

Agenda for presentation
to the Cornell Engineering Council
March 26, 2009

Jeff Tester
Croll Professor of Sustainable Energy Systems
Chemical and Biomolecular Engineering
Cornell University

Sustainable Energy Systems at Cornell

1. Review of sustainability issues relevant to energy
2. Cornell's capacity for and commitment to sustainability
3. Review of current CCSF activities
 - Vision and approach – structured around energy, environment and economic development
 - Academic Venture Fund
 - Faculty recruitment and retention
 - Educational initiatives
 - Research program development
4. Evolving plans for Cornell Sustainable Energy Institute
 - Identifying and developing “targets of opportunity”
 - Advanced materials for energy applications (PV, storage, carbon capture, etc.)
 - Geoengineering for carbon management, geothermal energy recovery and unconventional fuel upgrading
 - Biomass to energy and fuels – with CALS a full life cycle systems approach
 - Energy infrastructure – electric power systems, smart grids, energy storage
 - Sustainable buildings with Architecture and College of Human Ecology
5. Challenges facing us
6. Questions and advice from the Council

Cornell provides a rich portfolio of necessary skills and competence to tackle the multidisciplinary challenges of sustainability

- Few universities have the intellectual depth and disciplinary breadth that Cornell has across its 11 endowed and land grant colleges
 - from Agriculture and Life sciences and Veterinary medicine ...
 - to Physical sciences, Humanities and Social sciences ...
 - to Engineering with Earth and Environmental Science
 - to Ecology to Economics and Business ...
- Most US research universities are tackling problems in energy technology and science -- but few are committed to sustainability on campus and in classroom teaching as well

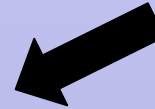
Cornell's approach to sustainability addresses three key elements in the CCSF

**Economic
Development**

Achieving energy
security



Achieving social equity
and resolving
population driven
damages



Energy



Environment



Resolving Climate Change

Cornell Center for a Sustainable Future (CCSF)

CCSF advances multidisciplinary research and cultivates innovative collaborations within and beyond Cornell to foster a sustainable future for all.

Economic Development

- Food & Water Systems
- Human Health, Nutrition and Education
- Institutions, Policy and Governance
- Population and Migration
- Poverty Reduction

Energy

- Renewable Sources – solar, wind, biomass, geothermal
- Infrastructure – electric power, smart grids, T&D
- Carbon capture and sequestration
- Efficiency and storage
- Transportation
- Systems Analysis



Environment

- Biodiversity
- Biogeochemistry
- Climate Change
- Buildings to Cities
- Environmental Sociology
- Mitigation/Adaptation
- Sustainable Agriculture
- Water Resource Mgmt.

Cornell Center for a Sustainable Future (CCSF)

CCSF advances multidisciplinary research and cultivates innovative collaborations within and beyond Cornell to foster a sustainable future for all.

Main Activities

- Academic Venture Fund: seeds collaborations that bridge to external partners (govt, industry, foundations, NGOs, ...)
- Faculty Hiring and Retention: Cross-college cluster hiring in keystone activities
- Development and support for multi-disciplinary/multi-investigator research proposals
- Rapid Response Program: Build teams to respond to known or expected RFPs

Sustainability in the context of energy, environment, and economic development



Recognized for quantitative, objective analysis covering the multiple attributes of sustainability with depth

Increasing impacts by making connections
with faculty and programs in different colleges
with govt. agencies and companies
with Cornell alumni
with people in communities in general

Many Opportunities for Energy Research and Education

- **Energy initiatives underway at Cornell:**
 - **Biofuels** from cellulosic , algae, and waste feedstocks – from basic bioscience to thermochemical conversion process development in a quantitative LCA context
 - **Advanced energy materials** for solar PV, energy storage and thermal and wind applications
 - **Fundamental science and technology** of associated with carbon capture and sequestration
 - **Energy infrastructure** – electric power systems, smart grids, and integrated transportation systems
 - **Advanced Geo-engineering** methods for geothermal energy recovery
- **Education** -- University wide curriculum development in sustainability – undergraduate minors and/or certificates
- **Major grant solicitations** – DOE Energy Frontier Research Centers (EFRC), NSF Integrated Graduate Education and Research Traineeship program (IGERT), Stimulus funds addressing energy deployment within Cornell's climate action plan, and ramp up of energy R&D support within DOE for specific applications
- **National forums** on sustainable energy to develop programs, showcase university research and energy infrastructure deployment
 - **Wind workshop in June 2009**
 - **Summer sustainable energy fellowship program May-June 2009**

LARGE SCALE WIND GENERATED POWER

June 12 - 14, 2009 Cornell University

This two-day workshop will explore some of the issues and obstacles to wind power including the effects of variable windloading, materials and drive train durability, effects on birds and bats, noise, aesthetics, cost, and the overhaul of the national power grid. Experts from the U.S. and abroad will present lectures and engage in panel discussions.

Tentative Speakers:

| | |
|--|---|
| Julian Hunt, University College London | Mike Robinson, National Renewable Energy Lab |
| Jim Lyons, Novus Energy Partners | John Saintcross, NYSERDA |
| Jakob Mann, RISO, Denmark | Michael Sirak, General Electric |
| Charles Meneveau, Johns Hopkins | Robert Thomas, Electrical & Computer Engineering, Cornell |
| Dale Osborn, Midwest ISO | Christopher Clark and Andrew Farnsworth, Laboratory of Ornithology, Cornell |
| Joachim Peinke, ForWind, Oldenburg | |
| Shu Quek, General Electric | |

Organizational Team:

David Caughey dac5@cornell.edu
Zellman Warhaft zw16@cornell.edu
Alan Zehnder atz2@cornell.edu

http://cf.d.mae.cornell.edu/~caughey/WindPower_09/

**SPONSORED BY THE
CORNELL CENTER FOR A SUSTAINABLE FUTURE**



Cornell University

Our Biggest Needs and Challenges

1. Securing support for multidisciplinary, energy research and educational and new energy deployment
2. Connecting multidisciplinary research in the domains of energy, environment, and economic development to external organizations that can accelerate change
3. Attracting and retaining new faculty with expertise in energy and other critical areas
4. Seed funds for nurturing new energy research and for sustainable energy curriculum development
5. Graduate student fellowships

Making this happen requires partnerships and alliances with Cornell's alumni, industrial supporters, foundations, NGOs, and state and federal agencies

**For further details
Please read the Annual Report for the CCSF available
on the CEC web site**