Energy Research
Energy Research

For more than a decade, UNLV researchers have engaged in world-class efforts to study various aspects of renewable energy. This research program has received funding by federal and state agencies, as well as many industrial partners. Our researchers have addressed questions related to many topics, including solar and wind energies, nuclear energy, fuel cells and “smart grid” technology.

We would like to introduce you to some of our researchers. Please contact us if we can help with future collaboration.

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Rendering on slide 1: Mojave Bloom, UNLV’s entry into the 2020 U.S. DoE Solar Decathlon, won third place overall, with first place wins in the operations and presentation contests.
Energy Research Areas of Expertise

- Electric power systems and power quality and static power converters
- Nanostructured light-absorbing coatings for advanced Concentrating Solar Power
- Design of grid-tied and standalone photovoltaic (PV) systems
- Solar-powered atmospheric water harvesting
- Game theoretic approaches for energy networks
- Digital twins
- Combined heat and power (CHP) system
- Assessing efficacy of decarbonization plans
- Photocatalysts for solar energy conversion
- Soft polymeric materials for efficient heat and mass transfer
- Corrosion modeling
- High temperature heat exchanger and decomposer design
- Molten salt reactors
- Land use change impacts of fossil fuel, bioenergy, and renewable energy
- Smart Grid concepts
- Speed scaling scheduling for CPUs
- Nuclear reactor operation
- Third-generation dye-sensitized solar cell
Energy Research

Why UNLV?

- UNLV is a leader among the state’s public entities dedicated to advancing renewable energy in the region and beyond.

- UNLV is located centrally in the southwest, close to many renewable energy resources including solar, wind, and geothermal energies.

- UNLV has been the host site of the *National Clean Energy Summit*, as well as other important international meetings.

- UNLV is now considered a convening center for renewable energy leaders throughout the nation and world.
Energy Research

Why UNLV?

- UNLV’s outstanding achievements in renewable energy research, its success in forging public/private partnerships, and its excellent academic programs place the university at the forefront of the field.

- UNLV has acquired more than $99 million in research funding in the past decade on wide-ranging subjects in the clean energy area, including:
  - Solar and geothermal power;
  - Biofuels;
  - Photonics;
  - Nuclear energy and the reprocessing of nuclear waste; and
  - Hydrogen production, storage, and use.
Faculty Involved in Energy Research

Dr. Yahia Baghzouz
Professor, Department of Electrical and Computer Engineering
Co-Director, Center for Energy Research

Dr. Alexander Barzilov
Professor, Department of Mechanical Engineering

Dr. Wolfgang Bein
Professor, Department of Computer Science
Co-Director, Center for Information Technology and Algorithms

Dr. Yi-Tung Chen
Chair & Professor, Department of Mechanical Engineering
Co-Director, Center for Energy Research

Dr. Jeremy Cho
Assistant Professor, Department of Mechanical Engineering

Dr. Marie-Odile Fortier
Assistant Professor, Sustainability in Arid Lands, Department of Civil and Environmental Engineering and Construction

Dr. Jaeyun Moon
Associate Professor, Department of Mechanical Engineering

Dr. Vince Wang
Assistant Professor, Department of Mechanical Engineering

Dr. Hui Zhao
Professor, Department of Mechanical Engineering
Energy Research Highlights
Dr. Yahia Baghzouz
Professor, Department of Electrical and Computer Engineering
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- Expertise
  - Electric power systems, power quality, and static power converters
  - Design of grid-tied and standalone photovoltaic (PV) systems
  - Impact of partial shading on PV array performance
  - Impact of distributed generation in electrical distribution systems
  - Hybrid electric vehicles and battery charging systems
  - Demand-side management
  - Smart Grid concepts

Determining voltage quality through computer simulations.

Testing bifacial PV panel to search for an accurate electrical circuit model.
Dr. Yahia Baghzouz  
Professor, Department of Electrical and Computer Engineering  
Co-Director, Center for Energy Research 

Relevant Publications  

Dr. Alexander Barzilov
Professor, Department of Mechanical Engineering
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• Expertise
  • Clean energy generation using nuclear power plants
  • Nuclear energy
  • Multiphysics modeling of nuclear systems
  • Liquid metal cooled fast reactors
  • Molten salt reactors
  • Small modular reactors
  • Nuclear power plant monitoring
  • Nuclear fuel cycle and waste management
  • Nuclear safeguards
  • Digital Twins
Dr. Alexander Barzilov
Professor, Department of Mechanical Engineering

Relevant Publications

Dr. Wolfgang Bein
Professor, Department of Computer Science
Co-Director, Center for Information Technology and Algorithms (CITA)

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• Expertise
  • Speed scaling scheduling for CPUs
  • Online energy management: manage variables, distributed and unpredictable supply from renewables
  • Game theoretic approaches for energy networks

Below: Dependable renewable energy distribution

Above: Algorithm designs for the Smart Grid
Relevant Publications

Dr. Yi-Tung Chen
Chair & Professor, Department of Mechanical Engineering
Co-Director, Center for Energy Research
Phone: (702) 895-1202
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- Expertise
  - Computational fluid dynamics
  - Numerical heat and mass transfer related to thermal system design
  - Renewable energy
  - High temperature heat exchanger and decomposer design
  - Corrosion modeling
  - Fuel cells (PEMFC and solid oxide fuel cell [SOFC])
Dr. Yi-Tung Chen  
Chair & Professor, Department of Mechanical Engineering  
Co-Director, Center for Energy Research  

Relevant Publications

• Yang Han, Chaoxiang Zhao, Hao Bai, Yanjun Li, Jiayue Yang, Yitung Chen, Guo Hong, David Lacroix, and Mykola Isaiev, “Modulating thermal transport in porous carbon honeycomb by cutting and deformation techniques,” Physical Chemistry Chemical Physics, Vol. 24, (2022), pp. 3207-3215
• Zirui Xu, Wangnan Chen, Jie Lian, Xiongwei Yang, Qiuwang Wang, Yitung Chen, and Ting Ma, “Study on mechanical stress of semicircular and rectangular channels in printed circuit heat exchangers,” Energy, 238, (2022), 121655, pp. 1-10
• Kaipo Kekaula and Yitung Chen, “Effect of ambient temperature variation on pressure drop during condensation in long inclined tubes,” Journal of Thermal Science and Engineering Applications, 14(2), (2022), 021005, pp. 1-12
• Hongyang Wei, Victor Quintanilla, Yitung Chen, Peiyao Qi, Xing Li, Shouxu Qiao, and Sichao Tan, “The numerical simulation and analysis of turbulent flow behavior in 5×5 fuel rod bundle with split-type mixing vane,” Annals of Nuclear Energy, 159, (2021), 108324, pp. 1-13
• Ting Ma, Yitung Chen, Aleksandr N. Pavlenko, and Qiuwang Wang, “Heat and mass transfer advances for energy conservation and pollution control in a renewable and sustainable energy transition,” Renewable and Sustainable Energy Reviews, 145, (2021), 111087, pp.1-3
• Wenxiao Chu, Xionghui Li, Yitung Chen, Qiuwang Wang, and Ting Ma, “Experimental study on small scale printed circuit heat exchanger with zigzag channels,” Heat Transfer Engineering, 42(9), (2021), pp. 723-735
Dr. Heejin Cho
Professor, Department of Mechanical Engineering
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- Expertise
  - Energy system modeling and optimization
  - Advanced sensor and control system for energy systems
  - Net zero energy/carbon building design and optimization
  - Distributed and renewable energy systems
  - Combined heat and power (CHP) system
  - Heating, ventilation, and air-conditioning (HVAC) systems
  - Integrated & smart building system
  - Nuclear ventilation and passive cooling
Dr. Heejin Cho
Professor, Department of Mechanical Engineering

Relevant Publications

Dr. Jeremy Cho
Assistant Professor, Department of Mechanical Engineering
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• Expertise
  • Liquid-vapor phase-change heat transfer for enhanced thermal management
  • Soft polymeric materials for efficient heat and mass transfer
  • Solar-powered atmospheric water harvesting
Dr. Jeremy Cho  
Assistant Professor, Department of Mechanical Engineering

Relevant Publications
Dr. Marie-Odile Fortier
Assistant Professor, Sustainability in Arid Lands, Department of Civil and Environmental Engineering & Construction
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Expertise

- Geospatial life cycle assessment, carbon footprints of energy systems
- Land use change impacts of fossil fuel, bioenergy, and renewable energy
- Assessing efficacy of decarbonization plans
- Energy data analytics

Modeling the performance and life cycle greenhouse gas emissions of emerging renewable energy technologies
Dr. Marie-Odile Fortier  
Assistant Professor, Department of Civil and Environmental Engineering and Construction

Relevant Publications

- Yang S, Volk TA, and Fortier M-OP. (2020) “Willow biomass crops are a carbon sequestration system or low-carbon biomass feedstock depending on prior land use and transportation distances to end users.” *Energies* 13(16), 4251.
Dr. Jaeyun Moon
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• Expertise
  • Thermoelectric nanomaterials and device fabrication
  • Nanostructured light-absorbing coatings for advanced Concentrating Solar Power (CSP)
  • Photocatalysts for solar energy conversion
  • Electrical and thermal properties of inorganic and hybrid (inorganic-organic) materials

Ivanpah Solar Electric Generating System and a schematic diagram of solar receivers.

Thermoelectric generators (TEGs) can directly convert heat energy to electricity.
Dr. Jaeyun Moon
Associate Professor, Department of Mechanical Engineering

Relevant Publications


Patents

Dr. Vince (Meng-Jen) Wang
Assistant Professor, Department of Mechanical Engineering with Emphasis on Nuclear
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• Expertise
  • Particle Transport Simulation and Method Development
  • Nuclear Reactor Core Design and Analysis
  • Radiation Shielding Analysis
  • Nuclear Reactor Operation

Neutron Radiography System

Spent Nuclear Fuel Cask Dose Rate Monitoring

Reactor Pressure Vessel Neutron Fluence Calculation

Detector
Dr. Vince Wang
Assistant Professor, Department of Mechanical Engineering

Relevant Publications

- C. Olson, J. Snow, M.-J. Wang, G. Sjoden, E. Cazalas, “An Experimental Validation of Spectrally Matched Neutron Detection Systems using \textsuperscript{3}He and BF”, \textit{Nuclear Technology} (2023)
- T. W. Hall, M.-J. Wang, G. Sjoden, C. Hines, and M. Watrous, “Computationally Optimized Irradiation Chamber Design for the Production of \textsuperscript{135}Xe in Washington State University TRIGA Reactor”, \textit{Nuclear Science and Engineering} (2023)
- T. W. Hall, M.-J. Wang, G. Sjoden, and M. Watrous, “Computational and Experimental Optimization of \textsuperscript{135}Xe Production in Calibration Sources”, \textit{Journal of Environmental Radioactivity}, Vol. 244-245, 106814 (2022)
Dr. Hui Zhao
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- Expertise
  - Third-generation dye-sensitized solar cell
  - Ionic-liquid-based energy storage technology
  - Lab-on-a-chip technologies toward biomedical diagnostics and analysis

Applications of ionic-liquid electrochemical capacitors.

Third-generation nanocrystal-enhanced dye-sensitized solar cell.
Dr. Hui Zhao
Professor, Department of Mechanical Engineering

Relevant Publications