

Renewable Energy Research



Renewable Energy Research



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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.

Photo on slide 1: DesertSol, UNLV's entry into the 2013 U.S. DoE Solar Decathlon, which 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
- Combustion and propulsion modeling
- Vehicle design with fuel cells and alternative fuels
- Hybrid electric vehicles and battery charging systems
- High temperature heat exchanger design
- Fuel cells design
- High-temperature properties of metallic alloys, ceramics, and composites
- Surface modification for enhanced heat and mass transfer (condensation, boiling, absorption, etc.)
- Metal hydride for use in energy devices and production

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 has been the host site of the National Clean Energy Summit for the past four years, as well as 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. Kwang J. Kim

*Southwest Gas Professor of Energy and Matter
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

*Associate Professor, Department of Mechanical
Engineering*

Renewable Energy Research

Dr. Yahia Baghzouz

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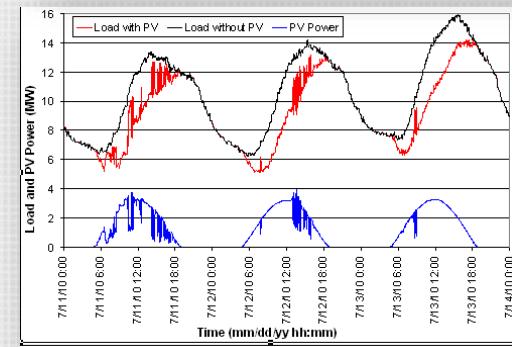
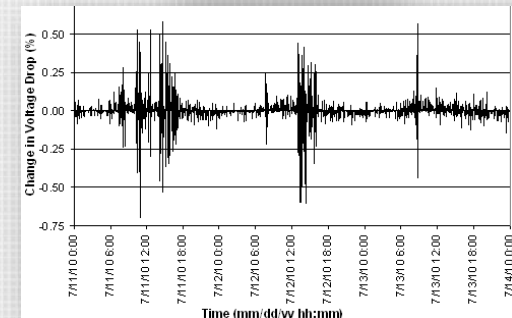
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- Expertise
 - Electric power systems, power quality, and static power converters
 - Design of grid-tied and standalone photovoltaic (PV) systems
 - Impact of partial shading on PV array performance
 - Impact of distributed generation in electrical distribution systems
 - Hybrid electric vehicles and battery charging systems
 - Demand-Side Management
 - Smart Grid concepts

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.



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Dr. Robert Boehm, P.E.

Distinguished Professor, Department of Mechanical Engineering

Director, Center for Energy Research

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 - Solar power generation (PV, CPV, CSP)
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 - 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

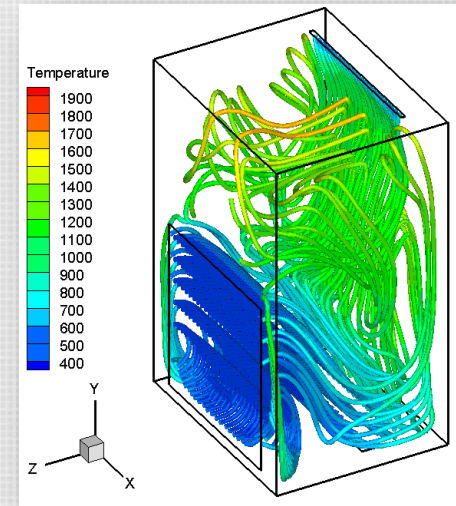
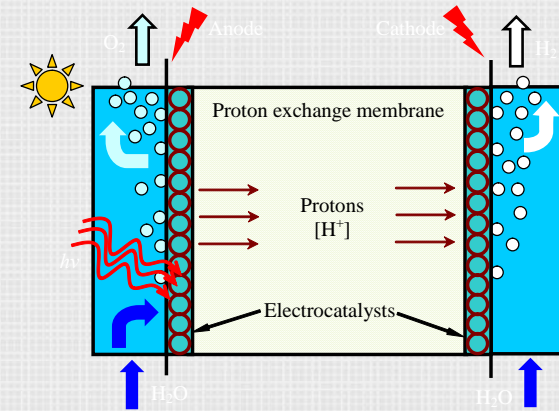
Dr. Yi-tung Chen

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- Expertise
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 - 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)



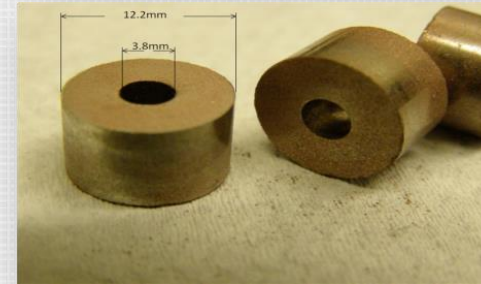
Renewable Energy Research

Dr. Kwang J. Kim

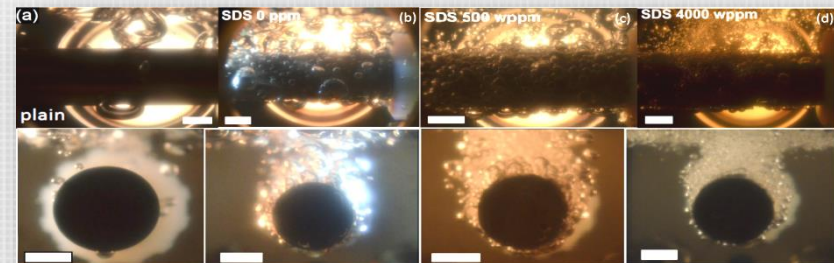
Southwest Gas Professor of Energy and Matter, Department of Mechanical Engineering

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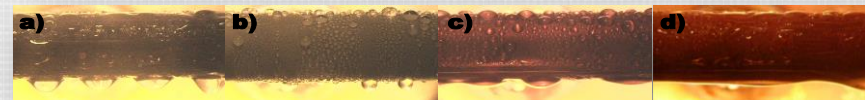
- Expertise
 - Surface modification for enhanced heat and mass transfer (condensation, boiling, absorption, etc.)
 - Metal hydride for use in energy devices and production



Hydrogen Sponge: source:
Int. J. Hydrogen Energy, 34(7), 2009



Boiling Surfaces: source: Int. J. H & M Transfer, 63, 2013



Condensing Surfaces: source: Int. J. H & M Transfer, 65, 2013

Renewable Energy Research

Dr. Samir Moujaes, P.E.

Professor, Department of Mechanical Engineering

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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

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.

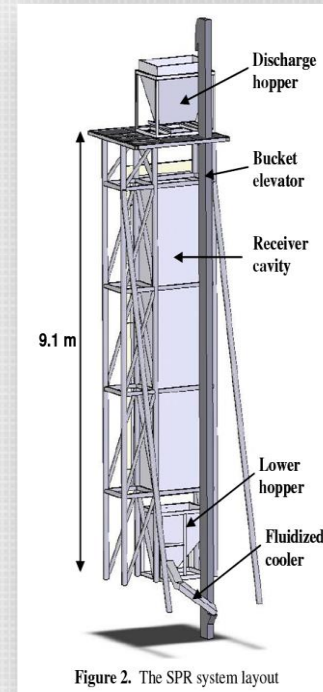


Figure 2. The SPR system layout

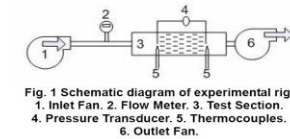


Fig. 1 Schematic diagram of experimental rig.
1. Inlet Fan. 2. Flow Meter. 3. Test Section.
4. Pressure Transducer. 5. Thermocouples.
6. Outlet Fan.

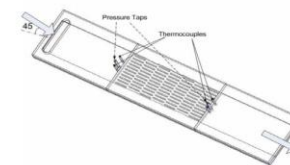


Fig. 2 SolidWorks drawing of test section

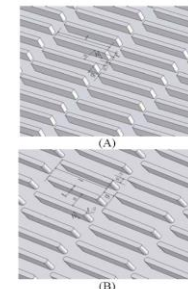


Fig. 3 Geometry of fins.
A. Square-edge-fins. B. Round-edge-fins.

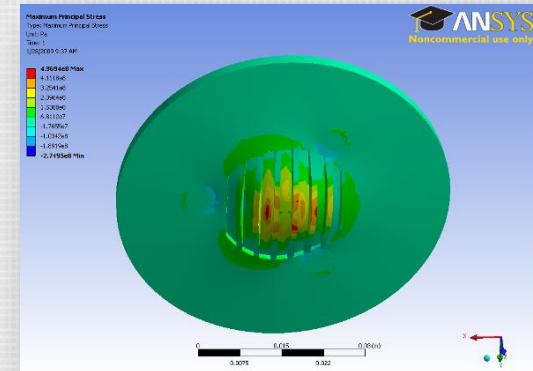
Renewable Energy Research

Dr. Brendan O'Toole

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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

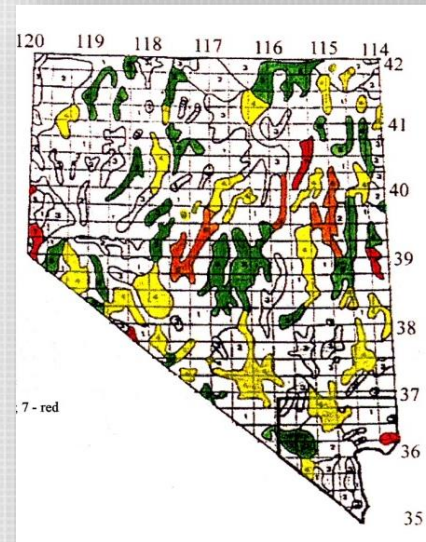
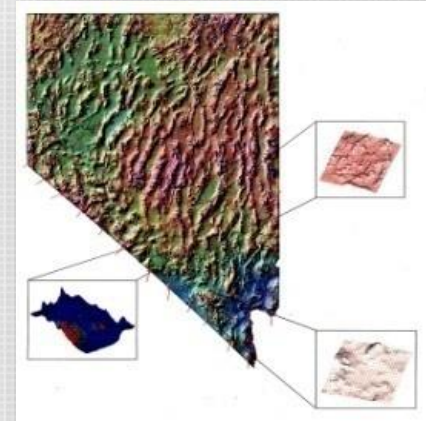
Director, Nevada Center for Advanced Computational Methods

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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

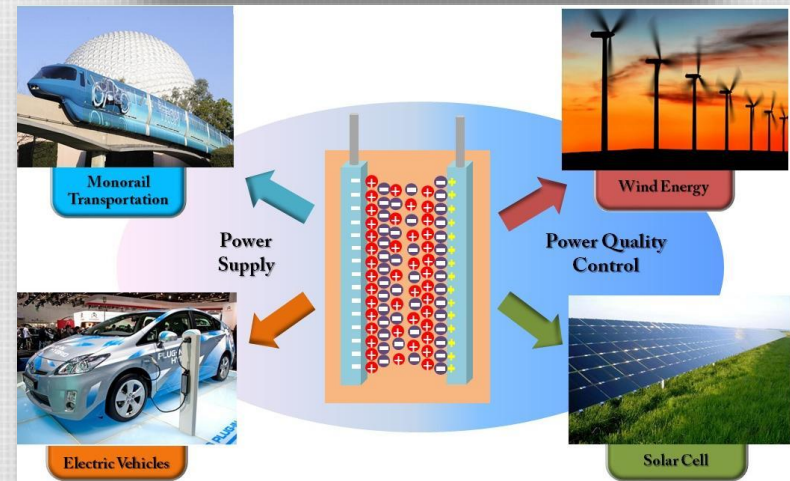
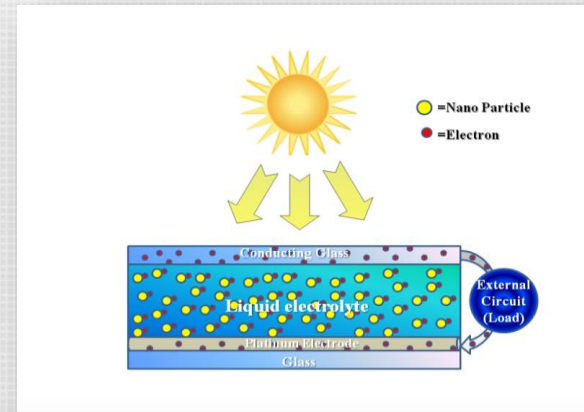
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- Expertise
 - Third-generation dye-sensitized solar cell
 - Ionic-liquid-based energy storage technology
 - Lab-on-a-chip technologies toward biomedical diagnostics and analysis

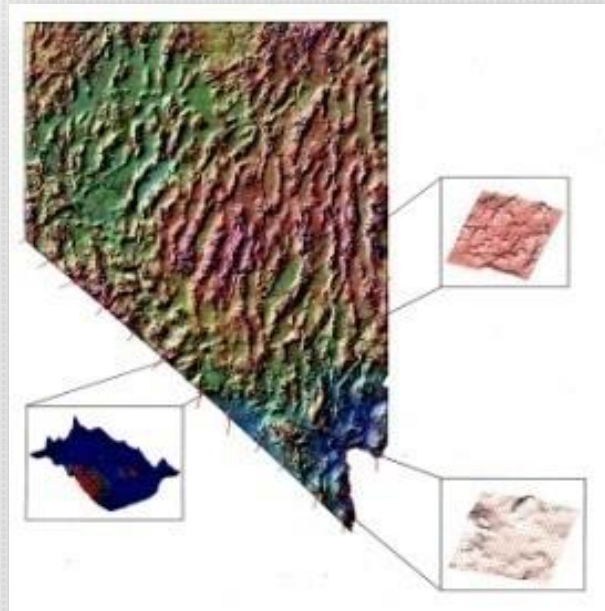
Top: Third-generation nanocrystal-enhanced dye-sensitized solar cell.

Bottom: Applications of ionic-liquid electrochemical capacitors.



Renewable Energy Research

Faculty CVs and Publications



Renewable Energy Research

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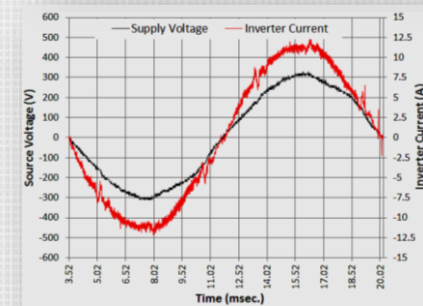
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Recent Publications

- A. Arabali, M. Ghofrani, M. Etezadi-Amoli, M. Fadali and Y. Baghzouz, "Optimal Genetic Algorithm-Based Optimization Approach for Energy Management", Submitted to *IEEE Transactions on Power Delivery*, Issue: 99, Nov. 2012.
- J. Johnson, D. Yoon and Y. Baghzouz, Modeling and Analysis of a Bifacial Grid-Connected PV System, *IEEE/PES General Meeting*, July 22-27, 2012.
- B. Blackstone, Y. Baghzouz, and S. Premrudeepreechacharn, Determining MPPT and Anti-Islanding Techniques in a Grid-Tie PV Inverter, *Proc. IEEE/ICHQP*, June 28-30, 2012.
- X. Chen, J.P. Caputo and Y. Baghzouz, Harmonic Analysis of Ferroresonance in Single-Phase Transformers, *Proc. IEEE/ICHQP*, June 28-30, 2012.
- W. Peng, S. Haddad, Y. Baghzouz, Improving power quality in distribution feeders with high PV penetration through inverter controls, *CIGRE*, May 29-30, 2012.
- W. Peng and Y. Baghzouz, "Accurate circuit model for steady-state and dynamic performance of lead-acid AGM batteries", *International Conference and Utility Exhibition on Power and Energy Systems*, Pattaya City, Thailand, September 28-30, 2011.
- G.K. Ari and Y. Baghzouz, "Impact of high PV penetration on voltage regulation in electrical distribution systems", *International Conference on Clean Electrical Power*, Ischia, Italy, June 14-16, 2011.
- Y. Riffonneau, S. Bacha, F. Barruel, Y. Baghzouz, "Optimal Reactive Power Supervision of Grid-Connected PV Systems with Batteries", submitted to *IEEE Transactions on Sustainable Energy*, Issue: 3, July, 2011.
- A. Emanuel, E. So, Y. Baghzouz, et al., "IEEE Standard Definitions for the Measurement of Electric Power Quantities Under Sinusoidal, Non-sinusoidal, Balanced, or Unbalanced Conditions", *IEEE Standard 1459*, 2010.

Renewable Energy Research

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University of Nevada, Las Vegas

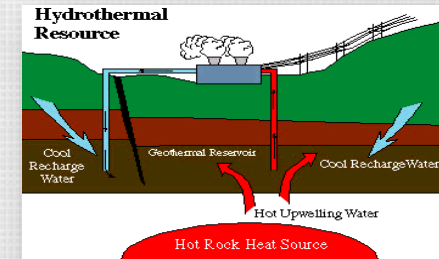
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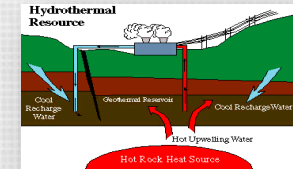


Geothermal electricity is generated from plants that tap the Earth's heat.

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Director, Center for Energy Research



Recent Publications

- "Assessment of Solar Development in Taiwan," ES91020, ASME 6th International Conference on Energy Sustainability, July 23-26, 2012.
- "Water Immersion Cooling of PV Cells in a High Concentration System." SOLAR ENERGY MATERIALS AND SOLAR CELLS, Volume 95, Issue 2, February 2011, pp. 538-545 (with Li Zhu, Y. Wang, C. Halford, and Y. Sun).
- "Some Solar Related Technologies and Their Applications," Chapter 1 in ENERGY & POWER GENERATION: SELECT APPROACHES (K. R. Rao, Editor), ASME, New York, N.Y. 2011.
- "Economic Feasibility of Energy Efficiency Measures in Residential Buildings," RENEWABLE ENERGY, 2011, Vol. 36, pp. 2925-2931 (with S. B. Sadineni, and T. France).
- "Passive Building Energy Savings: A Review of Building Envelope Components," Accepted to RENEWABLE AND SUSTAINABLE ENERGY REVIEWS, 2011 (with S. B. Sadineni, Srikanth Madala).
- "An Estimation of the Performance Limits and Improvement of Dry Cooling on Trough Solar Thermal Plants," APPLIED ENERGY, 88 (1), 2011, 216-223 (with H. Deng).
- "An On-Sun Parametric Study of Hydrogen Production Using WO₃ Photoanodes," EXPERIMENTAL THERMAL AND FLUID SCIENCE, 35(1), 2011, 180-189 (with C. Halford).
- "Impact of Storage Integrated Solar Photovoltaics (PV) Power System on Utility Peak Loads," ASME 5th International Conference on Energy Sustainability, August 7-10, 2011, Washington, D. C. (with K. Agyenim-Boateng).
- "Experimental Comparison for Utility Scale Installations," ASME 5th International Conference on Energy Sustainability, August 7-10, 2011, Washington D.C. (with Jonathan D. Realmuto, Suresh B. Sadineni, Srikanth Madala).
- "Measurements and Simulations of Electric Demand from Residential Buildings for Peak Load Reduction," ASME 5th International Conference on Energy Sustainability, August 7-10, 2011, Washington D.C. (with Suresh B. Sadineni, Fady Attallah).
- "Two Types of Calorimeters for Assessing Fresnel Lens Performance in Concentrating Solar Systems," Proceedings of the ASME 2011 5th International Conference on Energy Sustainability, ESFuelCell2011, August 7-10, 2011 Washington D.C. (with A. Sahm, K Agyenim-Boateng, K. Hynes, K. Hammer, T. Roberts, K. W. Stone).
- "Optical and Thermal Analysis for Immersed Cooling of Photovoltaic Cells in a Highly Concentrated Beam," ASME 5th International Conference on Energy Sustainability, August 7-10, 2011, Washington D.C. (with Ahmed Darwish).

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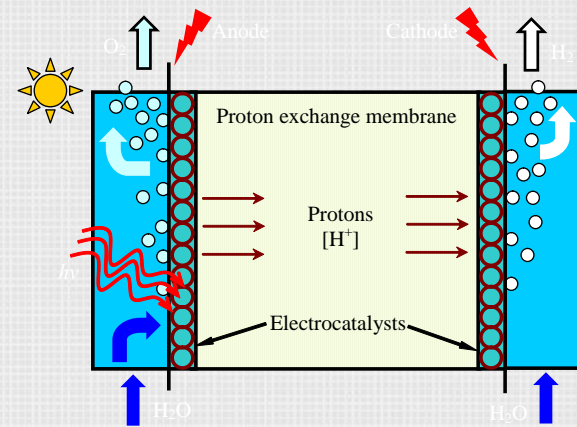
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- Expertise
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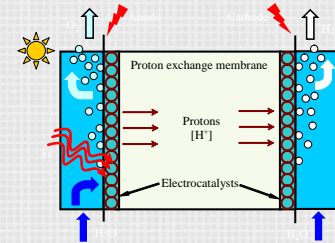
Renewable Energy Research

Dr. Yi-tung Chen

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Recent Publications

- "Review of Study on Solid Particle Solar Receivers," Renewable and Sustainable Energy Reviews, 14 (2010), pp. 265-276 (with T. Tan).
- "Wind Effect on the Performance of Solid Particle Solar Receivers with and without the Protection of an Aerowindow," Solar Energy, 83 (2009), pp. 1815-1827 (with T. Tan, Z. Chen, N. Siegel, and G. Kolb).
- "Simulations of Metal Oxidation in LBE at a Mesoscopic Level," Journal of Engineering for Gas Turbines & Power, May 2009, Vol. 131, 032903/pp. 1-11 (with T. Tan).
- "CFD Modeling and Experimental Validation of Sulfur Trioxide Decomposition in Bayonet Type Heat Exchanger and Chemical Decomposer for Different Packed Bed Designs," International Journal of Hydrogen Energy, 34 (2009), pp. 2543-2557 (with V. Nagarajan, V. Ponyavin, M. Vernon, P. Pickard, and A. Hechanova).
- "Scale removal cellular automaton oxidation models of metals in lead bismuth eutectic," Journal of Electroanalytical Chemistry, 626 (2009), pp. 89-97 (with T. Tan).
- "A Diffusion Controlling Oxidation Model with Scale Removal in Oxygen Containing Liquid Flow," Computational Material Science, 44, (2008), pp. 750-759 (with T. Tan and H. Chen).
- "Numerical of High Temperature Shell and Tube Heat Exchanger and Chemical Decomposer for Hydrogen Production," International Journal of Hydrogen Energy, 33, (2008), pp. 5460-5468 (with G. Kuchi, V. ponyavin, S. Sherman, and A. Hechanova).
- "Oxidation Companied by Scale Removal: Initial and Asymptotical Kinetics," Journal of Nuclear Science and Technology, Vol. 45, No. 7, pp. 1-6, 2008 (with T. Tan and H. Chen).
- "A Lattice Boltzmann Modeling of Oxygen Transport and Corrosion Behavior in the Nature Convection Lead-alloy Flow," Nuclear Engineering and Design 237 (2007) pp. 1987-1998 (with H. Chen and J. Zhang).



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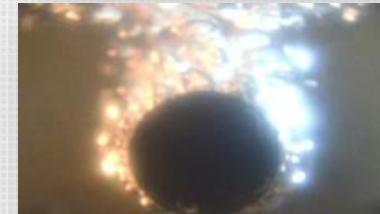


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 - Metal hydride for use in energy devices and production

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Dr. Kwang J. Kim

Southwest Gas Professor of Energy and Matter,
Department of Mechanical Engineering



Recent Publications

- B. J. Zhang, J. Park, and K. J. Kim, "Augmented Boiling Heat Transfer on the Wetting-modified Three Dimensionally-Interconnected Alumina Nano Porous Surfaces in Aqueous Polymeric Surfactants," *International Journal of Heat and Mass Transfer*, Vol. 63, pp. 224-232 (2013).
- S. Lee, H. K. Yoon, K. J. Kim, S. Kim, M. Kennedy, and B. J. Zhang, "A Dropwise Condensation Model Using a Nano-scale, Pin Structured Surface," *International Journal of Heat and Mass Transfer*, Vol. 60, pp. 664-671 (2013).
- B. J. Zhang and K. J. Kim, "Effect of Liquid Uptake on Critical Heat Flux Utilizing a Three dimensional, Interconnected Alumina Nano Porous Surfaces," *Applied Physics Letters (APL)*, Vol. 101, 054104 (2012).

For more publications: <http://scholar.google.com/citations?user=VX3wtWEAAAJ&hl=en>

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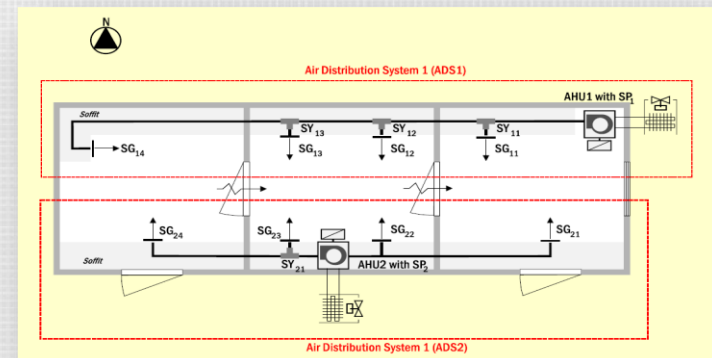
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- Flow studies for solid particle solar receivers
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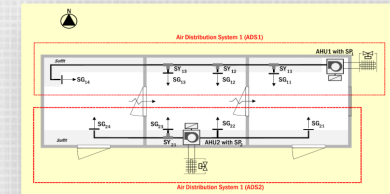


A schematic of UNLV's Air Duct Leakage Laboratory (ADLL).

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Dr. Samir Moujaes, P.E.

Professor, Department of Mechanical Engineering



Recent Publications

- "Experimental and Simulation Study on Wind Affecting particle Flow in a Solar Receiver", Solar Energy 2010, v.84, p. 263-270 (with K. Kim and G. Kolb).
- "A Study of Solid particle Flow Characterization in a Solar Receiver", Solar Energy, 2009, v 83, n 10, p 1784-1793 (with K. Kim, N. Siegel, G. Kolb, and V. Rangaswamy).
- "Two Phase Upflow in Rectangular Channels", International Journal of Multiphase Flow Vol. 11 No. 4 pp. 503-513, 1985 (with R. S. Dougall)
- "Comparative Predictions of a Computer Simulation to Experimental Data of a Thermosiphon Driven Domestic Solar Heater", International Journal of Energy Environment and Economics, Vol 2 No. 4, p.289-304, 1994 (with C. Willems).
- "Experimental Measurements of Local Axial Gas Velocity and Void Fraction in Simulated PWR Steam Generator Rod Bundles", The Canadian Journal of Chemical Engineering, Vol. 68, April, 1990, pp. 211-219 (with R. S. Dougall).
- "Testing of a Spherical Dual Tipped Optical Fiber Probe for Local Measurements of Void Fraction and Gas Velocity in Two Phase Flows", The Canadian Journal of Chemical Engineering, Vol.68, June 1990, pp. 504-510 (1990).
- "Measurement of Slurry Concentration and Flow Rates in Shell and Tube Slurry Heat Exchangers", The Canadian Journal of Chemical Engineering, Vol. 62, pp.62-67, 1984.
- "Experimental Investigation of Concurrent Two Phase Flow in a Rectangular Channel", The Canadian Journal of Chemical Engineering, Vol. 65, pp. 705-715(1987) (with R. S. Dougall).
- "Analysis of Falling Particles in Solid Particle Solar Receiver", AIChE- Annual Meeting, November 4-9 (2007), Salt Lake City, Utah, USA (with B. R. Vijayarangan).
- "Solid Particle Receiver Flow Characterization Studies", ASME-Energy Sustainability International Conference, June 24-27(2007), Long Beach, California, USA (with N. Siegal, G. Kolb, K. Kibum, and B. R. Vigayarangan).

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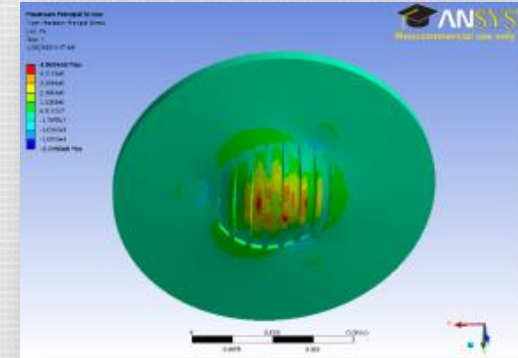
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- Expertise
 - Design and fabrication of polymer composite structures
 - High-temperature properties of metallic alloys, ceramics, and composites
 - Hydrogen-induced embrittlement of materials
 - Delayed hydride cracking of nuclear fuel rods
 - Energy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

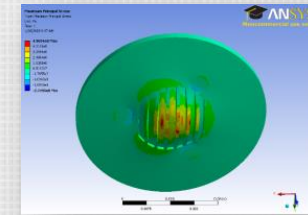


Renewable Energy Research

Dr. Brendan O'Toole

Professor, Department of Mechanical Engineering

Director, Mendenhall Innovation Program



Recent Publications

- "Experimental and Computational Study of Acceleration Response in Layered Cylindrical Structure Considering Impedance Mismatch Effect", S. Sueki, S. Ladkany, B. O'Toole, *Shock and Vibration*, 18: 807-826, 2011.
- "Wave Propagation in Layered Cylindrical Structures Using Finite Element and Wave Tracing Analysis", S. Sueki, S. Ladkany, B. O'Toole, *Journal of Solid Mechanics and Materials Engineering*, v.4, n.10, pp. 1480 - 1495, 2010.
- "Mechanical Characterization of a Porous State-Change Material for Water Soluble Tooling", S. Nelson, B. O'Toole, J. Thota, *World Journal of Engineering*, v6 sup, pp 737-738, 2009.
- "Optimization of Light-Weight Composite Blast Containment Vessel Structural Response", J. Thota, M. Trabia, B. O'Toole, and A. Ayyaswamy, *Journal of Pressure Vessel Technology*, v131 n3, pp 031209: 1-9, April 2009.
- "Identification of the Dynamic Tensile Properties of Metals under Moderate Strain Rates", Proceedings of the 16th Engineering Mechanics Conference (EM 2003), July 16-18, Seattle WA (with K. Zabolkin and M. Trabia).
- "Identification of Dynamic Properties of Metals under Moderate Strain Rates and Elevated Temperatures", Abstract, Proceedings of the 2003 ASME Mechanics and Materials Conference, Scottsdale, AZ, June 17-20, 2003 (with S. Dusi, H. Wang, and M. Trabia).
- "Effect of Stress Concentration on Cracking Behavior of Cladding Materials", Proceedings of the American Nuclear Society Accelerator Applications in a Nuclear Renaissance, San Diego CA, June 1-5, 2003 (with S. Pothana, H. Aquino, and A. Roy)
- "Environment-Induced Degradation of Spallation Target Materials", Proceedings of the American Nuclear Society Accelerator Applications in a Nuclear Renaissance, San Diego CA, June 1-5, 2003 (with A. Roy, R. Prabhakaran, M. Hossain, and S. Sama).
- "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

Dr. Darrell Pepper

Professor, Department of Mechanical Engineering

Director, Nevada Center for Advanced Computational Methods

Howard R. Hughes College of Engineering

University of Nevada, Las Vegas

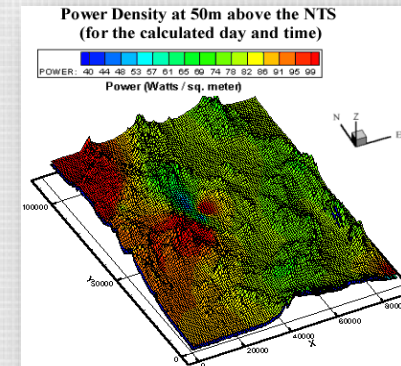
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- Expertise
 - Computational Fluid Dynamics, heat transfer and species transport
 - Advanced computational techniques
 - Wind energy assessment
 - Groundwater modeling and transport through porous media
 - Aerodynamics of turbine blades
 - Thin-film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



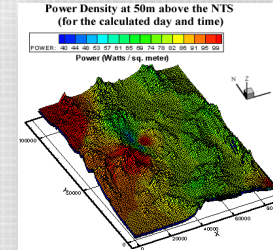
Top: Power density for a wind turbine with a 50-m hub height within the Nevada Test Site.
Bottom: Meteorological tower placed in the Nellis Dunes area.

Renewable Energy Research

Dr. Darrell Pepper

Professor, Department of Mechanical Engineering

Director, Nevada Center for Advanced Computational Methods



Recent Publications

- Pepper, D. W., A. Kassab, and E. Divo (to appear 2013): Finite Element, Boundary Element, and Meshless Methods, ASME Press, NY, NY.
- Pepper, D. W. (2012): Environmental Fluid Mechanics, McGraw-Hill Yearbook
- Pepper, D. W. (2010): Meshless Methods, Scholarpedia
- Pepper, D. W. and D. B. Carrington (2009): Modeling Indoor Air Pollution, Imperial College Press, London, UK, 346 p.
- Pepper, D. W. and J. C. Heinrich (2006): The Finite Element Method: Basic Concepts and Applications, Taylor and Francis, New York, NY, 2nd Ed., 312 p.
- Pepper, D. W. (2006), "Chapter 7: Meshless Methods," Handbook of Numerical Heat Transfer, 2nd Ed., W. J. Minkowycz et al (Eds.), John Wiley and Sons.
- Pepper, D. W. and J. M. Lombardo (2006), "Chapter 27: High Performance Computing for Heat Transfer," Handbook of Numerical Heat Transfer, 2nd Ed., W. J. Minkowycz et al (Eds.), John Wiley and Sons.
- Pepper, D. W. and X. Wang (2009), "An h-adaptive Finite Element Technique for Constructing 3-D Wind Fields," J. Appl. Meteor. & Climatology.
- Wang, X. and D. W. Pepper (2009), "An Adaptive Numerical Model for Contaminant Dispersion in Air," Int. J. Num. Meth. in Fluids.
- Wang, X. and D. W. Pepper, D. W. (2009), "An hp-Adaptive Procedure for Modeling Indoor Contaminant Dispersion," Comput. Modeling in. Engr. and Sci., Tech Science Press.
- Pepper, D. W. and X. Wang (2009), "An hp-adaptive Finite Element Model for Heat Transfer within Partitioned Enclosures," Int. J. Num. Meth. Fluid Flow and Heat Transfer.

Renewable Energy Research

Dr. Hui Zhao

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University of Nevada, Las Vegas

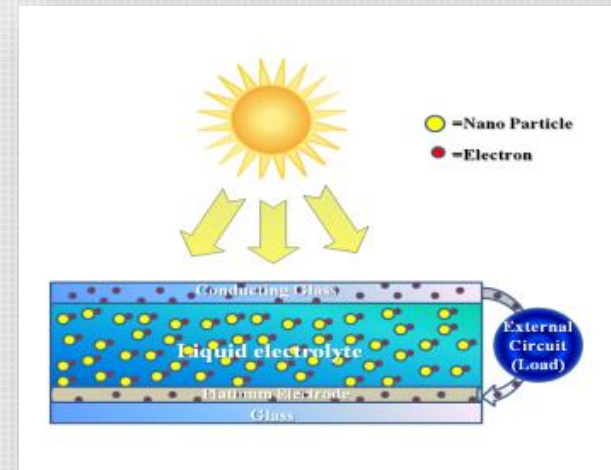
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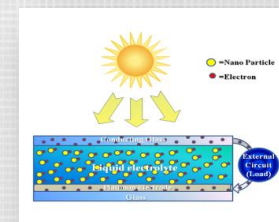
- Expertise
 - Third-generation dye-sensitized solar cell
 - Ionic-liquid-based energy storage technology
 - Lab-on-a-chip technologies toward biomedical diagnostics and analysis



Renewable Energy Research

Dr. Hui Zhao

Associate Professor, Department of Mechanical Engineering



Recent publications

- Zhao, H., 2012, The influence of nonelectrostatic ion-ion interactions on double layer capacitance, *Physical Review E*, **86**, 051502.
- Uppapalli, S. and Zhao, H., 2012, The polarization of a diffuse soft particle subjected to an alternating current field, *Langmuir*, **28**, 11164-11172.
- Zhao, H., 2011, Diffuse-charge dynamics of ionic liquids in electrochemical systems, *Physical Review E*, **84**, 051504.
- 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.
- Zhao, H., 2011, Streaming potential generated by a pressure-driven flow over super-hydrophobic stripes, *Physics of Fluids*, **23**, 022003. (selected for the Feb. 14, 2011 issue of Virtual Journal of Nanoscale Science & Technology) (Top 20 most downloaded articles in Feb. 2011).
- Zhao, H., 2010, Electro-osmotic flow over a charged superhydrophobic surface, *Physical Review E*, **81**, 066314.
- Zhao, H., 2010, On the Influence of Ion Excluded Volume (Steric) Effects on the Double Layer Polarization of a Non-Conducting Nano Particle in an AC Field, *Journal of Physical Chemistry C*, **18**, 8389-8397.
- Zhao, H., 2010, on the Effect of Hydrodynamic Slip on the Polarization of a Non-conducting Spherical Particle in an AC Field, *Physics of Fluids*, **22**, 072004.
- Zhao, H. and Bau, H. H., 2010, the Polarization of Nanorods Submerged in an Electrolyte Solution and Subjected to an AC Electric field, *Langmuir*, **26**, 5412-5420.
- Zhao, H. and Bau, H. H., 2009, the Polarization of a Non-conducting Nano Spherical Particle in the presence of a thick Electric double layer, *Journal of Colloid and Interface Science*, **333**, 663-671.
- Zhao, H. and Bau, H. H., 2008, the Effect of Double Layer Polarization on the Forces that Act on a Nanosize Cylindrical Particle in an AC Electric Field, *Langmuir*, **24**, 6050-6059.
- Zhao, H. and Bau, H. H., 2007, the Effect of Secondary Flows on Taylor-Aris Dispersion, *Analytical Chemistry*, **79**, 7792-7798.

Renewable Energy Research

Additional Resources

Center for Energy Research

www.unlv.edu/cer

Center for Materials and Structures

http://www.egr.unlv.edu/~bj/CMS/CMS_Home.htm

Nevada Center for Advanced
Computation Methods

<http://www.ncacm.unlv.edu/HTML/research/gwt/index.html>

Solar Energy Initiative

<http://www.unlv.edu/research/solar>

Team Las Vegas:
Solar Decathlon 2013

<http://solardecathlon.unlv.edu>