ABET and The Lemelson Foundation EOP Innovation in Sustainability Award

Nomination Form

DEADLINE: APRIL 20

I hereby nominate (check one): ✔ person ☐ program/institution

Name(s)

Matthew K. Heun

Nominee Contact Name

Matthew K. Heun

Nominee Email Address

mkh2@calvin.edu

AWARD CITATION

Write a suitable citation for the award that you are nominating. (30 words maximum)

For many, varied, innovative, and sustained initiatives backed by research to bring sustainability into engineering education, including curriculum development, undergraduate teaching and pedagogy, institutional service, and student research.

SUPPLEMENTAL MATERIALS

Please provide reference letters (2 or 3) and documented evidence of success (2-5 pieces of evidence—not to exceed a total of 5 pages).

1. Two or three letters of support, one of which is external (each 500 words max)

Name	Relation to Candidate
[redacted]	

2. Documented evidence of success (5 pages total max including all documents presented under this section)

Document Title	Summary
Evidence_Document.pdf	References, links, and course descriptions related to the nomination form
BSE_EESE_model_program.pdf	BS Engineering with concentration in Energy, Environment, and Sustainability

Submitted by

Print Name	Date
Jeremy G. Van Antwerp	4/19/2025

By checking this box and typing my name, I am electronically signing this document. ✔

This form and detailed supporting documentation and/or endorsements should be emailed to: **awards@abet.org**

ABET-Lemelson Foundation EOP Innovation in Sustainability Award – Matthew K. Heun

Nature and significance of contribution (495 words, as counted by MS Word)

Matthew Kuperus Heun has "demonstrated innovation in education by implementing sustainability topics into ABET-accredited programs" for more than two decades at Calvin University. He deserves the ABET-Lemelson Foundation EOP Innovation in Sustainability Award for his many, varied, innovative, and sustained initiatives to bring sustainability into engineering education. His contributions are exceptional in **curriculum development**, **undergraduate teaching and pedagogy**, **institutional service**, and **student research**. Although Calvin is a Predominantly Undergraduate Institution (PUI), Matt is also a dedicated researcher working at the intersection of energy, economics, and sustainability. He is an international and institutional leader in all things sustainability.

Curriculum Development

Matt has led many curricular innovations to make sustainability available to engineering students, beginning with an **engineering sustainability designation** in 2015 [1]. The designation provided transcript recognition for sustainability-focused coursework in an already packed engineering major. Because the engineering designation was successful, it was expanded into a university-wide offering in 2022 [2]. Matt also developed two **unique courses** [14,15] and a sustainability-themed interdisciplinary course in economics [16]. And, influenced by Matt's leadership as a faculty senator, the Calvin University 2020 **core curriculum revision** requires all students to engage with sustainability in two courses [3].

Calvin University has offered a 4-year, ABET-accredited engineering degree since 1985. Historically, the general engineering program (BSE) offered civil, electrical, mechanical, and chemical concentrations. Matt developed a new concentration called **Energy, Environment, and Sustainability Engineering** (EESE) [4] that prepares graduates for sustainability-related work in a wide range of engineering fields. The first EESE students graduate Spring 2025.

Undergraduate teaching and pedagogy

Matt won the Calvin University Presidential Award for Exemplary Teaching in 2023 because he is **a rigorous and engaging teacher who brings sustainability into the classroom** [5]. Matt organizes ENGR333 (Thermal Systems Design) [18] around a class-wide, semester-long research and design project [6] that is never repeated. For instance, Fall 2024 focused on a solar photovoltaic farm for campus. Matt developed The Economics of Energy and Sustainability [16] as a true interdisciplinary course, with a unique pedagogy; it is **team taught** by Matt and an economist.

Matt coauthored *A Framework for Sustainability Thinking: A Student's Guide to Sustainability Challenges* [7] (available with full electronic access through most engineering libraries). The book is both a **quantitative and qualitative introduction** to the field of sustainability. Uniquely, for an engineering textbook, it features 168 discussion questions across 12 chapters to help students think through the multidisciplinary nature of sustainability challenges.

Research and Service

Despite serving at a PUI, Matt has worked with more than 30 students on research projects, resulting in **publications with 9 student coauthors** [10]. Matt secured $150,000 in external funding to encourage student-faculty undergraduate research throughout the engineering department.

The Calvin Energy Recovery Fund (CERF) [8] is a student-led organization that manages a **Green Revolving Fund (GRF)**. CERF originated from Matt's 2008 ENGR333 project. Since inception, and leveraging $312,000 in donations, CERF has **saved Calvin more than $537,000 in energy costs**. Matt served as CERF's first director from 2010 to 2020.

Cause (200 words)

Matt's **long-term research question** is, "What is the relationship among energy, materials, and the economy when viewed through the lens of sustainability?" He addresses this question in all areas of his professional life, including undergraduate engineering education.

Matt's sustainability efforts span all class levels and disciplines, from the introduction to sustainability course (IDIS184) for all university students [14] to senior-level Sustainability Engineering, which serves as the EESE concentration's capstone analysis course [15,4]. Matt's sustainability activities include **co-curricular** (summer research mentor, CERF director, assessing the 100-hour sustainability experience required for the university sustainability designation [17]), **extra-curricular** (organizing and contributing to the campus-wide, end-of-semester sustainability showcase), and **faculty governance**. Matt has been a long-time chair of the Calvin Environmental and Energy Stewardship Committee. Matt was instrumental in encouraging both (a) Calvin's president signing the American College and Universities Presidents' Climate Commitment and (b) Calvin participating in the AASHE Sustainability Tracking, Rating, and Assessment System (STARS), leading to a silver rating (stars.aashe.org). Outside the university, Matt has served on the city of Grand Rapids renewable energy team and on the board of the West Michigan Environmental Action Council (WMEAC). He is currently on the Grand Rapids Mayor's task force for infrastructure and energy.

Impact (179 words)

The engineering sustainability designation [1] at Calvin University has been completed by 85 engineering students (about **16% of graduating engineers**) from 2017-2024. May 2025 graduates will bring the total to nearly 100. Future students will complete the university-wide, interdisciplinary sustainability designation [2]. The engineering Introduction to Sustainability Challenges course developed by Matt was the gateway for the sustainability designation. It was popular (for an engineering course) among non-engineering majors too, with enrollments of 10-15% non-engineers. After the conversion of the sustainability designation to a university-wide offering and the beginning of the EESE concentration in engineering, this gateway course has transitioned from one course section per year to three sections and is now listed as interdisciplinary [14].

Nearly 700 engineering students have participated in ENGR333 class projects under Matt's leadership. These class projects have brought **lasting change** and sustainability impacts to Calvin University and the broader West Michigan area. Examples include Calvin's commitment to carbon neutrality, CERF's long-standing and ongoing investment in campus energy efficiency, and the Fall 2021 ENGR333 sustainable-housing partnership with Habitat for Humanity of Kent County [11].

Commitment (198 words)

Matt has led 7 faculty development workshops over **15 years** with the goal of including **sustainability throughout the curriculum**, especially relevant since core 2020 requires two courses with sustainability-themed content for every student [3]. He has served as the interim sustainability director, chair of the campus Environmental and Energy Stewardship Committee, and as a sustainability teaching fellow on the core curriculum committee (responsible for university assessment of the sustainability electives).

Matt has raised over $600,000 for research with students, writing and publication, and seed money for CERF [8]. Matt has a **track record of sustainability research** publications going back to 2006, with an h-index of 20 and an i10-index of 38 (20 publications with at least 20 citations and 38 publications with at least 10 citations) [10]. His output continues to accelerate, in part because Matt is a friendly and skilled collaborator, not just in research, but also in teaching, mentoring, advising, and institutional leadership. Matt is a founding member of the International Exergy Economics research community [9], which has grown since 2014 from 20 to over 60 participants from dozens of universities worldwide. Matt has published 14 software packages and 7 repositories of macroeconomic sustainability data [10].

Legacy (198 words)

Matt's energy, dynamism, and dedication generate deep curiosity, insightful questions, and broadened perspectives among his colleagues. Under Matt's leadership, the engineering sustainability designation has become a **university-wide option** that will serve students for years to come. With his advocacy, the Calvin University **core curriculum** now requires a sustainability-themed elective. Matt has worked diligently to **equip colleagues** from all sides of campus to teach sustainability effectively, both through faculty governance structures, such as the core curriculum committee, and through 7 faculty development workshops. Simultaneously, Matt has brought together mechanical, chemical, and environmental engineering faculty around the EESE concentration [4] to **strengthen and deepen** the engineering department's sustainability focus. Matt has documented and publicized these curricular efforts in [7] and [1]. Both publications provide a **roadmap** for other instructors and institutions to replicate these curricular sustainability innovations.

Matt's research findings point to a fundamental modeling flaw in the IPCC's scenarios related to energy efficiency and the rebound effect [12]. Two hundred years of data [7,12] supported by rigorous analysis show that improvements in energy efficiency have never

resulted in a reduction in total energy use. The policy implications are truly global, and Matt brings these insights into the undergraduate classroom.

Dissemination and transportability (196 words)

In the classroom and on campus, Matt has been a tireless promoter of sustainability in many different arenas. In 23 years at Calvin University, he has taught **hundreds of undergraduate engineers**, including many that have gone on to graduate school in sustainable energy or become industry-recognized leaders in sustainability practice. Every ENGR333 project culminates in a campus-wide seminar at which students present results. The seminars are attended by **campus executive leadership** and have led to several **lasting initiatives** at Calvin University [8]. Furthermore, Matt's leadership in faculty development seminars has enabled dozens of Calvin faculty to teach sustainability-themed content in their course(s).

Beyond the Calvin campus, Matt has presented or been interviewed 13 times on **establishing and managing GRFs**, leading to GRFs at other institutions. The book *A Framework for Sustainability Thinking* [7] packages, in a portable way, the introduction to sustainability course taught at Calvin University. The preface describes several ways to use the book, **ranging from graduate research projects to informal neighborhood book clubs**. The 2023 ASEE paper [1] further describes the book, the course, and details of the sustainability designation, with suggestions on **how they can be incorporated into already full engineering programs**.

Innovation (199 words)

Matt is an innovative sustainability educator in many ways. The **multidisciplinary** nature of his approach and his holistic vision of sustainability are unique aspects of his praxis. Examples include the team-taught economics class [16] and *Beyond Stewardship: New Approaches to Creation Care* [13], a book Matt edited with Biology colleague David Warners and to which Matt contributed a chapter. The book *A Framework for Sustainability Thinking* [7] **equips** instructors to **incorporate "non-technical" aspects of sustainability into engineering courses**, in part with 168 discussion questions about various aspects of sustainability, including social and economic factors.

Matt uses a **unique form of project-based learning** to give engineering students practical, hands-on sustainability experience in ENGR333 [18]. Each class has a local, real-world customer [6]. Because sustainability challenges are inherently large, complex, and always have an economic component, Matt creates sub-teams, each responsible for a piece of the overall project, including a project management team.

The Calvin GRF (CERF) [8], which started from an ENGR333 project, and has been student-led from the start, is a **practical application of Matt's work on the rebound effect**. It can be (and has been) easily replicated elsewhere and has saved Calvin University over half a million dollars.

References and links

1. J. G. VanAntwerp, J. A. F. Wildschut, and **M. K. Heun**, "Sustainability designation, introductory course, and a new textbook in an engineering curriculum," *2023 ASEE Annual Conference & Exposition, Baltimore, Maryland* (2023)
2. Calvin University campus-wide sustainability designation requirements:
   - IDIS184 - Introduction to Sustainability Challenges (see [14] below)
   - IDIS384 - Sustainability Experience (see [17] below)
   - 8 semester hours of environmental sustainability tagged courses (no more than 4 semester hours from any one school)
3. Calvin University core curriculum requires cross-disciplinary integration in three areas of engaged citizenship commitments: diversity & difference, **environmental sustainability**, and global regions & cultures. "Complete at least one tagged course in all three areas. Engaged citizenship commitment courses may overlap with other core requirements. Test credit, including Advanced Placement, CLEP, and International Baccalaureate, may not satisfy Engaged Citizenship Commitment requirements." The catalog lists as options 27 classes with the environmental sustainability tag from 15 different academic programs.

   The core capstone, Contemporary Challenges and Enduring Questions, is expected to **revisit** all three areas of engaged citizenship commitment. For engineering students, the integrated senior design sequence is their core capstone.
4. Energy, Environment, and Sustainability Engineering (EESE) concentration. See the one-page model program sheet below.
5. Matthew K. Heun is the 2023 winner of the Calvin University Presidential Award for Exemplary Teaching
6. ENGR333-Thermal Systems Design course project history
   - 2024 "What should be the design of a Calvin solar farm?"
   - 2023 "What earlier year should Calvin University choose for its carbon neutrality date?"
   - 2022 "What would it take to eliminate Calvin's natural gas-related net CO_2 emissions?"
   - 2021 "What is the expected carbon emissions savings of the [Habitat for Humanity] carbon footprint build house?" And "If the carbon footprint build house is not carbon-neutral, you must answer a second question: How can carbon emissions be reduced by a further 20%?"
   - 2019 "How much energy does energy efficiency save?"
   - 2018 "What is the largest possible reduction in Calvin's annual energy costs from a $5M investment in renewable energy?"
   - 2017 (Fall) "What would it take for Calvin to save $75k/year on natural gas costs?" (Section A) and "What would it take for Calvin to save $150k/year on energy costs (mostly electricity) using a new on-site co-gen plant?" (Section B)
   - 2017 (Spring) "Can you construct a fine-grained, bottom-up electricity demand model that predicts the annual electricity consumption for the dormitories (section A) and the PE complex (section B) for each year of the last decade with an accuracy of ±2%?"
   - 2015 "What would it take for Calvin College to save $600,000/year on campus operations?"
   - 2014 "What would it take for a home in Grand Rapids to become net-zero?"
   - 2013 "What would it take for Calvin College to operate a biofuel vehicle from campus resources?"
   - 2012 "What will it take for Calvin College to install a geothermal HVAC system for the West Wing?"
   - 2011 "What would it take for Calvin College to obtain an Energy Star rating for the Bunker Interpretive Center (BIC)? Or, if the BIC already qualifies for an Energy Star rating, what would it take to improve the

energy efficiency of the BIC (as measured by Energy Star metrics) by 15%, thereby ensuring Energy Star performance of the building into the future?"
- 2010 (Fall) "What would it take to retrofit the Bolt-Heyns-Timmer dormitory heating and air-conditioning systems in a manner that achieves LEED certification?"
- 2010 (Spring) "What would it take to build a redundant data center at Calvin that is 30% more energy efficient than the existing data center?"
- 2008 "What would it take to implement a Calvin Energy Efficiency Fund?"
- 2007 "What would it take to make Calvin College carbon neutral?"

7. J. G. VanAntwerp and **M. K. Heun**, "A Framework for sustainability thinking: A student's introduction to global sustainability challenges," Springer (2022) DOI: https://doi.org/10.1007/978-3-031-79179-6
    - Reviewed in N. D. Grawe, "Review of A Framework for Sustainable Thinking: Is QL for Citizenship Even Possible?" Numeracy 15, Iss. 2 (2022): Article 5. DOI: https://doi.org/10.5038/1936-4660.15.2.1425
    - Author's summary: J. G. Van Antwerp and M. K. Heun. "An Introduction to A Framework for Sustainability Thinking." Numeracy 15, Iss. 2 (2022): Article 4. DOI: https://doi.org/10.5038/1936-4660.15.2.1423
8. Calvin Energy Recovery Fund (CERF), a green revolving fund (GRF).
9. International Exergy Economics research community: exergyeconomics.wordpress.com
10. Matthew K. Heun Google Scholar profile. Software/data repository: https://github.com/MatthewHeun/
11. video "Calvin Engineering Students help Habitat for Humanity" Full video is 3 minutes, 9 seconds, but the link provided starts the video at 1:20, making the video less than 2 minutes, as required. (Speaker at 1:50 is Mark Ogland-Hand, faith relations director of Habitat for Humanity Kent County.)
12. P. E. Brockway, S. Sorrell, G. Semieniuk, **M. K. Heun**, and V. Court, "Energy efficiency and economy-wide rebound effects: A review of the evidence and its implications". *Renewable and Sustainable Energy Reviews* 141(110781), pp. 1–20. (Jan. 28, 2021). doi: 10.1016/j.rser.2021.110781.
13. D. P. Warners and M. K. Heun, eds. *Beyond Stewardship: New Approaches to Creation Care*, Calvin College Press, Grand Rapids, MI (2019).

Below are Calvin University course descriptions of sustainability courses that Matt teaches from the university course catalog. Those marked [D] were also developed by Matt.

14. Interdisciplinary integrated studies IDIS184 - ***Introduction to Sustainability*** [D] (Fall, Spring, 2 semester hours). "Sustainability seeks to serve the needs of the present without compromising the ability of future generations to meet their own needs. This course examines the challenges to that goal in each of the three areas of sustainability: economic, societal, and environmental. Topics include the biblical basis for sustainability, global energy consumption and carbon emissions, application areas for sustainability, and personal and collective actions."
15. Engineering ENGR354 - ***Sustainability Engineering*** [D] (Spring, 4 semester hours). "Sustainability engineering seeks to serve the needs of the present without compromising the ability of future generations to meet their own needs. This course exposes students to engineering approaches to analyzing and designing engineering solutions to sustainability challenges. Topics include

sustainable energy systems, sustainability analysis methods, and collective action for sustainability. The biblical basis for sustainable living is explored."

16. Economics ECON233 - ***Economics of Energy and Sustainability*** [D] (Fall, 4 semester hours) "A discussion of economics with detailed focus on energy and sustainability issues. Students will explore interactions among economic, social, natural, and technological systems through the lens of sustainability; including global energy resource scarcity and historical patterns of economic growth and how they impact individuals and society through local and global economic systems. Topics include definitions of sustainability, economic systems, and energy markets: energy production and consumption systems, Biblical and ethical perspectives on consumption and production of goods and energy, and efficiency and equity of resource allocation."
17. IDIS384 - ***Sustainability Experience*** [D] (Fall, Spring, 1 semester hour) "Sustainability Experience involves a minimum of 100 hours per semester (or equivalent) in a professional setting with an approved sustainability-themed project in a research, business, or nonprofit organization. Academic work includes class meetings and in-person and online discussions, an assessment from the employer-supervisor, readings, seminars/workshops, reflective journals, and participation in the sustainability showcase. Primarily for students pursuing the sustainability designation."
18. ENGR333 - ***Thermal Systems Design*** (Fall, 4 semester hours) "Advanced heat transfer, thermodynamic, and fluid flow topics important for the design of thermal systems are presented. Sustainability and creation care topics are covered as they pertain to energy generation and fossil fuel resource depletion. Availability (exergy) analysis and methods for the optimization of system components are discussed. Selection and design of fluid flow and heat transfer equipment used in energy conversion systems are emphasized. Economic evaluation is studied. A co-generation system is studied throughout the semester to emphasize basic principles of analysis and design. A design project focused on sustainable energy generation or energy conservation is required."

The full Habitat for Humanity project description from ENGR333 2021 is 7 pages long, too long to include in the nomination materials but appropriate for a semester-long project for 50 engineering students. (https://matthewheun.com/2023-10-04-engr333-project-fall-2021/ENGR333_Project_Fall_2021.pdf). Below is a (slightly reformatted) version of the **Low-carbon Housing Project Peer and Project Assessment** for that project, provided as an example of Matt's approach to teaching in a project-based learning environment with a large class.

Throughout this semester, you analyzed rebound and backfire for energy efficiency interventions. Now, your professor would like your feedback about the process in the form of a peer and project assessment. Part of your grade for the project will be determined by the quality of your peer and project assessment. Your response is and will remain confidential. Peer and project assessments are due at 3:30 PM on Monday 29 November 2021 in Prof. Heun's office.

1. Write one paragraph identifying one or two members of the class who performed exemplarily during this project. Provide examples of their supererogatory efforts.
2. Create a bullet-point list of 3 personal learnings (takeaways) from the project.
3. Create a bullet-point list of 3 suggestions for future low-carbon home designs. In other words, what suggestions do you have for future Habitat for Humanity home designs?

4. Write one paragraph answering these questions: If you put this project on a resume, would you list it as “community service?” Does engineering (as a discipline) value volunteer work and community service? Why or why not?
5. Write one paragraph describing if or how your participation in this project caused you to alter your behavior this semester. Did you see any connections between your own personal behavior and energy efficiency? If you didn’t change your behavior at all, describe why not.
6. What nontechnical skills did you learn in the course of this project? Do you expect that these non-technical skills will be relevant to your future work as an engineer? If so, why? If not, why not?
7. Write three paragraphs addressing this question: what are the connections between (a) energy efficiency and (b) the twin challenges of (i) energy resource depletion and (ii) climate change caused by global warming?
8. Write one paragraph detailing your role and contributions to your small group team. Conclude the paragraph by assigning yourself a letter grade for your work on the project. Justify your grade.
9. Write one paragraph each detailing the roles and contributions of the three (or four) other team members. Conclude the paragraphs by assigning a letter grade for your teammates’ work on the project. [Total of three (or four) paragraphs and three (or four) individual letter grades.]
10. Write one paragraph indicating any topics relevant to the content of ENGR333 that, in your opinion, would be interesting for future classes to study. Also provide any suggestions for improvements to the structure of this project in future years.

When writing paragraphs assessing yourself and your peers, you may wish to use the following rubric. Did the individual:

- Research useful information for your group?
- Display punctuality in meeting deadlines?
- Thoroughly complete assigned duties?
- Share equally in work performed by the group?
- Perform work of high quality or did their work often require revision?
- Help direct the group in setting goals?
- Help direct the group in meeting goals?
- Encourage group members to share ideas?
- Display empathy during group discussions and work?
- Listen to ideas from other group members?
- Participate in helping the group work together better?

BSE: Energy, Environment, and Sustainability Engineering Concentration Model Program
(Starting Fall 2023 or Later)

First Year

Fall (16)

☐	4	Chemistry 101 + 101L	General Chemistry I (F,S)
☐	4	Engineering 101 + 101L	Intro to Engineering Design (F)
☐	4	Mathematics 171	Calculus I (F,S)
☐	*2*	*Core Foundations*	*CORE 100: Community and Commitments*
☐	*2*	*Interdisciplinary 102*	*Oral Rhetoric for Engineers* (or IDIS 184)

Spring(17)

☐	4	Engineering 205	Principles of Materials Science (S)
☐	4	Mathematics 172	Calculus II (F,S)
☐	4	Physics 133 + 133L	Introductory Physics: Mechanics and Gravity (S)
☐	*4*	*Core Comp and Skills*	*Foundational Writing (ENGL 101)*
☐	*1*	*Core Comp and Skills*	*Health and Movement (Personal Fitness)*

★ **ENGR 20X** - These courses are required but can be taken in any order (offered fall and spring):
- ENGR 202* - Statics and Dynamics
- ENGR 204 - Intro to Circuit Anal. and Electronics with Laboratory
- ENGR 209 - Intro to Cons. Laws & Fluid Mechanics

* Course offered as part of the Summer Program in Germany.

* Possibly insert Summer Program in Germany

Second Year

Fall (18)

☐	4	Engineering 20X ★	
☐	4	Mathematics 271	Multivariable Calculus (F,S)
☐	4	Physics 235 + 235L	Introductory Physics: Electricity and Magnetism (F)
☐	2	Comp Sci 104 + 104L	Applied Computing (F) (CS 106 or 108 may be substituted but each is 4 SH)
☐	*4*	*Core Foundations*	*Foundations of Christianity I*
☐	0	Engineering 295	Internship Workshop (F, S)

Spring (16)

☐	4	Engineering 20X ★	
☐	4	Engineering 20X ★	
☐	4	Mathematics 231	Differential Equations with Linear Algebra (F,S)
☐	2	Statistics 241	Engineering Statistics (S)
☐	*2*	*Core Foundations*	*Foundations of Christianity II*
☐	0	Engineering 294	Engineering Seminar (does not require registration in advance)

* Possibly insert Summer Program in Germany

Third Year

Fall (18)

☐	4	Engineering 305	Mechanics of Materials (F)
☐	4	Engineering 306	Environmental Engineering (F)
☐	4	Engineering 319	Introduction to Thermal/Fluid Sciences (F)
		or Engineering 303	Chemical Engineering Principles and Thermodynamics (F)
☐	2	Interdisciplinary 184	Sustainability Challenges
☐	*4*	*Economics 233*	*The Economics of Energy and Sustainability (F) (ES tag)*

Spring(17)

☐	4	Engineering 308	Environmental Engineering Design (S)
☐	4	Engineering 328	Intermediate Thermal/Fluid Sciences & Design (S)
		or Engineering 312	Chemical Engineering Thermodynamics (S)
☐	4	Engineering Elective	One of ENGR 315 (F), ENGR 318 (S), ENGR 321 (S), or ENGR 342 (S)
		or Engineering 330	Fluid Dynamics and Heat Transfer (S)
☐	*4*	*Core Knowledge and Understanding (see Core Options sheet) - D&D or GR&C tag*	
☐	*1*	*Core Comp and Skills*	*Health and Movement (Leisure, Sport, and Skills)*

Pink listings (Calvin Core) may be taken in any semester. ECON should be taken prior to BUS 357. See Core Options sheet.

See University Catalog or Elective Options sheet for courses allowed for the green, red, orange, blue and purple categories. Classes shaded in light brown are optional.

Fourth Year

Sustainability-related Internship Experience (optional for Sustainability Designation, ENGR 385 optional)

Fall (16)

☐	4	Engineering 320	Hydraulic Engineering (F)
☐	4	Engineering 333	Thermal Systems Design (F)
		or Engineering Elective: One of ENGR 315 (F), ENGR 318 (S), ENGR 321 (S), or ENGR 342 (S)	
☐	4	Elective: Basic Science or Advanced Math (2 SH minimum)	
☐	2	Engineering 339	Senior Design Project (F)
☐	2	Business 357	Business Aspects for Engineers (F)
	1	Interdisciplinary 384	Sustainability Experience (F,S) (Required for students seeking Sustainability Designation)

Spring (16)

☐	4	Engineering 340	Senior Design Project (S)
☐	4	Engineering 354	Sustainability Engineering (S)
☐	2	Elective: Basic Science, Advanced Math, Engineering, or Technical (2 SH minimum)	
☐	*4*	*Core Knowledge and Understanding (see Core Options sheet) - D&D or GR&C tag*	
☐	*2*	*Core Knowledge and Understanding (see Core Options sheet - 26 SH of total K&U minimum)*	
☐	0	Engineering 394	Engineering Seminar (does not require registration in advance)

Other Requirements

- ☐ *0-8 Core Comp and Skills: World Languages I (3 years in HS with B or better)*
- ☐ *0-3 Engaged Citizenship Commitment Tag: Diversity and Difference*
- ☐ *0-3 Engaged Citizenship Commitment Tag: Environmental Sustainability*
- ☐ *0-3 Engaged Citizenship Commitment Tag: Global Regions and Cultures*

Revised Mar 2024

Calvin Engineering