

SHOWCASE 2025

A hybrid event highlighting
senior design projects and
student achievements

MICHIGAN STATE
UNIVERSITY

Department of Biosystems
and Agricultural Engineering



The Biosystems Engineering (BE) Showcase is a long-standing highlight of the BE calendar. The day consists of three different types of presentations by each project team – poster presentations at Design Day, in-depth design review sessions with our Industry Advisory Board members, and brief public presentations of their overall design results. Showcase brings together the entire BE community – student teams, project clients, our Industry Advisory Board, faculty, other BE students, and friends and family – to get a brief glimpse of the final design reports from these real-world, client-sponsored projects.

Congratulations to all the students for the results of their creative and diligent efforts. Also, special thanks go to Drs. Luke Reese and Sang Jeong for managing senior design and the diversity of projects, as Dr. Jeong joined as a new member of the instructional team this year. Lastly, thanks to all the faculty advisors of the project teams, to the project clients for supporting our program, and to our Industry Advisory Board – whose expert insights, support, and evaluation of the projects are always impactful, in terms of both student learning and our overall program success and continuous improvement process.

Bradley Marks, Ph.D., P.E.

Professor and Department Chair

BE Senior Design is a unique, two-semester experience that prepares students for successful careers solving challenging problems in food, energy, environment and health. In Senior Design, teams of three to five students are paired with real-world clients to work on an actual issue the client is facing. With the help of a BE faculty mentor, these teams work with their client to come up with a solution for the problem using the technical knowledge they've accumulated during their time at MSU. Students also develop skills in teamwork, project management and communication.



The nature of the two-semester structure allows students to take a deeper dive into a project and establish a stronger relationship with their team and client, similar to an industrial co-op. The extended time on the project allows the students to become more knowledgeable about the specific problem and solutions they're working to address. In addition, students experience a more realistic ebb and flow of team and client dynamics that prepare them for the start of their professional career. As an instructor, there's nothing better than seeing your students' hard work come to fruition. It's always exciting when our Senior Design students see their work implemented by clients – and sometimes, receive job offers from them. We're honored to lead this course and eager to share all of the hard work our students have put into their projects over the course of this year.

*Sanghyup Jeong,
Ph.D., P.E.*

Assistant Professor

Luke Reese, Ph.D.
Associate Professor

Full descriptions and project posters are at:
www.canr.msu.edu/bae/senior-design-2025



(L to R) Ben Bridge, Sam Dougherty, McKenzi Brundage, & Mariam Shahab

Treatment of harmful algal blooms in Soldan Dog Park pond

Team Cyanobacteria Treatment

Sponsor: Ingham County Parks
Faculty Advisor: Dr. Dawn Dechand

Since 2019, large green algal blooms have repeatedly appeared in a local Lansing dog park, Soldan Dog Park. Because cyanobacteria was suspected in the blooms, concerns arose about toxins affecting dog health, prompting the park to close the pond. Ingham County Parks contacted Michigan State University and project advisor Dawn Dechand. From pond water samples, the team identified multiple toxin-producing cyanobacteria and found high levels of phosphorus in the pond. The team proposed a series of floating treatment wetlands (FTWs) as an effective way to remediate pollutant levels, removing nearly 418 g of phosphorus/year at a cost of ~\$22,000. The team successfully developed and tested a prototype to optimize the final design.



(L to R) Janie Cooper, Dov Myers, Ella Harrell, & Amari Selby

Prevention of harmful algal blooms in Soldan Dog Park pond

Team SDP Prevention

Sponsor: Ingham County Parks

Faculty Advisor: Dr. Dawn Dechand

Harmful algal bloom (HAB) events are increasing in prevalence at Soldan Dog Park Pond. This causes numerous park closures across multiple seasons. The leading cause of HAB events is excessive nutrients, specifically phosphate. This project aims to prevent HAB events at Soldan Dog Park Pond by controlling levels of phosphate entering the pond via stormwater inlet pipes. After measuring the phosphate in the pond and doing predictive modeling with OpenHydroQual, the chosen design solution is a water control structure with an iron-enhanced media filter. One filter is expected to cost \$1,500, replaced annually, and the first 10-years cost is \$96,100.



(L to R) Jakob Harper, Tushar Mukkatira, Ellen Mayes, & Collin Neal

Carbon intensity calculator for Michigan dairy farm renewable natural gas site selection

Team The Digesters

Sponsor: Consumers Energy (project under Non-Disclosure Agreement)

Faculty Advisor: Dr. Daniel Uyeh

Consumers Energy is establishing additional partnerships with Michigan dairy farmers. Dairy manure can be used to generate renewable natural gas (RNG) through anaerobic digestion. Producing RNG from dairy manure can have significantly negative carbon intensity (CI) scores, which indicates a reduction in greenhouse gas emissions. This reduction can offset Consumers' other operations such as conventional natural gas production. To decide if a dairy farm is suitable for a project, many logistic and economic factors are considered. To aid the decision process the team designed an Excel calculator to estimate RNG production and CI score for a potential project location. The model is informed by the USDA Quantifying Greenhouse Gas Emissions and Sinks Handbook, R&D GREET Model, and Joseph Mangino EPA Report. The user interface is coded in Excel VBA.



(L to R) Grace Dickerson, Tessa Versace, Ella Hubbard, & Sebastian Hawkes

Nature's Pulse: Mass producing an innovative pulse-based snack

Team IFT

Sponsor: IFT Competition

Faculty Advisor: Dr. Kirk Dolan

Team IFT developed a full process line for an innovative pulse-based trail-mix snack product. The product, developed by the Food Science Product Development Team, combines flavored bean-based crackers with tasty mix-ins. Design components include an optimized mathematical model of vacuum drying, an economic analysis of the processing line, as well as a sustainable packaging alternative. Vacuum drying is the primary focus of our design as it is the bottleneck of the processing line and there is potential for optimization. Our break-even point is projected to be under three years with a production cost under 40% of market price.



(L to R) Ben Getzen, Peyton Ma-Wong, Aidan Kile, & Christina Lin

Hog feet color improvement

Team Clemens

Sponsor: Clemens Food Group (project under Non-Disclosure Agreement)

Faculty Advisor: Dr. Bahar Aliakbarian

Team Clemens has selected to implement the solution of replacing the vertical scalding in the Coldwater facility with a horizontal scalding. The horizontal scalding will mitigate blood staining and blood pooling, the main causes for discoloration in the Coldwater facility. The new horizontal scalding, produced by Frontmatec, will have an initial capital cost of \$2,250,000. By reducing front foot discoloration, the Coldwater facility will save \$364,530 annually. This creates a payback period of 6.3 years.



(L to R) Renae Kenney, Praneeth Dattagupta, Shayla Le, & Catherine Maurer

Developing phosphorus removal column system using Eden Lakes' TimberChar™

Team Eden Lakes

Sponsor: Eden Lakes (project under Non-Disclosure Agreement)

Faculty Advisor: Dr. Younsuk Dong

This project focused on designing a phosphorus removal system using the biochar product TimberChar™, manufactured by Eden Lakes. The design consists of a column filtration system for phosphorus removal at a eutrophic wastewater lagoon, "Lake Leslie." The final design pumps wastewater through a series of columns containing TimberChar™, and a layer of pea gravel used to prevent media loss. This modular system maximizes phosphorus adsorption with improved scalability and transportability. Expected outcomes include meeting EGLE effluent discharge standards of 1 mg/L of phosphorus, and TimberChar™ media loss of less than 5% by weight. The team's design supports sustainable water management for MI eutrophic lakes.



(L to R) Begawan Samad, Cavanaugh Doud, Brett Dumaw, & Hunter Carene

Feasibility study of greywater reuse for dairy plant CIPs

Team Glanbia

Sponsor: Glanbia Nutritionals (project under Non-Disclosure Agreement)

Faculty Advisor: Dr. Wei Liao, PE

Glanbia is a multinational dairy processor with a large production plant in St. Johns, Michigan. Glanbia has a company-wide goal to reduce freshwater use by 10%. To achieve this, Glanbia tasked the team with exploring the feasibility of reusing treated wastewater to reduce freshwater intake. The team analyzed Glanbia's effluent wastewater samples and determined that reverse osmosis (RO) is the most effective solution for meeting FDA standards. Using RO, the team plans to recycle 20% of Glanbia's wastewater discharge at this plant. This amount of recycled water will eliminate 100% of the municipal water withdrawn from the city of St. Johns used for external non-food contact surfaces Clean-in-Place (CIP) operations (i.e., floor and wall cleaning, pipe exterior cleaning).



(L to R) Quinn Armstrong, Avery Partlow, Kelley Titus, & Cj Buchta

Preventing foreign material contamination in corned beef through detection

Team Grobbel

Sponsor: E. W. Grobbel (project under Confidential Disclosure Agreement)

Faculty Advisor: Dr. Ilce Medina Meza

The goal of this project is to prevent the risk of Foreign Material Contamination (FMC) in a corned beef processing facility. FDA Hazard Analysis Critical Control Point (HACCP) guidelines were used to identify the top contamination risks throughout the facility. Implementing new detection and prevention methods within specified Critical Control Points (CCPs) including X-ray scanning and vinyl curtain segregation are recommended. These implementations will decrease Foreign Material Contamination by 50% in the direct-to-deli process once installed, including a recommended selling price increase of \$2.47 per unit to eliminate out-of-pocket costs if financed over the expected machine lifetime of 5 years.



(L to R) Jacqueline Hawkins, Wes Broda, Justin Pecora, & Kathryn Benson

Optimizing a rapid block cooler for cheddar cheese production

Team Tillamook

Sponsor: Tillamook (project under Non-Disclosure Agreement)

Faculty Advisor: Dr. Ian Hildebrandt

Market demand for quality cheddar cheese is increasing, and the Tillamook County Creamery Association is poised to meet it. However, improperly cooled cheese can cause disruptions in the taste and texture, resulting in downgrading of the cheese and financial losses; Tillamook's high-quality standards must be met without compromise. Issues in the rapid cooling room were identified to provide solutions to determine the optimal cooling temperature and air velocity for cheddar cheese. The team is proposing solution recommendations interpreted from a MATLAB model using finite element method including decreasing air temperature and addition of fans. Overall projected savings are ~\$100,000.



(L to R) Lizzy Cross, Nikolay Siratskiy, Swathi Kambhatla, & Briya Berry

Phosphorus reduction through electrodialysis in pharmaceutical reverse osmosis reject

Team Perrigo

Sponsor: Perrigo (project under Non-Disclosure Agreement)

Faculty Advisors: Dr. Jade Mitchell and Dr. Emily Julien

Perrigo is looking to reduce the cost of wastewater treatment for their Reverse Osmosis (RO) reject water at their Allegan, Michigan plant. The RO system increases the phosphorus concentration in the reject water, exceeding the Environmental Protection Agency limit. Perrigo is required to send the reject water to a treatment plant instead of the stormwater system. This method has proven to be more costly. The team proposes the implementation of an in-house electrodialysis system to remove phosphorus so purge water can be discharged to the stormwater system within permit limits. This system aims to recover 75% of effluent phosphorus and cut the current operating cost by a minimum of 50%.



(L to R) Rosie VanLuven, Kylie Jamrog, Tyler Hillman, & Jordan Dashner

Improving existing oat transport system into food service mixer

Team Jiffy

Sponsor: Chelsea Milling Company (Jiffy) (project under Non-Disclosure Agreement)

Faculty Advisor: Dr. Yan "Susie" Liu

Chelsea Milling Company (CMC) uses a super-sack unloading system and screw auger to add ingredients into their Food Service mixer. Team Jiffy has been asked to create a design that improves cleaning efficiency and reduces ingredient loss from CMC's current system. The final design includes the addition of a new hingeless screw auger alongside the pre-existing screw auger for oat application. This system will reduce ingredient loss in transport by 100%, and reduce cleaning time by 10%, and maintain the current throughputs of the plant.



(L to R) Mimi Tarter, Mary Jane Hellem, Sophia Spencer, & Matteo De Mattia

Implementing a gMNP tuberculosis biosensor in Peru

Team EWH Tuberculosis

Sponsor: Dr. Kenny Briceno (Peru)

Faculty Advisor: Dr. Vangie Alocilja

Team EWH Tuberculosis collaborated with Engineering World Health and a local physician in Peru, Dr. Kenny Briceno, to implement a diagnostic gMNP Tuberculosis biosensor in Belén, Peru. Implementation of the biosensor improves current test sensitivity from 60% to 99.7% and reduces the wait time for accurate results from weeks to 30 minutes. To ensure seamless integration into the clinic, the team developed procedural guidelines and standard operating procedures (SOPs) to optimize workflow and enhance patient safety. To ensure accessibility, the guidelines are located within a publicly available website. The biosensor test remains cost-effective, at a cost of \$2.27.



(L to R) Anna Dziedzic, Alex Griffin, & Isabella Pucci

Affordable water sanitation for poor rural Peruvian Amazon communities

Team Vida del Río

Sponsor: Dr. Kenny Briceno (Peru)

Faculty Advisor: Dr. Vangie Alocilja

The Amazon River, the primary drinking water source for village communities near Iquitos, Peru, is subject to contamination from sources such as deforestation, improper mining, and waste disposal practices. To mitigate waterborne illness infection rates linked to the decreasing water quality, the team designed a multi-barrier approach: sedimentation, biosand filtration, and chlorination. This household-scale system was designed to remove 95% of pathogens, >85% heavy metals, and >85% turbidity. The annual costs associated with operation are less than 10% of the annual income of the communities and utilize local resources, ensuring accessibility.

The Advisory Board

The purpose of the Industry Advisory Board is to facilitate the exchange of ideas between Board members, faculty, and students of the BE program. Its function is to improve continuously the BE program quality by keeping it current and relevant to industry needs. Regular and adjunct board members also serve as external project evaluators.

Board

Janelle Barnes ~ Target
Ellen Bornhorst, Ph.D. - PepsiCo
Holly Bowers ~ Consumers Energy
Jessica Bruin ~ Kellanova
Lisa Buchholz ~ Corteva Agriscience
Matt Burt (Chair Elect) ~ AbbVie
Shelley Crawford ~ Jiffy
Michelle Crook, PE ~ MDNR
Laura Doud, PE (Past Chair) ~ MDOT
Cassandra Edwards ~ Tillamook Creamery
Gene Ford ~ Standard Process
Jeremy Hoeh, PE ~ EGLE
Eric Iversen, PE ~ PEA Group
Andrew Johnson - John Bean Technologies (JBT)
Kevin Kowalk, PE ~ EA Engineering, Science, and
Technology (MI) PLC
Mitch Miller ~ General Mills-Yoplait
Amber Mostiller - E.W. Grobbel Sons, Inc
Rob Yoder ~ BDI, Inc.
Dave Young - Perrigo, Inc

Ex-Officio

Todd Forbush, Techmark, Inc., (ASABE Rep)



If you are interested in sponsoring a BE 485/487 capstone project for the 2025_26 Senior Design teams, please contact Dr. Sanghyup Jeong, PE at jeongsa1@msu.edu or Dr. Luke Reese at reesel@msu.edu.

UNDERGRADUATE SCHOLARSHIPS

Agah Endowed Scholarship

The Agah Endowed Scholarship is awarded to students who look to make a difference as to how the world's food and water supplies are used, restored, and preserved.

F. W. Bakker-Arkema Endowed Scholarship

F.W. Bakker-Arkema was a professor of agricultural engineering at MSU for over 30 years. His scholarship recognizes students that contribute to the cultural and intellectual diversity of biosystems engineering through their leadership experiences.

A.W. Farrall Scholarship

The Farrall Scholarship is the most prestigious undergraduate scholarship awarded by the Department of Biosystems and Agricultural Engineering. It is named in honor of A.W. "Doc" Farrall, who chaired the department from 1945-1964 and helped establish the first agricultural engineering Ph.D. program in the nation. Farrall Scholars excel both academically and professionally, and are leaders in the biosystems engineering community.

DeBoer Family Scholarship

The DeBoer Family Scholarship is awarded to students who excel academically and demonstrate a passion for biosystems engineering

Carleton Scholarship

The Walter M. and Lillie M. Carleton endowed scholarship is awarded to students who excel in Biosystems Engineering. Dr. Walter Carleton was the recipient of the first PhD degree in the U.S. awarded in a standalone Agricultural Engineering department - in 1948 (now the Department of Biosystems and Agricultural Engineering). Dr. Carla Carleton, daughter of Walter and Lillie Carlton, and retired faculty member of the MSU College of Veterinary Medicine, was instrumental in establishing this fund in perpetuity. This is the first year awarding this scholarship.

Clarence and Thelma Hansen Scholarship

The Clarence and Thelma Hansen scholarship is awarded to Michigan natives and U.S. students who have demonstrated academic achievement, leadership, and experience working in agriculture.

George E. and Betty L. Merva Endowed Scholarship

Dr. George Merva was a faculty member in the Department of Biosystems and Agricultural Engineering for 30 years. This endowment, named in his and his wife's honor, recognizes upperclassmen who have demonstrated leadership and academic success.

George A. Mynsberge Experiential Learning Fund for Research

See Graduate Scholarships

John and Julianna Merva Endowed Scholarship

Dr. George Merva's father, John, was an immigrant from Slovakia, who, despite receiving no formal schooling and working full time in ore mines, was able to teach himself three languages. In this spirit, the John and Julianna Merva Scholarship is awarded to an undergraduate student who has balanced leadership and academic success, while also working to cover their educational expenses.

Howard F. and Esther L. McColly Scholarship

The Howard F. and Esther L. McColly Scholarship honors Dr. Howard McColly, who served on the faculty of the Department of Agricultural Engineering for more than 21 years, and his wife, Esther. The scholarship is awarded to students who have demonstrated academic achievement, leadership and service to the profession.

Michigan ASABE Section Scholarship

The Michigan Chapter of the American Society of Agricultural and Biological Engineers (ASABE) awards a scholarship to one college freshman and one college sophomore each year. Recipients must be registered as pre-professional members of ASABE.

FRESHMEN SCHOLARSHIPS

Robert J. Gustafson Scholarship

The Gustafson Scholarship is awarded to students with a high academic ability and/or financial need, with a first preference for incoming freshmen students.

Alfred & Mary Murray Scholarship

The Murray Scholarship is awarded to students with a high academic ability and/or financial need with a first preference for incoming freshmen students.

2024-2025 Undergraduate Scholarship Recipients

Agah Endowed Scholarship

Kathleen Grundel
Leah Jarmolowicz

F.W. Bakker-Arkema Endowed Scholarship

Luis Carlos Avalos
Isabelle DeLaet
Cavanaugh Doud
Finnian James
Amari Selby
Sophia Spencer

W & L Carleton Endowed Scholarship

Jocelyn Cayen

DeBoer Family Scholarship/Fellowship Fund

Rylie DuBois
Alexander Griffin
Katherine Heinecke

A.W. Farrall Scholarship

Nicholas Bray

Clarence & Thelma Hansen Scholarship

Brett Dumaw
Gillian Kuehnle

Howard & Esther McColly Scholarship

Ella Harrell
Summer Luick

George E. and Betty L. Merva Endowed Scholarship

Leah Wilson

John and Julianna Merva

Undergraduate

Benjamin Bridge
Olivia Schommer

George A. Mynsberge Experiential Learning Fund for Research

Sebastian Hawkes

Jimmy Butts Memorial Scholarship (ASABE Michigan Section)

Justin Pecora



2024-2025 Graduate Scholarships

Outstanding BE Research Fellowship & Fitch H. Beach Award

The Outstanding BE Research Fellowship & Fitch H. Beach Award is presented to one of the top Ph.D. students in the BE graduate program who has excelled in research productivity, and whose work suggests a high-level of direct impact on society. The recipient represents at the college level against similar nominees from other disciplines in the College of Engineering. Funding is based on placement in the competition at the college level and is funded by the College of Engineering and the BAE Endowment for Graduate Studies.

Most Outstanding BE Graduate Student Fellowship

The Most Outstanding BE Graduate Student Fellowship is awarded to top students in the BE graduate program. It recognizes their recipients' breadth of excellence and direct and indirect contributions to the BAE Department through professional productivity, service to the department and university, and contributions to the extended community. This honor is funded by the BAE Endowment for Graduate Studies, which was from former and current BAE faculty and other donors wishing to support graduate education.

Galen & Ann Brown Scholarship

The Galen & Ann Brown Scholarship supports graduate students working in the engineering domains that can be related or applied to the fruit and/or vegetable industries, a field to which Dr. Galen Brown dedicated his career. This scholarship is funded by the family of Galen and Ann Brown and others who respected and/or worked with Galen.

Katherine & Merle Esmay Scholarship

The Katherine & Merle Esmay Scholarship supports international graduate students with a clear passion and plan to return to their home country to implement their knowledge gained through their MSU BAE degree. It is funded by the family of Merle and Katherine Esmay and others who have the passion to make a difference around the globe, like Merle did.

George A. Mynsberge Experiential Learning Fund for Research

Candidates for the Mynsberge Experiential Learning Scholarship must conduct experiential learning research/outreach in water resource recovery, water quality, and/or wastewater treatment. The selected student(s) will work with a BAE faculty member for the experiential learning experience. The award has an expectation that the student presents their experience at a research conference hosted by MSU or a professional society.

M. Kent Taylor Assistantship Fund

The M. Kent Taylor Assistantship Fund supports graduate students in the academic pursuit of alternative, sustainable energy technologies to reduce the carbon load on the atmosphere and oceans.

Graduate Scholarship Recipients

College of Engineering Outstanding BE Graduate Student Fellowship

Josue Kpodo (2023/24)

Outstanding BE Research Fellowship & Fitch H. Beach Award

Babak Dialameh (2023/24)

Galen & Ann Brown Scholarship

Narindra Randriamiarintosa

Katherine and Merle L. Esmay Fellowship

Hoda Sadat Razavi

M. Kent Taylor Assistantship Fund

Gregory Rouland

Interested in supporting scholarships for Spartan biosystems engineers?

[Click here](#) to make a donation.

About the MSU Biosystems Engineering Program

BE graduates are expected to succeed in diverse careers where they integrate and apply principles of engineering and biology to globally important problems in food, energy, environment and health. This success is attained through a curriculum that focuses on:

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| <ul style="list-style-type: none">• Identifying and solving problems at the interface of biology and engineering, using modern engineering techniques and systems approaches.• Analyzing, designing, and controlling components, systems and processes that involve critical biological components. | <ul style="list-style-type: none">• Demonstrating vision, adaptability, creativity and a practical mindset when solving problems.• Developing communication skills for technical and non-technical audiences. | <ul style="list-style-type: none">• Working with diverse, cross-disciplinary teams.• Integrating sustainability into all facets of biosystems engineering.• The importance of continued professional growth and ethical conduct. |
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MICHIGAN STATE
UNIVERSITY

Department of Biosystems
and Agricultural Engineering

524 S. Shaw Lane, Room 216
East Lansing, MI 48824
517-355-4720
BAE-Info@anr.msu.edu
www.canr.msu.edu/bae