductor switches

**Photia** — Holographics for high-speed nanomanufacturing in energy applications

**Terzo Power** — Electro-hydraulics hybrid drive trains for heavy-duty equipment

**Treau** — Lightweight heat exchangers for easily installed cooling and heating

**HelioBioSys** – New ways to harvest cyanobacteria, which grow on air, seawater and sunlight, and processes them into sustainable biomaterials such as bioplastics and fossil fuel replacement chemicals.

**EnZinc** – A new zinc anode that can be used to create batteries that are cleaner, safer and more affordable. Potential markets include EVs, e-bikes, drones, consumer electronics, wearables, and more.
**Lucent** — Daylight-harvesting materials that can redirect sunlight deep into buildings to enhance daylighting, energy efficiency, glare reduction, and building comfort.

**Mosaic** — Metal organic frameworks to lower the cost and environmental impact of gas separation technologies. Applicable to many energy-intensive processes from submarines to power plants.

**Opcondys** — Power switching that uses light to surpass semiconductor switches and save up to 50% of energy wasted in applications such as renewable energy, grid-tied storage, and high voltage equipment.
Photia — Holographic lithography to enable high-speed nanomanufacturing of materials used in applications such as solid state lighting, radiative cooling, PV, batteries, and lightweight composites.

Terzo — Ultra-efficient electro-hydraulics and direct fluid control to bring cleaner power to heavy-duty equipment used in areas such as construction, agriculture, military and mining.

Treau — Lightweight heat exchangers to improve cooling and heating efficiency while reducing noise and emissions. Potential developed and developing world applications to reduce skyrocketing carbon levels associated with a global rise in AC adoption.
THANK YOU