Clean Energy Fund Awards for Undergraduate and Graduate Researchers | FY 2018

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Office of Fellowships, Opportunities, & Undergraduate Research

In the Fall of 2016 the Office of Fellowships, Opportunities, & Undergraduate Research (formerly known as the Office of Undergraduate Research) responded to a request for proposal submission to use Clean Energy Funds and we were granted $100,000 to use over three years. The following explains both how we awarded **$44,226** directly to undergraduates during fiscal year 2018 and how we intend to utilize the remaining balance of the original grant to the Office.

As stated in our proposal, FOUR is positioned in a unique way to facilitate student access to CEF money. The Office supports research experiences that are available to all undergraduate students regardless of major by facilitating faculty-sponsored, student-driven research projects. We assist students at every step of the process from finding faculty, to navigating the university system of protocols and policies, helping students with grant writing, awarding grants, and accounting for the final expenditures.

In this second year of the CEF grant, we continued to use the office's existing programs (small awards during the academic year, travel awards to present at conferences, and large summer awards) and innovate a limited number of other funding opportunities.

FOUR Existing Awards

Mini Grants are awarded on a rolling basis to cover research expenses of usually no more than $1000 during the academic year. This year we awarded one Mini Grant:

- Skylar Bagdon, Mechanical Engineering (CEMS), First Year
    - Faculty mentor: Paul Hines (CEMS)
    - Project title: *Power Scavenging*
      Skylar's project involved developing a prototype of a personal ambulatory power generation device that would use small vibrations or heat to create energy. These devices would increase mobility of power generation for small-scale, low-draw devices (eg., lights or communication) His goal is to eventually create devices that will completely replace power sources based on fossil fuels.

Travel Awards fund students to present their work at a conference, competition, or trade show. These are especially important opportunities as it allows for the dissemination of their research, provides networking and professional development opportunities, and promotes the university. This year we co-funded one travel award to a graduating senior to present her Honors College

thesis research at the national gathering of the American Physical Society (APS) March Meeting 2018, in Los Angeles. As a significant sidebar, Renee was the co-President of the student wing of that national organization.

- Renee Beneski, Physics (CAS), Senior
    - Project Title: *Critical Films on Graphene Substrates*
    - Faculty mentor: Adrian del Maestro

  Renee presented her thesis research, which created a model for the behavior of graphene and theorized its potential to store energy better than conventional chemical batteries.

Summer Undergraduate Research Fellowships (SURF) allow students the opportunity to spend the entire summer focused on their research by providing stipends ($4000) and research expenses (up to $1000). In this year's competition seven students qualified as clean energy projects, and four were awarded:

- Annaliese Keimel, Environmental Engineering (CEMS), Junior

  Annaliese's project focused on portable, low-cost gas sensors that may be used to measure vehicle emissions and air quality. She worked in the Transportation Research Center.
    - Project title: *Low-Cost Portable Air Quality Sensor Quality Assurance and Validation*
    - Faculty mentor: Britt Holmén, Civil & Environmental Engineering (CEMS)
- Ben Page, Biomedical Engineering (CEMS), First Year

  Ben focused on laboratory prototypes of energy-efficient ways to remove contaminants from ground water.
    - Project title: *Synthesis and Characterization of Green Tea - Zero Valent Iron (GT-ZVI) for Ground Water Remediation*
    - Faculty mentor: Appala Raju Badireddy (CEMS)
- Hannah Turner, Environmental Science (RSENR), Sophomore

  Looking at carbon cycling and interactions of energy with the environment, Hannah utilized GIS to exam the afforestation of the Cuban landscape.
    - Project title: *Examining the Historical Drivers of Land-Use Change in Cuba*
    - Faculty mentor: Gillian Galford (RSENR)
- Hannah Weiss, Environmental Science (RSENR), Senior

  Hannah experimented with ways to stockpile snow through the summer months, which would allow the local ski industry to save a considerable amount of energy and money at the start of each ski year.
    - Project title: *Testing the Feasibility of Over-Summer Snow Storage at the Craftsbury Outdoors Center*
    - Faculty mentor: Paul Bierman, Geology (CAS)

Public Impact Research Awards saw the largest number of funding requests. Sixty-seven students applied through the program, which supports students who are taking unpaid/underpaid research internships. This is by far the area that shows the greatest need in terms of CEF funding. We awarded five students, but only two were able to accept the award (the others did not get their internships). The students were:

- Amanda Cole, Environmental Science (CAS), Junior

    - Her internship at the *Gund Institute for Environment* focused on fuel efficiency and climate change focused on agriculture research
- Eva Hoskins, Environmental Studies (RSENR), Senior
    - Working through community outreach with *Energy Action Network Vermont*, Eva looked at leverage points in the Vermont's energy system where improvements can be made in terms of efficiency and production.

New Funding Initiatives

As proposed, we sought to create new funding opportunities to directly support students who would otherwise not be able to take advantage of innovative faculty mentoring. This summer we funded three undergraduates to participate in a research internship at the National Renewable Energy Laboratory (NREL) in Boulder, Colorado. The three students were able to spend 12 weeks at NREL learning about industry standards for digital alloy films and solar cell fabrication. The students who benefitted from this funding were:

- Bin Du, Business Administration (GSB), Senior
- Ben Isengard, Physics (CAS), Junior
- Olivia Sergiovanni, Physics (CAS), Junior

Funding in the coming year

In this first year we have granted one-third of the total amount received from the Clean Energy Fund. Clearly the most requested funding has been from students looking to pay for summer research, which follows the norm of the Office's base budget for awards. We will continue to focus CEF funding on the existing awards structures, but wish to consider more innovative opportunities, like the one exemplified by the "collective" internship experience of the three students who spent the summer in Boulder. Some potential ideas for future CEF money may be:

- Sponsoring a research showcase of undergraduate clean energy projects;
- Research internships created with local government (town, city or state level);
- Transition funding for students as they graduate and wish to continue their research projects during a "gap" period between college and graduate school or career launch;
- Working in conjunction with other campus offices (eg., Office of International Education, the Global Gateway Program) to fund international research experiences for students who would then be competitively positioned to apply for national scholarships and fellowships (eg. Fulbright, or Udall).

Financial statement

The following table shows awards FOUR made using the Clean Energy Fund grant during FY17:

Clean Energy Fund
FOUR Statement of Activity
2016-2018 Award Years

Total original CEF award	$100,000
FY17 actuals	($32,289)

Total original remaining for FY18	67,711
FY18 Fellowships awarded:	
A. National Renewable Energy Laboratory (NREL) internships (total $16,950)	
Bin Du	($5650)
Ben Isengard	($5650)
Olivia Sergiobanni	($5650)
B. Public Impact Research Award (total $7100)	
Amanda Cole	($4000)
Eva Hoskins	($3100)
C. Travel Awards total: $2807	
Renee Beneski	($2807)
D. Mini Grants Total: $1000	
Skylar Bagdon	($1000)
E. Summer Undergraduate Research Fellowships (SURF) Total: $	
Annaliese Keimel	($3000)
Ben Page	($4070)
Hannah Turner	($4299)
Hannah Weiss	($5000)
AWARDED FY18 GRAND TOTAL	($44,226)
Expected FY19 balance	$23,485

Graduate College

In fall 2018, the Graduate College awarded two CEF awards after a strong outreach effort that yielded stronger proposals than in 2017.

Alex Neidermerier, Master's student in the Rubenstein School of Natural Resources
Expected Graduation August 2019

Project Title: Physanitation in the wood pellet supply chain: Leveraging value and managing pests in a changing climate in the United States Eastern Forests

Economic potential and international interest in renewable energy sources have elevated the profile and potential of bioenergy. Multiple feedstock sourcing and production methods exist to provide solid bioenergy materials for both residential heating and industrial electricity generation. Wood pellet feedstock includes trees that are unusable to other sectors of the timber industry due to destructive forest pests. When not used for bioenergy, these residues may be incinerated, buried, or otherwise disposed of to minimize risk to the local environment. The use

of diseased trees for wood pellet fabrication has been recognized as a potential opportunity for the industry. Life cycle analyses of the wood pellet industry have considered its potential merits and environmental risks, such as emission reductions, sustainability, ecosystem degradation, and soil disturbance. However, the phytosanitation risks (or, risks posed by the movement of pests) during the pre-treatment phase of the wood pellet feedstock supply chain remain unaddressed in eastern North America. This research seeks to review the literature to date that considers the potential for forest pest management by the wood pellet industry, the risk for pest dispersal in the pre-treatment pellet supply chain, and to identify the key challenges and gaps in the literature.

Project Title: Physanitation in the wood pellet supply chain: Leveraging value and managing pests in a changing climate in the United States Eastern Forests

Duration: 4 months
Award: $2,400
Faculty mentors: Dr. Kimberly Wallin and Dr. Cecilia Danks (RSENR)

Lindsey Barbieri, PhD student Environmental Science (RSENR)

Project Title: Monitoring Clean Energy and Sustainable Production Systems: Greenhouse Gas Emissions Measuring with Small Unmanned Aerial Systems (sUAS)

This project brings together two key – but as yet formally unrelated - innovative research initiatives at the University of Vermont: Barbieri's dissertation research, supported through a UVM Reach Grant (Improving Greenhouse Gas Emissions Measurements in Agricultural Systems using Unmanned Aerial Systems (sUAS)) and the BioGas Collaboration Working Group (BCWG) initiative supported by a Gund Catalyst Award - bringing together a research network of transdisciplinary people to collaborate on biogas energy production in Vermont. Leveraging both innovative research projects currently underway, this project proposes to bridge the two, and expand the sUAS GHG measurement platforms and techniques that have been developed by Barbieri et al. to extend these same technologies for enabling more advanced and targeted monitoring of energy production in Vermont in collaboration with the BCWG.

Duration: 1 year
Award: $24,590
Faculty mentors: Dr. Carol Adair and Jarlath O'Neil-Dunne (RSENR)

Clean Energy Fund
Graduate College Statement of Activity
2018 Award Year

Total original CEF award	$100,000
FY17 actuals	($40,408)
Total original remaining for FY18	$59,502
FY18 Awards:	

Alex Neidermeier	($2,400)
Lindsey Barbieri	($24,590)
AWARDED FY18 GRAND TOTAL	($26,990)
Expected FY19 balance	$32,602