NSF INCLUDES: Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science

DSU received one of the 27 NSF INCLUDES Awards of 2017
DSU NSF INCLUDES AWARD

NSF INCLUDES DDLP: Expanding Diversity in Energy and Environmental Sustainability (EDEES) through the creation of learning opportunities for minority students in the Mid-Atlantic region
Participants

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NSF two-year pilot program

Start 09/15/2017
End 09/14/2019
Goals

- To grow STEM enrollment at DSU by enrolling at least 20 underrepresented minority (URM) students in majors related to green energy and environmental sustainability.
- To establish a BS degree in Green Energy Engineering at DSU based on the existing academic and research infrastructure, the educational and research collaboration within the alliance, and the creation of new coursework in the fields of green energy and environmental sustainability.
- To strengthen the pathway from two-year energy-related associates degree programs to four-year degrees by ensuring at least 5 students/year transfer to DSU in energy-related STEM programs.
- To increase the number of high school graduates from underrepresented groups who choose to attend college in STEM majors.
Initial Network

DSU - Delaware State University
SBU - Stony Brook University
UD - University of Delaware
UM - University of Maryland,
USDA-ARS - US Department of Agriculture-Agriculture Research Service
NRL - United States Naval Research Laboratories
DTCCC - Delaware Technical Community College
ECHS - Early College High School
REEC - Renewable Energy Education Center
Main Initiatives

Initiative 1 (I1): Develop the research and education activities in the DSU Renewable Energy Education Center (REEC) and promote its integration with the NSF INCLUDES EDEES program to support and engage URM students as they move from middle and high school to a STEM major in the college and university, into graduate school and STEM-related careers.

Initiative 2 (I2): Develop DSU’s research and education programs in Alternative Energy and Environmental Sustainability including a research internship program that will engage undergraduate and graduate students in laboratory research at DSU and partner institutions.

Initiative 3 (I3): Promote careers in alternative energy and environmental sustainability.

Initiative 4 (I4): Build partnerships with high-minority K-12 schools through Energy-related outreach programs at DSU and Delaware Technical Community College (DTCC) that will engage high school students in green energy research and STEM education.

Initiative 5 (I5): Promote collaboration within and outside the Alliance.

Initiative 6 (I6): Conducting continuous evaluation and shared metrics to improve the project and set it on a path to long-term sustainability.

Initiative 7 (I7): Promote a transition to a 100% energy self-sustainable city of Dover, Delaware.
Initiative 1 (I1): Launch the research and education activities in the DSU REEC and promote its integration with the NSF INCLUDES EDEES program.
Research Partner of the Initial Alliance

UMD IMET
UMCES
PU DCEE
UD IEC
USDA -ARS
NRL
SBU MPI
SBU HPL
BNL
UD CEED

DPE QOL
DPE LMP
DPE PSSL
DoC BNL
DoC CEL

DPE QOL is connected to:
- AGNR
- DPE LMP
- DPE PSSL

DPE LMP is connected to:
- DPE QOL
- DPE PSSL
- DoC BNL

DPE PSSL is connected to:
- AGNR
- DPE LMP
- DoC CEL
The Research Alliance

DSU Internal Group

- DPE QOL – Quantum Optics Laboratory, Department of Physics and Engineering
- DPE LMP – Laboratory of Mineral Physics, Department of Physics and Engineering
- DPE PSSL – Photonic Sensor Laboratory, Department of Physics and Engineering
- DoC CEL – Clean Energy Laboratory, Department of Chemistry
- DoC BNL – Bionanotechnology and Biomedicine Laboratory, Department of Chemistry
- AGNR – Department of Agriculture and Natural Resources
Groups Currently in Collaboration with DSU Scientists

- UD CEED – University of Delaware Civil and Environmental Engineering Department.
- UD IEC - University of Delaware Institute of Energy Conservation
- UMCES - University of Maryland Center for Environmental Conservation
- UMD- IMET - Institute of Marine and Environmental Technology of the University of Maryland.
- PU DCEE - Center for Mid-Infrared Technologies for Health and Environment and the Department of Civil and Environmental Engineering of Princeton University.
- SBU MPI - Mineral Physics Institute of Stony Brook University.
- SBU HPL - High-Pressure Laboratory of the same University.
- BNL - Brookhaven National Laboratory.
- PU DCEE - Department of Civil and Environmental Engineering of Princeton University.
Initiative 2 (I2): Develop DSU’s research and education programs in Alternative Energy and Environmental Sustainability.
BS in Renewable Energy Engineering proposed

Semester 1
- General Physics I
- Calculus I
- Energy I
- English Com I
- General Chem. I

Semester 2
- General Physics II
- Calculus II
- Programming
- English Com II
- Univ. Seminar

Semester 3
- Green Energy Lab I
- General Chem. II
- Circuit Analysis
- Speech

Semester 4
- Green Energy Lab II
- Calculus III
- Technical Elec.
- Electronic Analysis

Semester 5
- Ing. Mechanics
- Signal and systems
- Thermal Physics
- Statistics
- Global Societies

Semester 6
- Fluid Mechanics
- Technical Elec.
- Power Systems
- Materials Science

Semester 7
- Climate Change
- Adv. Energy Lab
- Technical Elec.
- Technical Elec.
- Gen Ed. Elec.

Semester 8
- Technical Elec.
- Technical Elec.
- Energy Conversion
- Ethics
- Senior Project
Initiative 3 (I3): Promotion of careers in alternative energy and environmental sustainability:

Initiative 4 (I4): Building partnerships with DTCC and high-minority K-12 schools:
Visits to green energy labs and facilities
Mentoring Science fair projects
New green energy educational material
Training of science teachers on green energy
Summer research experience
Mentoring Science fair projects
New green energy educational material
Training of science teachers on green energy
General public conferences by leading scientists
K-12 students

DTTC AS Energy

2+2

DSU BS Green Energy

BS Alliance Institutions

Alliance Graduate Programs

Job Market
Initiative 5 (I5). Promoting collaboration within and outside the Alliance:
Initiative 6 (I6): Conducting continuous evaluation with shared metrics
EVALUATION PLAN
Input

- Delaware State University (DSU)
- DSU’s Renewable Energy Education Center (REEC)
- DSU Early College High School (ECHS) and other local high schools
- Delaware Technical & Community College (DTCC)
- Research partners (see Figure 3)

Activities

**K12 Education and Community Outreach**

- Summer workshops for K12 students and teachers
- Develop five new educational modules in Green Energy
- Community outreach events

**DSU Institutional and Research Alliance Capacity Building**

- Develop new degree program (BS GEE) at DSU
- Develop new courses in Green Energy
- Create articulation agreement for students to transfer into DSU in energy-related programs
- Faculty increase green energy and environmental sustainability collaborations
- Organize one Energy Fair per year

Outputs

- Five K12 students participate in five educational experiences per year
- Ten undergraduate students participate in lab/activity development
- Two teachers trained in content and pedagogical content knowledge per year
- Two community engagement events reaching twenty participants
- Outreach component of website and over twenty discussants
- At least forty participants in Energy Fair

- Six new courses on green energy developed and offered
- Five ECHS URM students enroll in green energy course(s)
- Ten undergraduate students participate in green energy capstone and research experiences per year
- Ten URM students declare GEE major in two years
- Five students transfer to DSU green energy programs
- Six new research collaborations
- Five new undergraduate research opportunities
Students demonstrate:
• Increased interest in green energy
• Increased STEM self-efficacy
• Increased scientific identity and belongingness
• Increased intent to persist in green energy and sustainability
• Increased civic engagement

Teachers demonstrate:
• Increased understanding of content related green energy
• Increased science teaching self-efficacy

Impacts:
• Greater number of people interested in careers related to green energy and environmental sustainability
• Higher representation of URM individuals in green energy and environmental engineering related graduate programs
• Higher representation of URM individuals in green energy and environmental engineering related employment
• Community engaged to work for a 100% green city of Dover, Delaware
• DSU establishes partnerships with URM-majority middle and high schools and strengthens partnership with DTCC.
• Research Alliance expands and provides more opportunities for students.
Initiative 7 (I7). Promotion of a 100% energy self-sustainable city of Dover, Delaware:

The EDEES program will promote the idea to achieve a 100% energy self-sustainable city for Dover, Delaware, by developing wind, solar, advanced energy storage systems, and biomass power plants. The technology to complete the transformation exists. Several cities in the world have already done so. The initiative will be a case-study for our senior GEE students as part of the capstone class. We will also publicize their ideas and solutions to encourage public discussions with the local community to promote the idea of 100% green Dover, and the EDEES website will feature an open debate about the initiative.