Friday, January 11:

**Faculty Innovation Center Mediasite**

8:15  *Continental Breakfast*

8:45-9:00  *Welcome*

9:00-9:15  *Introduction of Advisory Committee, UT Investigators, and Program Overview*

Tom Edgar

9:15-9:45  *Pecan Street Inc. Update*

Brewster McCracken

9:45-10:30  *Discussion of Interdisciplinary Curriculum, Recruitment, and Outreach*

David Adelman, Tom Edgar, Alexis Kwasinski, Suzanne Barber, Michael Webber, and Risa Hartman

10:30-10:45  *Break*

10:45-11:45  *Introduction of New Trainees: Alex Headley, Erin Keys, Kristen Markham, Kate Mc Ardle, Abigail Ondeck, and Kristina Tajchman* and

*IGERT Trainee Presentations – Education and Research* (10 min. each)

Arturo Gutierrez, Robert Crawford, Sean Wood, Alex Headley, Kate McArdle, Kristina Tajchman

11:45-1:00  *Lunch*
1:00-2:05  **IGERT Affiliates – Education and Research** (5 min. each)
Josh Rhodes, Amir Toliyat, Wesley Cole, Robert Fares, Steve Bourne, Akshay Sriprasad, Harsha Kumar, Dave Tuttle, Hunter Estes, Matthew Charlton

2:05-2:15  **Report on Trip to Munich**
Arturo Gutierrez

2:15-3:00  **Meeting of Advisory Committee with IGERT Trainees**
Risa Hartman and Darlene Yanez

3:00-3:15  **Break**

3:15-3:45  **Write up Program Evaluation Report**

3:45-4:00  **Discuss Evaluation with IGERT Executive Committee**

4:00  **Reception in CPE 2.802F**

5:00  **Pike Powers Research Lab Tour**
External Advisory Committee

Members

Pat Chapman   Solarbridge
Mike Hightower  Sandia National Labs
John Hoffner   CH2M Hill
Bill Kramer   NREL
Brewster McCracken  Pecan Street Inc.
Richard Morgan   Austin Energy
Peter Sauer   University of Illinois U-C
Noel Schulz   Kansas State University
Jeff Tester   Cornell University
UT – Austin IGERT Grant Overview

Sustainable Grid Integration of Renewable and Distributed Resources

- 20 faculty from Architecture, Engineering, Business, Law, and LBJ School and 11 IGERT Fellows/year ($3 million over 5 years)
- Student research projects carried out in areas of power distribution, energy storage, business utility/consumer models, systems modeling and integration, and building-integrated solar energy (two year fellowships)
- Coordination of interdisciplinary course sequence from the five schools
- Based around goals of Pecan Street Inc.
- Internships in industry/government organizations and study abroad (TU München)
Executive Committee

- **Thomas Edgar**, PI
  Chemical Engineering
- **Ross Baldick**, Co-PI
  Electrical and Computer Engineering
- **Suzanne Barber**, Co-PI
  Electrical and Computer Engineering
- **Alexis Kwasinski**, Co-PI*
  Electrical and Computer Engineering
- **Michael Webber**, Co-PI**
  Mechanical Engineering

*Promoted to Associate Professor Fall, 2013
**Promoted to Associate Professor Fall, 2012
Participating Faculty

- David Adelman
- David Allen
- Michael Baldea*
- Maggie Chen*
- John Butler
- Ulrich Dangel
- James Dyer
- Matt Fajkus
- Robert Hebner*
- Kara Kockelman*
- Arumugam Manthiram*
- Steven Moore*
- Buddie Mullins*
- Atila Novoselac*
- Rod Ruoff
- Surya Santoso
- Alexandre da Silva*
- Keith Stevenson*

* PhD student supervisor
Administration

• Pam Cook, Project Coordinator (retired)

• Risa Hartman, Project Coordinator (new)

• Darlene Yanez, Assessment Coordinator

• Sarah De Berry-Caperton, Administrative Associate
IGERT Trainees
(Two Year Fellowships)

First Year

• Alex Headley – Mechanical Engineering (M. Chen)
• Erin Keys – Mechanical Engineering (M. Webber)
• Kristen Markham - Civil, Architectural, and Environmental Engineering (A. Novoselac)
• Kate McArdle – Electrical and Computer Engineering (S. Barber)
• Abigail Ondeck – Chemical Engineering (M. Baldea / T.F. Edgar)
• Kristina Tajchman – Architecture (S. Moore)

Second Year

• Rosaria Berliner – Civil, Architectural, and Environmental Engineering (K. Kockelman, M. Walton), transferred to UC Davis
• Robert Crawford – Mechanical Engineering (A. da Silva)
• Arturo Gutierrez – Materials Science and Engineering (A. Manthiram)
• Sean Wood – Chemical Engineering (B. Mullins)
IGERT Alums

Third Year (moved to different funding)

• Akshay Sriprasad – Chemical Engineering (T. Edgar), now Pecan Street Inc. funded
• Hunter Estes – Electrical and Computer Engineering (A. Kwasinski/R. Hebner)
• Matthew Charlton – Materials Science and Engineering (K. Stevenson)
• Dave Tuttle – Electrical and Computer Engineering (R. Baldick)
• Gregory Dahlberg – Electrical and Computer Engineering (A. Kwasinski), graduated with M.S. degree
IGERT Affiliates

- **Steve Bourne** – Civil, Architectural, and Environmental Engineering (A. Novoselac), Pecan Street Inc.
- **Wesley Cole** – Chemical Engineering (T.F. Edgar), NSF Fellow
- **Robert Fares** – Mechanical Engineering (J. Meyers), Pecan Street Inc.
- **Harsha Kumar** – Electrical and Computer Engineering (A. Kwasinski), Pecan Street Inc.
- **Krystian Perez** – Chemical Engineering (T.F. Edgar), Gates Fellow
- **Kody Powell** – Chemical Engineering (T.F. Edgar), UT Sustainability Fund
- **Josh Rhodes** – Mechanical Engineering (M. Webber), Pecan Street Inc.
- **Amir Toliyat** – Electrical and Computer Engineering (A. Kwasinski), Pecan Street Inc.
- **Charles Upshaw** – Mechanical Engineering (M. Webber), Pecan Street Inc.
Pecan Street Inc.
Mueller Demonstration Project

- DOE Smart Grid Funding $10.4 million + $15 million matching/infrastructure (12/2009), also CAPCOG, Doris Duke Foundation
- Data collection from pilot group of homes to see how various technologies affect electricity usage, bills, utility finances, environmental outcomes, and overall system performance
- Industrial affiliates program initiated Pecan Street Consortium (~$500 k/yr.)
IGERT Enrichment

- Weekly meetings and presentations (since 10/10)
- Ethics seminar (2/2011)
- Study abroad (May-June, 2011 and 2012) – TU Munich (Werner Lang – liaison)
- IGERT Project: Church energy audit (March-August, 2011)
- Commercialization Short Course (PSP – August 17-19, 2011)
- Outreach events, field trips (e.g., ExploreUT)
New Student Recruitment

- On-line application on IGERT website

- [http://research.engr.utexas.edu/igertsustainablegrids](http://research.engr.utexas.edu/igertsustainablegrids)

- 2010 class (existing UT students nominated by faculty)

- 2011 and 2012 classes (selection of students who applied, nominated by UT faculty)

- Diversity emphasized (6 women + 1 African American + 1 Hispanic out of 10 students in Fall, 2012)

- 2012 class (outreach to targeted schools)
IGERT Curriculum

- Interdisciplinary courses offered
- List posted on website
- Six new courses developed
IGERT Curriculum – New Courses

1. Energy Development and Policy (Adelman)
2. Modern Control Theory (Edgar)
3. Intro to Electric Power and Locational Marginal Pricing Short Course (Baldick)
4. Advanced Topics in Power Electronics (Kwasinski)
5. Animation of Home Energy Management Systems (Barber)
6. Technology Commercialization Short Course, etc. (Webber)
Energy Development and Policy - Spring 2013
Professor David Adelman (Law School)

• Introduction to legal, business, and engineering facets of energy development and entrepreneurship
• Two case studies: wind development and natural gas combined cycle plant
• Covers site selection, due diligence, permitting, contracting, and financing
• Involves outside experts in utility and renewable energy sectors
• Interdisciplinary teams from law, business, public affairs, and engineering (25 total students)
Modern Control Theory with Application to Energy Systems – Spring 2013
Professor Thomas Edgar

• **Control Theory** – linear systems, state space analysis, continuous/discrete time, nonlinear programming formulations, optimal control, model predictive control, Kalman filter, recursive parameter estimation, adaptive control

• **Energy Applications** – steam system (cogeneration), power systems control, solar thermal storage, energy efficiency, smart grid, solar maximum power point tracking
Introduction to Electric Power
Professor Ross Baldick

- **Topics:** Introduction to electric power industry, reviewing: Basic definitions of electric power quantities; Similarities and differences between electric power and other industries; Components of an electric power system, Electric transmission and power flow; Offer-based economic dispatch; Hedging energy price risk; Locational marginal prices; Hedging transmission price risk; Transmission planning.

- **Course arrangement:** Three-day short course most recently held Spring 2012 over three Fridays for both IGERT trainees and industry professionals.
• **Re-developed course:** Advanced Topics in Power Electronics (Fall of odd years)
  • Re-developed course with significant increased focus on issues found in power electronic circuits applied to sustainable energy systems, particularly, for integration of renewable energy sources and energy storage devices.
  • Pedagogical approach based on two main course goals:
    • 1) To discuss relevant technical topics related with advanced power electronics.
    • 2) To prepare the students to conduct research or help them to improve their research skills.

• **Improved course:** Distributed Generation Technologies (Fall of even years)
  • Added smart-grid related topics
  • Same pedagogical approach than Adv. Topics in Power Electronics. Both courses have been assigned permanent registration numbers.

• **Newly Developed course:** Power-Nets Development
  • Course developed under an IBM’s 2011 Smarter Planet Faculty Innovation Award.
  • 4-modules course (each 1-week long) intended to discuss fundamental concepts related to the development of an advanced smart grid.
Home Animation and Energy Security and Privacy
Professor Suzanne Barber

Completed *Home Animation course*. This course will challenge students as they form teams to deliver home animation designs satisfying constraints of the home, meeting customer requirements and taking full advantage of current and envisioned technology available from the commercial sector and R&D labs.

- **Developing Energy Security and Privacy course (semester long or short course).** Course topics to include:
  - **Energy Identity**: information exchanged in the Smart Grid that can be used to identify people, businesses, or devices
  - **Energy Identity security and privacy requirements** within Smart Grid system architecture currently under development by Pecan Street
  - **Use cases for Energy Identity** management, security and privacy
  - **Inventory of Energy Identity information**
  - **Security and privacy risk assessment and system design** using *Energy Identity Map* model and simulation
New Short Courses Have Been Created in Affiliation with the IGERT Program

Professor Michael Webber

- Short course target audience includes professionals and grad students
- “Clean.Smart.Energy”: 5-day course on energy technology and policy along with commercialization
  - Offered with Webber, ATI/CEI, and Pecan Street
  - Offered in August 2011 and May 2012
- “Water Technology & Policy”: 1- and 2-day versions
  - Offered with Center for Lifelong Engineering Education (CLEE) through UT Austin
  - Offered in August 2012 (1-day) and May 2013 (2-day)
- “Future of Energy”: 4-week series (Monday afternoons in April 2013)
  - Offered with Roger Duncan (President of Pecan Street, Inc.) and Webber
- “Energy Technology & Policy”: 1-, 2- and 3-day short course
  - Offered by Webber through McCombs School (in Houston) and CTSI (in Washington, DC)
A Group of Faculty Are Contemplating New Degree Programs Related to Sustainability

Professor Michael Webber

- UT recently created a new MS option for its Energy and Earth Resources program (it had only offered MA degrees beforehand)
- Funding from the Mitchell Foundation is supporting the initiative to examine how to integrate sustainability into higher education
  - Provost publicly pledged support to the broader notion of integrating sustainability more deeply into the education, research and operations at UT
- Possible creation of
  - New classes on sustainability
  - New class modules on sustainability for existing courses
  - Graduate portfolio programs
  - New undergraduate degrees
  - Interdisciplinary PhD pathways
Graduate Portfolio Program in Energy Studies

• Campus-wide interdisciplinary program
• Students must complete 4 thematically related courses in energy field
• Students must complete a research project and present results at a professional meeting or on-campus event
• Aiming for 100 students enrolled
• Students apply for the portfolio certificate, awarded upon graduation (in addition to disciplinary degree)
• Formal approval expected in early 2013