

Session IV – Designing Attractive Engineering Curricula

Robert J. Thomas

Cornell University

May 7 – 8, 2008

Presenters

- *Prof. Judy Cardell, Smith College*
- *Henry Louie, 3Tier Environmental Forecast Group*
- *Professor Tom Acker, Northern Arizona University*
- *Professor James Gover, Kettering University*

Developing a relevant course curriculum: common elements

- Faculty
 - University professors
 - Industry experts
- Content
 - Electrical
 - Cross-cutting/interdisciplinary
 - ⑩ Mechanical
 - ⑩ Civil
 - ⑩ Aeronautics
 - ⑩ Meteorology
 - ⑩ Economics
- Can common elements of a curriculum be identified

My take

- Electric Power Systems are **one component** of a sustainable energy future
- The electric grid is the **glue** that binds generating sources (supply) and loads (consumers)
- More electrification is the key to a **sustainable** future

Power Engineering Needs For the Wind Industry

Judy Cardell

Smith College

Picker Engineering Program & Computer Science Department

May 7 – 8, 2008

Issues

- Power engineering – challenges to system operation
 - Non-dispatchable, stochastic resource
 - Transmission system impacts and/or expansion
- Lack of communication and understanding across faculty in different disciplines
 - Power engineering
 - Economics
 - Policy making
 - Environmental science, engineering, economics
- Persistent misconceptions of wind power
 - “unreliable” vs. “install as much as possible”

Solutions

- Curriculum
 - Coordinate course sequences across disciplines
 - Introduce renewable energy early in power systems courses
 - Modernize “engineering economics” to include environmental economics, market design, the role of government
- Interaction between students and industry
 - Sponsor research and/or design projects
 - Could require relatively little money
 - Make data available (obscured as to source)
 - 5 – 10 minute & hourly
 - Predicted & actual windspeed
 - Individual turbine & windfarm power generation
 - ...for various, representative locations

Making it Relevant: Leveraging Public Interest in Renewable Energy to Promote Power Engineering Education

Henry Louie, PhD

3TIER

www.3tiergroup.com

UWIG/NREL Industry-University Workshop
on Power Engineering Needs for the Wind Industry

May 7-8, 2008

Interest in Renewable Energy

- Heightened conscience for renewable energy
 - Newspapers
 - Political debates
 - Green businesses
 - Pop culture, etc
- Interest is there, how do we use it to “fill seats”?
- What do we do once they are filled?

Relevant & Practical

- Curriculum is attractive if it is both relevant and effective in preparation for industry
- Needs from industry will change, curriculum must be flexible
- Greater focus on:
 - energy conversion technologies (both renewable and conventional)
 - statistical analysis
 - multi-disciplinary studies

Interdisciplinary Perspective of Power Systems – Mechanical Engineering

Tom Acker
Associate Professor
Department of Mechanical Engineering
Sustainable Energy Solutions Group

UWIG/NREL Industry-University Workshop on Power Engineering Needs for
the Wind Industry

May 7, 2008

Mechanical Engineering and Power Systems

- How a Mechanical Engineer views power:
 - Transforming natural resources into useful mechanical energy
 - Fossil, wind, solar, geothermal, biomass, efficiency
 - Thermodynamics / Aerodynamics / Heat Transfer / Material Science / Manufacturing / Controls
 - Mechanical & Electromechanical systems
 - Energy system analysis at the application
 - The power system is in the “balance of the system”

Relevant Issues

- Interdisciplinary connections
 - Power Systems - So what's a VAR and why is it important?
 - Demand response; grid/device interaction
 - Environmental / Biology / Ecology
 - Economics
- Issues
 - Faculty reward system
 - University multi-disciplinary focus on power/energy
 - Multi-disciplinary courses
 - Creation of new courses, textbooks

Wind Energy Education Workshop, Denver, May 7& 8.

james gover,
email: jgover@kettering.edu

**IEEE Vehicular Technology Representative
to IEEE-USA Energy Policy Committee**

**Professor of Electrical Engineering
Kettering University, formerly GMI**

The Issue of Wind Energy Education Is a Subset of Two Larger Issues

- **How to attract more students to study engineering, including wind energy engineering?**
 - **Engineering Programs that Appeal to Youth, Particularly Women.**
 - Programs that serve mankind.
 - **Partial Financing of Engineering Education.**
- **How to introduce transformational innovations into the energy sector, including wind energy?**
 - **Transformational education programs at undergraduate and graduate level.**

Proposed Green Energy BS Courses

1. **Overview of Energy Conversion (Freshman I)**
2. **Energy Conservation (Freshman II)**
3. **Manufacturing for Sustainability (Sophomore I)**
4. **Economics of Electric Power (Sophomore II)**
5. **Energy Public Policy/Regulations (Junior I)**
6. **Control and Management of Electric Grid (Junior II)**
7. **Global Warming Modeling (Junior II)**
8. **Solar Power Generation & Operations (Senior I)**
9. **Wind Power Generation & Operations (Senior I)**
10. **Fossil Fuel Plant Technology & Operation (Senior I)**
11. **Nuclear Reactor Power Plant Technology and Control (Senior I)**
12. **Fossil Fuel Carbon Cycle, Carbon Capture and Sequestration (Senior II)**
13. **Nuclear Power Fuel Cycle (Senior II)**
14. **Design & Operation of Other Power Generation Systems (Senior II)**
15. **Multi-Megawatt Electric Power Conditioning & Generator Design (Senior II)**
16. **Hybrid Electric Vehicle Design (Senior III)**
17. **Fuel Cell Technology (Senior III)**
18. **Battery Technology Chemistry & Electrical Engineering (Senior III)**
19. **Energy System Design Project (Senior III)**