



Course Syllabus – DRAFT
VERSION 1.7

ISEN 414 - Innovation in Energy & Sustainability (0.5 credit)

Northwestern University

Instructors:

Holly Benz, Northwestern University, ISEN / McCormick

Guest Lecturers:

Yann DeVries, Lillium

Erin Grossi, Accenture

Kris Hammond, Northwestern University

Panelists: Dave Donnan, Mark Pruitt, Dan Hahn

Possible Guest Lecturers:

John Bruce, Carbon Engineering Ltd

Rob Day, Spring Lane Capital

Gregg Dixon, Voltus

Dana Gunders, ReFed

Travis Katz, BrightDrop

Melissa Kaufman, Northwestern University, The Garage

Emmanuel Lagarrigue, Schneider Electric

Jonathan Todd, Todd Ecological

Office Hours: By appointment; <https://calendly.com/holly-benz/30min>

Class Room: Tech L211; all classes will be offered via Zoom and recorded as well; students are asked to make every effort to attend synchronously

Class Timing: Required MSES Core – Spring Quarter 2021, May 3 – June 4, 2021

Course Synopsis: This half-credit course is a special seminar to ensure that students have insight into the top trends in energy & sustainability innovation. This course content will be extremely dynamic and content & speakers will be updated just before the course is listed, however, the students will learn how to remain up to date on new trends and to determine their relevance for their area of specialization.

Course Goals:

- Understand some of the fundamental theories on innovation
- Gain a fresh perspective on the biggest innovations today and on the near horizon in energy & sustainability markets. At the time of initial syllabus draft, topics might include:
 - **Transportation** - On Demand Air Taxi / Electric Vertical Takeoff and Landing (eVTOLs)
 - **Food** - Rise in Plant Based Food, Indoor Agriculture, Cell-based meat
 - **Energy** - Blockchain & P2P

- **Water** - Desalination Technology
- **Cross Industry** - Data analytics / AI/machine learning; IoT / ubiquitous sensors
- Build the ability to have a functional / working knowledge of the “new” without being expert
- Establish familiarity with frameworks that allow students to assess the importance of new trends for their market / business / areas of interest
- Determine what resources can be used to stay up to date on the latest innovations

Grading/Assessment:

Grading will be based on the following rubric:

Component	Weight	Details	Due
Participation and Attendance	25%	Effort will be graded through attendance and class participation. Attendance is required. Students will lose 2.5% (25 points) for each class (unexcused) missed. Includes assessment of team prep for guest speaker Q&A, individual contribution	Ongoing; midpoint grade will be offered
Innovation Theories Quiz	10%	Online Quiz on Assigned Readings	End of Week #2
Innovation Group Pitch	15%	Students will provide a 12-15 min pitch on the most promising trend / offer in energy & sustainability in the next 8.5 years. Consider market potential & ease of implementation in this timeframe. Will have 1-3 presenters from the group. In general, students should choose an offer (EVTOLs) and then use an example company (e.g. Airbus, Lillium) to “pitch” the offer for evaluation. The pitch format is wide open. This does not need to be a traditional powerpoint presentation but you need to get the key information across. Please feel free to be creative and have fun with this pitch (as long as you don’t violate NU rules in the process) Peers will score pitches based on the RWW framework from George S. Day, so you need to get across the relevant points covered in this framework. However, you can do this in song/dance/other unusual delivery if you wish. <i>50 point (5%) extra credit to whichever student group wins “best pitch” as voted by their peers</i>	Week #4



Innovation Group Paper	15%	Written submissions for a group of 3-4. This is the paper that backs the innovation pitch. Students will submit one paper per group on their proposal for a new offer in E&S. They will utilize at least 2 concepts from the readings to analyze the prospects for this innovation. The concepts could include (but are not required to cover) the RWW framework. One paper per pitch group should be approximately 3 pages double spaced, 10-12 point font max.	Week #4
Personal Innovation Monitoring Plan	10%	Students will be asked to provide a one page outline on how they will monitor, evaluate and act upon market innovations as they move into the working world. Students should identify specific goals and resources that will be used on an ongoing basis (considering the demands of full-time work) to remain in touch with the latest in their market of choice. A sample plan will be provided but this assignment is only ~1 page in length.	Week #5
Final Paper	25%	Individual, short form final papers will be 2-3 page analyses of an innovation (offer) written to a particular stakeholder. Students will choose their stakeholder from a preselected list and will select a relevant innovation to analyze. <ul style="list-style-type: none"> Stakeholder profiles will be specific – with a job title, organization and some basic data about the organization. Students are expected to research their “stakeholder” Papers should apply the frameworks covered in class readings to assess an innovation. A set of potential trends to consider will be offered. Students may propose an alternate innovation with the instructor if desired. 	Week #5

Final Paper Stakeholder Options

- [Carrie Zalewski](#) - Chairman of the Illinois Commerce Commission
- [Dave Chen](#) – CEO, Equilibrium Capital
- [Kara Hartnett Hurst](#) - Vice President, Amazon; Head of Worldwide Sustainability

Final Paper Innovation Ideas

- Cell Based Meat
- Floating Solar Panels
- EVTOLs
- Desalination Technology
- Liquid Air Energy Storage (LAES)
- **Student's Choice (cannot be your practicum topic – could be another team's topic)**

**Grading Policy:**

- 10% will be deducted from late homework assignments turned in within 24 hours of the deadline. 50% will be deducted from late homework assignments that are more than 24 hours but less than 7 days late. No credit will be given for homework turned in more than 7 days after the deadline. All questions and problems regarding grades must be presented in writing within one week after the test, homework, or project has been returned.
- Grades will be assigned based on all the work you have completed during the quarter using the following scale:

A	93.333 to 100	C	73.333 to 76.666
A-	90.000 to 93.333	C-	70.000 to 73.333
B+	86.666 to 90.000	D+	66.666 to 70.000
B	83.333 to 86.666	D	63.666 to 66.666
B-	80.000 to 83.333	D-	60.000 to 63.333
C+	76.666 to 80.000	F	< 60.000

Required Readings:

- Harvard Business Review, Christensen, Clayton. On Innovation. February 9, 2016. Selected readings to be assigned.
 - Christensen, Clayton, Taddy Hall, Karen Dillon and David S. Duncan. "Know Your Customers Jobs to be Done" HBR, September 2016.
 - Day, George. "Is it real? Can we win? Is it worth doing?" HBR, Dec 2007.
 - Drucker, Peter. "The Discipline of Innovation" HBR, May 1985.
 - Christensen, Clayton, Stephen P. Kaufmann, Willy C. Shih. "Innovation Killers" HBR, January 2008.
 - Christensen, Clayton, Michael E. Raynor, Rory McDonald. "What is Disruptive Innovation?" HBR, Dec 2015.
 - Immelt, Jeffery, Vijay Govindarajan and Chris Trimble. "How GE is Disrupting Itself", HBR, October 2009.
 - Bettencourt, Lance and Anthony W. Ulwick. "The Customer Centered Innovation Map". HBR, May 2008.
- [Navi Radjou: Creative problem-solving in the face of extreme limits | TED Talk](#)
- Lenore, Jill. "The Disruption Machine: What the gospel of innovation gets wrong", The New Yorker, June 23, 2014.
- Christensen, Clayton. The Clayton M. Christensen Reader. February 9, 2016. Selected readings to be assigned.

- Christensen, Clayton. The Innovator's Dilemma. 2016. Selected readings (Introduction, Chapter 10)
- In addition to readings, students should read newsletters and / or subscribe to podcasts so that they will have class topics to present. Recommended subscriptions include: "Good Business" Newsletter, The Interchange etc

Recommended Readings:

- Gates, Bill. "How to Avoid a Climate Disaster: The Solutions We Have and the Breakthroughs We Need" February 16, 2021. Recommended on innovation p. 48-49, 63-64, 85-87, 115-133, 129-30, 147-53, 173-176, 190-203, 211-219, 228-233, 241-246, 250, 255-256, 262-277, 280-289, 299-301
- *(for those who are interested in tactical details of venture investing and entrepreneurship)* Feld, Brad and Jason Mendelson. "[Venture Deals: Be Smarter Than Your Lawyer and your Venture Capitalist](#)" August 27, 2019.

Speaker Preparation:

- In advance of each speaker, students will be asked to research the topic the speaker will cover and come prepared with questions. May use "warm call" groups as Q&A moderators for each speaker
- Guest speakers will often cover, but students should prepare additional questions
 - What is the innovation?
 - Who is it relevant for? Why?
 - How big could its impact be?
 - What are the biggest risks & opportunities?
 - Who are the key players (individuals, countries, organizations) in this trend?
 - How does it impact business, society, environment?

CLASS OUTLINE

Weekly Topic	Tuesday	Thursday
1: Innovation Concepts w/c May 3	<ul style="list-style-type: none"> ● Introduction to course logistics, grading and syllabus. (20 min) ● Review of concepts in the innovation readings + apply to examples (HBR, 45 min) ● Meet & brainstorm in 3 person groups for innovation pitch and paper (15 min) <p>IN-PERSON</p>	<ul style="list-style-type: none"> ● Overview of innovation (Erin Grossi, Accenture, 60 min) ● Student Facilitated Q&A (20 min) <p>ZOOM</p>
2: Resources in E&S Innovation + Transportation Innovation w/c May 10	<ul style="list-style-type: none"> ● Review and application of concepts in the innovation readings / videos (HBR, 45 min) ● Group discussion of critical tools (blogs, podcasts, conferences, magazines, online resources etc) to keep up on trends (35 min) – <i>will go into breakout groups based on professional interest / CIG this time</i> <p>IN-PERSON</p>	<ul style="list-style-type: none"> ● Discussion on Week 2 Readings (20 min) ● Top Resources – Panel Discussion (30 min) <ul style="list-style-type: none"> ○ Food & Sustainability (TBC) ○ Top Resources in Energy Technology (Dan Hahn) ○ Top Policy Resources (Pruitt) ● Top Resources – Breakout Groups (30 min) <p>IN-PERSON; QUIZ DUE</p>
3: Food, Ag and Transportation Innovation w/c May 17	<ul style="list-style-type: none"> ● Innovation in Food & Agriculture from an Investor (60 min, Dave Chen, Equilibrium Capital, remote presentation) ● Student Facilitated Q&A (20 min) <p>ZOOM</p>	<ul style="list-style-type: none"> ● EVTOLs (60 min, Yann DeVries, Lillium, remote presentation) ● Student Facilitated Q&A (20 min) <p>ZOOM</p>
4: Technology Driven Innovation w/c May 24	<ul style="list-style-type: none"> ● Student presentations (x4, 15 min each, 60 min) <ul style="list-style-type: none"> ○ They will need to introduce their innovation and explain why they think it is the most important ○ The purpose is to spark debate & discussion. Leverage readings in presentation 	<ul style="list-style-type: none"> ● Student presentations (x5, 15 min each, 75 min) <ul style="list-style-type: none"> ○ Teams will introduce their innovation and explain why they think it is the most important ○ The purpose is to spark debate & discussion; Leverage readings in presentation



	<ul style="list-style-type: none"> ● Breakout groups to discuss most compelling innovation pitch (20 min each) ● Voting on Best Pitch (10 min) ● Class Admin (10 min) <p>GROUP PRESENTATIONS GROUP PAPER DUE (May 25) IN-PERSON – will start at 9:00am</p>	<ul style="list-style-type: none"> ● Breakout groups to discuss most compelling innovation pitch (35 min each) <p>GROUP PRESENTATIONS IN-PERSON – will start at 9:00am</p>
<p>5: Artificial Intelligence and E&S + Summary w/c May 31</p>	<ul style="list-style-type: none"> ● AI / Machine Learning in Energy management (Prof Kris Hammond, 60 min) ● Student Facilitated Q&A (20 min) <p>IN-PERSON</p>	<p>Class Discussion w Breakouts</p> <ul style="list-style-type: none"> ● What does it take to innovate? ● Who has it? Who doesn't? ● Examine successes and failures ● How to bring innovation into your everyday life – even if you are not at a bleeding edge start up ● The need for innovation in tackling climate change (B. Gates book discussion) <p>Innovation Monitoring Plan Due at on June 4; Final Paper Due June 6</p> <p>IN-PERSON</p>

About the Instructor

Professor Benz is a faculty member in the McCormick School of Engineering and Applied Sciences and Director of the Master of Science in Energy & Sustainability Program (MSES) at Northwestern University. She teaches graduate level courses at Northwestern and is responsible for all aspects of the MSES program including staff, budgets, faculty, courses, facilities, and initiatives, Holly has worked in the energy & sustainability space in executive roles since 2005:

- CLEAResult (2016-2018)
- Schneider Electric (2010-2016)
- Centrica / British Gas / Direct Energy (2005-2010)

In her professional roles, Ms. Benz has led strategy for \$6-16B divisions of international energy companies, managed P&Ls including a team of >200 electrical engineers. Before working in the Energy sector, Holly was a strategy consultant with Bain & Company in the UK and worked in Andersen Consulting's Internet Center of Excellence in the US, Brazil and Argentina. She speaks Spanish and Portuguese. Holly obtained her MBA at The Wharton School and earned an MA in International Studies



at The Lauder Institute at the University of Pennsylvania. She is a graduate of Northwestern University, where she majored in economics.

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Northwestern University Policies & Resources:

Academic Integrity

Academic integrity is taken very seriously at Northwestern. Students are responsible for reading and understanding Northwestern's Academic Integrity policies. All suspected violations will be reported to the McCormick College of Engineering's Dean's Office. These include: cheating, plagiarism, fabrication, unfair advantage, unauthorized collaboration, and aiding and abetting of academic dishonesty. Students found in violation of academic integrity may receive a zero on the assignment or a failing grade for the course, and may be suspended or permanently expelled from the University. See [Academic Integrity: A Basic Guide](#) for more information.

AccessibleNU and Disability Accommodations

Any student requesting accommodations related to a disability or any other condition is required to register with AccessibleNU (847-467-5530) and provide professors with an accommodation notification from AccessibleNU, preferably within the first two weeks of class. All information will remain confidential. See the [AccessibleNU website](#) for more information.

Illness and Medical Leave of Absence

Review the University's [policy](#) on missing academic work due to illness. Your instructor cannot waive an assignment missed due to illness unless she can verify your illness with Health Services.

Discrimination and Sexual Harassment

Northwestern's Policies on Discrimination, Harassment, and Sexual Harassment apply to all members of the University community, including students, staff, faculty, and third parties. Any student, staff, faculty member, or third party who believes that they have been discriminated against or harassed on the basis of their race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, pregnancy, parental status, marital status, age, disability, citizenship, veteran status, genetic information or any other classification protected by law, should contact the Office of Equity at (847) 467-6571. Additional information about the University's discrimination and harassment policies, including the campus resources available to assist individuals with discrimination or harassment concerns, is available online on the [Office of Equity Website](#). Students, staff, and faculty who report harassment, discrimination, or sexual misconduct are also protected under the [University's Policy on Non-Retaliation](#).

**Sexual Misconduct and Reporting**

Northwestern University is committed to fostering an environment where students are safe and free from sexual misconduct. Confidential resources are available to those who have experienced sexual misconduct. Faculty and instructors are not confidential resources and are required to report incidents of sexual misconduct, whether discussed in your assignments or in person, to the Office of Equity, which can provide information about resources and options. We encourage students who have experienced sexual misconduct to talk with someone to get support. For more information, including how to request interim protective measures and academic accommodations or file a complaint, see the [Get Help page](#).

Other Resources

Students can find useful resources for safety and security, academic support, and mental and physical health and well-being at the [NUhelp website](#).