ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com

Room 126 Wilkerson

Syllabus Updated 7/21/2023

In-person: Thursdays the entire Semester
Distance: As needed

Instructor	Teaching Assistant
Guerry Grune, PhD, PA **ggrune@duke.edu** **guerry.grune@duke.edu** **Off campus office hours: Mondays 7-10 PM** or email/text Guerry to schedule appointment **Office Phone:** (757) 486-2088 **Cell Phone:** (757) 570-0883	**Simaranjeet Dua** **simranjeet.dua@duke.edu**

INTRODUCTION

The push for a "Green Sustainable Energy and Environment Policy" throughout the planet is well established and ongoing. This course has been developed to teach student how products can be designed to ensure that energy transitions for existing and new products can be managed properly and effectively while providing sustainability for worldwide consumption. The world's energy economy and the products and processes used to manufacture them remains driven primarily by fossil fuels. The shift to green, sustainable, alternative processes, products and services requires a multivariable approach ***which includes both risk assessment and gap analysis.*** This methodology is useful in order to reach the goals established by the WHO (World Health Organization) and supported by the WTO (World Trade Organization) as well as by most country centric governments.

Students will also be introduced to environmental, social, and governance (ESG) initiatives which are driving the next revolution in products introduced to the retail and wholesale markets. As consumers, regulatory bodies, and governments increase pressure on businesses to demonstrate their commitment to sustainability and ethical labor practices, it's critical that retailers effectively, profitably, and efficiently integrate ESG into their broader sourcing and supply chain strategies as products are developed.

In order to develop management and engineering skills to acquire the ability to achieve these goals, many tools will be introduced during the course of the semester. These include the use of Life Cycle Assessment (LCA) as it pertains to ISO 14000 (International Standards for Environmental Management Strategy) as well as implementing the ability to understand the importance of intellectual property with

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and
ggrune@epatentmanager.com
Room 126 Wilkinson
Syllabus Updated 7/17/2023

regard to prior art using a set of principles and techniques required to maximize product value. These IP tools include SciFinder, PatBase, Delphion, and PatSnap along with LCA software including openLCA.org, EcoChain, Sustainable Minds, LCAPIX, Umberto, and Sphera/GaBi among other open source and proprietary software systems to be utilized during the semester. ***As Artificial Intelligence (AI) is becoming widespread, it will be a classroom policy to utilize AI software as needed and with the consent of the instructor.***

Many students may have already been exposed to innovation and commercialization as well as green sustainable product models, but rarely provided an understanding regarding the use of valuation techniques to leverage technology driven solutions. This course will provide the student with the ***extraordinary ability*** to more fully understand all aspects of sustainably focused technologies that can all be brought together for application of these newly introduced skills in order to create products that meet new and existing governmental policies. Teams from the class (and perhaps several teams) ***may enter the MEMP GCI EXECUTIVE CHALLENGE March 2024 with a distinct advantage by taking this course***. Additional optional competitions students have competed in and won or placed with similar course material include Licensing Executive Society's LESI LICENSING COMPETITION or equivalent outside competitions including the Oak Ridge National Laboratory GLOBAL VENTURE ENERGY COMPETITION as well as both the EPA/ACS GREEN CHEMISTRY CHALLENGE and the DUKE START-UP CHALLENGE.

Description: It can be argued that the economy is a subset of the energy sector and needs for energy on our planet. There is no doubt that the energy and transportation industries are the among the most capital-intensive and fastest-growing industries in the world. Emerging economies are rapidly building infrastructures to meet the rising needs of their citizens, while developed markets are evolving their systems to balance product needs with services, costs, consumer preferences, and environmental load considerations. In this course, we will apply principles from life cycle assessment (LCA) and environmental management strategies ISO 14000 to help understand *energy transitions*, with a focus on developing new or existing green sustainable products that are energy efficient and profitable. Specifically, we will explore how market supply and demand, industry infrastructure, technology, and costs evolve over time to determine market price acceptance. We will also explore how value is created in these industries, and how risks are managed. Many of these factors will be demonstrated in simulation exercises using one or more LCA software tools. In addition, the use of prior art searching and IP protection for these new and existing products can increase the likelihood of successful product introduction and/or sustainability. The principal overriding concept is that without profitability there cannot be sustainability.

By using targeted readings, case studies, lectures, and guest lectures, we will observe

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

how these dynamics ***are useful for any technology sector*** as well as for specific markets including historical context. In addition, we will learn how to use practical analytical tools including cost curves and involve carbon credit analysis to make empirically grounded business decisions. With empirical grounding, each student and project group will consider the practical product and market factors that should be considered involving energy security, infrastructure, natural resources, climate regulation, and profitability. This class is designed to meet the learning needs of students with or without experience in green energy industries, but also provides a valuable introduction to green sustainable product development and/or augmentation for non-specialists.

Course Requirements (I = Individual deliverable; T = Team deliverable):

Due Dates	Assignments	Points
	Class attendance and participation (I)	10
Due Before Class Each Thursday	Homework Assignments (I) – required but not specifically graded – participation value	10
LCA Simulations (T)	Each project and group should work together for two (2) LCA tool simulations (software TBD) Then provide a short summary of the results	20
Project Participation (T)	Each project will likely have 5 students this semester – each student should participate equally – one (1) student will be designated as project leader each week and must provide written summary report for that week's team efforts.	N/A required for all
December 7-8 (T)	Final Project Presentation Drafts Presented to G Grune	30 Final Project Points
December 15 (T)	Final project - paper and presentation due (T&I)	15/15 - 30 total

Evaluation criteria for this course include:

- **Class attendance and participation (10%):** Class attendance and participation is a crucial part of the learning process in this course. You will learn a great deal from the ideas of others in the class. It is important that you come to class prepared to share your insights with others and to compare your perspective on the day's topic with the perspectives of your peers. You will be evaluated on the quality of your engagement in the discussion, creative and thoughtful insights, and respect for others' contributions. However, more is not better, so be prepared to contribute to a balanced conversation involving all participants.

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

- **Homework (10%):** Class homework assignments will be given weekly. Assignments are due prior to class the following week. Assignments can be submitted via Sakai, to the Teaching Assistant, or directly to Professor Grune.
- **LCA Simulation (20%):** Each student for each team/project will learn the use of Life Cycle Assessment by having access and utilizing at least 2 (two) software tools (currently openLCA and Sustainable Minds – with the intent to integrate LCAPIX) for at least one product (preferably one that the team has chosen to work on during the semester). After the LCA simulation is complete, project teams will document and submit their learnings in a Team Debrief document. This will include submission of a ~800-word debrief, in PDF format using 12-point single-spaced text.
- **Final project – paper (30%) and presentation (30 %) = (60%)**

The green product industry is currently undergoing profound shifts driven by new technologies, evolving policy priorities, emerging business models, and changing consumer needs and expectations. For your final project, you will select one of several technologies mentored by either Dr. Grune or an industry leader and assess their potential impact on projected profitability for the industry associated with that technology for the next 5-10 years.

You will write a group paper on this topic. Imagine preparing this analysis to share with industry professionals and investors at one or more major "energy futures" conferences in 2023/2024. Your paper should be at least 1,200 words (you will not be penalized if it is longer – with a 300 word or less executive summary) that summarizes three major issues; Energy consumption, Waste Analysis and Profitability. You may also include relevant tables or graphics and provide proper citations. You should use multiple data sources and demonstrate the breadth of your research by considering different perspectives. Highlight any key assumptions or debates that impact your assessment.

In addition, each team will prepare and deliver a 15-minute presentation, followed by a 10 minute Q&A in the draft sessions with Guerry during the last week of classes.

MEM Attendance Policy

- *Class Attendance:* MEM's policy is that campus students are expected to attend class regularly and in person, adhering to Duke's Academic Calendar. Attending MEM classes is mandatory. MEM follows the Graduate dates within the calendar when applicable. It is especially important that students attend the first day and the last day of class for all courses in which they are enrolled. Unless and until all coursework and examinations (whether comprehensive final exams, quizzes, or otherwise) have been completed for all courses in which a student is enrolled, a

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

student is expected to remain at Duke in person through the end of final exam week as set forth on Duke's Academic Calendar.

- In their first classes, faculty set course goals and standards, frame the course's subject matter, form student teams and begin to create the class community. ***At the conclusion of the first class of each course, the faculty will report any unexcused absences to the MEM program administration. Thereafter, such students shall be dropped from the course***. If students miss the first classes of the semester, they detract from their own educational experience and undermine that of their classmates. Furthermore, they create additional work for the professors and TAs. Responsibility for regular and punctual class attendance rests with individual students. The course faculty shall refer a student to MEM's administrators in the event of excessive absences. A student seeking an "excused" absence must work directly with her or his course faculty and must initiate the request in advance and as soon as possible. A student may be excused from attendance due to truly extenuating circumstances such as significant illness, personal/family emergency, or important religious observance. Whether an absence is excused or not, a student will be held fully accountable for any in-class graded participation or assignments an absence caused the student to miss.

Technology Innovation Options for Fall Semester (as of 7/21/2023 – subject to change):

1. "Micro" wind turbines – Daniel Lerner (1-2 projects) – Roof top compressors
2. OTEC – Ocean Thermal Energy Conversion – Dr. Hans Krock – maybe replaced by Roy Robinson of Excipioenergy.com – in fall or spring '23/'24
3. GoWheels – Bill Bateman
4. Sercel Downhole Components – Jackson Newberry
5. SpiderBond – Specialty Adhesives - Dr. Robert Greer
6. Modular nuclear/fusion - Chris Nestor – Westinghouse
7. LCAPIX software resurrection – Guerry (1 project) – other LCA software
8. EvGO charging stations – Ivo and Co. – on hold for now
9. CPS Biofuels – GTBE (jet fuel alternatives) – USP 10,344,235 – Marty Trivette

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com

Room 126 Wilkinson

Syllabus Updated 7/17/2023

10. CPS Biofuels – Hexane from fermentation with Kolbe– USP 8,241,881- David Bradin
11. CPS Biofuels – Heptanone – USP 8,148,579 - David Bradin
12. CPS Biofuels – Biodiesel Kolbe electrolysis – USP 8,481,771 – David Bradin
13. Biofuel additives (GTBE E10 Substitute for gasoline) – David B., Guerry, Marty

13 Distribution Oil Transformers – Guerry
14 Nutroleum (alternatives to Petroleum jelly) – Guerry
15 Nutrasporin (alternatives to Neosporin) – Guerry
16 Chelated Silver Oxide – Deodorant Spray and Breath Freshener (alternatives to colloidal silver) - Guerry
17 OTHER (topic to be approved ahead of time by Guerry)

<u>In your analysis, please consider the following questions:</u>

1. What is the potential impact of this product innovation in the world of green sustainable products and how is it likely to evolve with the global energy transition over the next 5-10 years?
2. What is the value proposition of this product innovation for waste reduction and energy transitions regarding energy efficiency, customization, affordability/profitability, reduced environmental impacts, and the value chain. What are the potential drawbacks, risks, or liabilities?
3. How might economic, political, regulatory, customer, and social trends over 5-10 years (global or regional) be perceived with this product innovation?
4. Using concepts learned in class, what impact might this product innovation have on waste reduction and energy supply/demand in the US and/or globally?
5. How might industry dynamics be affected by this product innovation?
6. What enablers or barriers exist that might influence the deployment of this product innovation?

PRESENTATION SUMMARY

What existing companies would be attractive investments for the product(s) described? What kinds of new ventures would you expect to emerge in this space? Your paper should be an objective analysis of your target innovation – including both the promise and the challenges of adoption. This is where some of your knowledge regarding Intellectual Property and patents will be of

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and
ggrune@epatentmanager.com
Room 126 Wilkinson

assistance. Please provide an executive summary that also recommends what industry participants and investors might anticipate in the coming decade regarding the product(s) described and how they should respond.

The ultimate goal of this course is to provide students with the ability to use critical thinking so that they can achieve the proper understanding for developing new products. These products will utilize sustainable environment tools for clean energy transitions in order to leverage emerging strategies. The use of these tools will allow for successful endeavors in any future engineering management career.

The goals of this FULL semester course are;

- Provide information and education involving development of new products using sustainable energy and environmental solutions for transforming economies
- Understanding the use of ESG as it relates to New Product Development and relationships to the Energy Star and closely associated programs
- Understanding and use of Life Cycle Assessment (LCA) and Activity Based Costing (ABC) for New Product Development plus the use of carbon credits to complete valuations
- Understanding and use of ISO 14000 for practices in developing new products
- Enable the participants to understand all aspects of product initiation, substantiation, and introduction into an accepting marketplace.
- Defining sustainability and green energy and environment Product ideation, creation, and Public Policy initiatives
- Prior Art Searching and Conceptualizing Innovation for Products that Meet New and Existing Market Demands
- It will also be shown how green, sustainable, ESG policy-based products can be leveraged for energy and environment transitions when applied in a technology-based organizational setting. This learning allows for the ability to make decisions that will allow for benchmarking the multiple opportunities

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

that an organization must consider before embarking on an energy transition program.

Specific Topics to be covered in detail:

1. Development of new products that allow pivoting from fossil fuels to sustainable green energy products for emerging governmental policies

2. Products that utilize technologies required to make these pivots

3. Assessment and proper decision-making regarding implementation of green product choices

4. Understanding how to develop products that meet local regional and global energy transition regulations and compliance

5. Understanding and implementation of regional and global Intellectual property laws and regulations

6. Search, retrieve, analyze and map IP for the products meeting energy transition sector(s)

7. Product licensing and licensing opportunities for products in a profitable and thus sustainable green energy and environment sector

RESOURCES:

There are 3 *suggested* textbooks for this course;

" Design for Environment: A Guide to Sustainable Product Development, 2nd Edition, Joseph Fiksel – 2009 – ISBN 9780071605564

"Energy Demand and Climate Change", Franklin Hadley Cocks, Wiley, VHC – Duke University, 2019, ISBN 978-3-527-32446-0

"The Singularity is Near" Ray Kurzweil - 2005 – Viking Publishing, Co., ISBN 978-0-670-03384-3

Additional References:

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

Coley, D. Energy and Climate Change Creating a Sustainable Future 2008 ISBN: 978-0-470-85312-2

Paul, B. Future Energy How the New Oil Industry Will Change People, Politics and Portfolios 2007 ISBN: 978-0-470-09642-0

Kruger, P. Alternative Energy Resources The Quest for Sustainable Energy 2006 ISBN: 978-0-471-77208-8

Olah, G. A., Goeppert, A., Prakash, G. K. S. Beyond Oil and Gas: The Methanol Economy 2006 ISBN: 978-3-527-31275-7

Synwoldt, C. Mehr als Sonne, Wind und Wasser Energie für eine neue Ära 2008 ISBN: 978-3-527-40829-0

Romm, J. J. Der Wasserstoff-Boom Wunsch und Wirklichkeit beim Wettlauf um den Klimaschutz 2006 ISBN: 978-3-527-31570-

"Introduction to Intellectual Property and IAM", G.L. Grune course notes

"Who Owns the Sun?" by Daniel Berman and John O'Connor, Chelsea Green Publishing Co., White River Junction, Vermont, ISBN 0-930031-86-5, 1996

WEEKLY SYLLABUS TOPICS AND ASSIGNMENTS

Week 1: 8/31/2022

Design of New and Existing Products

Week 1 - Defining DFE and LCA

Required Reading: – Discuss Energy and Environment Transitions and what to review
– **Design for Environment: A Guide to Sustainable Product Development, 2nd Edition – first 2 chapters**

Lecture Content:
Different definitions of DFE and LCA
The value of creativity in a technology related firm
Sustainability and Profitability

Initial Review of Projects and Project Considerations:

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

Discussion/HW:
How does policy driven energy and environmental concerns affect product value?
What risks are involved ?
What constitutes DFE ?
What is LCA and ABC ?

Week 2; - 9/07/2023 – Tentative Guest Speakers – Engineering Librarian (replacement for Sarah Park) – Deb Sabatini - GSE

DFE and GSE – As It Applies to Energy Transitions

Week 2 – Understanding DFE and GSE
Complete project assignment discussion (assign teams)

Required Readings:
– Chapters 4-6 **of Design for Environment: A Guide to Sustainable Product Development, 2nd Edition**

Lecture Content:
Relating DFE to policy matters – Deb Sabatini Hennelly
Understanding the past

Discussion/HW:
How to begin LCA
Determination of projects for DFE/GSE consideration
Initial DFE methodology
Search engines and search tools available to begin project work

Week 3; 9/14/2023 – Mentor Introductions – Mr. Daniel Lerner, Bill Bateman, Chris Nestor, Dr. Robert Greer, Jackson Newberry - Innovation in the Energy and Environment Transition Space

GREEN SUSTAINABLE AND RENEWABLE BENCHMARKING – Life Cycle Assessment and Activity Based Costing

Week 3 – will present a comprehensive review on LCA and Costing

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

Required Reading:

Design for Environment: A Guide to Sustainable Product Development, 2nd Edition

Lecture Content:

What is LCA ?
What is ISO 14000 ?
What is Activity Based Costing ?

Discussion/HW:

What are the basic requirements to develop a usable product ?
How to develop a useful global product ?
Distinguishing pretenders from saleable offers ?

Week 4; 9/21/2023 – Planned Guest Lecturers- Terry Swank, Makai McClintock (Sustainable Minds) and Leela Mansukhani (Gabi)

Week 4 – Merging DFE and GSE Strategies for New Products – Speed Reading Patents

Required Readings:

Chapters 7-10 of **Design for Environment: A Guide to Sustainable Product Development, 2nd Edition**

Chapters 1-5 of Who Owns the Sun ?

Assign projects to student participants – after drop/add date is complete -might extend to week 4

Lecture Content:

Selecting the best technical projects and assigning students to each group
The portfolio approach
Tools to utilize

Discussion/HW:

Discuss all issues and expectations for each project
Exercise on Technology Assessment
Exercise on Valuation

Optional Readings (in order of priority):

"Implementing a Stage Gate Process: A Multi-Company Perspective," by P. O'Conner, J. Prod. Innov. Manag., Volume 11, 1994

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson
Syllabus Updated 7/17/2023

"A Few Things Every Manager Ought to Know about Risk," Harvard Management Update, Reprint no. U9703D

Week 5; 9/28/2023 – Tentative Guest Lecturers Greg Twiss and Joseph Fiksel ? - Chris Nestor

DESIGN CAPABILITIES AND TECHNIQUES

Week 5 - Systematic product design

Required Reading:

Chapters 10-13 Design for Environment: A Guide to Sustainable Product Development, 2nd Edition

Finish Who Owns the Sun?

Discussion:

What limits creativity?
Is "creative organization" an oxymoron?
What is the role of creativity in an existing firm?
How do large firms utilize creativity?

Lecture Content:

Aspects and methods for performing industry analysis
Aspects and methods for perfoming competitive analysis
Importance of competitive and industry analysis

HW:

What is the importance of competitive analysis?
What are the methods that are useful for analyzing competitive products (services) and companies?
What is the role of competitive analysis in the business plan?

Week 6; 10/05/2023 – Tentative Guest Speakers (1 or more) - Chris Nestor, Dr. Hans Krock, Bill Bateman, Jackson Newberry

Product Examples

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

Week 6 – Modular Nuclear Reactors, Wind Turbines, Biofuels, Solar Alternatives - Contrast with existing Petroleum Technologies

Required Reading:

Chapters 14-17 Design for Environment: A Guide to Sustainable Product Development, 2nd Edition

Lecture Content:

Defining wind, biofuels, geothermal, hydroelectric (Schneider Electric) and solar technologies
The prior art search
Using prior art to your advantage

Discussion/HW:

What's been done before – what constitutes prior art ?
Using the past to create the future
What works and what does not work

Week 7; 10/12/2023 – Before Fall Break - Tentative Guest Speakers Marty Trivette and David Bradin

Product Innovation for DFE

Week 7 – How to Create the Future Product(s)

Required Reading:

Finish **Design for Environment: A Guide to Sustainable Product Development, 2nd Edition**
Begin - **"The Singularity is Near" by Ray Kurzweil**

Lecture Content:

Guest Lecturer – David Bradin/ Marty Trivette – Biomass and Biofuels

Discussion/HW

Implementing the Energy Equation and LCA to define the outcome
Using ISO 14000 to achieve the results
Begin Group Product design in earnest

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

Week 8; After Fall Break - 10/19/2023 – Tentative Guest Speakers – Nhiem Cao/ one or more of the Mentors – Focus on Projects – LCA Simulation Review

Work on projects – DFE product design review with each group week after break

Week 8 – Group Reviews of Product Design and Development

Required Reading:
Continue "The Singularity is Near" by Ray Kurzweil

Lecture Content:
Defining product innovation
Differences between innovation, imitation, and implementation
Licensing activities contemplated

Discussion/HW:
Project
What constitutes product innovation ?
Where, how and when do you design the next best DFE product ?
Real-life examples of DFEs that works

Week 9; – 10/26/2023 Tentative Guest Speakers: Fred Ehrsam, Anil Madden - LCA Simulations Due

Review of Products/Processes representing Green Sustainable Profitability

Review of Legal Issues that Affect Profitability

Week 10; 11/02/2023 Guest Speakers – Kevin Flynn and Focus on Projects

Week 10 – Implementing DFE with Tools Provided

Required Reading:

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson
Syllabus Updated 7/17/2023

Continue with **"The Singularity is Near" by Ray Kurzweil**
Lecture Content:
Review of each project with each group
Drafting the DFE product
Explaining how the new product design meets the energy transition requirements
Quantifying the basics

Discussion:
What constitutes a real DFE ?
Quantifying the energy and environment loads ?
Why the new product will be successful or not ?

Week 11; 11/09/2023 NO Guest Speakers Planned – Focus on Projects: FINALIZE PRODUCT/PROJECT ISSUES

Working with Groups to Finalize New DFE Projects/Products
Week 11 – Ensuring Success – Multi-variable factor analysis

Further Review of the Projects
Provide Roadmaps to Success

Required Reading:

Continue with **"The Singularity is Near" by Ray Kurzweil**
Lecture Content:
Product design differentiation
Product/Process Comparisons with Older Petro Based Technologies

Discussion:
Is the product/process novel and useful ?
Can this unique approach reach marketplace acceptance and success?
Is it workable, marketable, and protectable ?
Are LCA/DFE/GSE tools utilized to achieve benchmarking needs ?
Provide key features that address all of the above

Week 12; 11/16/2022 - NO Guest Speakers Planned – Focus on Projects – Valuation, Costs, and Pricing for Sustainability

Week 12 – Valuation, Costs and Pricing Models
Plus other project/product issues

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

International Perspectives

Required Reading:
Finish **"The Singularity is Near" by Ray Kurzweil**

Week 13; 11/23/2023 – Thanksgiving No Class

Mock Presentations Due

Week 13 – Review of Group Efforts

Week 14: 11/30/2023 Product/Project Presentations Mock Presentations of Product/Process by Groups

WEEK 15: Final Presentations Due – The week of December 08, 2023 TBD

Week 15 – Project Group Final Presentations

Final Exam date (Tentative); TBD during the class with student input

Green Classroom Certification

The Green Classroom Certification was created to provide faculty with the opportunity to reduce the environmental impact of their courses and classrooms at Duke University while demonstrating eco-friendly behaviors to students.

You are encouraged to take the Duke Sustainability Pledge and to use the Duke Carbon Calculator to estimate your climate impact.

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

Appendix – Resources for Students

See below a list of resources that will help you deepen your understanding of the energy industry and its history, priorities, and debates.

Newsletters:

- Axios Generate
- American Energy Society
- Utility Dive (several sector newsletters)
- VERGE Weekly

Web sites:

- Greentech Media
- ACS Green Chemistry
- ISO - ISO 14000 family — Environmental management
- Life Cycle Assessment (LCA) Software | Umberto (ifu.com)
- openLCA.org
- https://studiored.com/
- https://growensemble.com/environmentally-friendly-companies/
- Greenbiz
- https://www.renogy.com
- r/energy
- Climate Central
- Canary Media

Podcasts:

- The Energy Gang
- Interchange (subscription required)
- The Energy Transition Show
- Columbia Energy Exchange
- Long Now: Seminars about Long-Term Thinking

Energy Thought Leaders

- David Roberts – CLIMATE ONE
- Amy Myers Jaffe
- Geoffrey Styles – GSW STRATEGY GROUP

ENERGY/ENVIRONMENT TRANSITION TRACK:

Sustainable Products for Green Energy Transition(s)

MEMP EGRMGMT 590.08

7:00-9:40 PM on Thursdays – Beginning 8/31/2023

FALL 2023

Professor: Guerry L. Grune, Ph.D., PA (757) 570-0883 /ggrune@duke.edu and ggrune@epatentmanager.com
Room 126 Wilkinson

Syllabus Updated 7/17/2023

Additional Books:

- Ayres, Robert (2016). *Energy, Complexity, and Wealth Maximization*. Springer Press.
- Bradford, Travis (2018). *The Energy System*. MIT Press.
- Hawken, Paul (2017). *Drawdown: The most comprehensive plan ever proposed to reverse global warming*. Penguin Books.
- Mackay, David (2009). *Sustainable Energy – Without the Hot Air*. Chicago Review Press.
- Rhodes, Richard (2018). *Energy: A human history*. Simon & Schuster.