ND Energy

The kilo JOULE

2020 ANNUAL REPORT

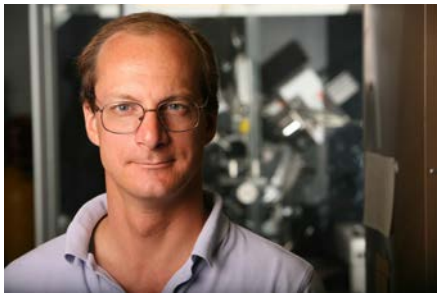
FIGHTING FOR SUSTAINABLE CLEAN ENERGY

UNIVERSITY OF NOTRE DAME | RESEARCH

Welcome

May 10, 2021

Dear Friends and Colleagues,



I write this letter with renewed hope that we will soon be returning to business-as-usual on campus and will, once again, be able to gather and partake in some much needed in-person discussion and networking. Although 2020 did not allow for “normal” interactions on campus, ND Energy, like so many other university entities, found various ways to continue offering its research services and educational programs either through virtual programming or by following University protocols for on-campus events.

Although we were confronted with many restrictions due to the coronavirus, we continued to advance the efforts of ND Energy towards accomplishing center goals. In fact, in 2020, we experienced the largest cohort of graduates in the energy studies minor since the program began in 2012. We also awarded the largest number of research grants to undergraduate students through the Vincent P. Slatt Fellowship for Undergraduate Research in Energy Systems and Processes since 2006. These small, yet important outcomes have made the challenges of the previous year easier to overcome.

As I reflect on 2020, there is no denying that as we battled the coronavirus, the world also experienced some of the worst climate disasters of our time. It is more critical than ever that we engage in discussions and discern a logical path forward as we work together to develop long-term energy solutions and ensure sustainable and resilient energy systems and infrastructures for generations to come throughout the world. Throughout the year, we held key events that enabled collaborative discussions and were useful in answering key questions related to energy and climate change. It is through these programs and other special events that we look forward to contributing further to the urgency to tackle climate change, reduce carbon emissions, and create a clean and sustainable energy future.

I hope you enjoy reading our annual report and learning more about ND Energy and its major accomplishments and initiatives throughout 2020.

I thank you for your continued support and wish you and yours the very best as we continue our fight against the coronavirus and climate change. I also welcome your comments and invite you to stop by my office as soon as we are back on campus safely. In the meantime, please do not hesitate to contact me or any member of my team, if you have questions or would like to know more about our programs and services.

Kindest regards,

Peter C. Burns
The Henry Massman Professor of Civil and Environmental Engineering and Earth Sciences
Director, Center for Sustainable Energy at Notre Dame (ND Energy)

ENABLING A SUSTAINABLE ENERGY FUTURE FOR ALL
ND Energy

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VISIT US AT

energy.nd.edu
mcf.nd.edu

This report covers calendar year 2020 and highlights the work of faculty affiliates, associated researchers, students, and other key partners, including metrics, news stories, and more.

Contents

Questions and comments may be directed to
Barbara Villarosa, Business and Communications Program Director, at bvillaro@nd.edu or
Ginger Sigmon, Managing Director, at gsigmon@nd.edu.

History, Mission, and Vision

The Center for Sustainable Energy at Notre Dame (ND Energy) is built upon the foundations laid by the Notre Dame Energy Center, a College of Engineering research center, founded in 2005, and the University-funded Strategic Research Investment (SRI), Sustainable Energy Initiative (SEI), founded in 2010. These two entities were integrated in 2011 to create ND Energy, a University research center, with a broad focus on energy-related research, education and outreach that spans all colleges/schools at Notre Dame.

The vision of the center is carried out by the leadership team under the auspices of Notre Dame Research, reporting directly to Robert Bernhard, Vice President for Research.

Center Leadership

ND Energy enables research, education, and outreach in support of energy-related scholarly initiatives and priorities at Notre Dame.

The center's strategic direction and financial sustainability are guided by Peter C. Burns, director of the center since 2014, in collaboration with other members of the leadership team and input from faculty affiliates, associated researchers, students, and key partners.

Center operations are directed by Ginger E. Sigmon and includes budgetary activities, marketing and communications, education and outreach, student fellowships, and research services. Research business development is led by Subhash L. Shinde and includes funding opportunities, proposal development, industry partnerships, external collaborations, research services, and the Materials Characterization Facility.

ND Energy relies on its strong relationships and ties with all colleges and schools at Notre Dame, focusing on building collaborations within and across departmental and college lines, centers and institutes, and groups and organizations with similar interests in creating a sustainable energy future for all.

Peter C. Burns
Director

Ginger E. Sigmon
Managing Director

Subhash L. Shinde
Associate Director

InterConnectedness

The interconnectedness of ND Energy enables easy access and fluidity for all constituents engaged in energy-related research and education. Maintaining a strategic focus on programs and services ensures we are meeting the needs of our community.

Essential to the growth of research at Notre Dame is research business development. This area focuses on broadening our energy research portfolio and providing state-of-the-art instrumentation and capabilities to support new research programs.

Education and outreach are essential elements to understanding our research environment. Undergraduate and graduate students and postdoctoral associates play an important role in translating research into meaningful interactions that demonstrate the relevance and impact of energy on today's society. The undergraduate minor in Energy Studies, available to all students, ensures a broad understanding of the various aspects of energy using a holistic approach for course requirements, preparing the next generation of energy leaders.

Marketing and communications are key to ensuring our constituents have a genuine knowledge and understanding of all that ND Energy has to offer, which includes sharing and celebrating major successes and key accomplishments.

Karl Cronberger
Electron Microprobe Technician

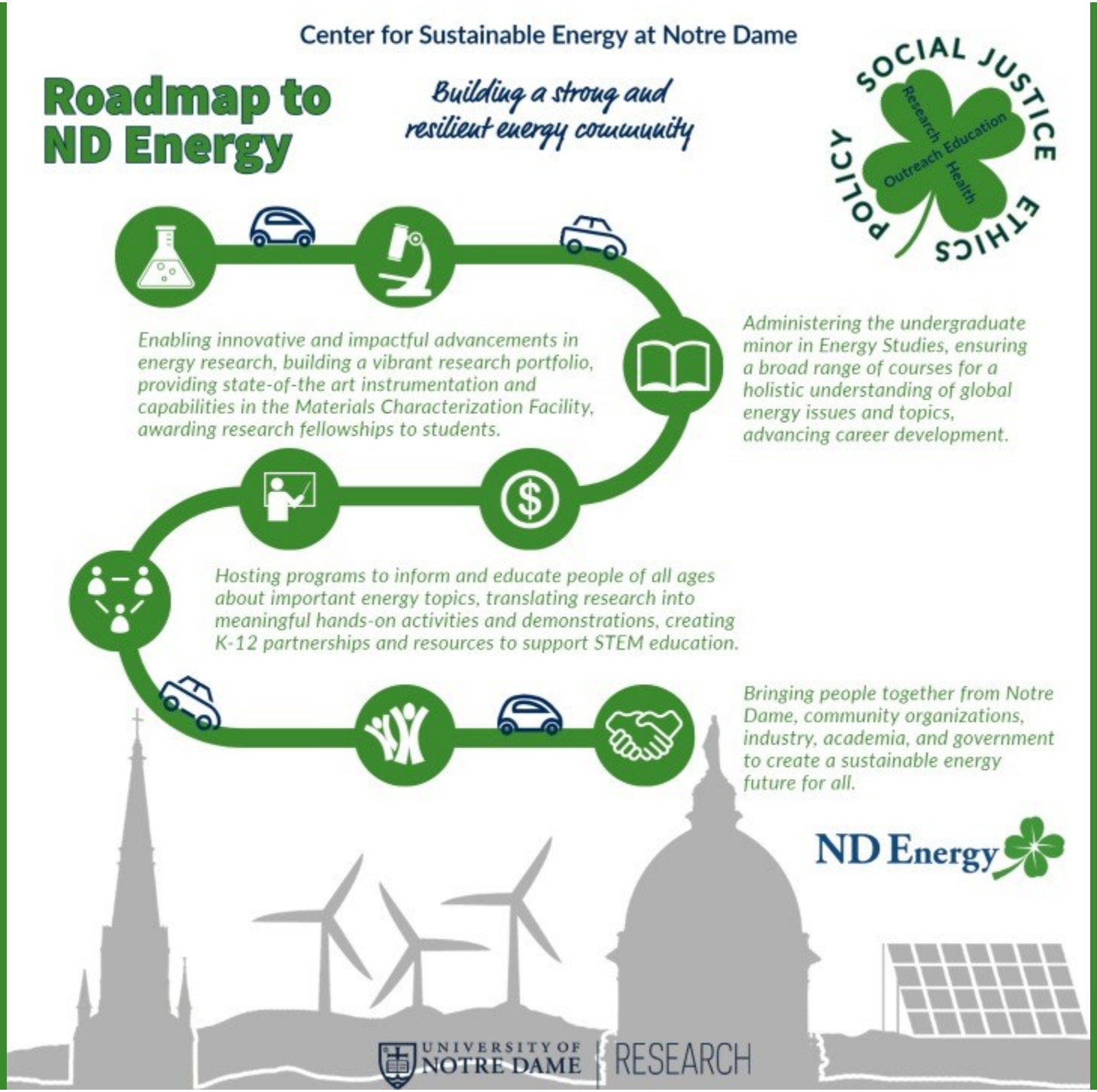
Koby Keck
Administrative Coordinator

Ian V. Lightcap
Research and Facilities Program Director

Anna Matzner
Laboratory Specialist

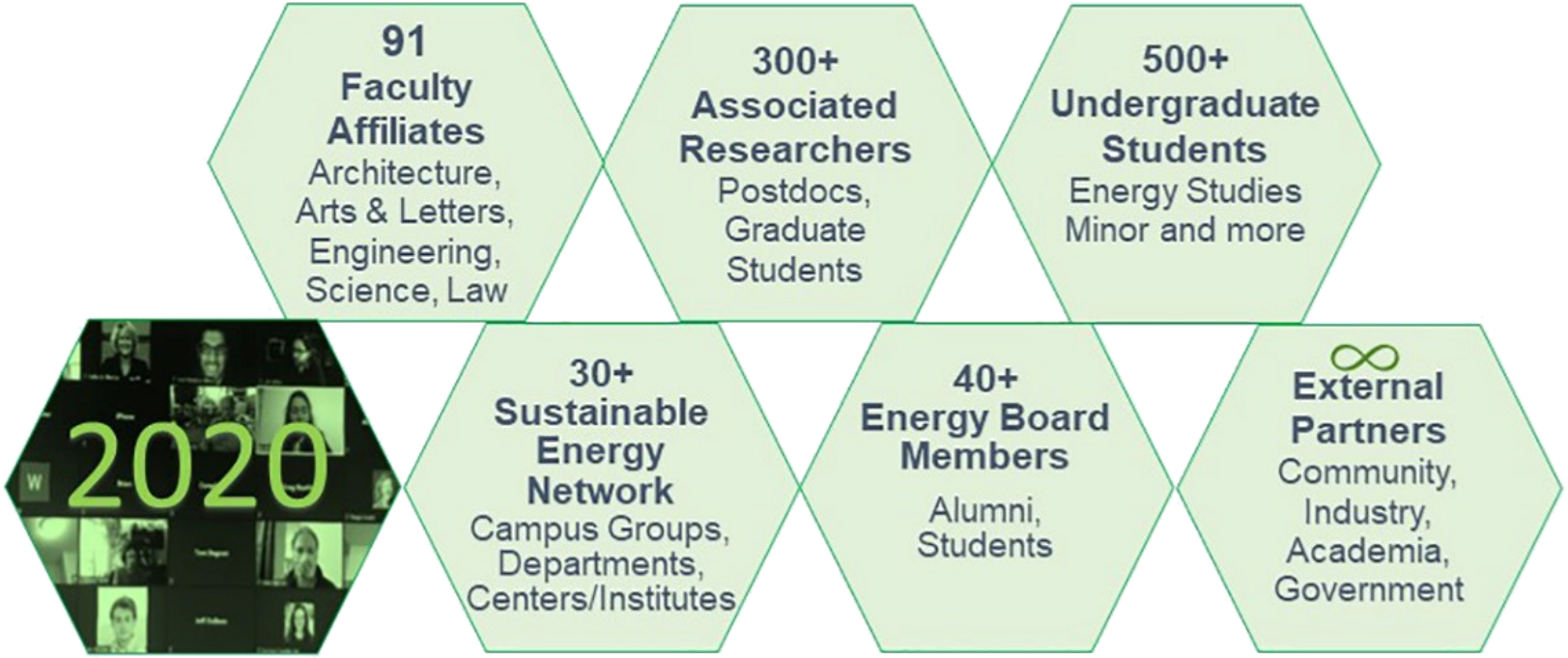
Anne Berges Pillai
Education and Outreach Associate Program Director

Barbara Villarosa
Business and Communications Program Director



Navigating the roadmap to ND Energy allows faculty, students, staff, and global partners to experience a full menu of programs, services, and research opportunities designed to enable a stronger, more resilient community of energy experts, leaders, and advocates who are committed to creating a clean energy future for generations to come.

Building Community



Creating a community of energy-interested partners is the foundation of ND Energy.

There is no doubt 2020 brought many new challenges as well as opportunities due to COVID-19. Continuing regular interactions across campus and beyond was no exception. Thanks to Zoom and other online platforms, with the help of staff in the Office of Information Technology, it did not take long before ND Energy and the rest of campus regained a sense of “business-as-usual” virtually. This new way of interacting enabled many new collaborations as educational programs were held virtually with speakers and attendees participating from across the globe.

Building strong relationships and a community of energy-interested partners continues to be a major focus for ND Energy. Successful research programs and other scholarly endeavors rely on community engagements and focused discussions to enrich our knowledge and help shape the future of energy.

Faculty Affiliates

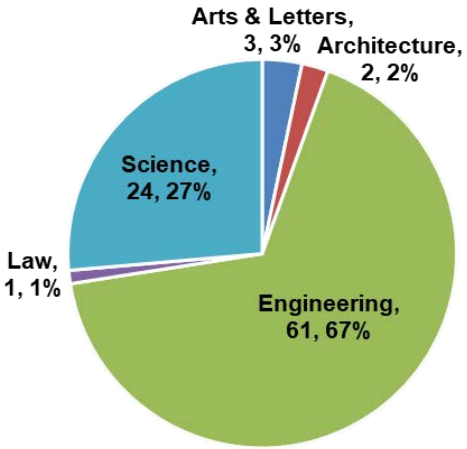
Notre Dame faculty affiliates are key members of the ND Energy community. Their research expertise and scholarly initiatives strengthen the education of our students and support major advancements in energy systems, new technologies, and sustainable infrastructures.

There are currently 91 faculty members affiliated with ND Energy, representing 5 colleges and schools: College of Arts & Letters, College of Engineering, College of Science, Notre Dame Law School, and School of Architecture. The majority of faculty are in the Colleges of Engineering and Science.

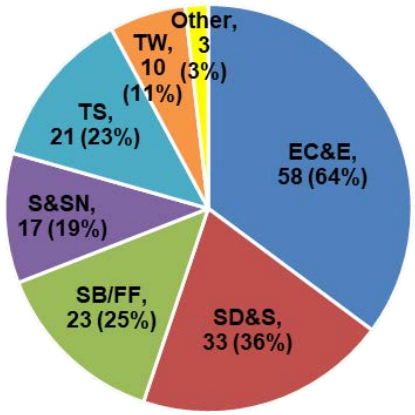
This year, ND Energy welcomed five new faculty affiliates. All affiliates and their profiles can be viewed at: energy.nd.edu/about/affiliated-faculty/.

The charts below show the number of faculty by college/school and the number of faculty with research expertise in each of ND Energy's major themes.

Faculty by College/School



Faculty by Research Theme



Research Themes

EC&C	Energy Conversion and Efficiency	TS	Transformative Solar
SD&S	Smart Distribution and Storage	TW	Transformative Wind
SB/FF	Sustainable Bio/Fossil Fuels	Other	Energy Economics, Law, and Politics
S&SN	Sustainable and Secure Nuclear		

New Faculty Affiliates in 2020

Albert Cerrone

Melchor Visiting Assistant Professor, Civil and Environmental Engineering and Earth Sciences

Interests:

Energy Conversion and Efficiency

Yazen Khasawneh

Associate Teaching Professor, Civil and Environmental Engineering and Earth Sciences

Interests:

Transformative Wind

Edward Kinzel

Associate Professor, Aerospace and Mechanical Engineering

Interests:

Energy Conversion and Efficiency, Transformative Solar

Sergey Leonov

Research Professor, Aerospace and Mechanical Engineering

Interests:

Energy Conversion and Efficiency, Transformative Wind

Paul Rumbach

Assistant Teaching Professor, Aerospace and Mechanical Engineering

Interests:

Energy Conversion and Efficiency

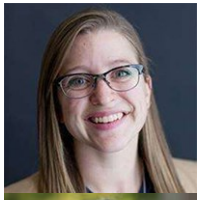
Associated Researchers

Postdoctoral associates and graduate students meet monthly to present their research projects and network to foster new relationships and cross-disciplinary research collaborations.

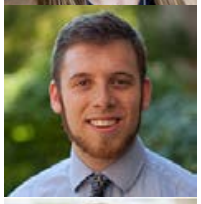
January 15:
Hrafn Traustason, fourth-year graduate student advised by Prof. Peter Burns in the Department of Chemistry and Biochemistry, presented, *Designing New Methodologies in Calorimetry to Define the Energy*

January 15:
Patricia Huestis, fifth-year graduate student advised by Prof. Jay LaVerne in the Radiation Laboratory, presented, *Identification and γ-Radiolysis of Thermal Transition Phases in Boehmite.*

February 19:
Graduate students Jerry Crum (Schneider lab), Zihan Huang (Guo lab), and Jessica Muhlenkamp (Hicks lab) from the Department of Chemical and Biomolecular Engineering, presented, *CISTAR: Responsibly Realizing the Potential of Shale Gas Resources*.



September 16:
Nicole (Moore) DiBlasi, fifth-year graduate student advised by Prof. Amy E. Hixon in the Department of Civil and Environmental Engineering and Earth Sciences, presented, *Plutonium-EDTA: Solubility, Redox Behavior, and Aqueous Speciation*.



October 20:
Hunter Ford, fifth-year graduate student advised by Prof. Jennifer Schaefer in the Department of Chemical and Biomolecular Engineering, presented, *Understanding the Interplay of Polymer Chemistry and Morphology on Polysulfide Transport in Metal-Sulfur Rechargeable Batteries*.

October 20:
Ilia Pavlovetc, fifth-year graduate student advised by Prof. Masaru (Ken) Kuno in the Department of Chemistry and Biochemistry, presented, *Suppressing Cation Migration in Hybrid Perovskites*.

November 18:
Jeffrey DuBose, fourth-year graduate student advised by Prof. Prashant Kamat in the Department of Chemistry and Biochemistry, presented, *TiO2 -Assisted Halide Ion Segregation in Mixed Halide Perovskite Films*.

Student Energy Board

The Student Energy Board is comprised of undergraduate students from all majors who are interested in advancing ND Energy's mission through service, leadership, and advocacy. Members serve a one-year term and are instrumental in developing K-12 outreach programs and planning the annual Notre Dame Energy Week.

Alumni Energy Board

The Alumni Energy Board is comprised of energy-interested alumni who serve on the College of Engineering Advisory Council. Members provide advice and counsel on ND Energy's strategic initiatives.

Anthony F. Earley, Jr.

Edward B. Fitzpatrick, Jr.

John M. Kelly, Jr.

Michael A. O'Sullivan

Robert N. Schleckser

Richard L. Stanley

Sustainable Energy Network

The Sustainable Energy Network is comprised of representatives from campus departments, centers/institutes, and student clubs and organizations with similar interests in topics surrounding energy and the environment. Members connect to share events and collaborate on relevant activities and more.

External Partners

ND Energy has cultivated and developed many new partnerships and collaborations within industry, national laboratories, and other organizations that have strengthened and enabled additional research proposals and opportunities for students.

Edward B. Fitzpatrick, Jr. ('54 Civil Engineering), friend and long-time supporter of ND Energy, passed away on February 21, 2021 in Bayville, New York (engineering.nd.edu/news/in-memoriam-edward-b-fitzpatrick-jr/). Our sincere condolences and deepest sympathy to the Fitzpatrick family.

Research Areas

ND Energy faculty affiliates and associated researchers focus their energy-related research in one or more of the following major research areas. These broad themes represent the expertise of faculty and enable multidisciplinary and cross-cutting research collaborations. Below is a summary of the number of faculty experts in each area and the number and total amount of external awards received in 2020. Please note this does not include the faculty affiliates with expertise in energy economics, energy law, and energy politics.

Energy Conversion and Efficiency (EC&E)

Subcategories
Building Energy, Catalysis, Conversion of Energy, Fuel Cells, Hydrogen, Solar to Fuels/Chemicals

58
Faculty Experts

28 $6,145,654
Awards and $ Amount

Sustainable and Secure Nuclear (S&SN)

Subcategories
Actinide Materials, Nuclear Forensics, Nuclear Physics, Nuclear Structures

17
Faculty Experts

8 $3,494,794
Awards and $ Amount

Smart Distribution and Storage (SD&S)

Subcategories
Hydrogen Storage, Smart Grid Technology, Energy Storage

33
Faculty Experts

11 $1,536,049
Awards and $ Amount

Transformative Solar (TS)

Subcategories
Solar Photovoltaics, Solar to Fuels/ Chemicals, Energy Conversion Efficiencies

21
Faculty Experts

1 $181,440
Awards and $ Amount

Sustainable Bio/Fossil Fuels (SBFF)

Subcategories
Biofuels, Carbon Sequestration, Fossil Fuels

23
Faculty Experts

4 $767,951
Awards and $ Amount

Transformative Wind (TW)

Subcategories
Structures, Turbines, Wind Engineering

10
Faculty Experts

3 $353,133
Awards and $ Amount

55 Awards Totaling $12.5M in Energy Research

Research Business Development

ND Energy provides consultation, research services, and programs to meet the research needs of faculty and the educational and career goals of students. Team members assist faculty with proposal preparation, project management, broader impacts, and other key areas to strengthen proposal submissions and aid in the completion of research goals. In many cases, this also includes team building and developing external collaborations with national laboratories, industry, and academia. The Materials Characterization Facility (MCF) provides comprehensive materials analysis and technical expertise for researchers at Notre Dame and beyond. Research and other scholarly initiatives are further supported and advanced through undergraduate and graduate student research fellowships.

The following information summarizes these activities in numbers, charts, and other key metrics.

2020 Awards

Faculty affiliates received 55 externally funded awards totaling $12.5M with nearly $8.9M (71%) affiliated with ND Energy. Of these awards, 29 were new projects starting in 2020, totaling more than $6M.

55 TOTAL AWARDS
$12,479,021
71%AFFILIATED
$8,877,579

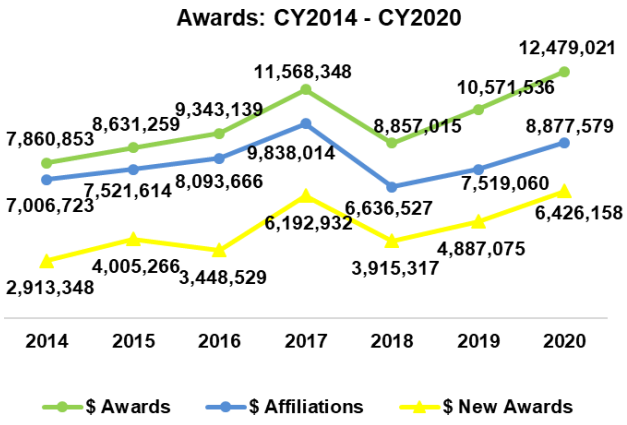
29 NEW AWARDS
$6,426,158 TOTAL AMOUNT

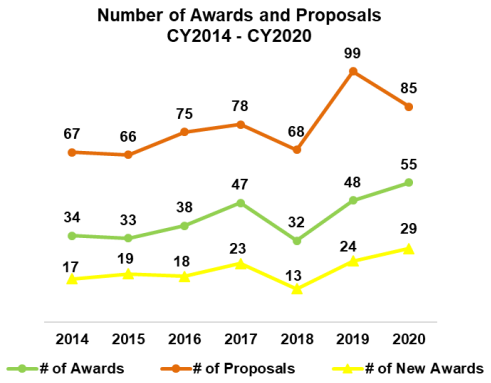
2020 Proposals

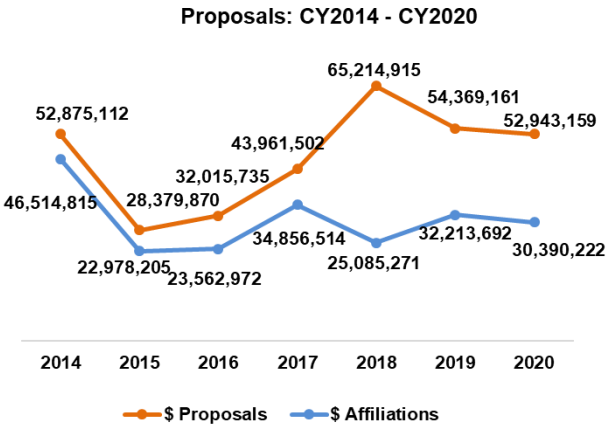
Faculty affiliates submitted 85 proposals totaling $52.9M with nearly $30.4M (57%) affiliated with ND Energy.

85 TOTAL PROPOSALS
$52,943,159
57% AFFILIATED
$30,390,222

NOTE: Awards and proposals affiliated with ND Energy are designated by the lead PI as attributable to energy-related research. This designation is optional and can be assigned to more than one center/institute.

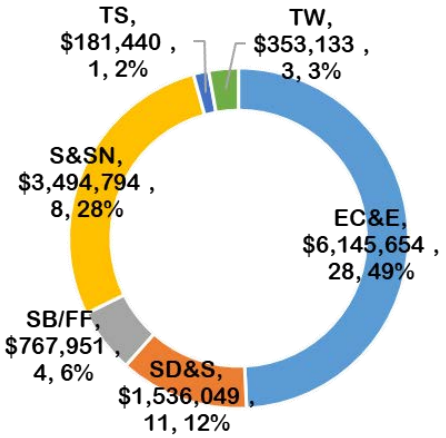






This shows a steady rise in awards since 2018 with a slight decline in proposals. Most fluctuations are due to changes in research and development priorities set by government funding agencies.

Total Number of Awards and Amount by Research Theme



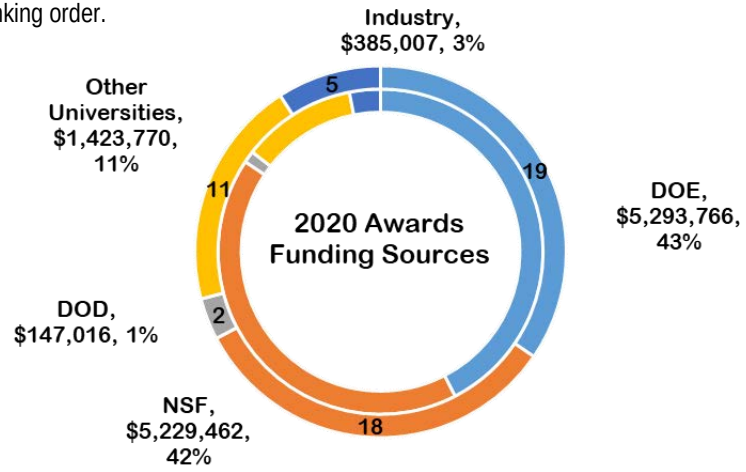
EC&E = Energy Conversion and Efficiency
SD&S = Smart Distribution and Storage
SB/FF = Sustainable Bio/Fossil Fuels
S&SN = Sustainable and Secure Nuclear
TS = Transformative Solar
TW = Transformative Wind

55 Awards
$12.5M

Funding Sources

The primary sources of external funding and the total number and amount of awards from each source are shown here, along with a list in ranking order.

U.S. Department of Energy (DOE) 19 awards $5.3M
National Science Foundation (NSF) 18 awards $5.2M
Other Universities 11 awards $1.4M
Industry 5 awards $385K
U.S. Department of Defense 2 award $147K



Research Publications

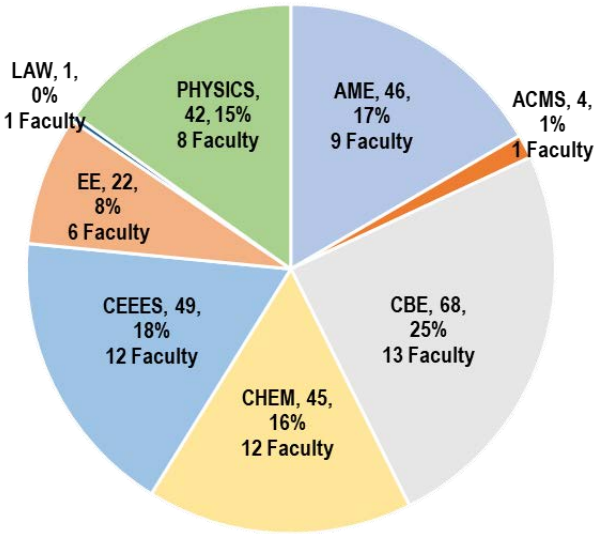
Sixty-two (62) faculty affiliates reported having energy-related publications in 2020. Seven (7) faculty affiliates listed below have published 10 or more journal articles, representing 34% of the total number of 277 publications reported in 2020. Since 2014, faculty affiliates have published 1,682 energy-related journal articles.

7 Faculty with 10+ Publications		
Luo, Tengfei	AME	20
Kamat, Prashant	CHEM, CBE	16
Burns, Peter	CEEES, CHEM	13
LoSecco, John	PHYSICS	12
Fernando, Harindra	CEEES	11
Maginn, Edward	CBE	11
Ptasinska, Sylwia	PHYSICS	11

Of the 277 journal articles reported in 2020, 12 were published in collaboration with other faculty affiliates, resulting in a net total of 265 unique publications.

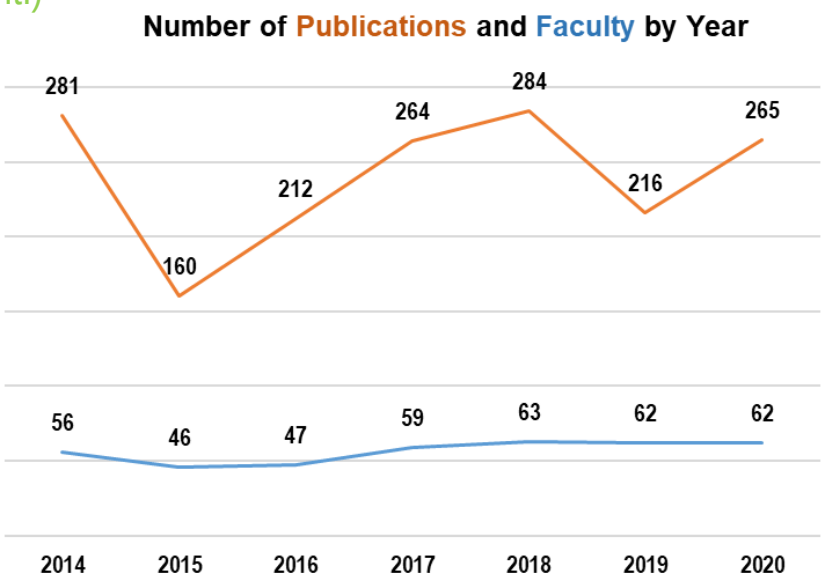
As shown, departments with the highest number of publications were Chemical and Biomolecular Engineering (CBE, 68), Civil and Environmental Engineering and Earth Sciences (CEEES, 49), Aerospace and Mechanical Engineering (AME, 46), Chemistry and Biochemistry (CHEM, 45), Physics (42), and Electrical Engineering (EE, 22). Faculty in Applied and Computational Mathematics and Statistics and Law were also contributing departments.

2020 Journal Articles by Department



Research Publications (cont.)

The total number of publications and faculty affiliates from 2014 to 2020 are highlighted here. There was a 23% increase in the number of energy-related publications from the previous year, while the number of faculty affiliates remained the same.



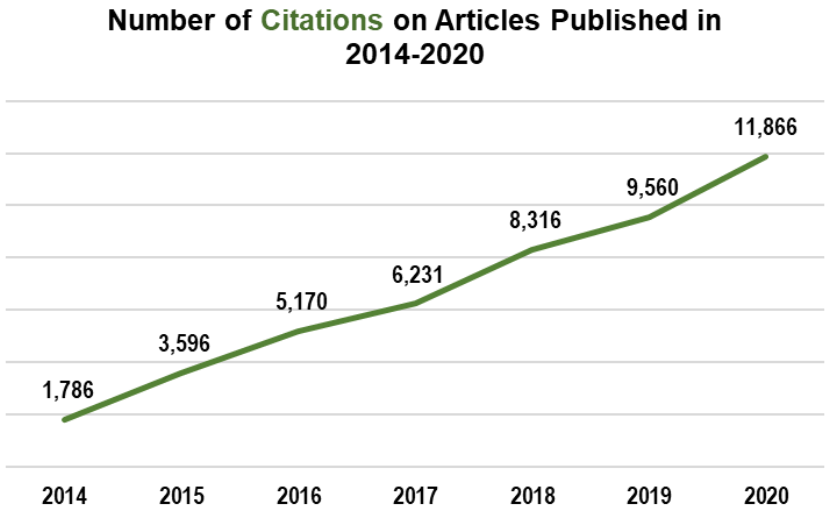
2014-20
1,682
Pubs

Citations

The total number of citations on energy-related journal articles published from 2014 through 2020 are highlighted here. This chart represents an increase each year in citations with the largest increase of 24% in 2020 from the previous year. There were 24 faculty with total citations of 100 or more in 2020 and are highlighted below in ranking order.

24 Faculty with 100+ Citations in 2020

PI	No.	PI	No.
Kamat, Prashant	2114	Hartland, Gregory	183
Schneider, William	1060	Nerenberg, Robert	181
Kuno, Masaru (Ken)	945	Gao, Haifeng	179
Luo, Tengfei	738	Phillip, William	179
Guo, Ruilan	418	Bohn, Paul	143
Burns, Peter	348	Ptasinska, Sylwia	136
Hicks, Jason	336	Camden, Jon	121
Go, David	285	LoSecco, John	117
Mukasyan, Alexander	274	Corcelli, Steven	110
Datta, Suman	264	Wiest, Olaf	107
Fay, Patrick	210	Whitmer, Jonathan	104
Maginn, Edward	203	Gupta, Vijay	103



2014-20
46,525
Citations

2020 AWARDS

Lead PI	Dept	Project Title	Theme	Sponsor	Increment Amount
Ashfeld, Brandon	CHEM	Low Temperature and Low Emission Water Desalination Using Ionic Liquids	EC&E	National Science Foundation (NSF)	$330,000
Brown, Seth	CHEM	Accessing and Tuning the Reactivity of Late-Metal Oxo and Nitrido Complexes Using Iminoxolene Supporting Ligands	EC&E	National Science Foundation (NSF)	$490,000
Burns, Peter C.	CEEES	Actinide Center of Excellence (ACE)	S&SN	National Nuclear Security Administration	$2,549,860
Burns, Peter C.	CEEES	Topological Structural Relationships, Properties, and Nano-structures	S&SN	Department of Energy	$93,298
Degnan, Thomas F.	CBE	Engineering Research Center for Innovative and Strategic Transformation of Alkane Resources - CISTAR	EC&E	Purdue University	$502,366
Dowling, Alexander	CBE	University of Notre Dame Subcontract for Carbon Capture Simulation for Industrial Impact (CCSI2)	EC&E	Lawrence Berkeley National Laboratory (LBNL)	$90,053
Dowling, Alexander	CBE	Design and Optimization Infrastructure for Tightly Coupled Hybrid Systems	EC&E	Lawrence Berkeley National Laboratory (LBNL)	$75,000
Dowling, Alexander	CBE	Multiscale modeling for reactor design and optimization	S&SN	Purdue University	$32,850
Dowling, Alexander	CBE	Institute for Design of Advanced Energy Systems (IDAES)	EC&E	Lawrence Berkeley National Laboratory (LBNL)	$31,135
Fay, Patrick John	EE	20-kV GaN Switch Technology Demonstrated in High-Efficiency Medium-Voltage Building Block	SD&S	Virginia Polytechnic Institute and State University	$150,000
Gao, Haifeng	CHEM	Collaborative Research: Design a New Polymer Platform for Engineering Fast and Selective Molecular Transport in Membranes	EC&E	National Science Foundation (NSF)	$474,677
Go, David Batten	AME	Plasma-Enhanced Catalysis: A Detailed Study of Surface Interactions Between Low-Temperature Plasma and Catalytic Materials	EC&E	Department of the Air Force	$50,112
Guo, Ruilan	CBE	Regulating Gas Transport in Molecularly Engineered Polymer Membranes	EC&E	Department of Energy	$145,003
Gupta, Vijay	EE	AI Institute: Planning: AI-enabled Secure and Responsive Smart Manufacturing	SD&S	National Science Foundation (NSF)	$500,000
Gupta, Vijay	EE	CDS&E: Collaborative Research: Fast Numerical Simulations of Low Void Fraction Disperse Multiphase Systems using Event-Triggered Communication	SD&S	National Science Foundation (NSF)	$270,000
Gupta, Vijay	EE	RAPID: Collaborative Research: Optimal design and placement of social distancing policies for US's return to normal after COVID-19	SD&S	National Science Foundation (NSF)	$100,000
Gupta, Vijay	EE	Distributed learning and controller design for assured autonomy	SD&S	DARPA	$96,904
Hicks, Jason C.	CBE	Process Intensification by a One-Step, Plasma-Assisted Synthesis of Liquid Chemicals from Light Hydrocarbons	EC&E	Department of Energy	$331,464
Hixon, Amy	CEEES	CAREER: Molecular-Scale Behavior of Actinide Elements at the Mineral-Water Interface	S&SN	National Science Foundation (NSF)	$286,328
Hixon, Amy	CEEES	Understanding the Chemical Complexity of Multi-Component Systems: Uranium Polyoxometalates as Nanosorbents	S&SN	Department of Energy	$152,570
Hixon, Amy	CEEES	Oak Ridge National Laboratory Fuel Cycle Science Fellowship (ORNL-FCSF) Program	S&SN	Oak Ridge National Laboratory	$50,000

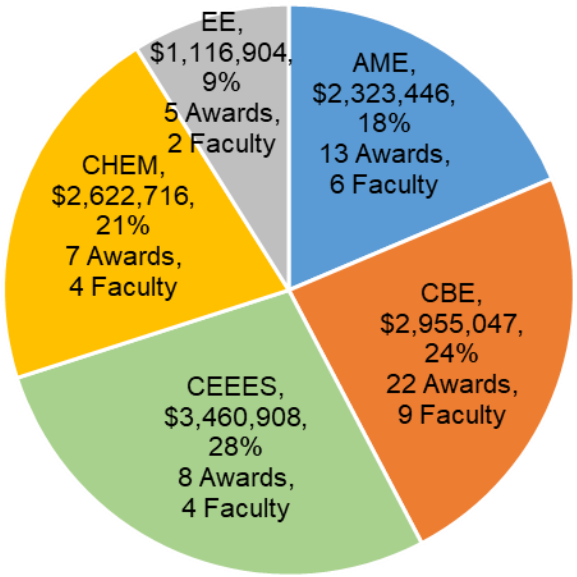
2020 AWARDS

Lead PI	Dept	Project Title	Theme	Sponsor	Increment Amount
Kuno, Masaru K.	CHEM	Realizing robust superfluorescence from nanocrystal superlattices	EC&E	National Science Foundation (NSF)	$500,877
Kuno, Masaru K.	CHEM	Mid-infrared intraband and localized surface plasmon resonance spectroscopies of doped semiconductor nanocrystals	EC&E	National Science Foundation (NSF)	$480,000
Kuno, Masaru K.	CHEM	Probing local, hybrid perovskite photophysics through spatially- and temporally-resolved absorption/emission microscopy	TS	Department of Energy	$181,440
Kuno, Masaru K.	CHEM	Multidisciplinary Approaches to Radiation Balanced LasErs (MARBLE): Rare Earths and Semiconductors in Disks, Fibers, and Microstructures	EC&E	University of New Mexico	$165,722
Leonov, Sergey	AME	Waves of Electric Charge Generated by Pulse Corona of Alternating Polarity	SD&S	Department of Energy	$72,087
Luo, Tengfei	AME	Optimizing Additive Manufacturing of Thermoelectric Materials using Bayesian Optimization-Enhanced Transfer Learning	EC&E	Department of Energy	$542,114
Luo, Tengfei	AME	Collaborative Research: Understanding the Synergistic Effect of Graphene Plasmonics and Nanoscale Spatial Confinement on Solar-Driven Water Phase Change	EC&E	National Science Foundation (NSF)	$210,000
Luo, Tengfei	AME	Leveraging a New Theoretical Paradigm to Enhance Interfacial Thermal Transport In Wide Bandgap Power Electronics	EC&E	Georgia Institute of Technology	$205,000
Luo, Tengfei	AME	Collaborative Research: Chemically Modified, Plasma-Nanoengineered Graphene Nanopetals for Spontaneous, Self-Powered and Efficient Oil Contamination Remediation	SB/FF	National Science Foundation (NSF)	$200,000
Luo, Tengfei	AME	EAGER: Collaborative Research: Dynamics of Nanoparticles in Light-Excited Supercavitation	EC&E	National Science Foundation (NSF)	$164,992
Luo, Tengfei	AME	Collaborative Research: Using molecular functionalization to tune nanoscale interfacial energy and momentum transport	EC&E	National Science Foundation (NSF)	$36,008
Maginn, Edward	CBE	Molten Salts in Extreme Environments	EC&E	Brookhaven National Laboratory (BNL)	$312,738
Maginn, Edward	CBE	Breakthrough Electrolytes for Energy Storage (BEES)	SD&S	Case Western Reserve University	$169,625
Maginn, Edward	CBE	EFRI DCheM Proposal: Next-generation Low Global Warming Refrigerants	EC&E	University of Kansas	$88,318
Myung, Nosang	CBE	Development of Energy Conversion/Storage Device using Flexible Solid State Piezoelectrolyte	SD&S	University of California, Riverside	$75,723
Nerenberg, Robert	CEEES	Wastewater Management Studies for ECOM Wet Mills	EC&E	ECOM Agroindustrial Corp. Ltd	$110,007
Sakaue, Hirotaka	AME	Collaborative Research: Ice melting-induced flows by an adjacent heated immiscible liquid layer	TW	National Science Foundation (NSF)	$238,133
Sakaue, Hirotaka	AME	Simulation of Supercooled Droplet Icing using Luminescent Imaging	TW	ANSYS Inc.	$65,000
Sakaue, Hirotaka	AME	Establishment of flow control technology using microfiber coating	TW	Tanaka Ai America, Inc.	$50,000
Schaefer, Jennifer L.	CBE	CAREER: Fundamental materials studies on fast ion diffusion in model side-chain ionomers	SD&S	National Science Foundation (NSF)	$101,710

2020 AWARDS

Lead PI	Dept	Project Title	Theme	Sponsor	Increment Amount
Schneider, William	CBE	Develop working plan for collaborative, computational research in NOx SCR catalysis	EC&E	BASF	$160,000
Schneider, William	CBE	CISTAR Summer Salary Supplement from Purdue Industry Funds	EC&E	Purdue University	$34,166
Schneider, William	CBE	GOALI: Multiscale Design of Zeolite Sites for Precise Catalytic Transformations	EC&E	National Science Foundation (NSF)	$308,923
Schneider, William	CBE	Coordinated Interrogation and Modeling in Ammonia Oxidation Catalysis	EC&E	Department of Energy	$248,159
Thrall, Ashley	CEEES	Additive Manufacturing of Reinforced Concrete Structures with Integrated Energy Efficiency	EC&E	Department of Energy	$218,845
Whitmer, Jonathan	CBE	Whitmer MICCoM Subcontract - SSAGES and COPSS Packages	EC&E	Argonne National Laboratory	$150,000
Whitmer, Jonathan	CBE	CAREER: Targeting Assembly in Colloidal Materials by Tilting the Free Energy Surface	EC&E	National Science Foundation (NSF)	$97,814
Yoon, Sangpil	AME	CAREER: The next generation intracellular delivery device for immunotherapy: The integration between ultrasonic transducer and microfluidic chip (UXuChip)	EC&E	National Science Foundation (NSF)	$440,000
Zhang, Yanliang	AME	Gradient Coatings for Molten Salt Corrosion Under Radiation Field	S&SN	Idaho National Laboratory	$50,000

Total Number and Amount by Department
Total Number of Faculty



$12,479,021

55 Awards

25 Lead Faculty

5 Departments

Aerospace and Mechanical Engineering (AME)
Chemical and Biomolecular Engineering (CBE)
Civil and Environmental Engineering and Earth Sciences (CEEES)
Chemistry and Biochemistry (CHEM)
Electrical Engineering (EE)

2 Colleges

College of Engineering
College of Science

Undergraduate Research Fellowships

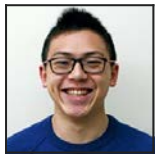
The Vincent P. Slatt Fellowship for Undergraduate Research in Energy Systems and Processes

There is no doubt 2020 presented many new challenges due to COVID-19, yet amidst the interruptions of business-as-usual, ND Energy continued to provide support for research programs and additional opportunities for undergraduate students to contribute to the advancement of energy-related research at Notre Dame. Not only did we offer the annual call for the Vincent P. Slatt Fellowship for Undergraduate Research in Energy Systems and Processes, but there were two additional calls for Slatt awards. One occurred in the fall when laboratories were starting to reopen. This allowed faculty and undergraduate students to collaborate in ways that would help bring research programs back to a steady state. The other occurred during the newly created Winter Session, allowing faculty and undergraduate students to once again collaborate on projects that would contribute to advancing research and the education of students during this unique time period.

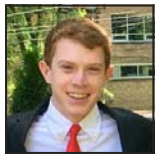
Given these new opportunities, 2020 experienced the largest cohort of 38 Slatt scholars since the program began in 2006. The following pages highlight Slatt recipients, their research projects, and the distribution of funds, which totaled $116,727.

Annual 2020 Vincent P. Slatt Scholars

Austin Booth is a sophomore chemical engineering major and energy studies minor. His project, "Development of an Operando Spectroscopic Tool for Studying the Structure and Dynamics of Membranes in Complex Environments" is in collaboration with Prof. Casey O'Brien.



Yi-Chung (Andrew) Chen is a junior majoring in aerospace and mechanical engineering. His project, “Determining the Effect of Microfibers for Drag Reduction in Fluid Flows” is in collaboration with Prof. Hirotaka Sakaue.



Peter Halloran is a sophomore science-business major and economics minor. His project, "Investigation of the Fast Pyrolysis of Lignocellulosic Biomass to Increase Bio-Oil Yield" is in collaboration with Prof. Jason Hicks.

Andrew Scott Manning is a sophomore chemical engineering major. His project, "Engineering and Characterizing Porous Polymer Morphology for Lithium-Sulfur Batteries" is in collaboration with Prof. Jennifer Schaefer.

Daniel Palmer is a junior majoring in physics. His project, "Studying Conduction of Nematic Liquid Crystals" is in collaboration with Prof. Jonathan Whitmer.

Kimberly Riordan is a junior majoring in chemistry. Her project, “Synthesis and Electrochemical Studies of T-shaped Sulfur Radicals” is in collaboration with Prof. Emily Tsui.

Matthew Riss is a junior environmental engineering major and Chinese minor. His project, "Synthesis, Characterization, and Thermodynamic Properties of a Suite of Thorium Nitrate Salts" is in collaboration with Prof. Amy Hixon.

Andrew Smith is a junior majoring in chemistry and biochemistry. His project, "Preparation and Analysis of Photoswitchable Ionic Liquids" is in collaboration with Prof. Brandon Ashfeld.

8 Awards
$37,500

Fall 2020 Vincent P. Slatt Scholars

Thomas Coates, sophomore in computer science and engineering, is collaborating with Prof. Sergey Leonov on nanosecond resolution camera imaging of a single-pin streamer electric discharge.

Hannah Collins, a junior in chemistry with a minor in energy studies, is conducting a fundamental materials studies on fast ion diffusion in model side-chain ionomers under the direction of Prof. Jennifer Schaefer.

Samuel Gruenler, a junior in economics with a minor in energy studies, is collaborating with Prof. Christiane Baumeister on a risk assessment in energy markets.

Alexander Hymes, a senior in chemistry with business, is collaborating with Prof. Haifeng Gao on designing a polymer network containing ex-changeable bonds, called covalent adaptable networks or CANs, based on the recently developed Friedel-Crafts (F-C) hydroxyalkylation polymerization technique.

Emma Kerr, a junior in chemical and biomolecular engineering with a minor in energy studies, is conducting a fundamental materials studies on fast ion diffusion in model side-chain ionomers under the direction of Prof. Jennifer Schaefer.

Seryeong Lee, a senior in chemistry, is collaborating with Prof. Emily Tsui to model the FTIR spectra of organometallic fragments coordinated to the surfaces of semiconductor nanocrystals.

Jacob Novitch, a junior in civil and environmental engineering and earth sciences, is studying the effect of hydroxylamine on the structure and function of nitrifying biofilms under the direction of Prof. Robert Nerenberg.

Melanie Perez, a sophomore in mechanical engineering, is studying nanomaterials for energy technologies that withstand high temperatures and harsh chemical environments under the direction of Prof. Svetlana Neretina.

Robert Schaefer, a senior in electrical engineering, is studying energy efficient parallel computing with applications in large scale fluid simulations and machine learning under the direction of Prof. Vijay Gupta.

Christina Tan, a junior in chemical and biomolecular engineering, is collaborating with Prof. Yamil Colon on the automated detection of defects in porous materials with machine learning.

Allison Taylor and Brendan Kane, juniors in aerospace engineering, are studying the advancement of icephobic coating for reducing ice accretion on a heat exchanger under the direction of Prof. Hirotaka Sakaue.

12 Awards
$17,866

Winter Session 2020 Vincent P. Slatt Scholars

Akin Adegoke, a junior in mechanical engineering with a minor in energy studies, is collaborating with Prof. Paul Rumbach on “Integrating Photovoltaic Infrastructure and Agriculture.”

Annika Barron, a freshman in physics in medicine and global affairs and a member of the Glynn Family Honors Program, is collaborating with Prof. Jay LaVerne on “Radiolysis of Lunar Regolith and Surrogates.”

Thomas Coates, a sophomore in computer science and engineering with a minor in energy studies, is collaborating with Prof. Sergey Leonov on “Probe Waveform and Nanosecond Imaging Comparative Analysis for Volumetric Space Charge Waves.”

Robert Crawford, a junior in architecture with minors in sustainability and computing and digital technologies, is collaborating with Prof. John Onyango on “Solar Energy Potential in South Bend.”

Neila Gross, a junior in chemical engineering, is collaborating with Prof. Albert Ceronne and Prof. Robert Nerenberg on “Understanding the Effects of Sonication on Biofilm Removal.”

Brian Kang, a junior in chemical engineering with a minor in energy studies, is collaborating with Prof. Prashant Kamat on “How Chloride Suppresses Photoinduced Phase Segregation in Mixed Halide Perovskites.”

Thomas Kasl, a junior in chemistry and bioengineering, is collaborating with Prof. William Phillip on “3D-Printing Hierarchical Nanostructure Absorbance for Contaminant Removal and Resource Recovery.”

Collin Kemper, a junior in chemical engineering, is collaborating with Kyle Doudrick on “Optimization of Fog Harps as an Energy-Free Method to Collect Drinking Water for Caribbean Nations.”

Cara Kilmartin, a junior in chemical engineering with a minor in energy studies, is collaborating with Prof. William Phillip on “Resource Recovery using Diafiltration Membrane Modeling and Separation Processes.”

Olivia Lanchoney, a senior in chemistry and Arabic, is collaborating with Prof. Vlad Iluc on “Synthesis of a Three-Coordinate Nickel Alkylidene.”

Erin Ludwig, a junior in environmental engineering with a minor in energy studies, is collaborating with Prof. Melissa Berke on “Using Chemical Lichenometry to Understand Coastal Storm Deposits.”

Audrey Miles, a sophomore in chemistry with computing and mathematics, is collaborating with Prof. William Schneider on “Benchmarking Ammonia Synthesis Entropies in Microkinetic Modeling.”

Stephanie Mueller, a junior in biochemistry and anthropology, is collaborating with Prof. Vlad Iluc on “Zinc(II) Carbene Synthesis and Reactivity.”

Marlena Muszynska, a junior in biological sciences, is collaborating with Ian Lightcap on “Synthesis, Characterization and Electrochemical Testing of Iron/Iron Oxide Clusters as Potential Replacements for Platinum in Hydrogen Fuel Cells.”

Amanda Patterson, a junior in environmental science with a minor in energy studies, is collaborating with Prof. Peter Burns on “Breakdown of Uranyl Peroxide Nanoclusters in Low Aqueous Concentrations; Pueblo of Laguna.”

Christina Tan, a junior in chemical engineering, is collaborating with Prof. Yamil Colon on “Automated Detection of Defects in Porous Materials with Machine Learning.”

Alex Tullman, a junior in finance with minors in energy studies and history, is collaborating with Ian Lightcap on “Can Coating Power Transmission Lines with Graphene Increase Conduction Efficiency?”

Noah Wamble, a senior in chemical engineering, is collaborating with Prof. Alexander Dowling on “Novel Diafiltration Cascades for Lithium-Ion Battery Recycling.”

18 Awards
$61,361

Graduate Research Fellowships

The Patrick and Jana Eilers Graduate Student Fellowship for Energy Related Research

The Eilers research fellowship program supports graduate student stipends ranging from $4,000 to $10,000 per student over a one-year period. Since the program began in 2012, there have been 30 awards totaling $262,946. Funding for the Eilers fellowship is made possible through the generosity of Patrick (‘90) and Jana Eilers; The Fitzpatrick Endowment for Excellence for the Center for Energy, established in 2008 by Edward Fitzpatrick, Jr. ('54); The Michael A. O'Sullivan Endowment for Excellence in Energy Research, established in 2014 by Michael A. O'Sullivan ('82); and the ND Energy President’s Circle fund.

In 2020, there were 5 recipients, each receiving an $8,000 award, totaling $40,000. The recipients and their research projects are highlighted below.

Shelby Brantley is a fourth-year chemistry student in the research group of Steven Corcelli, professor of chemistry and biochemistry. Her project titled, “Understanding the Dynamics of Solid-Electrolyte Interphase in Sodium Ion Batteries with Fluoroethylene Additive” focuses on improving the life and capacity of rechargeable batteries by changing the dynamics of the electrolyte solution to eliminate irreversible build-up on the electrode surface. This work is being done in collaboration with Colorado State University.

Jeffrey DuBose is a third-year chemistry and biochemistry student in the research group of Prashant Kamat, Rev. John A. Zahm Professor of Science. His project titled, “Understanding How Phase Segregation Occurs in Mixed Halide Perovskite Solar Cells” focuses on studying the process that will allow scientists to develop strategies to improve the stability and performance of solar cells.

Elvis Eugene is a third-year chemical engineering student in the research group of Alexander Dowling, assistant professor of chemical and biomolecular engineering. His project titled, “Revolutionizing Lithium-Ion Battery Recycling with Membrane Separations: Multiscale Modeling, Optimization, and Uncertainty Quantification” focuses on developing model-based designs to predict minimum membrane characteristics and innovative network topologies to improve existing battery recycling technology and materials. This work is being done in collaboration with William Phillip, associate professor of chemical and biomolecular engineering, and the WATER lab.

Hunter Ford is a fourth-year chemical engineering student in the research group of Jennifer Schaefer, assistant professor of chemical and biomolecular engineering. His project titled, “Electrochemically Stable Ionomers with Minimal Sulfur Affinity for Mitigating the Polysulfide Shuttle in Metal-sulfur Batteries,” focuses on developing transport altering polymers for "beyond lithium-ion" high energy density rechargeable batteries.

Mitsugu Hasegawa is a fifth-year aerospace and mechanical engineering student in the research group of Hirotaka Sakaue, associate professor of aerospace and mechanical engineering. His project titled, “Development of a Drag Reduction Technique Using a Microfiber Coating Inspired by Hair-follicles on the Seal,” focuses on developing a hairy coating, similar to aquatic mammals, that will reduce aerodynamic drag and improve fuel efficiency.

5 Awards $40,000

The Forgash Fellowship for Solar Energy Research

The Forgash fellowship provides an award of $5,000 to a graduate student interested in conducting solar energy research. Since the program began in 2009, 11 students (6 undergraduates and 5 graduates) have received awards ranging from $1,500 to $5,000, totaling $29,000. Funding for the Forgash fellowship is made possible through the generosity of John (’00) and Karla Forgash.

The 2020 recipient is highlighted below.

Ilia Pavlovetc is a fourth-year chemistry and biochemistry student in the research group of Masaru Kuno, associate professor of aerospace and mechanical engineering. His project titled, “Cation Migration in Mixed Cation Lead Halide Perovskites Thin Films and Solar Cells” focuses on exploring, understanding, and suppressing electric-field induced cation migration in perovskite solar cells, overcoming one of their intrinsic instabilities that impede their commercialization.

1 Award $5,000

Overall Impact

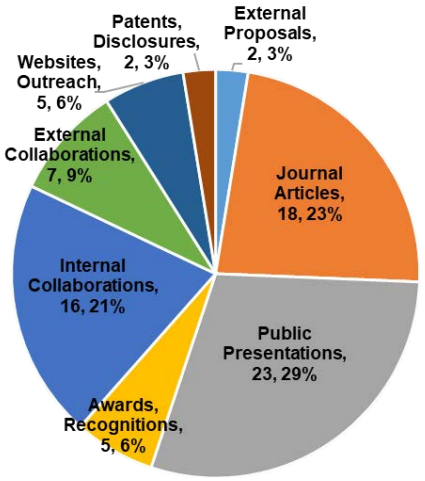
Fellowships are important for many reasons, and the overall impact can be endless, including the key areas highlighted below.

Financial: Fellowships add funding to the already vibrant financial support from colleges and schools for undergraduate and graduate research and education.

Education: Fellowships broaden the educational experiences of students and support their career goals through research and other opportunities like outreach.

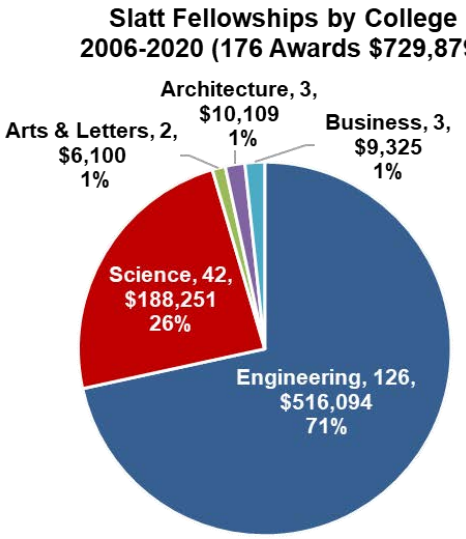
Research: Fellowships support faculty affiliates and their research programs, and help to advance energy-related research at Notre Dame.

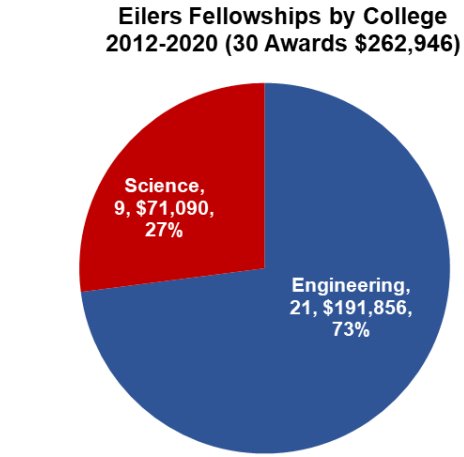
In 2020 alone, 44 students received awards totaling $161,727 to support energy-related research and other scholarly initiatives. Some of the results are shown in the pie chart below.

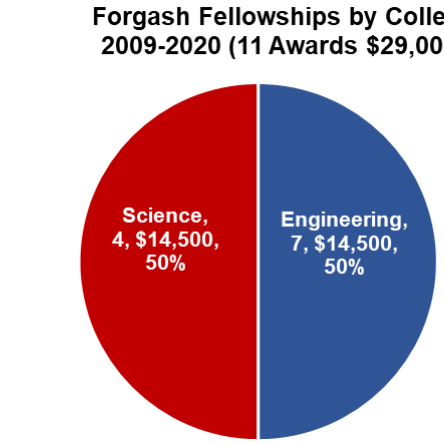


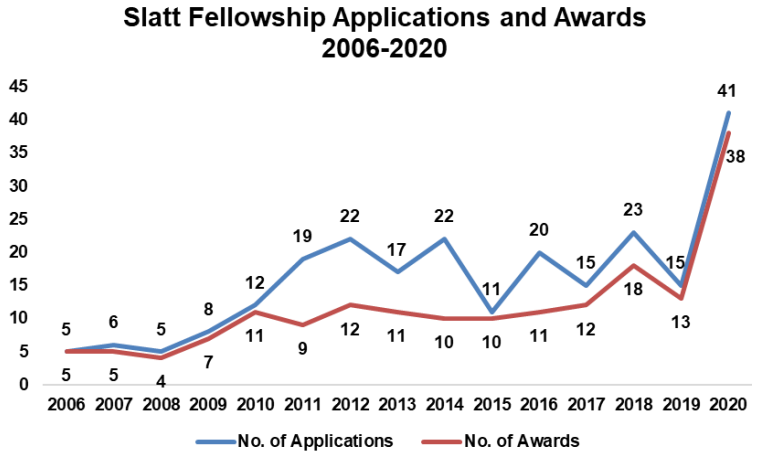
Since 2006, 217 students have received fellowships with awards totaling $1,021,825 to advance energy-related research and other scholarly endeavors.

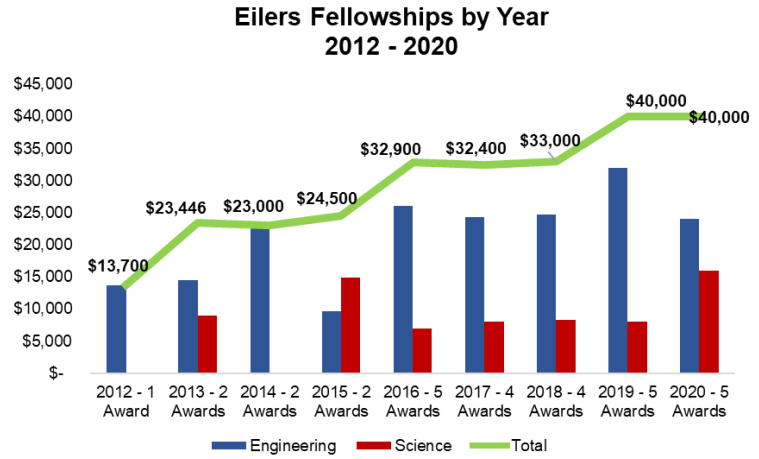
217 Awards
$1,021,825

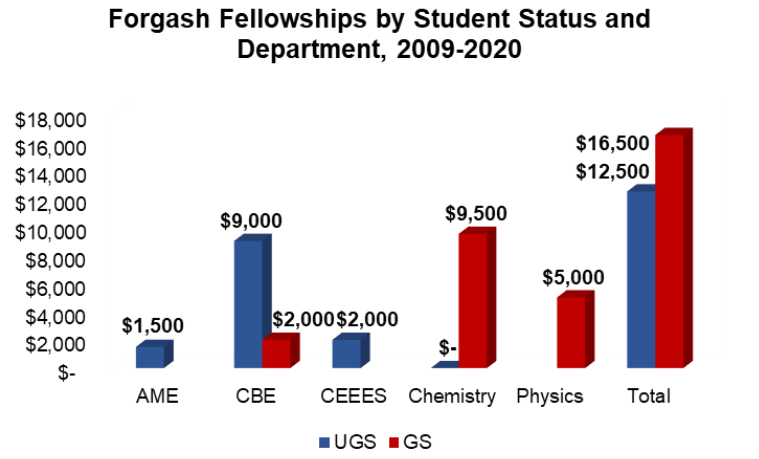












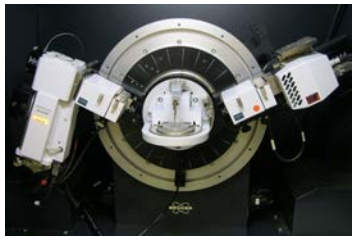
Materials Characterization Facility (MCF)

The Materials Characterization Facility (MCF) houses 30 state-of-the-art instruments with unique capabilities and provides analytical services and expertise to resolve some of the most relevant scientific problems facing researchers today. Managed by Dr. Ian Lightcap, Research and Facilities Program Director; Anna Matzner, Laboratory Specialist; and Karl Cronberger, Electron Microprobe Technician, the MCF has proven to be a valuable and highly regarded facility that focuses on partnering with Notre Dame researchers and external users to deliver excellent services and research results.

Although the MCF was closed temporarily due to COVID-19 and when it was scheduled to reopen, strict protocols had to be put in place to ensure the safety of facility users, team members never missed a beat. When the lab was closed, they conducted virtual presentations to individual research groups on specific topics of interest. Prior to the lab reopening, they designed and executed new safety protocols for COVID prevention, resulting in 871 documented, safe visits. They also developed standard operating procedures (SOPs) to guide users and ensure instrument training would be performed safely.

Professional development continued to be a high priority as well, both before and during the COVID-19 shutdown. Dr. Lightcap attended advanced training for AFM and an analytical instrumentation conference (Pittcon) prior to the shutdown. Other team members attended 30+ webinars during COVID-downtime to advance their analytical knowledge. Dr. Lightcap and Dr. Shinde made it a priority to mentor Dr. Karl Cronberger who was appointed director of the newly created core facility, ASEND (Analytical Science and Engineering at Notre Dame), while maintaining his role with ND Energy.

Throughout this unusual year, the MCF team also maintained the following instruments, which are located in the MCF at 146-147 Stepan Chemistry Hall:



Crystallography

Powder XRD
Single Crystal XRD
High-Res XRD

Electrochemistry

Solar Fuels and
Electrocatalyst Testing Stations

Gas Analysis

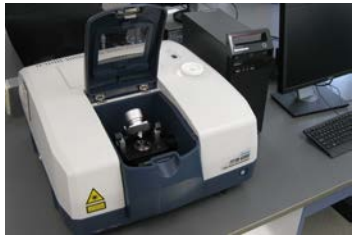
GC-FID
GC-TCD
Triple Quad GC-MS

Polymer/Particle Analysis

SEC-MALS
Zetasizer and DLS

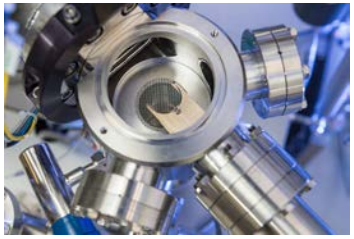
Rheometry/DMTA/ Tribology

Hybrid Rheometer



Spectroscopy

FTIR
FTIR Transmission
Confocal Raman Microscope
Solar Simulators
UV-Vis



Surface Analysis

ASAP 2020 Surface Area and
Porosity Analyzer
Profilometer
AFM Park XE7
XPS
Electron Microprobe
XRF

Synthesis

Microwave Reactor
Thermal Evaporator

Thermal Analysis

DSC
Calorimeter - Drop Solution
Calorimeter - Reaction
TGA/DSC
TGA/DSC-Mass Spec

External Users

The MCF provides external users customized analytical solutions that range from customer-specified analytical work to sponsored R&D projects involving coordinated use of analytical services across campus with the option to consult with faculty experts in materials areas important to the issues being investigated.

New Instrument Proposals

Dr. Lightcap assembled teams of PIs and co-PIs to prepare the following new instrument proposals for submission:

- DURIP (Department of Defense): Multimodal Nanoscale Metrology: Chemical, Physical, and Nanomechanical Mapping for Comprehensive Agile Testing and Evaluation of Materials Surface and Interface ($669,000, declined)
- MRI, Track 2: Acquisition of Surface Analytical Capabilities for Advanced Characterization of Semiconductor Devices, Multilayers, SEnsors, and Energy Storage/Conversion Materials ($1,575,000, pending)
- NSF STTR: Graphene Synthetic Fuels ($143,708, pending)
- ERR: Expansion of Campus Particle Sizing Capabilities ($132,815, funded)
- ERR: Renewal and Upgrade of XPS to Add Comprehensive Band Gap Characterization ($176,200, funded)

MCF Outreach

The MCF participated with other core facilities in the virtual Core Facility Fair on September 15, hosted by ND Research. Researchers from the Notre Dame community and prospective external customers attended. Dr. Lightcap presented information about MCF's state-of-the-art instruments and capabilities and unique services provided to both internal and external users. Attendees also browsed digital exhibit booths for more information.

MCF in Numbers

17 Awards, $5.9M Awards were received by faculty who indicated use of the MCF to achieve their research goals, totaling $5,922,141.

38 Proposals, $43M Proposals were submitted by faculty who indicated use of the MCF to achieve their research goals, totaling $43,295,903.

48 Publications Faculty reported publications using data obtained from the MCF.

4,037 Hours of Instrument Usage

>150 Users Trained

$88K in Gross Recharge Gross recharge was $88,784, which is close to average, even after COVID-19 related laboratory closures.

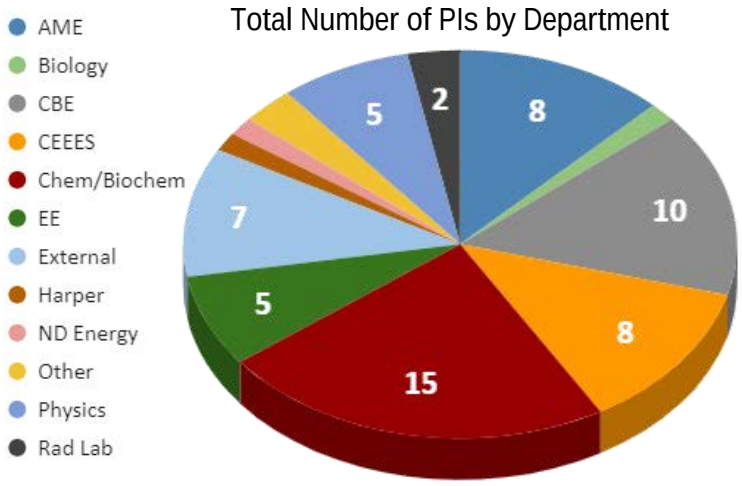
USERS

65 PIs
12 Departments
125 Active Users
11 External

There were 65 principal investigators (PIs) from 12 different departments and centers/institutes with research groups using the MCF in 2020. This represents a slight increase in PIs from the previous year and 125 active internal and external users.

The MCF has been actively working with 11 external groups, 6 academic and 5 industrial.

The chart shows the total number of PIs by department. This indicates the largest number of users are from Chemistry and Biochemistry (15) and Chemical and Biomolecular Engineering (10).



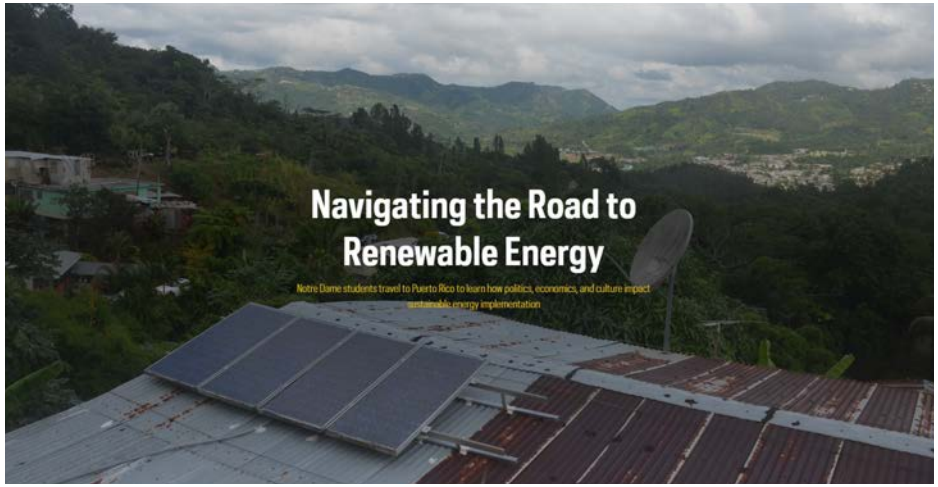
EDUCATION

Energy Studies Minor (ESM)

In cooperation with all colleges and schools, ND Energy supports undergraduate education through the Energy Studies Minor (ESM), which is open to students in all majors at Notre Dame. The minor is designed to provide a broad understanding of key energy topics and challenges in the world today. Courses range from *Fundamentals of Semiconductors* to *Advanced Chemical Engineering Thermodynamics* to *Water, Disease & Global Health* to *General Ecology*. Students are required to take 16 credit hours for successful completion of the minor. This includes two, 3-credit courses focused on energy and society and the business of energy, a 1-credit capstone course, and 9 credits of elective courses.

Navigating the Road to Renewable Energy

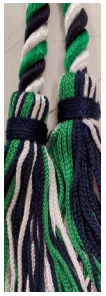
There are several options for students to complete the capstone requirement, including a semester-long course led by ND Energy focused on a broad range of energy topics, on-campus research opportunities, summer internships, and voluntary or credit-based learning experiences. Additionally, in fall 2019, ND Energy introduced a new capstone course titled, *Puerto Rico: Road Map to a Renewable Future*. Students attended weekly classes and a fall break immersion in Puerto Rico where they learned first-hand about the technological challenges communities face when attempting to reduce their carbon footprint, while considering the economic, political, historical, and ethical issues unique to Puerto Rico. To commemorate this inaugural experience, the following story was developed to introduce the capstone course and the group of students who were the first to experience what it's like to navigate the political, cultural, and technological challenges of implementing renewable energy. Due to COVID-19 and University travel restrictions, this capstone course was temporarily suspended and will resume in Spring 2022.



Click here to view story.

Largest Cohort of Energy Studies Minor Students Graduate in Class of 2020

Twenty-seven (27) undergraduate students completed the requirements of the Energy Studies Minor in 2020, making this the largest cohort in the history of the program. ESM graduates represented 17 different majors in four colleges: the College of Arts and Letters, College of Engineering, College of Science, and Mendoza College of Business. Since the program began in 2012, there have been 132 graduates.



Although the in-person certificate ceremony was unable to be held in 2020, students received for the first time cords to represent their achievement in energy studies. A three-color cord was selected in green, dark blue, and white to signify clean and sustainable energy for all (green/white) in a responsible and powerful way (blue).

ESM Alumni Network

Upon graduation, students are invited to join the ESM Alumni Network to stay apprised of current initiatives in energy and activities at Notre Dame. Members are also provided future opportunities to represent the minor through various outreach activities and other events.

Meet the Class of 2020

Jason Gilbert Ballard, Chemical Engineering (Future plans: Undecided)

Breanna Marie Belz, Mechanical Engineering (Future plans: Manufacturing/Design Engineer, Flowserve Corporation)

Dante C. Bergamotto, Physics, Data Science Minor (Future plans: Technology Analyst, Morgan Stanley)

Emily Louise Black, Environmental Engineering (Future plans: Service Year, Jesuit Volunteer Corps then employed as a Technology Analyst, Deloitte Consulting)

Janaya Brown, Aerospace Engineering (Future plans: Undecided)

Slater Sparr Chesser, Mechanical Engineering (Future plans: Reservoir Engineer, ExxonMobil)

James Noble Drysdale, Chemistry, Glynn Family Honors Program (Future plans: DPhil Candidate in Condensed Matter Physics, University of Oxford)

Thomas Eckburg, Computer Engineering (Future plans: Web/Systems Developer, Technology Services Group)

Madelyn Marie Francesconi, Environmental Engineering (Future plans: Incoming Healthcare Consulting Analyst, Huron Consulting Group)

Alexander Joseph Gerbo, Mechanical Engineering (Future plans: Design Engineer, NextEra Seabrook Station Nuclear Power Plant)

Daniel Gonzalez Diaz, Mechanical Engineering (Future plans: Masters of Science in Management, University of Notre Dame)

Daniel J. Holmes Jr., Economics, Russian Supplementary Major (Future plans: Undecided)

James R. Hunter, Finance (Future plans: Restructuring Analyst, FTI Consulting)

Jordan K. Isner, Chemical Engineering, Engineering Corporate Practice Minor (Future plans: Analyst, Dean Capital Investments Management)

Erika Kim, Civil Engineering (Future plans: Civil Engineer)

Cristian Lagunas, Mechanical Engineering (Future plans: Field Engineer, Kiewit Power Constructors)

Angelo Rafael Diokno Liu, Science-Business (Future plans: Healthcare Consultant, Huron Consulting Group)

Loyal Patrick Murphy, Chemical Engineering (Future plans: Chemical Engineering Ph.D. program, Auburn University)

Alison O'Neil, History, Political Science (Future plans: ACE Teaching Fellow)

Erin Rausch, Political Science, Theology Minor (Future plans: Legal Writing Analyst, Hudson Legal)

Jonathan Paul Reuvers, Business Technology (Future plans: Healthcare Consultant, Optum)

Kyersten Rae Siebenaler, International Economics, International Development Studies Minor (Future plans: Fulbright Scholar to Mexico, Mexico City)

Jared Patrick Smith, Economics, Constitutional Studies Minor (Future plans: Underwriter, Vanliner Insurance)

Kyle Edward Tomshack, Chemical Engineering, Engineering Corporate Practice Minor (Future plans: ARC Chemical Engineer, Airgas)

Donald Francis Welsh, Jr., Environmental Earth Sciences (Future plans: Graduate school to study Earth Science)

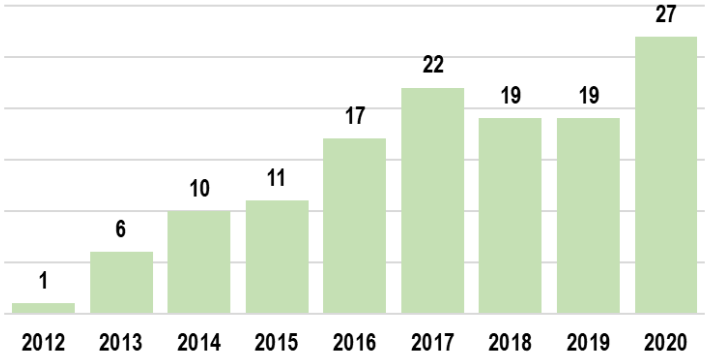
Patrick Henry West, Environmental Engineering, Theology Minor (Future plans: Masters of Science in Environmental Engineering, University of Michigan)

Matthew Winkler, Chemical Engineering (Future plans: Technology Consulting, EY)

From left to right, graduates are pictured in the order listed here. indicates photo is not available.

ESM in Numbers

This chart shows the number of graduates in each year from the start of the minor in 2012 through the class of 2020.



OUTREACH

Symposiums, Workshops and Presentations

Faculty Forums

Faculty forums are held monthly to foster new relationships and enable synergies across interdisciplinary lines in an effort to create broader research areas and cross-cutting collaborations. These forums engage faculty in discussions on specific research topics in consideration of upcoming or anticipated external funding opportunities. Due to COVID-19 restrictions and the need for safe distancing, only two forums were held in person, while other faculty seminars were held virtually.

Jan. 22, *Semiconductor Laser Cooling*, by Masaru (Ken) Kuno

Feb. 27, *Non-Equilibrium Plasmas as the Next Frontier: Perspectives from Catalysis, Electrochemistry, and Energy Conversion*, by David Go

"John Ruskin: Prophet of the Anthropocene" Conference

ND Energy co-sponsored the "John Ruskin: Prophet of the Anthropocene" conference hosted by the John J. Reilly Center for Science, Technology and Values the weekend of John Ruskin's 201st birthday, Feb. 7–8, 2020. This conference explored how Ruskin's legacy continues to challenge the disciplinary divides that separate art from science and ethics from economics, and how his critique of Victorian capitalism and industrialization can address our own concerns today.

Science Alive

On Feb, 8, The St. Joseph County Public Library held its 28th annual Science Alive in the Jordan Hall of Science at the University of Notre Dame, due to reconstruction of the downtown library location. Members of the Student Energy Board participated as did faculty affiliates and their research groups who translated energy-related research into meaningful hands-off activities and demonstrations. They included Peter Burns, Alexander Dowling, David Go, Amy Hixon, Prashant Kamat, Svetlana Neretina, Jennifer Schaefer, William Schneider, Emily Tsui, and Jonathan Whitmer.

"A Chemist's Stint with Nuclear Forensics at the State Department"

Co-sponsored by the John J. Reilly Center and ND Energy, Christopher Cahill presented, "A Chemist's Stint with Nuclear Forensics at the State Department" on Feb. 20. Cahill described his career trajectory and evolution of interests of an academic and PhD chemist, while exploring an 'alternative' career path in government.

Northern Indiana Regional Science and Engineering Fair (NIRSEF)

On Feb. 29, Student Energy Board members evaluated the energy-related projects and awarded prizes for both junior and senior division participants in the 2020 Northern Indiana Regional Science and Engineering Fair (NIRSEF). The senior division winner was Mufei Li from Culver Academies for her project titled, "Using Eggshells and Turkey Bones as Catalysts to Produce Biodiesel Through Transesterification." The junior division resulted in a tie, and the winners were Kate O'Shaughnessy from St. Joseph Catholic School, South Bend for her project titled, "Magnetizing Oil Spills" and Will Michalski from St. Thomas the Apostle Catholic School, Elkhart for his project titled, "A Functional Homemade Radon Detector."

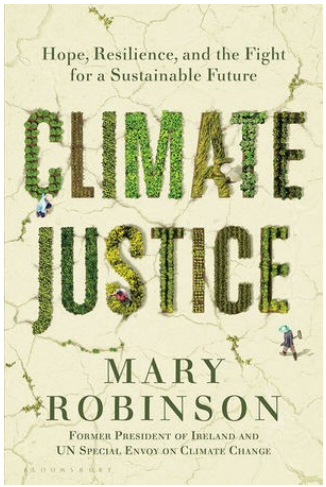
Book Reviews and Discussions

Throughout the summer, as the world began to function virtually, ND Energy hosted a series of book discussions to delve deeper into the topics and issues surrounding climate change.

Participants were encouraged to share their perspectives and what more they could do to help the planet.

The books read were the following:

- *Climate Justice*
- *A Field Guide to Climate Anxiety*
- *The Future We Choose*

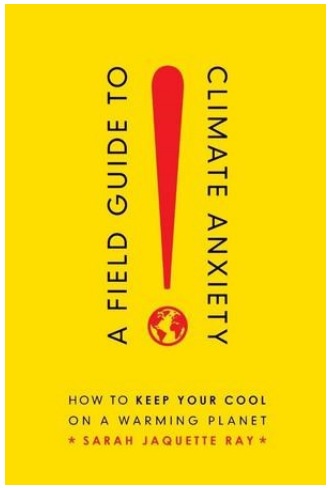


Living Climate Justice - One Action at a Time

In celebration of the 50th anniversary of Earth Day, ND Energy kicked off its five-part book review and discussion on *Climate Justice* by Mary Robinson. This book tells the story of people around the globe that are experiencing climate change first-hand and what they are doing about it. The objective is to help jumpstart changes in personal lifestyles that could influence how people shop, what people consume, and how people can change the future for others by making better choices. All ultimately leading to a greater impact on the future of humanity.

Discussions were held April 29, May 6, 13, 20, 27.

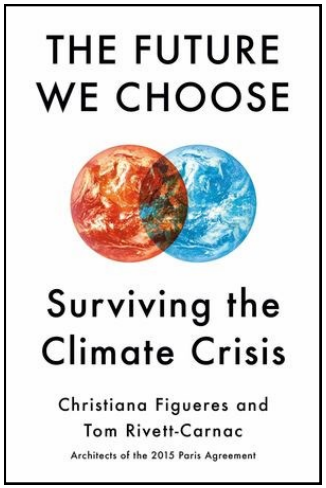
Inspired by the book, *Climate Justice*, Ginger Sigmon, managing director of ND Energy, stands in front of the compost box she's been wanting to start for years.



A Field Guide to Climate Anxiety: How to Keep Your Cool on a Warming Planet by Sarah Jaquette Ray

The second, three-part book review and discussion focused on Ray's creation of an "existential tool kit" for the climate generation, drawing on a decade of experience leading and teaching in college environmental studies programs.

Discussions were held June 17, July 1, and July 15.



The Future We Choose: Surviving the Climate Crisis by Christiana Figueres and Tom Rivett-Carnac

The third and final two-part book review and discussion focused on climate change and how we address it in the next thirty years will determine the kind of world we will live in and will bequeath to our children and to theirs. The authors outline two possible scenarios for our planet. In one, they describe what life on Earth will be like by 2050 if we fail to meet the Paris climate targets. In the other, they lay out what it will be like to live in a carbon neutral, regenerative world. They argue for confronting the climate crisis head-on, with determination and optimism.

Discussions were held July 29 and August 13.

Summer Programs for Undergraduate Researchers

Summer undergraduate researchers participated in social and professional development events that were virtually held and organized by REU/Fellowship programs in the College of Engineering, ND International, and ND Research. Although students were unable to be on campus this year, these events provided opportunities to network with peers, interact with faculty, learn about other research programs, and prepare for the Summer Undergraduate Research Symposium where students were invited to present their research projects virtually. Remote researchers were from the Center for Research Computing REU, Chemical and Biomolecular Engineering Research Opportunities for Undergraduates, ND Energy Slatt Fellowships, ND International iSURE, and NDnano NURF.

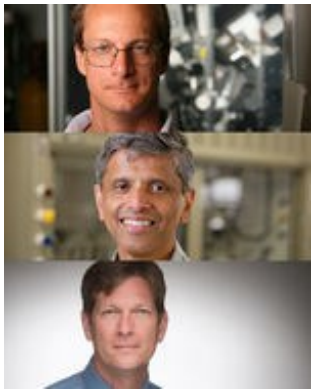
Events were: Meet n' Greet/Game Night, Finding the Right Library Resources, DVT Show: Space Science Beyond the Dome, Interdisciplinary Computational Research, Idea to Impact: Science & Engineering Entrepreneurship at IDEA Center and ESTEEM Graduate Program, Nanoscience and Technology Research Overview, Graduate School: What's it Good for and Should I Go?, Creating Effective Posters, Effective Communications, and Summer Undergraduate Research Symposium.

The 14th Annual Notre Dame Energy Week was held Aug. 23-28 to raise awareness and learn about key topics in sustainable energy. Throughout the week, a wide range of virtual events and activities were offered for the Notre Dame community and general public. This included a documentary, live presentations, and an environmental justice digital messaging contest for students. The recap and presentations recordings are available at: energy.nd.edu/outreach/2020-energy-week.

2040 Documentary

The week kicked off with an online screening of the forward-looking documentary, 2040. Award-winning director Damon Gameau took viewers on a journey of "fact-based dreaming" to envision a better world. While circling the globe, he focused on solutions by embracing what exists today, starting in Bangladesh where bottom-up systems are used to develop reliable, affordable, and decentralized grids for communities, to New York City where on-demand driverless vehicles will lead to more green space, urban food farms, and regrowth in manufacturing, to Australia where planting a variety of plants can pull CO_2 from the atmosphere into the soil to make it healthier and give way to natural livestock grazing and industrial agriculture, to Massachusetts where oceans will regenerate themselves to restore fish habitat and generate more seaweed for food, animals, and biofuels. Through this, travelers imagined a world in 2040 where climate change has been sharply curtailed and the Regeneration Movement, steeped in urgency to act now, successfully preserves the earth for future generations.

ND Energy Bouts … Fighting for Renewable Energy



Prashant Kamat, Rev. John A. Zahm, C.S.C., Professor of Science in Chemistry and Biochemistry and reigning champion put his title belt on the line against challengers Peter Burns, Henry Massman Professor of Civil and Environmental Engineering and Earth Sciences, and Scott Morris, professor of aerospace and mechanical engineering, each representing their own areas of expertise — solar, nuclear, wind — respectively.

After several rounds of hard jabs and landed punches, Burns emerged as the new ND Energy Champion, victoriously receiving 44 percent of the votes. Morris and wind energy finished second with 35 percent, and Kamat finished third with 21 percent.

Notre Dame's Energy Future … Growing Greener

Paul Kempf, assistant vice president for utilities and maintenance, gave an annual update on Notre Dame's move toward de-carbonization. Kempf highlighted Notre Dame's strategy for powering campus facilities while maintaining its long range plan to diversify and be flexible.

It Can't Be Done … Or Can It?

Former Notre Dame professor Patrick Regan and his business partner Marty Whalen shared the early successes and unexpected challenges of establishing Crossroads Solar, a solar panel manufacturing company that employs and trains former convicted felons to fulfill its mission of providing clean energy solutions for domestic customers.

The Future of Mobility … Tough Choices Ahead

In partnership with Notre Dame's Net Impact Club, three experts from the transportation industry discussed the future of mobility. The panel was moderated by Jonathan George, Mendoza MBA student and president of Net Impact.

Matt Peak, managing director of Energy Systems Network, outlined a move toward electrified, automated, and shared transportation options.

Michael Noland, president and general manager of the South Shore Line, described current initiatives to improve connectivity between Chicago and Northern Indiana.

Chris Tindal, assistant director of Commercial Aviation Alternative Fuels Initiatives, acknowledged that electric aviation is a long way into the future, but alternatives to fossil fuels sourced from waste, oils, fats, and greases can provide more renewable and sustainable liquid fuels for aviation.

The Gift of Solar in Puerto Rico … Philanthropy and Climate Change

The final presentation was co-sponsored by the Puerto Rican Student Association of the University of Notre Dame (PRSAND) and moderated by Álvaro Carrillo Marcano ('22), an accounting and political science major and president of PRSAND.

Dory Trimble, executive director of the Honnold Foundation, and Arturo Massol Deyá, executive director of Casa Pueblo, discussed their ambitious partnership to create a cooperatively managed community-owned solar microgrid in the mountain town of Adjuntas, Puerto Rico.

This endeavor will connect 17 businesses to the grid and, the funds collected from the energy savings will help disadvantaged community members with energy security. This initiative is new to Puerto Rico and is intended to create a model that can be replicated in other communities.

The Honnold Foundation supports worldwide projects with an emphasis on social justice and access to solar energy.

Dorm Environmental Justice Competition

Energy Week concluded with the announcement of the placement winners in the inaugural Dorm Environmental Justice Competition. Students were invited to develop a digital advertisement to influence attitudes and behaviors toward environmental justice through the use of words, terms, and phrases along with images, photos, and digital graphics. The submissions were evaluated by a select group of judges and a public vote from the Notre Dame community. The winners are shown below.

1st Place Winner **Pasquerilla East**

2nd Place Winner **Badin Hall**

3rd Place Winner **Flaherty Hall**

PD&GS Seminar —Special Guest

On Sept. 16, Valli Sarveswaran, Graduate Career Consultant for the College of Engineering, spoke with associated researchers about the many valuable services provided to students through the Meruelo Family Center For Career Development.

Introduction to Department of Energy Research Opportunities

On Oct. 1, Subhash L. Shinde, associate director of ND Energy, and Derek Lake, associate director of NDnano, led a discussion moderated by Jill Pentimonti, Director of Research Advancement, Office of Federal & Washington Relations, Office of Public Affairs and Communications. Shinde and Lake provided an overview of the U.S. Department of Energy and the offices that fund research.

Faculty Seminar

On Oct. 1, faculty were invited to a presentation on *Monsoon Intraseasonal Oscillations in Equatorial Atmosphere and Oceans* by Harindra (Joe) Fernando.

Notre Dame Sustainability Expo

The annual Notre Dame Sustainability Expo was held virtually for undergraduate and graduate students to explore career opportunities in the areas of energy, the environment, and sustainability studies over two evenings on Oct. 6 and 7. Several groups and local and national organizations and businesses participated in the live panel discussions, focusing on opportunities in the areas of academic programs; experiential learning; service learning; field, laboratory, and analytical research; internships; and job openings.

Students were also invited to browse digital Exhibit Booths with more information from the presenters, as well as from other groups and organizations unable to participate.

Panelists from the following organizations each gave a brief program overview and details on specific opportunities for students:

- Sustainability Minor
- IDEA Center
- St. Joseph County Parks
- Invenergy
- John J. Reilly Center
- Office of Sustainability
- enFocus
- Conservation Corps
- ND Energy
- Center for Civic Innovation
- Inovateus Solar
- Moontree Studios
- Kellogg Institute for International Studies
- Pulte Institute for Global Development
- Indiana Dunes National Park
- National Parks Conservation Association
- Merry Lea Environmental Learning Center
- Sunrise Movement South Bend
- City of South Bend Office of Sustainability and Green Corps
- The Public Interest Network
- Environmental Sciences
- Environmental Change Initiative
- Unity Gardens
- US Farmers and Ranchers Alliance

The expo is co-sponsored by ND Energy; John J. Reilly Center for Science, Technology, and Values; Meruelo Family Center for Career Development; Minor in Sustainability Studies; Notre Dame Environmental Change Initiative (ND-ECI); and Notre Dame Nanoscience and Technology (NDnano).

Fall Undergraduate Research Fair (FURF)

On Oct. 8, Anne Berges Pillai, education and outreach associate program director for ND Energy, participated in the virtual fair hosted by the College of Science to meet with interested undergraduate students about the Energy Studies Minor, Student Energy Board, and Slatt research fellowships.

NOTE: Outreach programs normally held throughout the year but were canceled in 2020 due to COVID-19 restrictions are listed below:

Mishawka High School Internship Program, CISTAR Young Scholars Program, What's it Really Like?, ND for the Environment, Art2Science Summer Camp, St. Joseph County 4H Fair, Learning activities with Madison STEAM Academy and St. Adalbert Catholic School.

3rd Annual ND Energy Research Symposium

The 3rd Annual ND Energy Research Symposium was held virtually on Nov. 12 and 13, 2020, beginning in the afternoon on Thursday with invited talks, followed by a panel discussion with Notre Dame faculty. The event resumed Friday afternoon with more talks and concluded with a poster session presented by Notre Dame postdoctoral associates and graduate students.

The theme of the symposium, *Waste-to-Energy: Reimagining the Possibilities*, brought together research experts from Columbia University, University of Michigan, McMaster University, and Purdue University, and industry leaders from LanzaTech and Brightmark Energy. Presentations included current initiatives related to waste carbon resources and technology, CO_2 capture and conversion, heat harvesting and redistribution, industrial symbiosis at the small-scale, upcycling plastic waste, and turning plastic waste into useful products. The recap and presentation recordings are available at: energy.nd.edu/research/research-symposium/2020-highlights.

ND Energy RESEARCH SYMPOSIUM
November 12-13, 2020
University of Notre Dame
WASTE-TO-ENERGY
Reimagining the Possibilities

Invited Talks

Overview of ND Energy by Peter C. Burns, Director of ND Energy, Director of NNSA Actinide Center of Excellence, Henry Massman Professor of Civil and Environmental Engineering and Earth Sciences, University of Notre Dame

KEYNOTE: "*Becoming CarbonSmart*" by Rachel Brenc, Chief of Staff to the CEO, LanzaTech

"Towards Sustainable Energy and Materials: Carbon Capture, Utilization and Storage (CCUS)" by Ah-Hyung (Alissa) Park, Lenfest Chair in Applied Climate Science, Department of Earth and Environmental Engineering & Department of Chemical Engineering, Director of the Lenfest Center for Sustainable Energy, Columbia University

"Using Industrial Symbiosis at the Small-scale to Increase Communities' Sustainability and Well-being" by José Alfaro, Assistant Professor of Practice, School for Environment and Sustainability, University of Michigan

"Energy Research Cooperative: Integrated Community Energy and Harvesting Systems" by James Cotton, Professor, Department of Mechanical Engineering, Associate Director of the McMaster Institute for Energy Studies, McMaster University

"Converting Polyolefin (Plastic) Waste into Fuels" by Nien-Hwa Linda Wang, Maxine Spencer Nichols Professor of Chemical Engineering, Purdue University

KEYNOTE: *"Using Technology and Innovation to Manage Plastic Waste and Turn it Back into Useful Products"* by Bob Powell, President & CEO, Brightmark Energy

Panel Discussion

Panel Discussion: *Transforming Waste to Meet our Energy Needs*, moderated by Jennifer Schaefer, Assistant Professor of Chemical and Biomolecular Engineering

"Cyber Infrastructure Energy Consumption, Conservation and Reuse" by Paul Brenner, Senior Associate Director, Center for Research Computing, Associate Professor of the Practice

"The Membrane-Biofilm Photobioreactor (MBPR) for Biofuel Production from Waste CO_2" by Robert Nerenberg, Professor, Department of Civil & Environmental Engineering & Earth Sciences

"CISTAR: Creating the Bridge to a Fossil-free Energy Future" by William Schneider, Dorini Family Chair of Energy Studies and Department Chair of Chemical and Biomolecular Engineering

"Thermoelectric Devices for Harvesting Waste Heat" by Yanliang Zhang, Associate Professor, Department of Aerospace and Mechanical Engineering

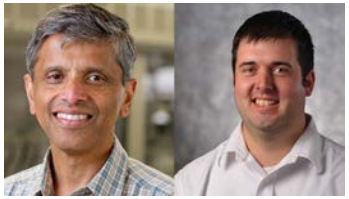
Poster Award Winners

Jeff DuBose, ***"TiO2**-Assisted Halide Ion Segregation in Mixed Halide Perovskite **Films"*** (Kamat lab); Ashley Hastings, *"Advancements in Actinide MOF Chemistry via Synthesis of Pu-UiO-66"* (Hixon lab); and Tsuyoshi Kohlgruber, ***"Synthesis of Actinide Polyoxometalates Using Ionic Liquid Media"*** (Burns lab).

MARKETING COMMUNICATIONS

News Articles

A major component of ND Energy's mission is marketing communications. By using various marketing channels, such as digital print media, the World Wide Web, Facebook, Twitter, and Linked-In, ND Energy promotes the initiatives and accomplishments of faculty affiliates, associated researchers, students, and other partners in support of energy-related research and education at Notre Dame. Our efforts feature a broad range of topics from new discoveries to educational achievements to policy changes, and ethical and social justice issues. The following pages highlight major news announcements published in 2020.



Two Notre Dame professors listed as Highly Cited Researchers for 2020

Dec. 3, 2020

Stuart Jones and Prashant Kamat, both professors in the College of Science at the University of Notre Dame, have been named Highly Cited Researchers by Clarivate Web of Science. Read More

Newly developed risk chart identifies the hidden costs of health care during power failures

Nov. 23, 2020

A team headed by a University of Notre Dame researcher delved into the hidden costs of electrical failures in hospital settings and has created a new model. Read More

iNDustry Labs at Notre Dame announces inaugural faculty affiliates cohort

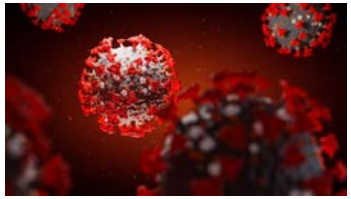
Nov. 12, 2020

Faculty to serve as ambassadors, experts in collaboration with regional businesses. Read More

Rapid construction of energy-efficient concrete structures — by 3D printing

Oct. 20, 2020

The potential of additive manufacturing — 3D printing — to help build a better world is expanding all the time, from customized surgical implants to parts for commercial jet engines. Read More



COVID-19 lockdowns in China, Europe averted tens of thousands of premature deaths related to air pollution, study finds

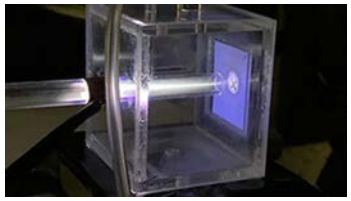
Oct. 15, 2020

According to research published in The Lancet Planetary Health, scientists at Notre Dame found that particulate matter concentrations in China dropped by an unprecedented 29.7 percent. Read More

David Go appointed chair of aerospace and mechanical engineering

Oct. 2, 2020

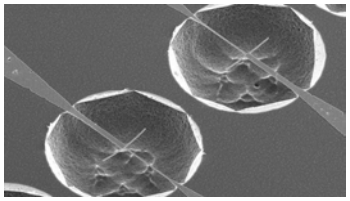
David B. Go, the Rooney Family Collegiate Professor, has been selected to chair the Department of Aerospace and Mechanical Engineering beginning Nov. 1. Read More



Cutting the timeline to improve energy efficiency in manufacturing

Sept. 24, 2020

The Notre Dame-led team seeks to tighten the materials development timeline in manufacturing using transfer learning. Read More



Engineers developing high-speed light detectors for closer look at the sun

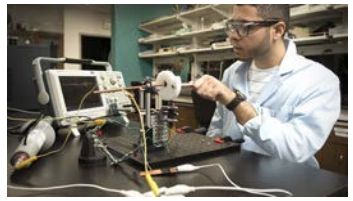
Sept. 15, 2020

Notre Dame researchers will use data from the new high-speed light detectors to determine the temperature of the sun's lower atmosphere. Read More

From Here to There: Program helps underrepresented students advance their academic career

Sept. 10, 2020

When Yamil Colón arrived at the University of Notre Dame from Puerto Rico, he had yet to spend much time outside of the island. Read More



Human/mechanical powered plasma: AME faculty/student researchers help create the future

Sept. 2, 2020

A team of engineers in mechanical engineering have published research that explores making plasma devices that can be operated without electrical power. Read More

News Articles

Notre Dame-backed solar project breaks ground in St. Joseph County

Aug. 20, 2020

As a partner in the project, Notre Dame has committed to purchase 40 percent of total output from the facility in the form of clean energy credits over 30 years. Read More

Fifteen Notre Dame undergraduates named summer or fall Gilman Scholars

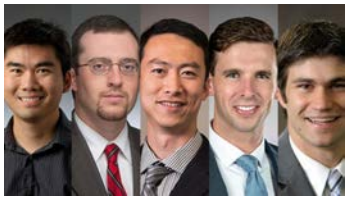
Aug. 12, 2020

Winners have until 2021 or later to use the award because of cancellations and restrictions related to the pandemic. Read More

Notre Dame faculty receive National Science Foundation awards

Aug. 6, 2020

Nine University of Notre Dame faculty members received prestigious National Science Foundation (NSF) Early Career Development (CAREER) Awards in 2020. Read More



AME announces faculty promotions and new hires

Aug. 3, 2020

The Department of Aerospace and Mechanical Engineering continues to grow and thrive, promoting accomplished faculty and adding new faculty to meet the needs of students and research. Read More

CBE promotions and new faculty

Aug. 2, 2020

The Department of Chemical and Biomolecular Engineering is pleased to announce faculty promotions and new hires for the 2020 academic year. Read More

Two CBE professors named 2020 ACS PSME Young Investigators

July 28, 2020

Jennifer L. Schaefer and Matthew J. Webber have been named 2020 Polymeric Materials: Science and Engineering Young Investigators by the PSME Division of the American Chemical Society. Read More

The distance between Puerto Rico and Notre Dame bears little to no consequence on remote learning and undergraduate research

July 23, 2020

The decision to conduct research over the summer for many undergraduate students at the University of Notre Dame presented new challenges and considerations relative to remote learning. Read More

Aprahamian appointed to JINR Scientific Council

July 8, 2020

The Committee of Plenipotentiaries of the Governments of the Member States of the Joint Institute for Nuclear Research (JINR) has appointed Freimann Professor of Physics Ani Aprahamian as a new member. Read More

Two CBE faculty to serve key positions with The Journal of Physical Chemistry C

July 2, 2020

William F. Schneider and Edward J. Maginn, in the Department of Chemical and Biomolecular Engineering (CBE), have been appointed to new editorial roles at The Journal of Physical Chemistry C. Read More

Five engineering faculty receive 2020 NSF CAREER awards

July 1, 2020

Five engineering faculty members received National Science Foundation (NSF) Early Career Development (CAREER) awards in 2020, bringing the total CAREER award winners in the College of Engineering to 31 over the last five years. Read More

News Articles

University of Notre Dame establishes Hypersonic Systems Initiative

June 28, 2020

To further engage the University's expertise for developing efficient, hypersonic flight vehicles, Notre Dame has launched the Hypersonic Systems Initiative. Read More

2020 Naughton awardees announced

June 26, 2020

Twenty-three students and faculty have been announced as awardees of the Naughton Fellowships for 2020. Read More

Yanliang Zhang receives International Thermoelectric Society 2020 Young Investigator Award

June 18, 2020

Yanliang Zhang, associate professor of aerospace and mechanical engineering, has been named the 2020 International Thermoelectric Society Young Investigator. Read More

Gezelter named College of Science associate dean of undergraduate studies

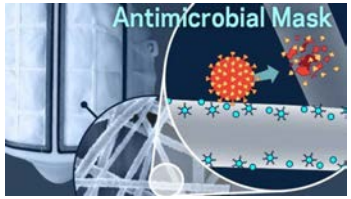
June 18, 2020

Dan Gezelter has been named associate dean for undergraduate studies for the University of Notre Dame College of Science, effective July 1, 2020. Read More

Gregory Hartland Named Deputy Editor of Journal of Physical Chemistry C

June 9, 2020

Gregory Hartland has been named Deputy Editor for the Journal of Physical Chemistry C of the American Chemical Society. Read More



Notre Dame researchers to create material for new antimicrobial mask

June 9, 2020

Scientists and engineers are collaborating to translate existing water filtration technology to create a new fabric that will not only capture viruses, like the coronavirus, but also deactivate them. Read More

Steven Corcelli Receives 2020 Thomas P. Madden Award

May 29, 2020

Steven Corcelli, Professor in the Department of Chemistry & Biochemistry and Associate Dean for Interdisciplinary Studies and Faculty Development, has been selected as the 2020 recipient of the Thomas P. Madden Award. Read More

College of Science 2019-2020 awards announced

May 22, 2020

Seniors in the College of Science and faculty were recently honored with awards for the 2019-20 academic year. Read More

Twenty-six students and alumni awarded Fulbright grants

May 22, 2020

Notre Dame has been a top producer of Fulbright students for six consecutive years. Read More

College of Engineering faculty awards honor excellence in undergraduate teaching and advising

May 18, 2020

William Phillip, associate professor of chemical and biomolecular engineering, is the 2020 recipient of the College of Engineering Excellence in Teaching Award. Read More

News Articles

Faculty awards honor undergraduate teaching and advising

May 14, 2020

Twenty University of Notre Dame faculty members have received Rev. Edmund P. Joyce, C.S.C., Awards for Excellence in Undergraduate Teaching, and three have been honored with Dockweiler Awards for Excellence in Undergraduate Advising. Read More

Sixteen doctoral candidates receive outstanding teaching awards

May 13, 2020

Sixteen doctoral candidates in the College of Engineering have received the 2020 Outstanding Graduate Student Teaching Award. Read More

Notre Dame researchers to study wastewater, focus on short-term forecasts in response to pandemic

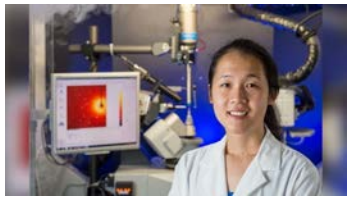
May 7, 2020

Alex Perkins and Kyle Bibby are looking at short-term forecasts of potential infection and are monitoring spread of the coronavirus in wastewater. Read More

Dowling receives 2020 NSF CAREER Award

April 28, 2020

Alexander W. Dowling, assistant professor of chemical and biomolecular engineering, has received a 2020 National Science Foundation Early Career Development (CAREER) Award, the highest honor given by the U.S. government to young faculty members in engineering and science. Read More



Chemistry professors innovate new ways to perform labs during e-learning

April 23, 2020

"One of the great things about being at Notre Dame is seeing how our students and faculty have stepped up to the challenges posed by COVID-19," said J. Dan Gezelter, professor in the Department of Chemistry and Biochemistry. Read More

Amid pandemic, climate scientists imagine Earth Day 2070

April 22, 2020

Earth Day 2020 will mark 50 years since the first nationwide effort to educate the public and raise awareness of environmental issues that threaten the health and sustainability of the planet. Read More

Aprahamian assisting Armenia in fight against COVID-19

April 13, 2020

Ani Aprahamian, Freimann Professor of Physics at the University of Notre Dame, is presently on leave in Armenia as a Fulbright Fellow, where she serves as the Director of Armenia's Alikhanyan National Laboratory in Yerevan. Read More

Why climate scientists are **watching the world's response** to coronavirus

April 13, 2020

Climate scientists at Notre Dame say despite the challenge to collecting data, the current crisis is already spurring new proposals for research and revealing interesting parallels to the climate crisis that could provide valuable lessons for the future. Read More

Expert says coronavirus economy could bring U.S. shale market to its knees, break up OPEC

April 3, 2020

Although Christiane Baumeister definitely foresees a rollercoaster ride in the oil markets in the coming weeks, she thinks there might also be a small silver lining. Read More

ND Engineering taps Schneider to lead chemical and biomolecular engineering

April 2, 2020

William F. Schneider, the H. Clifford and Evelyn A. Brosey Professor of Engineering, has been appointed the new chair of the Department of Chemical and Biomolecular Engineering beginning July 1, 2020. Read More

News Articles

Notre Dame elects Marie Lynn Miranda provost

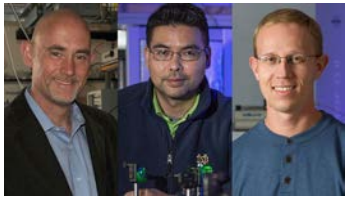
March 17, 2020

Marie Lynn Miranda, the former provost of Rice University and a distinguished scholar in the field of children's environmental health, has been elected the Charles and Jill Fischer Provost of the University of Notre Dame by its Board of Trustees. Read More

Women Lead 2020

March 5, 2020

The challenges of today cannot be met with the thinking of yesterday. Meet seven outstanding faculty members who are shifting paradigms in their fields as they work to build a better tomorrow. Read More



Researchers develop new method for imaging electrons in gold nanowires

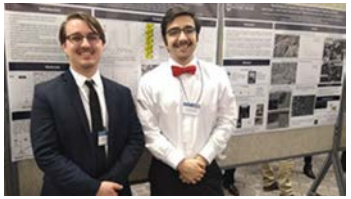
March 25, 2020

Researchers at the University of Notre Dame recently developed an all-optical tabletop technique, called infrared photothermal heterodyne imaging (IR-PHI), that beats normal infrared microscopes by overcoming limitations caused by how tightly light can be focused. Read More

Solar energy improves quality of life in Adjuntas, Puerto Rico

March 3, 2020

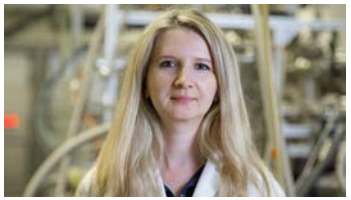
When the young students of Domingo Massol Ramos School in the mountain town of Adjuntas, Puerto Rico saw tiny solar cars scoot along the ground powered only by light energy, they were amazed. Read More



Physics faculty and students participate in the 2020 Stewardship Science Academic Programs Symposium

March 3, 2020

Freimann Professor Ani Aprahamian, Research Assistant Professor Khachatur Manukyan, and graduate students participated in U.S. Dept. of Energy's National Nuclear Security Administration (NNSA) 2020 Stewardship Science Academic Programs (SSAP) Symposium. Read More



Ptasinska appointed new editor-in-chief of EPJD

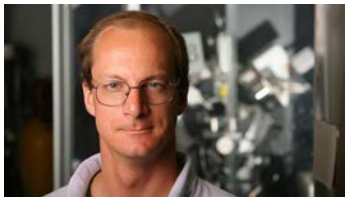
Feb. 21, 2020

Sylwia Ptasinska, associate prof. of physics and an ND Energy faculty affiliate, was recently named an editor-in-chief for European Physical Journal D (EPJD) effective January 2020. Read More

Researchers awarded DOE/NETL grant to develop one-step process for converting natural gas into liquids

Feb. 19, 2020

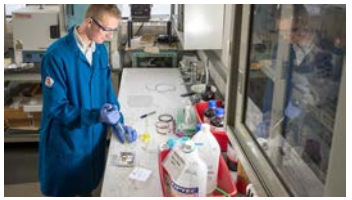
A team of Notre Dame engineering researchers has been awarded a grant from the Dept. of Energy's National Energy Technology Laboratory (DOE/NETL) to design, develop, and test a one-step, plasma-assisted catalytic process for direct conversion of natural gas to liquid chemicals. Read More



ND Law students launch Journal on Emerging Technologies

Feb. 18, 2020

Concluding that the pressing societal questions posed by emerging technologies would be best studied from an interdisciplinary perspective, third-year law student Rolando Rengifo conceived of an innovative academic journal that would bridge legal scholarship with that of science, policy, and ethics. Read More



Chemistry major fosters solar power from Nepal to Notre Dame

Feb. 13, 2020

Last summer, chemistry major Jake Drysdale studied perovskite solar cells in the Notre Dame lab of Prashant V. Kamat, worked with the Nepal-based company Gham Power to bring solar-powered water pumps to small farmers, and founded his own company, YeTI Photovoltaic. Read More

Physics graduate student Nirupama Sensharma works to create nuclear energy awareness

Feb. 11, 2020

Nuclear Energy – The Better Energy is an initiative to promote knowledge and awareness about the peaceful uses of nuclear energy. Physics PhD student Nirupama Sensharma's vision in developing 'Nuclear Energy – The Better Energy' is to bridge the gap between her research as a nuclear scientist and her responsibilities towards society. Read More

Marketing Channels

ND Energy uses various marketing channels to share relevant news articles, events, and major accomplishments in energy-related research, education, and outreach at Notre Dame. This is done through weekly and biannual newsletters, annual reports, social media posts, and maintaining a vibrant and up-to-date Website. We invite you to stay connected and visit us often.

The milliJoule is ND Energy's weekly internal publication that covers upcoming events, recent news, and other timely announcements.

The Joule is ND Energy's biannual external publication that highlights major initiatives and accomplishments throughout the previous six months.

The kiloJOULE

The kiloJoule is ND Energy's annual external publication that covers major initiatives and accomplishments throughout the previous calendar year.

ND Energy maintains an active social media calendar, posting almost daily to Facebook, Twitter, and LinkedIn. Follow us on:

Facebook: https://facebook.com/centerforsustainableenergy

Twitter: https://twitter.com/NotreDameEnergy

LinkedIn: https://www.linkedin.com/company/nd-energy/
LinkedIn: https://www.linkedin.com/company/nd-mcf/

LOOKING AHEAD with renewed hope

What's ahead for ND Energy? Looking at the first three months of 2021, the first quarter brought renewed hope and spirit as the world began to administer the coronavirus vaccine. With many of the students, faculty, and staff receiving the vaccination, this allowed the University to loosen some restrictions and look forward to the potential of returning to business-as-usual this fall.

The following is a brief look at some major initiatives and accomplishments from January through March 2021.

Q1-2021 Research Awards and Proposals

12 Awards Totaling	$1,363,166	2 New Awards	$284,637	29 Proposals Totaling	$11,972,219
Affiliated Amount	$1,108,788	Affiliated Amount	$284,637	Affiliated Amount	$6,584,164
Affiliated %	81%	Affiliated %	100%	Affiliated %	55%

Early Career Awards

Two faculty affiliates received early career awards from the National Science Foundation (NSF), a highly competitive and prestigious external award for young researchers.

David Burghoff, assistant professor of electrical engineering, for his CAREER project, *"Intersubband Neurons for Ultrafast Optical Neural Networks"* Read More

Emily Tsui, assistant professor of chemistry and biochemistry, for her CAREER project, ***"Formation and Redox Chemistry of Metal Polysulfanido Complexes for Sulfur Transfer Reactions"*** Read More

Notre Dame hosts international virtual workshop on thermal transport, material informatics, and quantum computing Mar. 22-26

The University of Notre Dame hosted a four-day virtual workshop on thermal transport, materials informatics, and quantum computing, sponsored by the National Science Foundation (NSF) and the Japan Science and Technology Agency (JST). For workshop details and recordings, view aithermworkshop.nd.edu,

2021 Student Research Fellowships

ND Energy announces 2021 Slatt fellowships for undergraduate research Read More

ND Energy announces 2021 fellowships to support graduate education and energy-related research

Read More

Distinguished Lecture Mar. 11

Gregory Keoleian, Peter M. Wege Endowed Professor of Sustainable Systems and Director of the Center for Sustainable Systems (CSS), University of Michigan presented, "Accelerating Carbon Neutrality: Mobility, Buildings, Food, and Emerging Technologies".

Four-Part Series: Advances in Nuclear Technology

Accidents involving nuclear materials have been few and far between, yet their stories have remained etched in history, leading to misinformation and disagreements, especially among policymakers and the public, about their use. The good news is that researchers have learned from these incidents and are leading the way toward the next-generation of nuclear power and life-sustaining technologies.

In this four-part series, participants learned about the many ways nuclear is being used to generate power, preserve human health, and support universal discoveries. Speakers delved into topics surrounding research and development and some of the hard questions about environmental and intergenerational justice.

Feb. 10 Part One: "Fact, Fiction, and the Future" by Peter C. Burns, Massman Professor of Civil and Environmental Engineering and Earth Sciences; Director of ND Energy

Feb. 17 Part Two: "A Moral Imperative" by Don Howard, Professor of Philosophy

Feb. 24 Part Three: **"A Case Study in Puerto Rico"** by Jesus Nunez, Chief Executive Officer of Nuclear Alternative Project (NAP); Valerie Lugo, Chief Operations Officer of NAP; and Ramón Martinez, Chief Nuclear Officer of NAP

Mar. 3 Part Four: "Beyond the Nuclear Power Plant" by Captain Mark Prokopius, Professor of ND Naval Science, and J. David Robertson, Professor of Chemistry and Director of MU Research Reactor, University of Missouri

For presentation details and recordings, view Distinguished Lectures.

K-12 Resources En Español

With the help of undergraduate student, Melanie Torres '22, we have added a Spanish language section to our free resources which help STEM teachers, students, parents, and researchers explain the concepts of energy to K-12 students.
View the resources page here

Northern Indiana Regional Science and Engineering Fair (NIRSEF) Feb. 27

As a longstanding partner of the Northern Indiana Regional Science and Engineering Fair (NIRSEF), ND Energy provided judges and awards for energy-related projects during its annual competition.

Four awards were presented by ND Energy to the top two projects in each of the high school and middle school categories. The winners were:

- Anna Kelley, high school student at Trinity School at Greenlawn, for her project titled, "High Energy-Low Cost Plasma Device for Chemical Degradation".
- May Weston, high school student at Marian High School, for her project titled, "What type of bioplastic creates the most durable biodegradable water bottle?".
- Joseph Hunckler, eighth grader at St. Matthew Cathedral, for his study of the pitch of windmill blades.
- John Gutierrez, eighth grader at Schmucker, who compared the performance of solar versus traditional batteries in solar cars.

View a full recap of the science fair here.

2021 Virtual Science Alive! Feb. 1-28

Science Alive was held virtually throughout the month of February and presented several new opportunities and challenges due to COVID-19. In spite of these changes, ND Energy and its student volunteers embraced the opportunity and created some amazing online demonstrations and activities for virtual viewers.

Undergraduate students on ND Energy's Student Energy Board (SEB) presented 30-minute, live demonstrations at various times throughout the event. All of the presenters encouraged viewers to pursue their interest in science and answered many interesting questions about being a student at Notre Dame.

Graduate students from affiliated research laboratories videotaped energy-related demonstrations, activities, and laboratory tours. Participating faculty research groups included: Peter Burns, David Go, Amy Hixon, Prashant Kamat, and William Schneider.

View a full recap and the virtual demonstrations here.

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