

View results

Respondent

11 Deborah Schmitt

92:15

Time to complete

ACKNOWLEDGMENT

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Please read and acknowledge the following:

- SSC funding can take ****1 MONTH OR LONGER**** to receive after the SSC has voted to approve a project because it includes several steps:
 - the authorization of an award letter by SSC, iSEE, Division of Student Affairs, the project's advisor (*student-led projects only*), and the project lead;
 - the creation of the CFOP by the project team's departmental financial contact in conjunction with the project team;
 - the transfer of funds from SSC to the project's CFOP.
- If you are a project lead for a new project that is approved by the SSC, be sure to check your email regularly for the prompt to sign the award letter to help facilitate the efficiency of the process.
- Project teams for funded SSC projects do NOT receive funds directly. After a project's SSC funds have been transferred to the project's CFOP, the project team must work with the sponsoring department to purchase the approved budgeted items on behalf of the project team.
- This application will be shared publicly on our SSC Illinois Climate Action Plan (iCAP) portal so that others can learn from your project.
- Funded projects have grant reporting requirements. See our website for more information.

*

I acknowledge that I have read this information.

APPLICATION INSTRUCTIONS

Prior to starting your application, make sure you have the following information available:

- Project personnel including project lead, confirmed faculty/staff advisor (**student-led projects only**), departmental financial contact, other team members
- Working Group attendance information
- Project title and abstract
- Project description including timelines, deliverables, detailed description about the project, project feasibility information
- Intended student impacts
- Intended sustainability impacts
- Optional supporting documentation (e.g., Working Group presentation, letters of support)
- Detailed project budget information
- Information about changes to the Step 2 application submitted compared to the Step 1 application submitted

See our website for a sample application:

<https://studentengagement.illinois.edu/studentsustainability/illinoisgreenfund/funding>

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Today's Date *

11/5/2025



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Please tell us how you heard about the availability of SSC's funding for your sustainability project. *

- I Have Received SSC Funding Previously.
- Instagram
- MassMail
- SSC's Newsletter
- Departmental Newsletter
- Digital Signage
- LinkedIn
- SSC Website
- SSC Board Member or Other Member of the Committee
- Other Project Teams that Received Funding
- Illinois Faculty or Staff
- At a Tabling Event
- General Word of Mouth
- Other

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A follow up project presentation at a SSC Working Group meeting is *occasionally* requested of a project team prior to submitting their Step 2 application. Did someone from the project team present updates to their originally proposed Step 1 project at a SSC Working Group meeting this semester?

*

YES

NO

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Select the Working Group meeting you attended. *

Energy + Transportation & Infrastructure Working Group Meeting

Food & Waste + Land, Air, & Water Working Group Meeting

Education & Justice Working Group Meeting

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Date of the Working Group meeting you attended. *

9/29/2025



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What is the name of your project? *

Magnetically Driven Biodiesel Catalysis With Deep Eutectic Solvent-Functionalized Nanoparticles

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Amount of funding requested from the SSC for this project *

The amount entered here must match the amount reflected in your detailed primary budget spreadsheet that you will be prompted to submit with this application.

66,220.00 (original) to 113,852.00 (if personal wages are included)

PROJECT DESCRIPTION

Project Category *

- Education & Justice
- Energy
- Food & Waste
- Land, Air & Water
- Transportation & Infrastructure

Project Abstract *

In approximately 100 words, describe your project.

The Illinois Biodiesel Initiative at the University of Illinois Urbana-Champaign is a student-driven research program focused on practical, sustainable approaches for biodiesel production. This project addresses one of the key challenges in converting waste cooking oils with high free fatty acid content into high-quality biodiesel feedstocks. The approach combines deep eutectic solvents (DES) as green catalysts with superparamagnetic nanoparticles to enable efficient, recyclable, and energy-efficient conversion under magnetic heating. The comparison between covalently bonded and non-bonded catalysts on the particles will give insight into how chemical anchoring at the particle surface improves catalytic performance and reduces leaching during repeated use. Overall, the study combines catalytic process design with materials development to enhance the performance and reusability of biodiesel catalysts. Built on sustainable principles, the project provides students with hands-on experience in developing efficient catalytic processes and involves them in interdisciplinary research across chemistry, materials science, and engineering.

What key changes are reflected in your Step 2 application compared to your Step 1 application, if any, and why? *

Added the requested personal wages in the budget sheet and provided more detailed information about training requirement on MRL/SCS devices. Added additionally different sheets (with and without the wages) as well as changes in the instrument amounts and publishing costs to gain reduced amounts of funding.

Describe your proposed project in detail. Ensure the SSC has sufficient details to be able to evaluate the merits and feasibility of this project. *

Be sure to address the following:

-What are your project's goals and how do you intend to accomplish them?

-What are your project's deliverables?

The Illinois Biodiesel Initiative (IBI) at the University of Illinois Urbana-Champaign is a student-driven research group that combines sustainability, hands-on education, and applied materials science. Originally founded as a biodiesel production group converting waste cooking oil from campus dining halls into ASTM-grade biodiesel, IBI has evolved into a group for interdisciplinary research in chemistry, materials science, and chemical engineering. Under the guidance of a postdoctoral PI, undergraduate students lead all stages of research from experimental design to data analysis to gain direct experience with modern analytical tools and sustainable energy systems.

This proposed project focuses on one of the main challenges in biodiesel production: the pretreatment of waste cooking oils that contain high amounts of free fatty acids. These impurities reduce biodiesel quality and are responsible for large waste streams when processed with conventional acid or base catalysts. To address this, we aim to develop a sustainable catalytic system based on deep eutectic solvents (DES) coupled with superparamagnetic nanoparticles. This combination enables inductive heating and magnetic recovery of the catalyst, reducing the need for strong acids and minimizing energy use.

The work is divided into three main objectives. First, DES catalysts will be screened and characterized to identify the most active and stable compositions for esterification and glycerolysis reactions. Reaction progress will be monitored by GC-MS and NMR to determine turnover numbers, selectivity, and catalyst reusability. Second, magnetite nanoparticles will be synthesized and coated with silica to create a stable, functional surface. The DES will then be immobilized on the particle surface to enable catalytic activity at magnetic heating sites and allow easy recovery. Structural and magnetic properties will be confirmed using TEM, FTIR, TGA, and SQUID measurements.

The third objective is to establish a magnetic field system for inductive heating by using the ability of superparamagnetic nanoparticles to generate heat under an alternating field. The developed system will allow precise control over field strength and frequency to evaluate heating performance and catalytic efficiency.

Comparative experiments with covalently bonded and non-bonded DES systems will reveal how surface attachment affects conversion, selectivity, and stability.

Catalyst reusability will be assessed over multiple reaction cycles (> 10) to verify long-term stability and energy efficiency.

Deliverables include a validated synthesis protocol for DES-functionalized magnetic nanoparticles, a tested inductive heating setup, and full catalytic data on activity, selectivity, and recyclability. Combined, these results will be the basis for greener, more efficient biodiesel pretreatment. Beyond the scientific outcomes, the project directly involves undergraduate students in every experimental step, giving them next-level experience in sustainable research, problem-solving abilities, and interdisciplinary collaboration.

List your proposed project's timeline and major milestones. *

NOTE: SSC funding agreements remain active for two years. Thus, your timeline should reflect your activities over a two year period or less.

Objective 1. Investigation of sustainable DES-based catalyst: Fall 2025 - End of Fall 2026

1a. Screening and kinetic investigation of deep eutectic solvent catalysts: Fall 2025 - End of Spring 2026

1b. Transfer of optimized DES systems to free fatty acid glycerolysis in waste oils: Fall 2025 - End of Fall 2026

Objective 2. Synthesis, functionalization and characterization of superparamagnetic nanoparticles: Fall 2025 - End of Spring 2027

2a. Synthesis and stabilization of Fe₃O₄ particles: Fall 2025 - End of Spring 2026

2b. Covalent anchoring of DES on particle surfaces: Spring 2026 - End of Spring 2027

Objective 3. Development and implementation of magnetically driven glycerolysis: Fall 2026 - End of Spring 2027

3a. Magnetic field application and process integration: Fall 2026 - End of Spring 2027

3b. Catalytic evaluation of functionalized nanoparticles under inductive heating: Spring 2027 - End of Spring 2027

3c. Reusability of immobilized DES catalysts: Spring 2027 - End of Spring 2027

Have you spoken with anyone in UIUC's Facilities & Services (F&S) department regarding the feasibility of your project? *

NOTE: While this step is optional for many projects, all projects involving infrastructure (e.g., internal or external physical infrastructure of university buildings, etc.) or grounds (e.g., plantings, installing structures on campus grounds, etc.) must have F&S approval prior to receiving SSC funding. If you need assistance evaluating the feasibility of your proposed project, please reach out to SSC-Advisor@illinois.edu PRIOR to submitting your application.

- YES
- NOT YET
- N/A

STUDENT IMPACTS

How many students will be directly impacted by this project? *

30-40 students per semester will be directly involved in research activities.

How many students will be indirectly impacted by this project? *

Approximately 200-250 undergraduate students per year will be indirectly impacted through outreach events, research presentations, class demonstrations, and collaborations with other student organizations. The research will be presented at large public events like the Engineering Open House, where students guide visitors through each stage of biodiesel production with separation funnels and demonstrate the cleaner burning of biodiesel compared to diesel fuel.

What is the intended student impact? *

Be sure to address the following:

- How will this project benefit students?**
- How will students be involved with this project?**
- What educational components are in your project?**

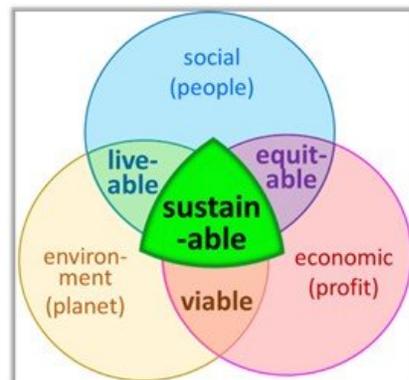
Each semester, 20-30 undergraduates from chemistry, chemical engineering, materials science, and related fields will work directly in the lab. They investigate how waste oils can be pretreated for real world process requirements, learn how new designed catalysts affect efficiency, and how energy use influences the overall process. Students work under the supervision of a postdoctoral researcher but are encouraged to take initiative in planning and carrying out their own experiments. They bring in their own ideas, discuss results openly, and learn from one another by explaining methods and troubleshooting together. The postdoctoral mentor reviews protocols, corrects procedures when needed, helps students understand the reasoning behind each step. She remains closely involved at every stage, offering scientific guidance and ensuring that students have the knowledge and direction required to advance their research effectively. Communication and outreach are a key part of the program. Students present their research at departmental symposia and student engineering groups, gaining confidence in explaining their results to peers. At large public events like the Engineering Open House, they guide visitors through each stage of biodiesel production with separation funnels, demonstrate the cleaner burning of biodiesel compared to diesel fuel, and display applications such as a go-kart powered by their own biodiesel. These experiences connect their research to broader environmental, real world context and help them understand the real-world impact of their work. Through this combination of hands-on research, teaching, and outreach, IBI offers students more than technical skills. They learn to approach problems from different perspectives, to understand the role of chemistry in sustainable resource use, and to communicate effectively with different audiences.

SUSTAINABILITY IMPACTS

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Authentic sustainability consists of the overlapping area of 3 spheres: Environment, Society, and Economy.

Describe how your project addresses sustainability. *



Environmental:

The project promotes cleaner biodiesel production by reducing chemical waste, energy demand, and solvent use. Using deep eutectic solvents (DES) as catalysts and magnetic nanoparticles for inductive heating allows reactions to run under milder conditions and enables simple magnetic recovery. This lowers environmental impact while improving process control and efficiency.

Economic:

A major goal is to make biodiesel pretreatment more cost-effective through reusable catalysts and reduced material consumption. Magnetic recovery and stable surface anchoring minimize catalyst loss, lowering costs and waste generation. The magnetically driven heating setup also improves energy efficiency with the immobilized DES particles, showing how laboratory design can support practical, production methods.

Social:

The Illinois Biodiesel Initiative is run by students who gain direct experience with sustainable energy research. Around 30-40 undergraduates each semester plan and conduct experiments under the guidance of a postdoctoral mentor, learning how to connect chemical research with real environmental and societal challenges. Through presentations and outreach, they communicate their results to peers and the public, strengthening understanding of renewable energy and responsible resource use.

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How does your project promote and increase environmental stewardship at UIUC? *

If applicable, also address what the carbon, water, waste, and/or energy savings is associated with your project.

This project promotes environmental responsibility by developing cleaner catalytic systems for biodiesel production that use less energy and generate less waste. The use of deep eutectic solvents (DES) replaces corrosive acid catalysts, reducing chemical waste and hazard exposure. Inductive magnetic heating minimize overall power consumption in combination with the functionalized particles, and allows controlled, efficient reactions. Together, these methods demonstrate how careful materials design can lower the environmental footprint of biodiesel production. In addition, students gain direct experience with sustainable laboratory practices—waste sorting, solvent minimization, and material reuse, supporting stewardship as part of scientific work.

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Does your project aim to advance one or more of the Illinois Climate Action Plan's (iCAP) objectives? If so, indicate which and describe how. If not, enter N/A.

A full list can be found here: <https://icap.sustainability.illinois.edu/objectives>

The project directly advances several iCAP objectives, including 2.2 Increase Energy Efficiency, 2.3 Clean Energy Sources, 5.2 Reduce Landfilled Waste, 5.3 Establish a Culture of Reuse, 6.1 Broaden Sustainability Education, 6.3 Environmental Leadership Program, and 7.4 Local Collaborations.

By developing energy-efficient catalytic methods for biodiesel pretreatment, the work contributes to cleaner energy production and reduced chemical waste.

Recyclable materials and circular use of resources support a culture of reuse, while the collaborative, mentored structure strengthens leadership and teaching skills for both undergraduate researchers and the postdoctoral mentor. By working with campus dining, departments and facilities, the project combines laboratory research with on-campus sustainability practice and local resource management.

PROJECT LEAD

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Project Lead's Full Name *

Dr. Deborah Schmitt

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Project Lead's Department *

Chemical and Biomolecular Engineering

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Project Lead's University Email Address *

sdeborah@illinois.edu

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The Project Lead must be a UIUC faculty, staff, or currently enrolled student. Which category describes the Project Lead's primary role at the university? *

- Currently enrolled UIUC student
- UIUC faculty
- UIUC staff

PROJECT'S FINANCIAL CONTACT

The project's Financial Contact must be a full-time Illinois employee who has the authority to make university purchases, manage the project's financials, and generate financial reports on behalf of the project.

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Financial Contact's Full Name *

Dr. Deborah Schmitt (as mentioned before, Prof Xiao Su (x2su@illinois.edu) can act as financial contact, if faculty instead of staff would be required (see Letter of Support). But according to the grant management, a postdoc can act as the financial person too)

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Financial Contact's Department *

Chemical and Biomolecular Engineering

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Financial Contact's University Email Address *

sdeborah@illinois.edu

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Are there additional members of your project team? *

YES

NO

ADDITIONAL TEAM MEMBER

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Team Member's Full Name:

Wolfgang Trier

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Team Member's Department/Campus Affiliation:

Undergraduate Student (Student Lead of the project) in the Department of Material Science

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Team Member's University Email Address:

wtrier2@illinois.edu

Do you have additional team members? *

YES

NO

SUPPORTING DOCUMENTATION

OPTIONAL: Attach any letters of commitment or support here along with any supplemental media that will support your application (presentations, photos, etc.).

 [Su UIUC Letter of Support Deborah Schmitt.pdf](#)

 [IBI support letter-IBRL Deborah Schmitt.pdf](#)

 [IBI-Safety and Hazards Deborah Schmitt.pdf](#)

 [IBI research proposal without financial sheet Deborah Schmitt.pdf](#)

PROJECT FINANCES

Describe in detail how SSC funds will be used in your project.

NOTE: Only address the use of SSC funds, specifically, even if the project will be funded by multiple sources.

The SSC funds will be used to purchase the necessary equipment and materials required to carry out the project and is currently the only funding opportunity for our IBI project. This includes the purchase of essential equipment, the purchase of chemicals and consumable supplies, and the coverage of instrument time for analytical measurements. In addition, the funding will be used for the training of undergraduate students working on the project (in lab and in the facilities for characterization), ensuring they receive laboratory instruction and supervision for analytical devices. SSC funds could be used for personal wages, if funding for that part is available. All SSC funds will be used directly to enable the students work and student involvement required for the project's research goals.

If you receive SSC funding, will your project require additional sources of funding to achieve your project's overall goals? *

NOTE: SSC cannot guarantee financial support beyond that provided in an approved funding agreement.

YES

NO

Has your project team or department previously been awarded funding from the SSC for the same or a similar project? *

YES

NO

Download, complete, and submit the **SSC-Budget-Timeline_NEW APPLICATION_template** file linked below. Please be very detailed so that the SSC can fully evaluate the merits of your funding request. **We STRONGLY recommend providing alternate budgets in addition to your main budget in case SSC cannot fully fund your project. There are alternate budget tabs in the template.**

<https://studentengagement.illinois.edu/sites/default/files/2024-09/SSC-Budget-Timeline-NEW-APPLICATION-template.xlsx>

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 IBI-SCS-01-SSC-Budget-Timeline-IBI applicatio Deborah Schmitt.xlsx