

Dr. George Gogos

Education

- Ph.D. (Mechanical Engineering and Applied Mechanics)
University of Pennsylvania, Philadelphia, PA, 1986
- M.S. (Mechanical Engineering and Applied Mechanics)
University of Pennsylvania, Philadelphia, PA, 1982
- B.S. (Mechanical Engineering)
Massachusetts Institute of Technology, Cambridge, MA, 1980

Current Positions

- Professor and Associate Chair for Graduate Studies and Research
Department of Mechanical and Materials Engineering
- Director, Nebraska Center for Energy Sciences Research (NCSR)
- Co-Director, Center for Electro-optics and Functionalized Surfaces (CEFS)



IN OUR GRIT, OUR GLORY™

Experience on Energy Research

Most of my Research has been directly related to energy

Overarching Goals

- Increase Efficiency
- Prevent Pollution
- Commercialize

Record

- 115 Refereed Publications
- Funding (PI or Co-PI)
 - Completed: \$10.2 million
 - Current: \$4.8 million
 - Pending: \$15.9 million
- 5 Patents
- 2 Startups

Research Areas

Combustion

- Funding: NSF, ARO, NASA
- 1986 – 2014

Plastics Processing

- Funding: Industry, ARM
- 1995 – 2004

Pathogen Detection (Fast PCR)

- Funding: NIH, ARO
- 2002 - 2007

Blast Wave Mitigation

- Funding: ARO
- 2003 - 2010

Flame Weeding in Agriculture

- Funding: PERC, NET, NEDED
- 2007 – Present

Femtosecond Laser Surface Processing Applications

- Funding: **NCESR**, NASA, ONR, DURIP, Honeywell, Boeing, Textron Aviation, Millennium Space Systems
- 2012 - Present



NPPD Liaison Team



John Swanson, Director of Generation Strategies & Research



Roman Estrada, Generation Research Sr. Program Manager



Alan Dostal, Part-time Director of Research



Director Predecessors of the Energy Center

Dr. Jerry Hudgins – Interim Director



- August 19, 2019 – August 13, 2023
- Dr. Hudgins also continued to Chair the Electrical and Computer Engineering Department at UNL while fulfilling the interim director position. He has been the center's associate director since 2009 and previously served as the center's interim director in 2011.
- He continues to lead the UNL Electrical and Computer Engineering Department in addition to his faculty member role.

Dr. Michael Nastasi - Director



- January 3, 2012 – August 18, 2019
- Dr. Nastasi came to UNL from Los Alamos National Laboratory where he was a longtime researcher. At the time he started at UNL, he had also directed the U.S. Department of Energy's Energy Frontier Research Center on Materials at Irradiation of Mechanical Extremes since 2009.
- He left UNL to become head of Texas A&M University's Department of Nuclear Engineering.

Dr. Kenneth Cassman – Founding Director



- June 2006 - 2011
- Dr. Cassman was head of UNL's agronomy and horticulture department from 1996 until 2004 when he returned to the faculty to concentrate on his crop production ecology research and teaching. Before joining UNL, he worked with the International Rice Research Institute in the Philippines and on the faculty at the University of California, Davis.
- He is an Emeritus Professor – UNL Agronomy & Horticulture and agricultural science consultant.



NCESR: NPPD Leadership's Vision on Energy (2005)

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)

NPPD Leadership

- Established NCESR in 2005
- Funded NCESR for \$24 million

Similar Entities Established Only Recently:

- John Hopkins University (2023)
- Louisiana State University (2023)
- University of Pennsylvania (2017)





Darrell J. Nelson - 2023 Summer Internships

- Annual summer internship opportunity in energy sciences research
- Started offering undergraduate internships in the summer of 2014
- Increased in 2023 from \$5,000 to \$6,000 awarded for each internship
- Starting in 2022, the number of internships *increased from four to eight*

1. **Bakir Mohammed Al-Ameri**, Department of Mechanical and Materials Engineering
Power Generation via Thermionic Electron Emission
2. **Abbegail Bowers**, Department of Physics and Astronomy
Structural Changes and Dislocations of Rare-Earth Ferric Oxide Thin Films
3. **Jarod Harris**, Department of Chemical and Biomolecular Engineering
The Effect of Polymer Properties on Carbon Dioxide Absorbance Capacity of Supported Ionic Liquid Membranes
4. **Bryce Herrington**, Department of Physics and Astronomy
Electronic Transport Properties of $Fe(qsal)_2(TCNQ)_2$ Molecular Films
5. **Emma Kurtz**, School of Natural Resources
Norfolk Integrated Waste-Energy Framework
6. **Keegan Nitsch**, Department of Chemical and Biomolecular Engineering
A Study on Electrocatalytic Nanoelectrode Using Local Electrochemistry
7. **Khaleb Pafford**, Department of Mechanical and Materials Engineering
Nationwide Trends of Battery Electric Vehicle Crashes
8. **Truman Stoller**, Department of Mechanical and Materials Engineering
Flow Boiling with Femtosecond Laser Processed Surfaces and Dielectric Working Fluid



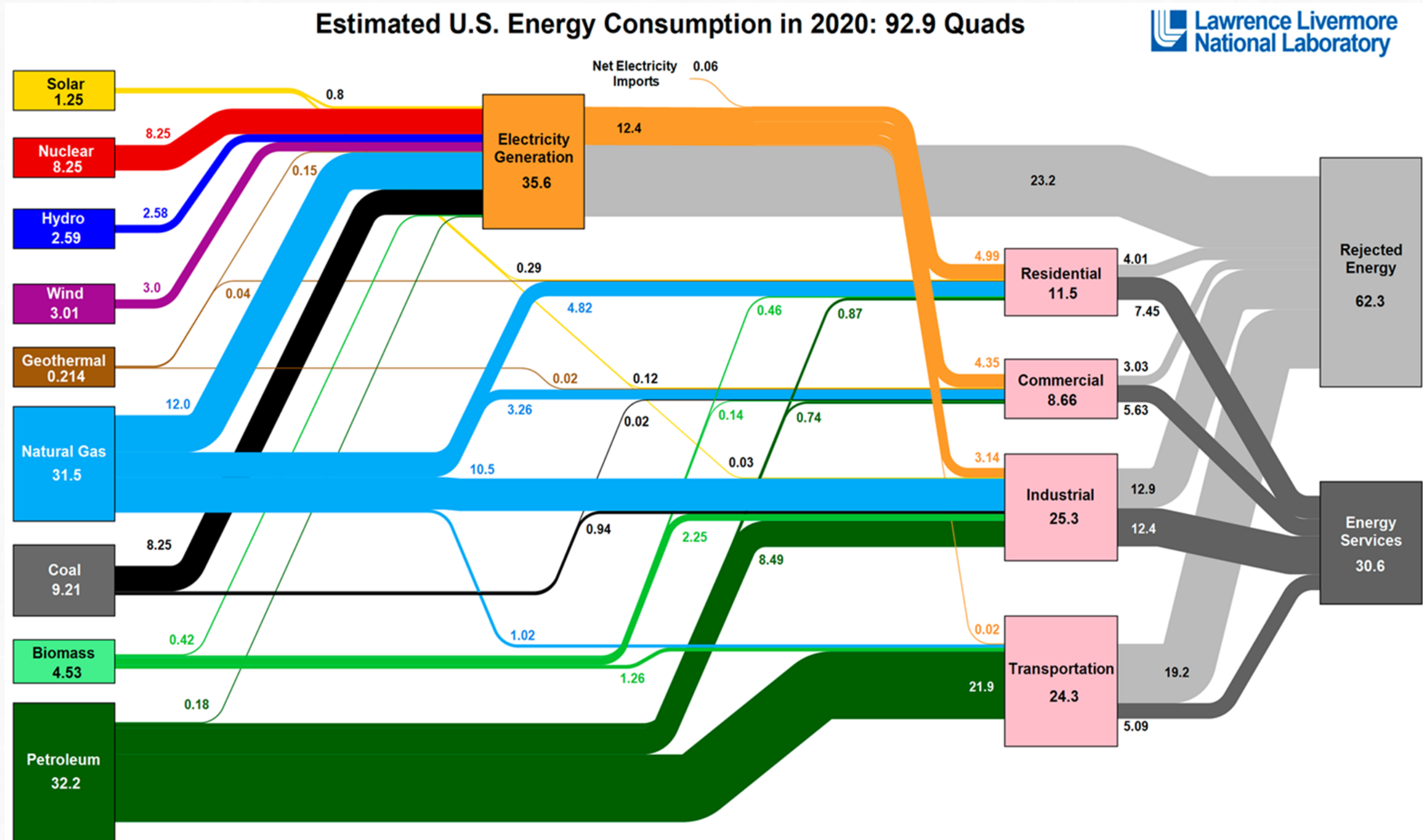
Darrell J. Nelson

My NCESR Success on Leveraging Its Funding

- Alexander D. and Gogos, G., "Enhanced Hydrogen Electrolysis and Heat Transfer Using Femtosecond Laser Produced Micro/Nano Structured Surfaces, \$145,000, Nebraska Center for Energy Sciences Research (NCESR), 1/1/12- 12/31/13.
- Gogos, G., Alexander, D. and Ndao, S. " Numerical Modeling of the Formation of Micro/ Nanostructures on Metals using Femtosecond Laser Surface Processing," Nebraska Center for Energy Sciences Research (NCESR), \$250,000, 1/1/2014 - 12/31/2015.
- **External Funding Directly Related to the NCESR Seed Funding:**
 - Completed and Current: \$7.73 million
 - **20:1 Leveraging**
 - Funding sources: **NCESR**, NASA, ONR, DURIP, Honeywell, Boeing, Textron Aviation, Millennium Space Systems
 - Pending: \$15.9 million



NCESR VISION



Source: LLNL March, 2021. Data is based on DOE/EIA MER (2020). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant heat rate. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential sector, 65% for the commercial sector, 21% for the transportation sector and 49% for the industrial sector, which was updated in 2017 to reflect DOE's analysis of manufacturing. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

NCESR VISION

Analysis of LLNL Graph

Percentage of Various Energy Sources

- **Fossil Fuels** [Petroleum: 34.66%, Natural Gas: 33.91%, Coal: 9.91%]: **78.5%**
- **Nuclear**: **8.9%**
- **Renewables** [Solar: 1.35%, Hydro: 2.79%, Wind: 3.24%, Geothermal: 0.23%, Biomass: 4.9%]: **12.6%**

Wasted energy: 67%

Research on various Energy Sources

- **Research on Biomaterials, Renewables & Nuclear (zero-carbon)**
- **Two or more decades of fossil fuels. Therefore, include research to:**
 - Increase efficiency of energy consumption
 - Capture of carbon dioxide (GHG)



NCESR VISION

The **vision** of NCESR is to be a global leader in the urgent transition to sustainable forms of energy for all.

The **mission** of NCESR is to harness science and technology through diverse, inclusive and innovative workforce development in order to lead the way towards a sustainable energy future for Nebraska, the United States, and the World.

To achieve the vision, we need to:

- Work closely with NPPD leadership in formulating innovative paths to the vision
- Balance funding between sustainable & fossil fuel energy sources targeting increase in energy efficiency and carbon capturing
- Pursue additional funding sources for NCESR (industry, etc.)
- Expect external funding to leverage NCESR funding ~10:1
- Build a community of UNL energy researchers and increase the visibility of NCESR nationally and internationally
 - Invite to UNL program managers from funding agencies (DOE, ARPA-E, DARPA, NSF etc.)
 - Organize an annual conference where NCESR funded research will be presented
 - Emphasize interdisciplinary research, Intellectual Property and start-ups
 - Co-fund research projects with other UNL funding centers (Daugherty Water for Food Global Institute, etc.)
 - Fund proposals strategically to build the infrastructure for BIG GRANTS (multi-million)
- Fund nuclear energy research (not renewable but carbon free)

