



Spring Quarter 2010 Course Outline

PROGRAM	NUvention Energy (ISEN 430)
TIME	Thursdays, 2:00-5:00 p.m.
LOCATION	Room 165, Jacobs Center, NU Evanston Campus
FACULTY DIRECTORS	Nicholas Switanek , Visiting Assistant Professor of Management and Organizations, Kellogg School of Management, n-switanek@kellogg.northwestern.edu , 847-491-8074 Michael Marasco , Clinical Associate Professor & Director, Center for Entrepreneurship and Innovation, McCormick School of Engineering, m-marasco@northwestern.edu , 847-467-6347 Thomas McMahon , Adjunct Lecturer, Initiative for Sustainability and Energy at Northwestern (ISEN), thomas-mcmahon@northwestern.edu , 847-864-5987
PROGRAM WEBSITE	http://energy.nuvention.org
PROGRAM COORDINATOR	Joyce Gab Kneeland , Associate Director, Center for Entrepreneurship and Innovation, McCormick School of Engineering, joycegabkneeland@northwestern.edu , 847-467-4432
CLASS COORDINATOR	Arthur Zitao Zhang , Graduate Representative of ISEN Advisory Board, Ph.D. Candidate, Transportation Center, zitao-zhang@northwestern.edu , 847-467-1852
PROGRAM OFFICE	Ford Engineering Design Center, 2133 Sheridan Road, #2-331, Evanston, 847-467-6347, 847-467-4727 (fax) and ISEN, 2145 Sheridan Road, L550, Evanston, 847-467-1972
OFFICE HOURS	Each NUvention faculty member maintains office hours. Please contact them directly to schedule an appointment.
BOARD RELATIONS	Bridget Calendo , Director of Operations and Outreach, ISEN, bridget@northwestern.edu , 847-467-0863
COURSE OVERVIEW	NUvention Energy provides students an authentic experience of developing new business ideas in the sustainable energy and energy efficiency sector. Over an intense quarter, graduate students from schools across campus come together in interdisciplinary teams to develop a product or service: from concept, through market and environmental life-cycle analyses, culminating in a business pitch to take the product or service to market. Consistent with the NUvention approach, student teams develop their own business ideas, rather than consult to companies to develop company ideas or technologies. Projects come from Northwestern or Argonne laboratories, from industry and not-for-profit partners, and from students themselves. By simulating the product/service and business development process, NUvention Energy helps students develop creative, interpersonal, business, and technical skills.

**PROGRAM
OBJECTIVES**

NUvention Energy has been designed to facilitate student learning experiences around the following entrepreneurial challenges:

- Build a team from individuals with diverse professional backgrounds
- Use design to translate an idea into a product or service
- Assess and prioritize market opportunities for new business concepts
- Link innovation to a business concept with technical, financial viability
- Assess potential financial and environmental returns
- Convince experts and funders to back a new idea

**PROJECT-BASED
LEARNING
APPROACH**

Successful entrepreneurship in the sustainable energy sector demands basic skills and understanding of many disciplines, including in design, market analysis, business strategy formation, financial modeling, energy policy analysis, and environmental life cycle assessment. To help students develop these skills, they are matched to projects centered on one of a variety of technologies and service ideas at points in the energy system extending from generation through transmission or storage to industrial or individual use.

NUvention Energy is designed so students learn in and outside the classroom, and the principal learning takes place within the team, working on the team project. The class organizes learning around deliverables pertaining to business and design, crucially including an examination of the environmental aspects of their projects. By crafting these deliverables, students will build core skills and insight crucial to forming an energy venture that is sustainable both economically and ecologically.

Team Assignments: Since innovation and entrepreneurship are never individual efforts, most NUvention assignments will be performed by teams. According to student interests and expertise, faculty compose cross-disciplinary teams for the work of the quarter.

According to the nature of the deliverable, it is expected that the students with the deepest expertise in the assignment area will take a lead role, but all team members share responsibilities for every deliverable and those taking lead roles should elicit contributions from team members rather than simply doing the work themselves. The team meetings and work sessions that result in a completed assignment will be great opportunities to develop skills in communicating your expertise and learning from your peers from other disciplines, including an advisory board of industry experts.

For tailored support as they rapidly proceed through the entrepreneurial development stages, teams attend lectures and discussions in the classroom and meet with technical and other experts.

Classes: We have a diversity of students and faculty coming together weekly to discuss topics relevant to energy entrepreneurship. Faculty experts will be leading each class topic using a variety of teaching approaches from lecture to case discussion. Guest experts will be involved where appropriate. Each student's background and experience can help enhance the learning: your active and thoughtful participation is strongly encouraged.

Technical Advising: Each student team will be working with a McCormick,

Northwestern, Argonne, or industry advisor in their specialty area. Throughout the quarter, but at least once a month, teams should arrange to meet with the technical advisor for the specialist's perspective and advice on the project.

FACULTY ROLES

Each student will interface with faculty in the following roles:

Team Faculty Director: Each team will be assigned one faculty director that will be working closely with the team. This director will become very knowledgeable of the team's efforts and will grade each team assignment. Where the director is not an expert on the specific assignment, they will work with the faculty director that is to ensure each assignment is graded appropriately. Each faculty director advises and grades the assignments of 2-3 teams.

Supporting Faculty: A number of faculty subject matter experts will teach the student teams in areas like market research, design, environmental sustainability analysis, and uncertainty assessment. Each of these faculty will be in communication with the Team Faculty Director on their efforts and their input will be factored into grading.

ADVISORY BOARD

The NUvention Energy Advisory Board is composed of representatives from the energy and energy finance sectors who have supported the curriculum development of NUvention Energy and who bring unique perspectives to the program. Advisory Board members will be invited to participate in certain classes including the final presentations. They will be available to advise the faculty and student teams over the course of the program as needed.

GRADING

Participation:	<u>300 Points</u>
In class	100 points
In team	100 points
Blog posts	100 points
Deliverables:	<u>700 Points</u>
Market Research Plan	50 points
Storyboard	50 points
Baseline Life Cycle Assessment	50 points
Draft Business Pitch	100 points
Final Presentation	200 points
Supporting Documentation	250 points

Final Grades will be calculated using the following scale as a framework:

Total Points	Grade
900-1000 points	A
800-899 points	B
700-799 points	C
600-699 points	D
Below 600 points	F

All points earned will be posted on Blackboard. Students will receive feedback on their performance at the midpoint of the quarter. NUvention Energy faculty will grade according to the distribution/curve requirements of their respective schools for students from those schools.

STUDENT CONDUCT

The highest level of ethical behavior is expected from every NUvention Energy student. Every student must abide by his or her school's code of conduct. Any alleged or actual violation of any code will be investigated.

TECHNOLOGY USE

Students may use laptops to take notes only during faculty-led case discussion, lectures, and exercises. **All laptops must be powered down when any guest speaker visits. No exceptions!** All mobile phones and PDAs must be muted during class. Lack of adherence to these policies will lower a student's participation grade.

STUDENT EXPECTATIONS

NUvention Energy faculty and students expect the following:

- *Preparation:* Come prepared for class and out-of-class activities.
- *Presence:* Attend all classes and activities. Attendance sign-in rosters will be circulated at each class. Any planned absence must be discussed with your team faculty director.
- *Promptness:* Be on time for class and out-of-class activities. Submit assignments by or before due dates.
- *Participation:* Participate fully in class discussions and team activities.

**PROGRAM
OUTCOMES**

The NUvention faculty directors have high expectations for what students and their teams will accomplish. We expect every student will:

- Drive the evolution of a need through all stages of product and business development
- Generate and prioritize business ideas
- Navigate the uncertainties of new technology and policy
- Communicate a compelling business concept to potential funders
- Develop evidence to support for funding conversations

The NUvention faculty encourage students to pursue ideas developed in class after the class has ended, and will provide guidance on appropriate next steps for teams wishing to do so.

**INTELLECTUAL
PROPERTY**

Since some of the students and faculty efforts in NUvention Energy may lead to the creation of intellectual property, we have developed an Intellectual Property Agreement that each NUvention Energy student must execute to define the potential interests of involved students, faculty, Northwestern University, and (if relevant) Argonne National Lab or other parties.

TEXTS
(recommended)

Technology Ventures: From Idea to Enterprise, Byers, Dorf, and Nelson (2010)

Sustainable Energy – without the hot air, McKay (2009), available for free download at <http://www.withouthotair.com/>

Brief Outline of Class Sessions

Week	Topic	Related Deliverable
1	Course Overview	
2	The Design Process	Storyboard
3	Market Research	Market Research Plan
4	Business Models	
5	Feasibility and Uncertainty	
6	Developing the Pitch	Draft Business Pitch
7	Design for Environment	Baseline Life Cycle Assessment
8	Go-to-Market, Strategy, & IP	
9	Funding and Finance	
10	Dry-run Presentations	
11	Final Presentations	Final Presentation & Supporting Documents

Outline of Class Sessions

APRIL 1: COURSE OVERVIEW

The course begins with an introduction to the coupled trends in energy use and environmental degradation that bring business opportunity. We discuss the great need for sustainable energy entrepreneurship, previewing some of the themes of the remainder of the course. A sustainable energy entrepreneur shares his perspective.

1.1 The Energy Challenge

Faculty Prof. **Mark Ratner**, Co-Director of the Initiative for Sustainability and Energy at Northwestern (ISEN), Professor of Chemistry, College of Arts and Sciences
Mark Petri, Technology Development Director, Argonne National Laboratory
Ronald Fleckman, President & CEO, Energy Recovery Technologies, LLC

Then, we form temporary teams to participate in a preview of the class sessions to come. The teaching team then connects the experience to the course outline.

1.2 The Course in One Hour

Faculty Professor **Switanek**

APRIL 8: THE DESIGN PROCESS

Businesses profit by satisfying real or perceived needs. Entrepreneurs innovate by finding new needs or new ways to satisfy needs. Today is a high-energy, interactive session. From two top Chicago designers we learn techniques to guide the process of generating and refining business ideas in sustainable energy. Technical or industry advisors join project teams to participate in the activities.

2.1 Brainstorming, Prioritizing, and Storyboarding

Faculty **Joey Nakayama**, Principal Designer, HLB
Don Lehman, Designer, HLB

APRIL 15: MARKET RESEARCH

What are effective ways for learning more about customers and their needs? Student teams learn how to research potential target markets for their product or service.

3.1 Market Research

Faculty Professor **Vincent Nijs**

3.2 Team Break Out

Focus Identify one or two markets as main areas of promise.
Develop list of people to contact to learn more about target customers' needs.
Develop list of questions to ask.
Discuss team member roles and responsibilities for the project overall.

APRIL 22: BUSINESS MODELS

Business models specify the business's customers, the value that the business offers customers, and how the business gets paid for providing customers value. This session introduces the variety of models used in the energy sector and beyond, and the considerations that affect the appropriateness of a model for a business idea.

4.1 Business Model: Customer, Value Proposition, and Revenue Model

Faculty Professor **Marasco**
 Ronald Fleckman, President & CEO, Energy Recovery Technologies, LLC

4.2 Team Break Out

DUE **Market Research Plan** (50 points)
 Team Roles & Responsibilities Agreement (0 points)

Focus Estimate scope and scale, number and value, of customers in target market.
 Draft value proposition in light of market research.
 Assess potential revenue models for target market.
 Assess sources of differentiation from rivals.

APRIL 29: DESIGN FOR ENVIRONMENT

We next introduce methods for assessing the environmental impact of the proposed business and for comparing it to incumbent businesses you hope to displace. The core practice for assessing relative environmental impacts is Life Cycle Assessment (LCA) addressing both the manufacturing process and the product, a streamlined version of which we learn and apply.

5.1 Life Cycle Assessment

Faculty Jim **Cahan**, Sidley Austin LLP

5.2 Team Break Out

DUE **Storyboard** (50 points)
 Business Model Description (0 points)

Focus Decide on the scope of the LCA.
 Using the model of the product and its components, extend this model through the life cycle, creating an inventory.
 Prioritize the elements to address and plan to research them.

MAY 6: DEVELOPING THE BUSINESS PITCH

Over the prior sessions we gained a deeper understanding of the proposed business's potential customers needs. What elements must be in place to make a compelling case for funding? In this session, Professor Marasco will introduce an outline for the final presentation.

6.1 Developing the Business Pitch

Faculty Professor **Marasco**

6.2 Team Break Out

Focus Draft and deliver elevator pitch.
 Identify gaps in the business pitch.
 Create plan to fill the gaps by term-end.

Refine revenue model.
Refine market size estimates given refined revenue model.

MAY 13: ASSESSING FEASIBILITY AND UNCERTAINTY

Until now we have assumed that the proposed product or service functions as hoped. In this session we provide a framework for assessing what it would take to make that assumption a reality. We open the fully functional “black box” and identify the key components on which the proposed business depends. Based on these components, we will address two basic questions: 1) What are the technical hurdles and risk regarding the functionality of the product or service; and 2) What are the legal and regulatory hurdles and risks presented by the product or service.

7.1 Assessing Feasibility and Uncertainty in Technology and Regulation

Faculty **Amy Francetic**, Managing Director & Co-Founder, Invention Bridge
 Tom McMahon, ISEN Adjunct Lecturer
 Jim Cahan, Partner, Sidley Austin LLP

7.2 Team Break Out

DUE **Draft Business Pitch** (100 points)

Focus Sketch model of product/service and its components.
 Sketch model of the regulatory/legislative context.
 Identify key dependencies and uncertainties with technology and regulation.
 Sketch timeline of the technological and regulatory context of the business.

MAY 20: GO-TO-MARKET, STRATEGY, AND IP

Entrepreneurial business models evolve over time. At the time they’re designed, they reflect a goal for the business. “Go-to-market” is concerned with the many tactical steps that entrepreneurs take in trying to reach that desired future position. Strategy seeks to ensure that the model is robust to a variety of threats and obstacles, including rivals and regulation. This session focuses on a framework for prioritizing business development activities, identifying appropriate milestones, and protecting the fledgling business. The strategic use of legal protections such as IP is discussed.

8.1 Go-to-Market, Strategy, and IP

Faculty **Professor Marasco**
 Ronald Fleckman, President & CEO, Energy Recovery Technologies, LLC
 Professor **Francis** or Professor **Conley** (IP)

8.2 Team Break Out

DUE **Baseline Life Cycle Assessment** (50 points)

Focus Develop a development timeline for the business. What needs to happen when in order for the business to succeed?
 What are the three most important things that need to happen for the team to know that the business is moving in the right direction?

MAY 27: FUNDING AND FINANCE

Clarity about business model, strategy, and development milestones lets you know what additional resources you need to increase the chances of your venture's success. But whom should you ask? A panel of experts introduces and assesses the variety of funding sources available to energy entrepreneurs, with their diverse advantages and drawbacks.

9.1 Funding and Finance

Faculty **Jason Schmitt**, Clean Technology Fund Manager, ArcelorMittal
 Michael Gruber, Founder, Cornerstone Angels, Co-Founder/Partner,
 Independence Equity, L.P.
 Mark Petri, Technology Development Director, Argonne National Laboratory

9.2 Team Break Out

Focus Brainstorm what you would ask for from investors, in light of go-to-market needs.
 Assess the relative appropriateness of different forms of financing.
 Plan the construction of a financial model.

JUNE 3: DRY-RUN PRESENTATIONS

Teams do practice runs of their presentations before the class and instructors.

Faculty Professors **Switaneck, Marasco, McMahon**
Focus Compelling story with persuasive evidence.

JUNE 10: FINAL PRESENTATIONS AND COURSE CONCLUSION

Teams do formal final presentations before panel of industry and expert judges, members of the NUvention Energy Advisory Board.

Faculty Professors **Switaneck, Marasco, McMahon**
DUE **Final Presentation** (200 points)
 Supporting Documentation (250 points)