Renewable Energy Research
Renewable 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, 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.

Photo on slide 1: DesertSol, UNLV’s entry into the 2013 U.S. DoE Solar Decathlon, won second place, making it the highest-ranked of all U.S. schools.
Renewable Energy Research Areas of Expertise

- Electric power systems and power quality
- Solar power generation
- Design of grid-tied and standalone photovoltaic (PV) systems
- Power plant dry cooling
- Solar thermal applications: domestic hot water, process heat, cooling
- Thermosiphon-driven solar heaters
- Solar hybrid lighting
- Wind energy assessment
- Aerodynamics of turbine blades
- Solar-powered atmospheric water harvesting
- Vehicle design with fuel cells and alternative fuels
- Hybrid electric vehicles and battery charging systems
- Third generation dye-sensitized solar cells
- Flow studies for solid solar receivers
- Photocatalysts for solar energy conversion
- Molten salt technology as a heat energy storage medium
- Combustion and propulsion modeling
- Molten salt properties and storage vessel design
- Soft polymeric materials for efficient heat and mass transfer
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.
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 Renewable Energy Research

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

Dr. Shubhra Bansal
Assistant Professor, Department of Mechanical Engineering

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

Dr. Robert Boehm, P.E.
Distinguished Professor, Department of Mechanical Engineering
Director, Center for Energy Research

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

Dr. Jeremy Cho
Assistant Professor, Department of Mechanical Engineering

Dr. William Culbreth
Associate Professor, Department of Mechanical Engineering

Dr. Samaan Ladkany
Professor, Department of Civil & Environmental Engineering & Construction

Dr. Jaeyun Moon
Associate Professor, Department of Mechanical Engineering

Dr. Samir Moujaes, P.E.
Professor, Department of Mechanical Engineering

Dr. Darrell Pepper
Professor, Department of Mechanical Engineering

Dr. Hui Zhao
Associate Professor, Department of Mechanical Engineering

April 2020
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## Additional Resources

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Renewable Energy
Research Highlights
Renewable Energy Research

Dr. Yahia Baghzouz
Professor, Department of Electrical and Computer Engineering
Co-Director, Center for Energy Research
Phone: (702) 895-0887
Email: yahia.baghzouz@unlv.edu

- 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

- Testing bifacial PV panel to search for an accurate electrical circuit model.
- Determining voltage quality through computer simulations.
- Searching for the impact of PV power fluctuations.
Renewable Energy Research

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

Relevant Publications

• C. Hicks and Y. Baghzouz, “Experimental Steady-State and Transient Analysis of a Behind-The-Meter Battery Storage for Residential Customers with PV Systems”, IEEE International Conference on Clean Electric Power, Otranto, Italy, July 2-5, 2019. art. no. 8890193, pp. 438-443.


Renewable Energy Research

Dr. Shubhra Bansal  
Assistant Professor, Department of Mechanical Engineering

Phone: (702) 895-2720  
Email: shubhra.bansal@unlv.edu

- Expertise
  - Performance and reliability of thin film photovoltaic devices
  - PV module and device reliability
  - Physics-based life prediction models for design and materials control
  - Energy conversion and storage
Dr. Shubhra Bansal  
Assistant Professor, Department of Mechanical Engineering

Relevant Publications

Renewable Energy Research

Dr. Wolfgang Bein
Professor, Department of Computer Science
Co-Director, Center for Information Technology and Algorithms (CITA)
Phone: (702) 895-1477
Email: wolfgang.bein@unlv.edu

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

Algorithm designs for the Smart Grid.
Renewable Energy Research

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

Relevant Publications

Dr. Robert Boehm, P.E.
Distinguished Professor, Department of Mechanical Engineering
Director, Center for Energy Research
Phone: (702) 895-4160
Email: bob.boehm@unlv.edu
Website for the Center for Energy Research: www.unlv.edu/cer

- Expertise
  - Solar power generation (PV, CPV, CSP)
  - Power plant dry cooling
  - Solar thermal applications: domestic hot water, process heat, cooling
  - Energy conservation and solar applications in buildings
  - Solar hybrid lighting
  - Renewable hydrogen generation
  - Vehicle design with fuel cells and alternative fuels
  - Geothermal power production

Center: At UNLV, a solar powered supercritical CO2 engine has been developed. It is driven by the dish system shown in the picture.
Bottom: Pictured are some of the roofs in the Villa Trieste project with solar PV panels. 164 project homes were built to minimize peak electrical demand by Pulte Homes with the design assistance of the UNLV CER.
Renewable Energy Research

Dr. Robert Boehm, P.E.
Distinguished Professor, Department of Mechanical Engineering
Director, Center for Energy Research

Relevant Publications

Renewable Energy Research

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

Phone: (702) 895-1202
Email: yitung.chen@unlv.edu

- 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 SOFC)
Renewable Energy Research

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

Relevant Publications

• Wei, H., Chen, Y.-T. “Numerical investigation of the internally heated melt pool natural convection behavior with the consideration of different high internal Rayleigh numbers” (2020) Annals of Nuclear Energy, 143, art. no. 107427.
• Bennett, K., Chen, Y.-T. “Thermal-hydraulic correlations for zigzag-channel PCHES covering a broad range of design parameters for estimating performance prior to modeling” (2020) Thermal Science and Engineering Progress, 17, art. no. 100383.
• Bennett, K., Chen, Y.-T. “One-way coupled three-dimensional fluid-structure interaction analysis of zigzag-channel supercritical CO<sub>2</sub> printed circuit heat exchangers” (2020) Nuclear Engineering and Design, 358, art. no. 110434.
Renewable Energy Research

Dr. Jeremy Cho
Assistant Professor, Department of Mechanical Engineering
Phone: (702) 895-4701
Email: jeremy.cho@unlv.edu

- 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
Renewable Energy Research

Dr. Jeremy Cho
Assistant Professor, Department of Mechanical Engineering

Relevant Publications


Renewable Energy Research

Dr. William Culbreth
Associate Professor, Department of Mechanical Engineering
Phone: (702) 895-3426
Email: william.culbreth@unlv.edu

- Expertise
  - Research on molten salts as a heat energy storage medium
  - Molten salt properties and storage vessel design

Dr. Samaan Ladkany
Professor, Department of Civil & Environmental Engineering & Construction
Phone: (702) 895-3438
Email: samaan.ladkany@unlv.edu
Renewable Energy Research

Dr. William Culbreth
Associate Professor, Department of Mechanical Engineering

Dr. Samaan Ladkany
Professor, Department of Civil & Environmental Engineering & Construction

Renewable Energy Research

Dr. Jaeyun Moon
Associate Professor, Department of Mechanical Engineering
Phone: (702) 895-5611
Email: jaeyun.moon@unlv.edu
Website: http://jmoon.faculty.unlv.edu/

- 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.
Renewable Energy Research

Dr. Jaeyun Moon
Associate Professor, Department of Mechanical Engineering

Relevant Publications

Renewable Energy Research

Dr. Samir Moujaes, P.E.
Professor, Department of Mechanical Engineering

Phone: (702) 895-3265
Email: samir.moujaes@unlv.edu

• Expertise
  • Phase studies for alternative fuels derived from coal
  • Flow studies for solid particle solar receivers
  • Computer simulation of thermosiphon-driven solar heaters
  • Two-phase and three-phase flow thermal hydraulics studies
  • Energy conservation and HVAC systems

Above left: A solid-particle receiver (SPR) gravity feed to heat particles for a high-temperature production facility, using concentrated solar energy.

Above right: Testing apparatus used at UNLV to characterize the heat exchanger suggested for high-temperature hydrogen production, using nuclear energy as the heat source.

A schematic of UNLV’s Air Duct Leakage Laboratory (ADLL).
Renewable Energy Research

Dr. Samir Moujaes, P.E.
Professor, Department of Mechanical Engineering

Relevant Publications

Dr. Darrell Pepper
Professor, Department of Mechanical Engineering

Phone: (702) 895-1056
Email: darrell.pepper@unlv.edu

- Expertise
  - Computational fluid dynamics, heat transfer and species transport
  - Advanced computational techniques
  - Wind energy assessment
  - Groundwater modeling and transport through porous media
  - Aerodynamics of turbine blades
  - Thin-film solar panels
  - Combustion and propulsion modeling

Meteorological tower placed in the Nellis Dunes area.

Nevada topography and prevailing wind pattern.

Areas in Nevada with wind energy potential (Class 4-7).

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Renewable Energy Research

Dr. Darrell Pepper
Professor, Department of Mechanical Engineering

Relevant Publications

Renewable Energy Research

Dr. Hui Zhao  
Associate Professor, Department of Mechanical Engineering  
Phone: (702) 895-1463  
Email: hui.zhao@unlv.edu

- 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.

Third-generation dye-sensitized solar cell.
Renewable Energy Research

Dr. Hui Zhao
Associate Professor, Department of Mechanical Engineering

Relevant Publications