

- Draft Minutes -
Engineering College Council Meeting
October 30-31, 2014
Ithaca, New York

Members Present: Najib Canaan, Lance Collins, Bob Cowie, Michael Even, Sarah Fischell, Greg Galvin, Virginia Giddings, Michael Goguen, Kent Goklen, Frank Huband, Marcus Loo, Ivan Lustig, Jim McCormick, Don Morel, Howard Morgan, Jack Neafsey, Evelyn Pearson, Justin Rattner, Jim Ricotta, Bob Shaw, Dan Simpkins, Elissa Sterry, Duane Stiller, Joseph Thanhauser

Emeriti Present: Dick Aubrecht, Jay Carter, Bill Hudson

The meeting presentations and materials can be found at:
<https://confluence.cornell.edu/display/ECC/2014+Fall+ECC+Meeting>

Username: eccmeeting@gmail.com

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Welcome and Introductions

Duane Stiller, ECC Chair, welcomed the Council to the Fall '14 ECC Meeting and announced that the focus of the meeting would be the College strategic plan and energy. He also welcomed the new members to the Council: Najib Canaan, Marinus Capital Advisors, LLC; Michael Even, Numeric Investors, LLC; Marcus Loo, Weill Medical College of Cornell/New York Presbyterian Hospital; Don Morel, West Pharmaceutical Services, Inc.; and Joseph Thanhauser, Byrnam Wood, LLC.

Strategic Plan Presentation

Lance Collins, Dean of Engineering

Lance gave a presentation on the College's strategic plan. He pointed out that the College is striving to rise in the rankings from a five to a top-three engineering college in undergraduate and graduate studies. He noted our four enabling goals differentiate us from our peers, which are:

1. To recruit, retain and enable a diverse community of exceptional faculty, students and staff.
2. To educate undergraduate and graduate students to become global leaders.
3. To be world leaders in important areas of research
 - a. to sustain and expand our leadership role in: advanced materials; complex systems, network science and computation.
 - b. to be the premier research university in the emerging areas of: energy and the environment; and bioengineering.
4. To increase our interactions with industry; and create a fertile environment for entrepreneurial activities for faculty and students.

Lance discussed the new educational paradigm for engineering in the 21st Century which is to: create, lead, disrupt, and invent. In the past, engineers were taught how to make things work efficiently, and leadership was not stressed. The current College curriculum is grounded in rigorous fundamentals and puts classroom knowledge to the test. He added that we outclass our

competitors through Cornell's experiential programs that emphasize learning by doing. Some examples include:

- Project teams (we have 24 projects teams with over a thousand students participating). The basement of Upson Hall will be renovated for project teams.
- eLab/Pop Shop and eHub expansion. There is a growing interest in entrepreneurship.
- Business minor with the Dyson School (undergraduate business school). This is an opportunity to learn business skills without a full MBA. Its impact has been phenomenal. Over 500 engineering students are enrolled in this minor.
- Engineering Leadership Program. This program teaches students leadership skills.
- Product Design and Manufacturing Institute: in order for us to return to manufacturing, we also need to learn the business and technical side of manufacturing. Lance indicated that this is a unique capstone project that would create teams to manufacture products and we envision rolling this out to the entire College. He has asked Les Trotter, Associate Dean for Undergraduate Programs, to assist with this effort.

Lance pointed out we need to find a way to package and brand these efforts to let students know why they should come to Cornell. He noted that "Engaged Cornell" represents the founding father's vision that has inspired public engagement. Engaged Cornell is a \$150 million, 10-year initiative to bring societal engagement into the curriculum across the university. Many of our project teams have been involved in public engagement (i.e., Agua Clara) as well as some of our non-profit entrepreneurship activities. Lance added that he'd like to help revitalize our local economy and public good would result from these efforts. He added that leadership is part of that engagement.

Thrust Areas

Bioengineering

Lance gave an overview of the emerging research area of Bioengineering which involves the application of engineering principles to biological systems. He explained that bioengineering at Cornell covers a very broad area of study including elements of biological (BEE), bio-molecular (CBE), biomedical (BME), bio-materials (MSE), bio-mechanics (MAE), bio-imaging (AEP), and facilities such as CNF, Synchrotron, CCMR, and MRI, as well as the Weill Cornell Medical, Cornell Tech and the Cornell Veterinary College.

Comments on Bioengineering:

- Startups in EE and bio are doing extremely well. The combination of those two fields is creating amazing discoveries and devices. There are great synergies when you combine various fields.
- Lance suggested that Mike Goguen, Marjolein van der Meulen and Clif Pollock discuss ways to create those synergies. CBE has a strong group focused on this effort. Having tenured faculty in those areas brings depth to the bioengineering effort which creates a collaborative environment.
- There are enormous opportunities in devices such as prosthesis through this interdisciplinary effort.
- Systems Engineering should also be a part of this effort.

- Digital health is a growing area. Many partners with different skills will need to collaborate to advance this area. Lance noted that Cornell Tech would be at the center of this effort.
- Marjolein van der Meulen noted that cancer research has involved cross campus efforts. The creation of biomedical engineering created synapses across several groups and the Vet School. One of Cornell's attributes is its outstanding collaborative efforts.

Energy

Lance discussed the emerging area of energy and the environment that involves the Energy Institute and the ACSF. The Energy Institute is the lead organization for technology-based research and education in energy in the College. The Institute focuses on “1) education through the development and delivery of energy related curricula, 2) technology- based energy research leading to scalable, sustainable energy solutions, 3) connecting energy education and research in a ‘living laboratory’, and 4) outreach to promote energy literacy and responsible deployment of sustainable energy options.” Some of these efforts include research on: hydrocarbon extraction, sequestering carbon, renewable energy sources, distribution and management, and energy storage. Lance added that Cornell considers itself a living laboratory (i.e., lake source cooling), in collaboration with engineering and facilities.

Lance indicated that the Energy Institute also works closely with the Atkinson Center for a Sustainable Future (ACSF). “ACSF is the lead Cornell organization in convening and connecting internal and external stakeholders and in seeding new collaborations across the broad and interconnected themes of sustainability: energy, environment and economic development”.

Advanced Materials

Lance gave an overview of the advanced materials thrust area. The College strives to be a world leader in this innovative research area which is conducted at several materials research centers on campus including the Cornell Center for Materials Research (CCMR), the Cornell Nanoscale Science and Technology Facility (CNF), the Cornell High Energy Synchrotron Source (CHESS), the Kavli Institute and King Abdullah University of Science and Technology (KAUST).

Lance noted that the next frontier in advanced materials is the field of materials by design. Professor Craig Fennie, who was awarded a MacArthur Fellowship (Genius award), is conducting research in this area. His research is focused on the use of theory to uncover new structurally and chemically complex bulk solids, nanostructures, and interface materials with a particular interest in Energy Materials, Correlated Oxides, and Ferroics. The vision of his research group “is that the application of a novel *first-principles* approach to materials discovery will accelerate fundamental and technological innovation by providing efficient strategies to survey the vast space of never-before-seen materials to target for synthesis, thereby making Materials-by-Design a reality”.

Lance also noted that bottom-up nanotechnology and energy storage/fuel cells are also a part of advanced materials research.

Complex Systems, Network Science and Computation

Lance indicated that complex systems, network science and computation (involving physical and virtual networks) is another thrust area that is one of the College's top priorities. This involves the

Institute for Computational Sustainability (ICS), the Institute for Computational Science and Engineering (ICSE), big data and machine learning and leveraging Cornell Tech. He added that Cornell Tech is transforming the university and NYC. Cornell has extremely devoted alumni. He added that we have grown our faculty to 15 and have over 100 students.

Strategic Plan Discussion

ECC Chair Duane Stiller

Duane Stiller facilitated a discussion on the strategic plan. He noted that Cornell is a 150-year university and that Lance needs the Council's help to get to #3 in the reputational rankings. The Council gave their feedback on the strategic plan and reputational rankings.

Flip Chart Notes by Duane Stiller re. discussion on Strategic Plan

- Rank / Rep
- Impact
- What is – What could be

Ithaca NY

1. Recruit
2. Educate
3. Thrust
 - a. Bioengineering
 - b. Energy
 - c. Advanced Materials
 - d. Digital
4. Entrepreneurship / Industry
5. Facilities

Comments on strategic plan

- Inspired about the College's strategic goal to increase our rankings.
- We should think about which companies could emanate from Cornell.
- Strongly encourages undergrads to be exposed to entrepreneurship.

Comments on reputational rankings

- Rankings matter in recruiting the best students.
- Stanford, MIT and Cornell have a phenomenal product.
- Getting people to use our products could increase our reputational ranking.
- What are the things that feed reputation?
- We need to think about all the pieces, including PhD students.
- Stanford is very effective at communicating externally. Why isn't Cornell more connected with TED events?
- We need more events here that will get press. Big data analysis at Cornell needs more press.
- Rankings come from perception from the community around you (at one time Cornell had reps on campus from IBM, Xerox and GE). Cornell keeps its leadership hidden and needs to do a better job in reaching the media.

- Be and be perceived (Intel motto). You can't have a product that nobody knows about.
- Will transportation to Ithaca be improved? Can they be engaged to discuss improving transportation?
- Industry sponsored research can help propel these efforts. Cornell has been tough to work with. Need to communicate that with the university.
- Need to get money from industry, philanthropy, etc.
- Need new measurements, incentive systems and to determine how we are going to allocate resources.
- Measure well and reward well. Need targets so that we can measure our progress.
- Need to create metrics. Get suggestions from external constituents (i.e., venture capitalists) and faculty. Then brainstorm with them about ways to create metrics and determine what's going to move the College's reputation up.
- Boston and Silicon Valley weren't successful overnight. We can't expect instantaneous success. It will take time.
- Need to solve transportation problem (finance something like a NetJet, rental of private business jets).
- As part of the tenure process, require that there be a visibility test for faculty. Faculty need to promote their work.
- Need to master new technologies to create linkages with NYC.
- Mike Moyer pointed out that we need to think differently. We need to own NYC. We do our deep thinking in Ithaca and develop our companies in NYC. Perception wise, we need to own NYC and highly promote this.
- Lance needs to come up with an action plan of five things.

Cornell Energy Framework

Jeff Tester, Croll Professor of Sustainable Energy Systems, School of Chemical and Biomolecular Engineering

Jeff gave an overview of energy research and education at the Cornell Energy Institute. Some examples of energy research at Cornell include: Earth Energy program (geothermal, unconventional fossil energy, and carbon management); wind and water power Aerodynamic and Hydrodynamic energy; solar energy and energy materials. He noted that the Cornell Energy Institute is the lead organization for technology-based energy research and education. Their focus is to tackle sustainability challenges with innovative research and education. Jeff also discussed the evolving roles of the Energy Institute and Cornell's approach to sustainability by enhancing Cornell's presence in the energy sector; promoting the development of course curricula to educate the next generation of energy leaders, strategic faculty hiring, engagement in campus sustainability, and engaging industry, government, NGO's and foundations to create partnerships and new avenues for supporting multi-investigator research.

Jeff indicated that leadership in the institute involves: CBE, EAS and CEE faculty, as well as over 50 faculty and staff. He also pointed out that Cornell's approach to sustainability research address three key elements: energy, economic development and the environment.

Jeff summarized the Energy Institute's involvement in energy education that involves:

- Leadership in creating accessible energy courses for seniors and graduate students.

- MEng specialization in Energy Economics and Engineering.
- Assistance in organizing College's weekly energy seminar.
- Management of the Graduate and Undergraduate Minor in Sustainable Energy Systems. Leadership of Earth Energy IGERT educational program.
- Created and deployed 3 core energy analysis courses and 14 modular energy courses with accompanying text.

Jeff pointed out that this effort involves learning in a living laboratory and represents scalable demonstrations of energy technology on campus, in NY State, and other regions, such as:

- Energy efficiency improvements in cell towers and data centers.
- Sustainable agriculture with energy and nutrient recovery.
- Renewable energy options for accelerating Cornell's Climate Action Plan -- geothermal, biomass, wind and solar PV.

Jeff noted that last February, in response to a resolution from the Faculty Senate, President Skorton "committed the university to creating a plan to accelerate our efforts to achieve carbon neutrality on the Ithaca campus by 2035 – a full 15 years sooner than originally planned." Jeff concluded that our mission is to achieve climate neutrality in 20 years.

Comments on energy

- Is anything happening in the nuclear area? Jeff responded that we're bringing people in from the outside to teach this. This will continue to have a strong presence and there's a lot of interest from students.
- Is research being done on CO₂ and temperature change? Jeff replied that climate scientists are embedded in EAS and are working on mitigating this issue.
- Rick Allmendinger added that there's no doubt that global warming is happening. Greenhouse gases have increased by 50% since they've begun studying this issue.

Energy Institute Strategic Plan for Corporate Connection

Gus Noojin, CBE '69, Former President and CEO of Shell US Gas and Power, Chairman of Cornell Energy Institute Advisory Council

Gus Noojin gave an overview of the strategic plan for the Cornell Energy Institute where he serves as chair of their advisory board. He explained that their focus is to engage with external parties for funding and collaboration. In January 2014 they held an Innovation Workshop generating ideas and many have found their way into their business plans. Four of their advisory board members met and drafted the following business plan modules:

- Mission/Vision/Approach
- Areas of Concentration
- Metrics/Objectives/Goals
- Market Segmentation
- Competitive Assessment
- Value Proposition
- "Product" Offering

Gus explained that the CEI aspires to create “a world in which people can satisfy their energy needs without compromising the environment or the ability of future generations to do the same”. Their mission is: “CEI brings together people with diverse capabilities (faculty, students, alumni, external partners) in pursuit of a common purpose: Creating the capacity to conceive, develop and deploy sustainable solutions, to meet the world’s critical energy challenges.”

Gus discussed the approach of the CEI which is to:

- Educate (next generation of engineers and scientists in the fundamentals of sustainable energy systems).
- Innovate (conceive solutions to sustainable energy problems through novel research and development).
- Implement (deploy new energy solutions via “living laboratories”).
- Engage (building strong, comprehensive partnerships with external parties that have common aspirations and complementary resources).

Gus indicated that the CEI reviewed market segmentation, looked at several potential partners and then rated them. They filtered that down to a list of 20 potential partners. He added that some of our peer institutions are extremely well funded. Gus asked for the council’s feedback on whether the CEI is something they would want to invest in.

Gus highlighted the areas of concentration of the CEI which include:

- Subsurface Systems: developing multiscale approaches to sustainable subsurface resource utilization at the intersection of Engineering disciplines and Earth Science.
- Biofuels and bioproducts: expanding Cornell’s biomass portfolio using novel feedstocks and thermochemical processing.
- Aerodynamic and Hydrokinetic Energy: focusing on power from wind and tidal flows, including their effect on avian and marine mammal populations.
- Community energy usage: applying a unique systems approach to evaluating options for sustainable energy systems in the context of rebuilding aging infrastructure.

Gus also explained that Cornell is ideal for the Energy Institute due to:

- Institutional commitment to sustainability at Cornell and in society.
- Land Grant University (the only Ivy League institution with a Land Grant mission).
- Multidisciplinary, systems approach.
- Breadth of academic disciplines.
- Distinguished faculty.
- Outstanding students (the chief product).

Sustainability – The Final Frontier: Cornell Leads the Way

Todd Cowen, Professor, School of Civil and Environmental Engineering, Faculty Director for Energy, David R. Atkinson Center for a Sustainable Future

Todd Cowen gave an overview of the David R. Atkinson Center for a Sustainable Future (ACSF) and indicated that its purpose is to:

- Lead the University in multi-disciplinary sustainability-based research on campus.
- Convene and connect internal and external stakeholder from all Cornell's colleges and schools.
- Seed new collaborations across broad and interconnected themes of sustainability involving the 3 E's (energy, environment and economic development).
- Partner externally to co-create and take applied solutions to scale to have impact.

He noted that Cornell is a unique institution that is both a land grant and endowed university with enormous breadth and depth. Their mission is "To discover and implement sustainable solutions to world's needs for reliable energy, a resilient environment, and robust economic development". The ACSF is the only academic institution in America that connects the three pillars of sustainability – energy, the environment, and economic development – in one center. Their priority is to engage with external non-academic partners to jointly make discoveries, to maximize real-world impact.

Todd described one of their seed projects, Biochar, which is a stable, carbon-rich product produced by thermal decomposition when biomass is heated in an anoxic environment (pyrolysis). He noted that the ACSF impacts more than 400 faculty fellows, 75 departments, and 11 colleges. He also described the dynamic engagement of this center which involves: topical lunches (which often lead to proposals), Rapid Response Fund, Atkinson Post-doctoral Scholars, Academic Venture Fund, policy briefings, events, lectures and engaging alumni.

Todd pointed out that as part of ACSF's new strategic plan, they have identified six research areas as priorities for a sustainable future:

- New Materials
- Energy Transitions
- One Health
- Sustainable Communities
- Computational Sustainability
- Sustainable Agriculture and Food Systems

These focus areas match Cornell's strength and expertise with urgent global need in energy, the environment, and economic development. The Atkinson Center strives to support a broad range of sustainability research across the three "E's" through the Academic Venture Fund, and other flagship programs, while new strategic activities will target the focus areas.

Todd indicated that nationally other institutions and municipalities look to Cornell to achieve climate-neutrality goals on a campus-community scale. He also highlighted the successes of Cornell's Climate Action Leadership that has led to:

- 50% reduction in carbon emissions since 1990.
- 32% since climate commitment signed in 2007
- Colleges and units are incorporating sustainability into their culture and operations.
- New academic programs focused on energy and climate.

- Combined heat and power and beyond coal.
- Lake source cooling (90% reduction in electricity for cooling = 15 MW peak avoided).
- Energy conservation and green building policy.
- Solar and wind project under development.

Todd noted that a climate neutral campus enhances our mission to provide:

- Intellectual depth – requires us to wrestle with tough questions across disciplines.
- Engagement – humanities, social science, and community engaged learning and research are all necessary.
- Impact – translation of fundamental knowledge to real world problem solving.
- Scalable model – for New York State and the country.
- Stewardship – Land grant mission and cooperative extension.

Todd pointed out that he would like Cornell's legacy to be one of the leading university's in the U.S. in this climate action effort.

Breakout Group Sessions

The afternoon was dedicated to breakout group sessions to address the following questions:

Breakout Group Questions

1. How can we work to establish and promote connections between industry and the Energy Institute?
 - a. Would you consider investing?
 - b. What is a reasonable annual amount?
2. How can we best describe our goal of using the Cornell campus as a living laboratory?

Flip Chart Notes and Comments from Breakout Groups

Four breakout groups met and reported back the following:

Breakout Group 1 Comments

Led by Bob Shaw

The group focused on Question 1 (points a. and b.):

Would you consider investing?

- There was very little interest in investing. However, should consider organizing a group of people who would contribute \$50,000/yr. and have that group would meet once or twice a year. However, would need a staff person to manage this. Conclusion, over time, there would be a number of contracts that would arise from this.
- On the contract side, need to work on giving the IP over to the funder.

What is a reasonable annual amount?

- Cost of entry would be initially \$50K a year, which wouldn't be too much of a burden for companies.

- There was also discussion on turning this into a membership that companies would be proud to be a member of this. Need to make this attractive for companies to want to be a part of this.
- Living Laboratory: the notion of carbon neutrality is antagonizing to some potential donors. However, it's popular with the younger population.
- Also, discussed that our efforts should be technically creative and intelligent to appeal to a wider audience beyond Cornell. Need to find creative solutions to solving this problem and publicize them.

Breakout Group 2

Led by Howard Morgan

- Need to determine what product you're pitching.
- Think bigger.
- Need more partners and need to make a pitch to them.
- Need to have a real focus on a pitch to the companies. (i.e., hold 2 seminars a year).
- Need a marketing/development person to get this going. Several schools are able to do so, i.e., MIT, Stanford. Could do this with companies such as Walmart, McDonald's, etc.
- Could see 30-50 companies giving \$50-100K per year. What will they get for this? Possibly the ability to get someone on campus for a few months at a time.
- \$1-2 million will be for a specific project. The first thing is to stay alive. Get the \$3MM that you need to keep it alive.
- Concerned about IP.
- On the living laboratory: believe it's important and a draw. By using Cornell, you have a real example and real scale of this effort.

Breakout Group 3

Led by Elissa Sterry

- Would we invest?
- Why would someone invest?
- Focus; energy large.
- Need to know what you get out if you put something in.
- Define scale up earlier than traditional product development before investing in technology success. Must have ability to deal with commercial scalability, manufacturing, policy, not just technology.
- Science to science interaction. Need to rely on companies' policy.
- How much?
- Attract as much as you can -> market will determine.
- Living lab -> what will we demonstrate?
- Show capabilities, let companies define program / leverage other funding sources.
- Utilize living lab to demonstrate proof of concept.
 - Targeted applications (Verizon)
- Role model for other small cities.
- Partners
- Knowledge information centers. Pay into consortia that would be interesting partners.
- Ease of doing business is important to attract funds.

- Buy-in consortium on target and solutions w/sub-programs that are large and are funded separately (higher hurdle).
- Need specific value proposition by + under -> may cluster.
- Use living lab to show other cities and companies how to be carbon neutral.
- Is there a way to bring advanced technology to developing countries and partner on living lab? They need energy systems that are quite different. Systems that aren't interconnected. Is that a role that Cornell can play? Aging infrastructures and infrastructures that don't exist should be considered in this effort.
- Developing countries cannot afford infrastructure. Micro local delivery options.
- Economics matter, funding from infrastructure companies (GE, Siemens, etc.).
- Economic development grants.
- Foundations w/sustainability goals.
- Business model that is "self-funding" from energy efficiency credit.
- The money is relative to attracting the goal. First, need to focus and be clear if you want to attract industrial partners. They need to know what they'll get out of what they put in. You have many challenges.
- Scalability of Ithaca.
- Multifaceted problem. Needs to be a commercial success.
- How do you solve that? Several models were discussed:
 - Start with one or two pillars.
 - Start with a low threshold of funding. Need to narrow focus to what is unique about Cornell to attract funding.
 - Everything needs to have a commercial focus.

Breakout Group 4

Led by Gus Noojin

- We need to spend more time learning and understanding the needs of our partners. Then focus programs around those relevant needs to get those partners closer to us. This would be much more compelling. Also, put research partners on campus. Lance indicated that he's considering having a business development officer assist work in this effort.
- Start with customer segmentation and focus groups.
- Have industrial partners and municipal partners. Know you're target. Lance noted that we might consider partnering with municipalities that are interested in making progress on their energy efforts.
- Need to design your outreach to expose opportunities that we might not be aware of.
- Creative financing should be considered. There is a real carbon cap program (i.e., such as in England).
- We should have a presence at Energy conferences.
- Open IP. That would be easiest for numerous reasons. You get the best faculty to work on your problem when they have least constrictions on IP.

Summary of the comments on establishing connections between industry and the Energy Institute:

- Clarify value proposition. What's the product?
- Establish owner for marketing (connector). Circulate job description by council.
 - Need pitch

- Granular detail needed for strategic plan.
- Differentiate institute's program.
- [Caltech associates, MIT \$25K – 100K/yr, Annual Meeting, progress]
- Reconsider 10 company/institute limit
 - Not thinking big enough!
 - “Go big or go home”
 - What's the goal?
 - Look internationally as well.
- Disaggregate program for associates.
- Reconsider IP offer. Take off table.
- Offer access
 - Research
 - Sabbatics for faculty
 - Access to students
- Revisit target list, increase number.
 - Include DOE, Gates Foundation
 - Actionable plan, 2-year window.
- Dedicated liaison/sales manager for each focus area.
- Business development – connect university research with industry needs.
- Leverage strength.
- Focus number of researchers, research topics - test interests.
- Would you consider investing?
 - Question: In what?
- What is a reasonable amount?
 - \$10K - \$150K

After this discussion, Duane Stiller adjourned the ECC into Executive Session. The next Engineering College Council Meeting is scheduled for March 12-13, 2015, in New York City.