Renewable Energy Research
Renewable Energy Research

For more than a decade, UNLV researchers have been conducting a world-class effort in various aspects of renewable energy. This research program has been funded by federal and state agencies as well as many industrial partners. Our researchers have addressed questions related to many fields, including solar and wind energies in addition to fuel cells and ‘smart grid’ technology.

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

- Vehicle design with fuel cells and alternative fuels
- Hybrid electric vehicles and battery charging systems
- High temperature heat exchanger design
- Fuel cells design
- Aerodynamics of turbine blades
- Combustion and propulsion modeling
- High-temperature properties of metallic alloys, ceramics, and composites
Renewable 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 at a central location in the West that is close to many renewable energy resources including, solar, wind, and geothermal energies.
- UNLV is the host site of the National Clean Energy Summit for the past three years and other important international meetings. UNLV is now considered a convening center for renewable energy leaders throughout the nation and world.
Renewable 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 Renewable Energy Research

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

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

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

Dr. Brendan J. O’Toole  
Professor, Department of Mechanical Engineering  
Director, Mendenhall Innovation Program

Dr. Darrell Pepper  
Professor, Department of Mechanical Engineering  
Director, Nevada Center for Advanced Computational Methods

Dr. Hui Zhao  
Assistant Professor, Department of Mechanical Engineering
Renewable Energy Research

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

Top: Testing of bifacial PV Panel to search for an accurate electrical circuit model.
Center: Searching for the impact of PV power fluctuations.
Bottom: Determining voltage quality through computer simulations.
Renewable Energy Research

Dr. Robert Boehm, P.E.
Professor,
Department of Mechanical Engineering
Director, Center for Energy Research
Bob.Boehm@unlv.edu

- 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

Top: At UNLV, photovoltaic systems are being developed to provide solar energy, including this Amonix Integrated High Concentration Photovoltaic (IHCPV) system.
Bottom: The Villa Trieste community of homes in Las Vegas have many energy-reducing features, including solar energy panels and an intelligent communications system between users and the utility.
Renewable Energy Research

Dr. Yi-Tung Chen
Professor,
Department of Mechanical Engineering
Co-Director, Center for Energy Research
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)
Dr. Samir Moujaes, P.E.
Professor,
Department of Mechanical Engineering
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

Left: A solid-particle receiver (SPR) gravity feed to heat particles for a high-temperature production facility, using concentrated solar energy.
Right: Testing apparatus used at UNLV to characterize the heat exchanger suggested for use in high-temperature hydrogen production, using nuclear energy as the heat source.
Renewable Energy Research

Dr. Brendan O’Toole
Professor,
Department of Mechanical Engineering
Director, Mendenhall Innovation Program
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- Expertise
  - Design and fabrication of polymer composite structures
  - High-temperature properties of metallic alloys, ceramics, and composites
  - Hydrogen-induced embrittlement of materials
  - Delayed hydride cracking of nuclear fuel rods
  - Energy absorbing and thermal properties of polymer foams
  - Identification of dynamic properties of materials

Analysis (top) of micro-featured disks (bottom) to understand the effect of temperature, environment, and manufacturing techniques on the strength of ceramic components with micro-features.
Renewable Energy Research

Dr. Darrell Pepper
Professor, Department of Mechanical Engineering
Director, Nevada Center for Advanced Computational Methods
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- 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

Top: Nevada topography and prevailing wind pattern.
Bottom: Areas in Nevada with wind energy potential (Class 4-7)
Renewable Energy Research

Dr. Hui Zhao
Assistant Professor,
Department of Mechanical Engineering
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

Top: Third-generation nanocrystal-enhanced dye-sensitized solar cell.
Bottom: Applications of ionic-liquid electrochemical capacitors.
Renewable Energy Research

Faculty CVs and Publications
Renewable Energy Research

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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
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  - Demand-Side Management
  - Smart Grid concepts
Renewable Energy Research

Dr. Yahia Baghzouz
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Co-Director, Center for Energy Research

Recent Publications

Renewable Energy Research

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  - 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

Geothermal electricity is generated from plants that tap the Earth’s heat.
Renewable Energy Research

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

Recent Publications

- “Performance of Liquid-Immersed Silicon Solar Cells under Highly Intensified Illumination,” The International Conference on Concentrating Photovoltaic Systems CPV-7, 4-6 April, 2011, Las Vegas, USA (Yong Sun, Li Zhu, Yiping Wang, A M Sahm and Zhengjian Zhao).
Renewable Energy Research

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Co-Director, Center for Energy Research

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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
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  - Fuel cells (PEMFC and SOFC)
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Recent Publications

Renewable Energy Research

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- 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
Renewable Energy Research

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

Recent Publications

- "Two Phase Upflow in Rectangular Channels", International Journal of Multiphase Flow Vol. 11 No. 4 pp. 503-513, 1985 (with R. S. Dougall)
Renewable Energy Research

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- Expertise
  - Design and fabrication of polymer composite structures
  - High-temperature properties of metallic alloys, ceramics, and composites
  - Hydrogen-induced embrittlement of materials
  - Delayed hydride cracking of nuclear fuel rods
  - Energy absorbing and thermal properties of polymer foams
  - Identification of dynamic properties of materials
Renewable Energy Research

Dr. Brendan O’Toole
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Recent Publications


• “Microbial treatment increases colonization and decreases mechanical strength of wood and metal samples”, Abstract, Proceedings of the 103rd General Meeting of the American Society for Microbiology, May 18-22, 2003 (with C. Pantle, T. Else, and P. Amy).
Renewable Energy Research

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• 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

Top: Power density for a wind turbine with a 50-m hub height within the Nevada Test Site. Bottom: Meteorological tower placed in the Nellis Dunes area.
Renewable Energy Research

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Recent Publications

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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
Renewable Energy Research

Dr. Hui Zhao
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Department of Mechanical Engineering

Recent publications

- Zhao, H., 2011, The role of hydrodynamic behavior of DNA molecules in dielectrophoretic polarization under the action of an electric field, Physical Review E, 84, 021910.
- Zhao, H., 2011, Double layer polarization of a non-conducting particle in an alternating current field with applications to dielectrophoresis, Electrophoresis, 32, 2232-2244.
# Renewable Energy Research

## Additional Resources

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