

Michigan Green Chemistry Awards Program Student Award Category

What is the Green Chemistry Awards Program?

The Michigan Green Chemistry Awards Program (Awards Program) is a program established by the Michigan Department of Environmental Quality (DEQ) to recognize innovations in green chemistry.

This application is for students majoring in chemistry and engineering to receive recognition for their recent design projects that incorporate one or more of the green chemistry principles. The primary direction of this Awards Program is to promote public awareness about green chemistry and green engineering, to promote and support perception and behavioral changes both in industry and in consumers, changes that are critical components for a substantial shift towards benign environmentally safe and sustainable processes, systems, and products.

Education of the new generation of specialists, our future decision makers, is essential to ensure the protection and well-being of the humans and our planet. Promotion and support for the integration of green chemistry and green engineering in the educational system is a solid investment in the future generation of professionals, including scientists and engineers. The new generation should be better equipped with an understanding of the fundamental principles of green chemistry and green engineering, with the methodology, technology, and policies related to these principles.

What are the goals of this Awards Program?

The major goal is to educate a new generation able to understand the importance of preserving valuable resources and eager to work toward avoiding future harmful impacts on our planet environment. This can be achieved through investments in Michigan's future by supporting a new generation of students in their effort to recognize and understand (1) the significance of green chemistry and green engineering, and (2) the significance of benign and sustainable practice of these concepts throughout their career. The Awards Program recognizes and rewards innovation, education, and application projects that are based on green chemistry and green engineering principles and/or facilitate commercializing of green technologies.

To achieve this objective the following specific goals are to be achieved:

- Encourage green chemistry research, development, demonstration, education, and technology transfer (see Attachment 1);
- Promote the use of chemical technologies that reduce or eliminate the use or generation of hazardous substances during the design, manufacture, and use of chemical products and processes; and
- Encourage the use of safer, less toxic, or non-toxic chemical alternatives to hazardous substances to promote sustainable economic development in Michigan.

The educational component will bring the knowledge of green chemistry principles and the successful industrial applications, and will constitute the necessary foundation for further adoption into local industries. Behaviors can be changed if the benefits are clear and important to the company. As they become aware of the opportunities brought forth by the knowledge of green chemistry and its applications, the decision-makers should become more willing to change institutional behavior, from only *benefit driven* to *green-processes, green-product, and benefit driven*. Economic benefits and environmental costs are decision tools that can drive production changes. This is why it is extremely important to educate our science and engineer students, the future generation of decision-makers. The incentives brought up by this state initiative are expected to stimulate the students interest and motivate them to creatively apply their knowledge of the green chemistry principles.

This aspect of Awards Program will be conducted in two phases. The **first phase** will require students to submit an abstract for their project (application form in Attachment 2). Projects that qualify for consideration will advance to the **second phase** of the Awards Program, here students/authors will be notified of their selection and will be invited to submit a complete project description/report. Winners will receive an award valued up to \$1500 for their design projects.

Category 1: Science innovation, including human health and environment

Recognize and reward:

Theoretical and/or innovative research based on **novel** and cutting-edge principles and theories or on **proven, but not yet accepted** as common practice principles. This includes, but is not limited to, projects with high **potential applications** in the area of human health (reduce acute or chronic toxicity, reduce or eliminate the potential for illness or injury to humans, animals, or plants, etc.) and environment protection (reduce flammability or explosion potential; reduces the use or generation of hazardous substances, or releases to the environment; or promotes the efficient use of natural resources, like substituting a renewable feedstock for a petrochemical feedstock).

Category 2: Design for practical application

Recognize and reward:

Projects that bring forward **novel innovative solutions** to existing problems utilizing pollution prevention, green chemistry and green engineering principles that are based on **existing, current in-use best practices and methodology**; the proposed new design should be cost effective and have the ability to remedy a real environmental and/or human health problem, to prevent or reduce pollution, and to promote sustainability.

Eligibility Information:

Undergraduate and graduate students attending public and private Michigan institutions of higher learning with accredited chemistry and engineering programs, are eligible to participate in the Awards Program. The student must be able to verify authenticity/ownership of the paper and the content, and the application must be certified by an authorized faculty member at the attending university. The faculty member must be able to verify the authenticity of the design project.

Eligible Projects:

Projects that incorporate one or more of the 12 Principles of Green Chemistry listed on page 4, are eligible to compete in the Awards Program. This includes projects that:

1. Design new green synthesis approaches for currently used chemicals/materials, develop new chemicals/materials with technological value, but minimal toxicity, or contribute to the basic understanding of key mechanistic steps inherent in the synthesis or use of a valuable chemical product to guide in the design of more efficient processes.
2. Promote safety through the use of safer solvents and reaction conditions; minimize the potential for accidents, or more accurately and quickly assess the full toxicity and environmental impact of an important chemical/material.
3. Development of new products with end-of-life-cycle that will degrade to components that are not harmful to the environment.
4. Design chemical production processes that run at mild conditions, use energy efficient and renewable feedstocks, and/or operate with stable catalyst(s) rather than stoichiometric reagents.
5. Demonstrate a novel process for remediation and/or recycling of a useful chemical product or by-products.

Requirements to Advance to Second Phase

Milestone Activities	Schedule
Design project must have been completed by	April 30, 2009
Complete applications of abstracts are due by	May 15, 2009
Notification of acceptance abstract to phase 2	May 22, 2009
Accepted projects must submit a full report (up to 10 pages) by	July 15, 2009
Notification of award winners	August 21, 2009

Ineligible Projects:

Projects that do not incorporate one or more of the 12 Principles of Green Chemistry will not be considered for the Awards Program. Projects that are solely pollution prevention oriented, or projects that only emphasizes energy efficiency, or projects that provide benefits only to manufacturing or increase monetary profits only to industry, will not be considered.

Submission Deadlines:

Abstracts can be submitted electronically, or if paper submission by U.S. mail, but the applicant must submit three copies to DeLEG no later than 4:00 p.m on *May 15, 2009*. Please download the student application form from the DEQ's Web site, at http://michigan.gov/deq/0,1607,7-135-3585_49005-186289--00.html, and mail it to "Michigan Green Chemistry Awards Program, attention to Mr. Jim Goodheart, Department of Energy, Labor & Economic Growth (DELEG), Bureau of Energy Systems, P.O. Box 30221, Lansing, Michigan 48909; or submit it by e-mail to GoodheartJ@michigan.gov. Successful candidates will be notified of acceptance of project abstracts on or before May 22, 2009, and additional information may be requested.

Agency Contacts:

For more Awards Program information contact Mr. Jim Goodheart, Green Chemistry Student Internship Program Manager, DeLEG, by e-mail at GoodheartJ@michigan.gov, or by telephone at 517-241-7418.

ATTACHMENT 1

Green Chemistry Definition: Green chemistry is the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances.

The 12 Principles of Green Chemistry:

1. **Prevent Waste:** Design chemical syntheses to prevent waste, leaving no waste to treat or clean up.
2. **Design Safer Chemicals and Products:** Design chemical products to be fully effective, yet have little or no toxicity.
3. **Design Less Hazardous Chemical Syntheses:** Design syntheses to use and generate substances with little or no toxicity to humans and the environment.
4. **Use Renewable Feedstocks:** Use raw materials and feedstocks that are renewable rather than depleting. Renewable feedstocks are often made from agricultural products or are the wastes of other processes. Depleting feedstocks are made from fossil fuels (petroleum, natural gas, or coal) or are mined.
5. **Use Catalysts, Not Stoichiometric Reagents:** Minimize waste by using catalytic reactions. Catalysts are used in small amounts and can carry out a single reaction many times. They are preferable to stoichiometric reagents, which are used in excess and work only once.
6. **Avoid Chemical Derivatives:** Avoid using blocking or protecting groups or any temporary modifications if possible. Derivatives use additional reagents and generate waste.
7. **Maximize Atom Economy:** Design syntheses so that the final product contains the maximum proportion of the starting materials. There should be few, if any, wasted atoms.
8. **Use Safer Solvents and Reaction Conditions:** Avoid using solvents, separation agents, or other auxiliary chemicals. If these chemicals are necessary, use innocuous chemicals.
9. **Increase Energy Efficiency:** Run chemical reactions at ambient temperature and pressure whenever possible.
10. **Design Chemicals and Products To Degrade After Use:** Design chemical products to break down to innocuous substances after use, so that they do not accumulate in the environment.
11. **Analyze In Real Time to Prevent Pollution:** Include in-process real-time monitoring and control during syntheses to minimize or eliminate the formation of by-products.
12. **Minimize The Potential for Accidents:** Design chemicals and their forms (solid, liquid, or gas) to minimize the potential for chemical accidents including explosions, fires, and releases to the environment.

Sustainable Chemistry Definition: Design, manufacture and use of efficient, effective, safe and more environmentally benign chemical products and processes.



Michigan Green Chemistry Design Awards Competition STUDENT APPLICATION FORM

(Authority: Part 145, PA 451 of 1994, as amended. To be considered for an intern, completion of this application is required.)

Please print with black ink or type all information.

SECTION I. GENERAL INFORMATION		
1. TITLE OF DESIGN PROJECT		
2. SELECT AN AWARD CATEGORY FOR YOUR DESIGN PROJECT		3. ADDITIONAL INVESTIGATORS INVOLVED?*
Theoretical Research and/or Innovative Design <input type="checkbox"/>		YES <input type="checkbox"/>
Practical and/or Simple Design <input type="checkbox"/>		NO <input type="checkbox"/>
4. ORIGIN OF DESIGN PROJECT (COURSE AND PROFESSOR WERE THE PAPER WAS FIRST PRESENTED)		
5. FULL NAME OF THE STUDENT (Additional copies of the 1 st page for each partner.)		6. MAJOR
7. ATTENDING UNIVERSITY		8. CLASS STANDING (LEVEL) FR <input type="checkbox"/> SO <input type="checkbox"/> JR <input type="checkbox"/> SR <input type="checkbox"/>
9. TELEPHONE NUMBER (include area code)	10. E-MAIL ADDRESS (if available)	
11. MAILING ADDRESS OF THE STUDENT.		
12. CITY	13. STATE (ABBREVIATE)	14. ZIP CODE
15. FULL NAME OF THE PROFESSOR THAT REVIEWED THE DESIGN PAPER		16. COLLEGE
17. TELEPHONE NUMBER OF THE PROFESSOR (include area code)		18. PROFESSOR'S E-MAIL ADDRESS

*Every principle investigator must fill out and sign an additional first page (attending faculty included) of the application form.

SECTION II. STUDENT CERTIFICATION	
I certify that I am the author of this design project, and the information contained in this submittal is the result of my efforts. Furthermore, I agree that the State retains an irrevocable license to reproduce, publish, and use in whole or in part, and authorize others to do so, any copyrightable material submitted under this application whether or not the material is copyrighted by me or another person(s).	
SIGNATURE	DATE

SECTION III. ATTENDING PROFESSOR CERTIFICATION	
I certify that I have reviewed the design project submitted by _____ and the work to my knowledge is original, and that the design project was used to fulfill the requirements of a course or independent study, or offered by the student for discussion. I also certify that the student is eligible to compete in the Michigan Green Chemistry Design Awards Competition.	
SIGNATURE	DATE

SECTION IV. PROJECT DESCRIPTION

1. DETAILED DESCRIPTION OF PROJECT

Provide a brief description of your design project. Include information about the purpose of the project, and the reduction, or elimination of waste from landfill disposal, or other releases to the environment. Limit the description to the space provide, one additional page can be used if needed, limiting your application to 3 pages or less. If your design project was for a company please allow the company to view your application, and any additional information prior to the submittal, and include a release letter signed by the company. (NOTE: Do not provide a copy of the complete project report.)

Goal:

Project Description:

Reduced/Eliminated Waste:

Mail completed form to: Michigan Green Chemistry Design Awards Competition, Mr. Jim Goodheart,
DELEG, Bureau of Energy Systems, P.O. Box 30221, Lansing, MI 48909



MICHIGAN DEPARTMENT OF ENERGY, LABOR & ECONOMIC GROWTH

Michigan Green Chemistry Design Awards Competition

JUDGE APPLICATION FORM

(Authority: Part 145, PA 451 of 1994, as amended. To be considered for an intern, completion of this application is required.)

Please print with black ink or type all information.

SECTION I. GENERAL INFORMATION		
1. FULL NAME OF THE APPLICANT		
2. JOB TITLE OF APPLICANT		
3. NAME OF THE UNIVERSITY OR BUSINESS OF APPLICANT		
4. MAILING ADDRESS OF THE APPLICANT		
5. MAILING ADDRESS OF THE APPLICANT.		
6. CITY	7. STATE (ABBREVIATE)	8. ZIP CODE
9. TELEPHONE NUMBER (include area code)	10. E-MAIL ADDRESS (if available)	

SECTION II. EDUCATION AND WORK EXPERIENCE
1. BRIEF DESCRIPTION OF EDUCATION AND PROFESSIONAL WORK EXPERIENCE (Please Attach Resume)

SECTION III. APPLICANT CERTIFICATION	
I certify that the information that I have provided on this page concerning my education and occupational work experience is accurate and true to my knowledge, and if selected to be a judge in the Michigan Green Chemistry Awards Competition I will be impartial in the performance of my activities as a judge.	
SIGNATURE	DATE

Mail completed form to: Michigan Green Chemistry Design Awards Competition, Mr. Jim Goodheart, DeLEG, Bureau of Energy Systems, PO Box 30221, Lansing, MI 48909