

THE POWER OF **RED** and **BLUE**



Nebraska Center for Energy Sciences Research Benefits Review

NPPD Board of Directors Meeting
Strategic Business Matters
June 8, 2023

John Swanson
Director of Generation
Strategies & Research



Nebraska Public Power District

Always there when you need us

Jerry Hudgins
Interim Director, NCESR
University of Nebraska

≡ Mission

*To **conduct energy research** that produces new technologies, processes and systems that **provide new or significantly enhanced energy sources** and **improve the quality of life and economic opportunity for Nebraskans***

(Energy Center Charter Document)



To Accomplish the Mission

- **Train Students**
- **Fund Research**
 - Seed projects in promising new areas
 - Facilitate interdisciplinary collaborations
- **Have Economic Impact & Leverage Funding**
 - Attract external funding from federal agencies, foundations and other public or private entities
 - Provide new solutions to problems for Nebraskans
- **Efficient and Effective Operations**



Student Opportunities



Darrell J. Nelson

Summer Undergraduate Internship



- Annual summer internship opportunity in energy sciences research – **started in 2014**
- Awarded 4 internships annually from 2014 – 2021 (**INCREASED to 8 starting in 2022**)
- Stipend increased from a maximum of \$5,000 to \$6,000 in 2023
 - **First increase since the inception of the internship program**
- Application process is through a web-based system
- NCESR & NPPD hosted a Meet & Greet on 5/25/2023
- Planning a tour to Cooper Nuclear Station for interns & sponsoring faculty
- Interns will present posters at the Summer Research Symposium 8/3/2023
- Reports are due 9/29/2023

Poster Presentations at UNL Student Research Days

3 undergraduates, 19 graduate students and 1 postdoc associated with Energy Center projects presented 20 posters on March 28 & 29, 2023

(some posters had more than one student presenting)

Poster Session Award Recipients:



Alan Dostal, Arjun Subedi, Roman Estrada

Arjun Subedi, a graduate student working with Dr. Xia Hong, Dr. Takashi Komesu, Dr. Xiaoshan Xu & Dr. Peter Dowben in Physics and Astronomy.

- Presented a poster, titled, "A model for electronic phase transition of CoFe₂O₄ and NiCo₂O₄ thin film surfaces: Temperature dependent X-ray photoemission studies of CoFe₂O₄ and NiCo₂O₄ thin films".
- Received a \$400 award/travel grant to present his research at a regional or national conference or to support other research costs.

Poster Presentations at UNL Student Research Days

Continued... **Poster Session Award Recipients:**



Roman Estrada, Alyssa Simpson, Dr. Jerry Hudgins

Alyssa Simpson, an undergraduate student working with Dr. Xia Hong with Physics and Astronomy.

- Presented a poster, titled, “Free-standing $\text{PbZr}_{0.2}\text{Ti}_{0.8}\text{O}_3$ top-gated two-dimensional MoS_2 photovoltaics”.
- Received a \$250 award from the College of Arts and Sciences.

NCESR Collaborates with Project Energy Nebraska

- A UNL student-led project - assists local Nebraska communities in assessment of energy-use, emission outputs & reduction strategies
 - David Gosselin is Director of Project Energy Nebraska and UNL's Environmental and Sustainability Studies Program
 - 61 UNL students involved in project over the past five semesters
 - Baseline energy and greenhouse gas emissions inventory completed for **Norfolk (NPPD Retail Community)**, Grand Island, Lincoln and South Sioux City
 - About \$350,000 of impact in these communities
 - Four summer interns (Summer 2023) working directly with:
 - Lincoln
 - **Norfolk (NPPD Retail Community)**
 - **NPPD**
- **Collaborators:** International Council for Local Environmental Initiatives (ICLEI), Conservation Nebraska AmeriCorps Program, and UNL Rural Prosperity Network 8





The Research

Laboratory Resources for the Energy Center

Energy Center Researchers have access to world class labs at UNL:

- **Instrumentation Grant**
 - Awarded 7/1/2022 and ends 6/30/2023
 - Report is due in July 2023

The instrumentation funding for 2022-2023 was awarded to:

PI: Dr. Lucia Fernandez-Ballester, Assistant Professor,
Mechanical and Materials Engineering

Title: *Flash DSC acquisition for novel energy materials and thin films*



Laboratory Resources for the Energy Center

Energy Center Researchers have access to world class labs at UNL:
Continued...

- **NCESR Director Discretionary Award of \$40,000 for a polarization control and tapping mode upgrade for nanoIR2-s**
 - Awarded 4/5/2023 and ends 12/31/2023
- **The Nebraska Research Initiative is funding an additional \$44,500**
 - This was supported by the UNL Office of Research and Economic Development

PI: Dr. Joseph Turner, Assistant Professor,
Mechanical and Materials Engineering





Process - Schedule / Timeline

up to 5 NPPD Executives & Board Members participate

- **Cycle 17** (2023-2024)
 - 6 projects started 1/1/2023
 - Progress Reports due by 7/14/2023
 - Progress Review Meeting on 10/19/2023
 - This review will determine who will be funded for Cycle 17 Year 2



Cycle 17 Grant Recipients (6 Total)



Co-application of biochar and biosolids for carbon sequestration and sustainable soil management in urban-agricultural landscapes

Michael Kaiser, Assistant Professor
Agronomy and Horticulture



Additive Manufacturing of Advanced Magnets for Power Systems ((AM)²PS)

Jeff Shield, Professor
Mechanical & Materials Engineering



Photocatalytic Corrosive Nanostructured Electrode to Split Water

Ravi Saraf, Professor
Chemical and Biomolecular Engineering



Smart grid cybersecurity enhancement using smart authentication and intelligent threat detection

Byrav Ramamurthy, Professor
School of Computing

≡ Cycle 17 Grant Recipients (6 Total) continued...



*Biohydrogen systems for electricity
and transportation*

Paul Blum, Professor
School of Biological Sciences



*Reducing energy to produce corn
ethanol by optimizing fermenter
operation and off gases treatment*

Bruce Dvorak, Professor
Civil and Environmental Engineering



Process - Schedule / Timeline continued...

up to 5 NPPD Executives & Board Members participate

- **Cycle 18** (2024-2025)

- RFP Released 3/20/2023

- Research Focus Areas

- Cybersecurity
- Energy Storage
- Carbon Sequestration
- Hydrogen Generation
- Electric Powered Tractors/Class VI Vehicle Testing
- Energy Infrastructure Resilience
- Energy Literacy
- Non-Carbon Combustion Fuel for Utility Scale Gas Turbines and Reciprocating Internal Combustion Engines (RICE); and Ethanol Fuel for Aviation
- Nuclear Technologies
- Simulation and Modeling
- Special Support Program in Hydrogen Technology



Process - Schedule / Timeline continued...

up to 5 NPPD Executives & Board Members participate

- **Cycle 18** continued...
 - Preproposals will be reviewed by Executive Council (EC) on 6/12/2023
 - A select number will be invited to submit Full Proposals by 7/31/2023
 - Subject matter experts outside of UNL will review the Full Proposals
 - PIs will present Full Proposals to EC on 11/17/2023
 - EC will determine which projects to recommend to External Advisory Committee (EAC) for Funding
 - EAC will Select Projects for Funding on 12/8/2023

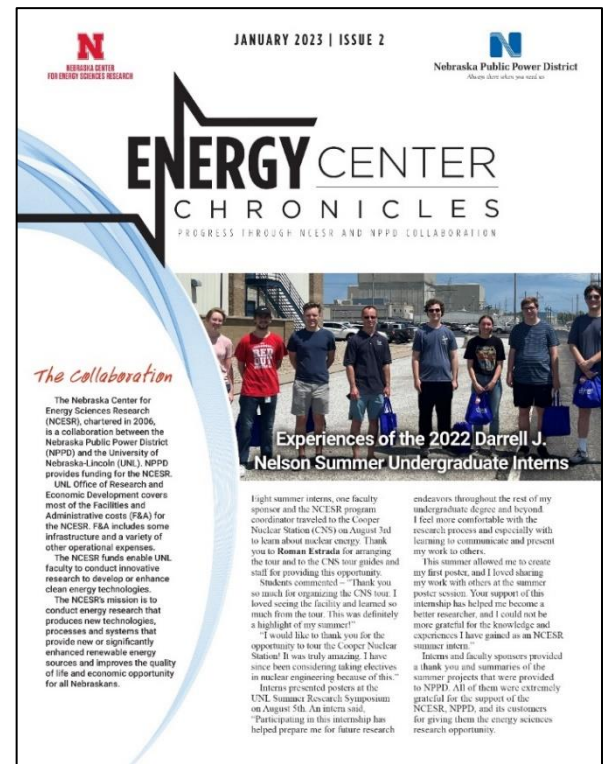


The Impact

NCESR Newsletter

Started the *Energy Center Chronicles* in 2022

- The newsletter is an outcome of the external review of the Energy Center for increased communications
- The frequency of the Newsletter starting in 2023 is 3 times per year (January – May – September)
- May 2023 Newsletter changed to e-newsletter format
- It is disseminated to UNL faculty, students involved with NCESR, NPPD leadership, staff & customers
- The newsletter, subscription and feedback opportunity is available on the NCESR website, and the link is provided on the NPPD website
- NPPD also posts on social media



Thank you!

to the many individuals from NPPD and UNL who provide content and edit reviews.

Discussing the Future of Electric Utility Efforts

NCESR Hosted a meeting with EPRI on 4/27/2023

- Steve Stella discussed EPRI and collaboration possibilities
- Provided an overview of NCESR's work and partners
- Dr. Bob Wilhelm gave updates about UNL's involvement to support electric utility efforts
- NPPD discussed their work in Nebraska and region to explore new electric utility technologies
- 5 UNL faculty/researchers presented NCESR project updates on research supportive of EPRI's electric utility efforts plus 5 lab tours



Power of People Campaign

Alan Dostal suggested taking NPPD's new Power of People campaign and modify to include people at NPPD and UNL to display at the Energy Center.



Info that is being printed 

Alan led this project with the collaboration of NCSER staff.

Mock-up of the location in the Energy Center Office 



Entrepreneurship Workshop for STEM Researchers

Hosted by NCESR

- The *FREE* September 6, 2023, workshop is open to all UNL STEM Researchers
- For those considering launching a company or may have already started the process, this workshop will provide the tools and resources needed to succeed
- Includes a Networking Event to interact with founders, experts, and service providers from the local entrepreneurship ecosystem
- **Roman Estrada**, NPPD Generation Research Sr. Program Manager and NCESR Liaison will participate as one of the speakers

Co-hosts and partners are:



Return on Investment

Description

As of May 2023

External Funds Awarded to Recipients of NCESR-funded Seed Grants: **Cycle 1 through Cycle 16***

\$ 107.10 million

Other External Funds Awarded to UNL and Administered through NCESR: **Cycle 1 through Cycle 16***
(Excludes cycle funding, only includes special projects)

\$ 7.28 million

Total External Funds

\$ 114.38 million

NCESR-funded Seed Grants: Cycle 1 through Cycle 16*
(Includes Instrumentation Funding)

\$ 14.99 million

Overall Return on each \$1 invested ... \$ 7.63



By the Numbers (as of May 2023)

- 123 Research Projects funded for Cycles 1-16 and 129 for Cycles 1-17
 - Includes seed & instrumentation funding
- 543 Publications with 29,475 Citations
 - Includes Cycles 1-17 and the Water, Energy & Agriculture Initiative (WEAI)
 - Includes journals, books & conference presentations that have been published
- 657 Students working with Cycles 1-17 (counting students each time they worked on a different cycle, etc.)
 - Includes a student each time if reported on multiple cycles / was a summer intern more than once / worked on a cycle as an undergrad, then another cycle as a grad student or postdoc
 - Includes students from PI reports (undergrads, grad students, postdocs) & summer interns

NOTE - This number is lower than the 2022 Board Meeting Presentation. A few incorrect formulas were found from earlier cycles after conducting an audit. Checks and balances have been put into place.

572 Students for Cycles 1-17 (counting a student only once when worked on multiple cycles, etc.)



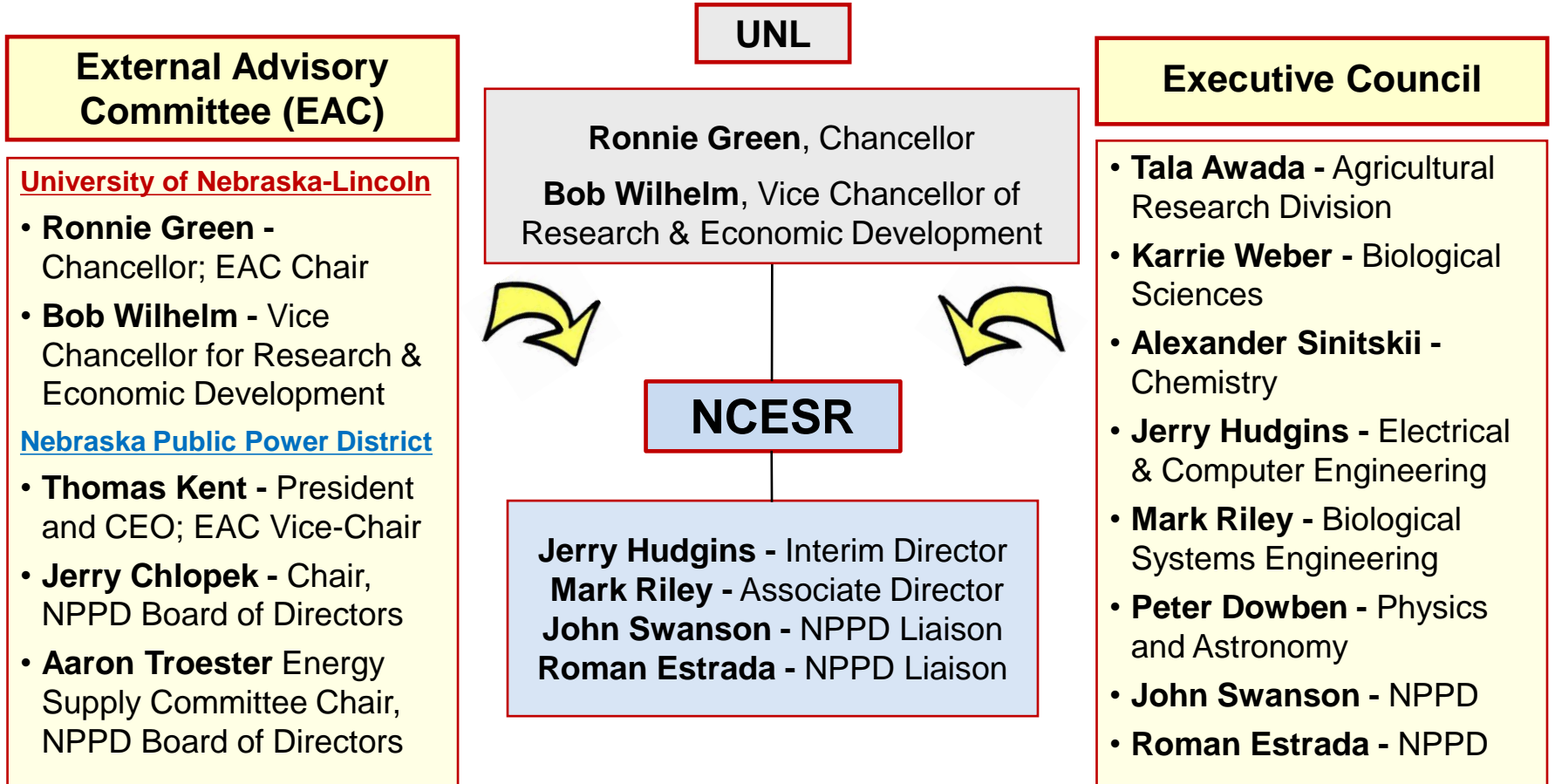
By the Numbers (as of May 2023) continued...

- \$ 15.53M investment from NPPD (Cycles 1-16) and \$16.08M (Cycles 1-17 year 1)
 - Includes seed & instrumentation funding, special projects, summer interns
- 12 patents awarded and 6 pending from NCESR Researchers
 - Information from NUtech
- \$114.38M External funding for Cycles 1-16
- **\$100'sM economic benefit to Nebraskans**



The Operations

Organizational Chart





NCESR Personnel

- Dr. Jerry Hudgins, Interim Director since August 2019
- Brenda Coufal, Program Coordinator since 1/3/2022
- Sue Wesely, Administrative Associate since 9/30/2022
- **Status of Director Search**
 - Established new Search Committee in 2022 (includes NPPD)
 - Used Search Firm – Harris Search Associates
 - Advertised Position mid-May; Reached out to potential candidates May – July
 - Semifinalist virtual interviews were conducted in August 2022
 - On-campus interviews were conducted in November 2022
 - **Started Internal Search April 2023**
 - **Will Interview 4 Candidates in June 2023**

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Nebraska Center for Energy Sciences Research

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Lincoln, NE 68588-0857

<http://ncesr.unl.edu>

Questions?

Stay connected with us.

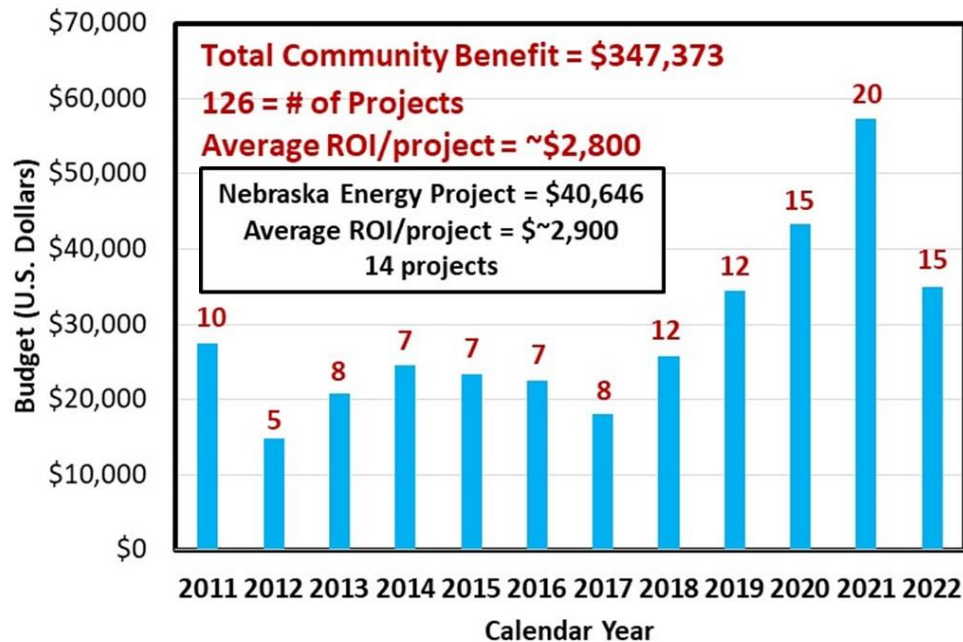


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NCESR Collaborates with Project Energy Nebraska

ENVR 319 Economic Impact



Note: Data through Fall 2022. Does not include Summer Interns (Summer 2022) > \$15,000

Community Benefits

- **Baseline GHG Emissions Inventory**
 - Electricity
 - Stationary Fuels
 - Transportation
 - Waste
- Forecast of Emission reductions for changes in practice (e.g., Diesel to EV)
- Foundation of Reporting and Planning

Deep Dive into Community Practices

- Science Based Emissions Target
- Forecast of Business As Usual Emissions
- Policy and Strategy Research
- Emissions Modelling and Analysis
- Transportation focused Strategy