Friday, January 10:

**Faculty Innovation Center Mediasite**

8:00  
*Continental Breakfast*

8:30-8:45  
*Welcome*

8:45-9:00  
*Introduction of Advisory Committee, UT Investigators, and Program Overview*  
Tom Edgar

9:00-9:45  
*Discussion of Interdisciplinary Curriculum, Recruitment, Outreach and Study Abroad Program*  
Tom Edgar, Alexis Kwasinski, Suzanne Barber, Michael Webber, Risa Hartman

9:45-10:00  
*Introduction of New Trainees: Donna Chen, Oluwaniyi Mabayoje Bonnie Roberts, Daniel Urieli, Benjamin Weaver, Andrea Christina Wirsching*

10:00-10:15  
*Break*

10:15-10:45  
*Pecan Street Project Update*  
Brewster McCracken

10:45-12:15  
*IGERT Trainee Presentations – Education and Research* (7 min. each)  
Kristina Tajchman, Daniel Urieli, Kristen Cetin, Kate McArdle, Bonnie Roberts, Alex Headley, Erin Keys, Oluwaniyi Mabayoje, Donna Chen, Christina Wirsching
12:15-1:00  
**Lunch**

1:00-2:05  
**IGERT Affiliates – Education and Research** (5 min. each)  
Steve Bourne, Wesley Cole, Robert Fares, Abigail Ondeck, Krystian Perez, Dave Tuttle, Arturo Gutierrez, Sean Wood, Matthew Charlton

2:05-2:15  
**Program Evaluator’s Report**  
Darlene Yanez

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**
External Advisory Committee Members

Pat Chapman  Solarbridge
Mike Hightower  Sandia National Labs
John Hoffner  CH2M Hill
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
Participating Faculty

• David Adelman
• David Allen
• Michael Baldea*
• Maggie Chen*
• John Butler
• Ulrich Dangel
• James Dyer
• D.K. Ezekoye*
• Matt Fajkus
• Robert Hebner

• Christine Julien*
• Kara Kockelman*
• Arumugam Manthiram*
• Steven Moore*
• Buddie Mullins*
• Atila Novoselac*
• Rod Ruoff
• Surya Santoso
• Keith Stevenson*
• Bjorn Sletto*
• Peter Stone*

* PhD student supervisor
Administration

• Risa Hartman, Project Coordinator

• Darlene Yanez, Assessment Coordinator
IGERT Trainees
(Two Year Fellowships)

First Year

- Donna Chen - Civil, Architectural, and Environmental Engineering (K. Kockelman)
- Bonnie Roberts - Mechanical Engineering (O. Ezekoye)
- Daniel Uriele – Computer Science (P. Stone)
- Benjamin Weaver – Mechanical Engineering (R. Manthiram)
- Christina Wirsching – Architecture (B. Sletto)

Second Year

- Kristen Cetin - Civil, Architectural, and Environmental Engineering (A. Novoselac)
- Alex Headley – Mechanical Engineering (M. Chen)
- Erin Keys – Mechanical Engineering (M. Webber)
- Kate McArdle – Electrical and Computer Engineering (C. Julien)
- Kristina Tajchman – Architecture (S. Moore)
IGERT Alums

Third and Fourth Year (moved to different funding)

• Matthew Charlton – Materials Science and Engineering (K. Stevenson)
• Hunter Estes – Electrical and Computer Engineering (A. Kwasinski/R. Hebner)
• Arturo Gutierrez – Materials Science and Engineering (A. Manthiram)
• Dave Tuttle – Electrical and Computer Engineering (R. Baldick)
• Sean Wood – Chemical Engineering (B. Mullins)
IGERT Affiliates

- **Steve Bourne** – Civil, Architectural, and Environmental Engineering (A. Novoselac), Pecan Street Inc.
- **Wesley Cole** – Chemical Engineering (T. Edgar), NSF Fellow
- **Robert Fares** – Mechanical Engineering (M. Webber), Pecan Street Inc.
- **Niyi Mabayoje** – Chemical Engineering (B. Mullins), UT Fellowship, IGERT Trainee beginning 6/14
- **Abigail Ondeck** – Chemical Engineering (M. Baldea), Pecan Street, Inc.
- **Krystian Perez** – Chemical Engineering (T. Edgar), NSF Fellow
- **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 Pecan Street Consortium (~$500 k/yr.)
IGERT Enrichment

- Weekly meetings and presentations (outside speakers)
- Ethics and professional development seminars
- Outreach events, field trips (e.g., ExploreUT)
- K-12 Curriculum materials development
New Student Recruitment

• On-line application on IGERT website

• http://research.engr.utexas.edu/igertsustainablegrids

• Selection of students based on nominations by UT faculty

• 2014 class (outreach to targeted schools, e.g., UTEP)
IGERT Curriculum

- Interdisciplinary courses offered
- List posted on website
- Six new courses Developed
- Energy Technology and Policy (Edgar, Webber) – gateway course
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
Professor David Adelman (Law School)

• Introduction to legal, business, and engineering facets of energy development and entrepreneurship
• Four 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)
Power Electronics and Smart Grids
Professor Alexis Kwasinski

- **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.
Energy Security and Privacy
Professor Suzanne Barber

• Gathered Smart Grid Security and Privacy Use Cases from Pecan Street Partners

• Leveraged computational model of Smart Grid Security and Privacy requirements to build draft architectures by
  - Software Architecture class team
  - Pecan Street Security and Privacy Subcommittee members
Webber Short Courses In Affiliation With The IGERT Program
Professor Michael Webber

- Short course target audience includes professionals and grad students


- “Future of Energy”: 3-week series in April 2013

- “Energy Technology & Policy”: 1-, 2- and 3-day short course

- “Clean.Smart.Energy”: 5-day course on energy technology and policy along with commercialization (2011, 2015)

- Possible courses/conferences/symposia in 2014/2015
  - Campus-wide energy conference via Energy Institute in early 2015
  - Energy & Happiness (via Harrington Society) in late 2014
Energy 101 MOOC: Massive Online Open Course
Professor Michael Webber

- “Energy101” launched Sep-Dec 2013
  - Used 30 modules (video, exercises, widgets)

- 44,000+ students enrolled globally

- Nearly 5000 students completed (>13%)

- Questions from each continent

- Covered in Forbes, AAS, ABJ, Daily Texan
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
Several Outreach Efforts Are Being Launched
Professor Michael Webber

- “Energy at the Movies” nationally syndicated on PBS on March 29, 2013

- Webber working with PBS Learning Media to create educational videos that will be distributed to 600,000+ public school teachers nationally

- Launched “Energy and Popular Culture” radio series on NPR
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. To be repeated in 2014.
Graduate Portfolio Program in Energy Studies

• Campus-wide interdisciplinary program administered by Energy Institute
• 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 obtained in Fall, 2013
Developing a Cadre of Professionals

IGERT is developing an interdisciplinary community of students prepared to meet the challenges faced in today’s workforce.
Professional Development & Enrichment

- Engineering Ethics Seminar, Patent Law Seminar & Presentation Skills Workshop
- IGERT trainees and alums serve as mentors for the new cohort of students
- Learning tours to local industry & weekly seminars
- Team planning sessions that dictate each semester’s agenda

Learning tour at a local utility cooperative: Bluebonnet Electric
Munich Study Abroad Program

• Exposure to the diverse energy approaches employed by Germany
• Exchange ideas with researchers from the Technical University of Munich
• Present research and/or network at energy related conferences
• Three trainees participated in 2013
• Seven trainees are applying for the program during 2014

TUM Ph.D. Students Maximillian Irlbeck and Vasileios Koutsoum with Trainee Kristina Tjachman

Trainee Sean Wood visited the Münster Electrochemical Energy Technology (MEET) Center
Group Project: Creating K-12 Curriculum

• Collaboration with UTeach*Engineering to develop energy systems curricula
• Trainees created a mini-module for the High School course, *Engineer Your World*
• Course currently taught in over 80 schools nationwide
• Activities highlight electric power grid & solar panel electricity generation into a traditional electric grid

*Desktop model of a conventional electric power grid*  *Model home with solar panels connected to vent cooling*
K-12 Outreach

- Science Club at Texas School for the Deaf (TSD)
- Science Fair at TSD
- Middle School Science Club at Ann Richard’s School for Young Women Leaders
- Science Sunday at Austin Children’s Museum (ACM)
- Summer Camp Fieldtrips with ACM
- Explore UT
- NanoDays at ACM
IGERT Recruitment 2014-2015

• GOAL - Recruit a diverse group of students
• Connect with Engineering Undergraduate & Graduate Coordinators to disseminate IGERT information and application
• Request nominations from engineering faculty members
• Communicate the opportunity to student led engineering organizations
• Conduct intentional recruitment at UT-El Paso, UT-San Antonio, & UT-Pan Am to attract a pool of diverse candidates (details to be worked out this Spring)