Final Progress Report

Project Title: "Resource Conservation and a Sustainable Las Vegas"

Covering Period: August 30, 2009 - March 31, 2014

Date of Report: May 15, 2014

Recipient: University of Nevada Las Vegas

Award Number: DE-EE0000716

Working Partners:

Cost-Sharing Partners:

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DOE Project Team:

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Project Objective: This research project developed educational, research, and outreach activities that addressed the challenges of Las Vegas as related to a secure energy supply through conservation, clean and adequate water supply, economic growth and diversification, air quality, and the best use of land, and usable public places. This was part of the UNLV Urban Sustainability Initiative (USI) that responded to a community and state need where a unifying vision of sustainability was developed in a cost-effective manner that promoted formal working partnerships between government, community groups, and industry.

Background: The project was important for the Southern Nevada region to support sustainable economic growth and for UNLV to develop new interdisciplinary research efforts focused on urban sustainability. The major technical issues addressed were related to hard infrastructure (e.g., water, energy, transportation) and soft infrastructure (e.g., health, education) that are at the core of urban sustainability.

The major outcomes for this project were:

1. Initiation of interdisciplinary research efforts on urban sustainability. This was measured by peer-reviewed publications and submission of competitive grant proposals to DOE and other appropriate funding agencies.
2. Coordination of sustainability efforts at UNLV with those of other local entities as part of an effort to develop a coherent regional approach to sustainability.
3. Development of new curriculum that recognized the need to consider environmental, economic, and social sustainability in existing degree programs.

Work Finished During the Final Quarter:

- Completion of research by URBAN21 teams and USI GAs
- USI GAs worked on various planning efforts for the Southern Nevada Sustainable Communities Planning Grant
- USI GAs, Solar Minor, and Solar Decathlon students promoted UNLV's research activities related to sustainability, renewable energy and the Solar Decathlon project to community members, Clark County School District students, and numerous conference and meeting attendees.
- With the assistance of donor funds, UNLV's Solar Decathlon entry DesertSol, was placed at the Springs Preserve (http://www.springspreserve.org/), a 160-acre botanical preserve that promotes sustainable and energy efficient living. Research will continue in the future that will benefit the campus and all of Southern Nevada.

Significant accomplishments during project period:

1. Participated in various planning efforts for the Southern Nevada Sustainable Communities Planning Grant.
2. Student presentations and participation at GREENFest, a yearly event which honors Earth Day and focuses on educating Southern Nevadans on environmental topics and a sustainable lifestyle. Solar Minor students provided interactive learning activities related to sustainable living for community members of all ages.
3. Co-sponsor of the National Clean Energy Summit from 2008 – 2014 with Senator Reid, the Center for American Progress, Clean Energy Project, and MGM Resorts International. Each year, UNLV participated as a speaker and exhibitor in order to promote sustainable research activities on campus.
4. Co-hosted the Global Solar Summit (October 30-November 1, 2011) with the City of Henderson, Nevada.
5. Support provided for the Preserve Nevada Sustainability as Preservation Symposium on December 1, 2012 and presentations by USI Graduate Assistants
6. Presentation of the City of Las Vegas Solar Data Portal to the sponsors.
7. Presentations at the graduate student program *In Search of Las Vegas Sociological Investigations Beyond the Neon* which was held on May 15th, 2013. This event focused on housing and food issues, the built environment, and community.
8. The UNLV Solar Decathlon team and Solar Minor students continue to promote sustainable living and energy efficiency at various outreach events in the community including at DesertSol's new home at the Springs Preserve.

9. The UNLV campus strives to continue to promote campus sustainability efforts as a result of research completed on this project. At present time, the campus is highly involved in providing hydration stations in the majority of campus buildings in order to significantly decrease the usage of water bottles on campus. Campus sustainability efforts throughout the project include turf reduction, increased recycling efforts, installation of solar panels on campus buildings, and retrofitting of equipment in order to increase energy efficiency.
10. Various presentations (see below)

Status:

Task 1: Research on Resource Conservation

- Updates from USI Graduate Research Assistants and URBAN21 research teams were provided through various informal meetings throughout the project period.

Task 2: Outreach Activities

- Throughout the entire project period, USI Graduate Research Assistants and URBAN21 research teams participated in numerous outreach activities in order to promote sustainable living practices and energy efficient building practices in Southern Nevada. In addition to multiple campus and community events, two specific activities allowed the university to present our sustainable living research to large audiences. In the past 7 years, UNLV promoted sustainable and energy efficient living to over 5,000 attendees at the National Clean Energy Summit. In October of 2013, approximately 16,000 people visited our Solar Decathlon project house which was designed for desert living and promoted options for sustainable living in the Mojave Desert.

Task 3: Curriculum Development

- UNLV addressed environmental, economic and social sustainability concerns when developing new curriculum.

- **Task 4: Campus Sustainability Efforts**

  - An intern worked on developing sustainability Action Plans as well as the STARS report that was submitted on June 11, 2011. Campus sustainability efforts continue to include turf reduction, increased recycling efforts, installation of solar panels on campus buildings, and retrofitting of equipment in order to increase energy efficiency.

Task 5: Project Management and Reporting

- All internal competitions were administered through the PIs Office of Urban Sustainability Initiative.
- All teams have completed their research activities. A list of publications is included below.

Patents: Not applicable

Publications/Presentations/Travel:

Publications:

Beck, A. and K. Stave. 2011. Understanding Urban Quality of Life and Sustainability. Proceedings of the 29th International Conference of the System Dynamics Society. Washington, DC, July 24-28, 2011.

Beck, A. and K. Stave. 2012. Urban Quality of Life and Sustainability: Model Development and Validation. *Proceedings of the 30th International Conference of the System Dynamics Society.* St. Gallen, Switzerland, July 23-26, 2012

Cole, J.K., B.A. Gieler, D.L. Heisler, M.M. Palisoc, A.J. Williams, A.C. Dohnalkova, H. Ming, T.T. Yu, J.A. Dodsworth, W.J. Li and B.P. Hedlund. 2013. Kallotenue papyrolyticum gen. nov., sp. nov., a cellulolytic and filamentous thermophile that represents a novel lineage (Kallotenuales ord. nov., Kallotenuaceae fam. nov.) within the class Chloroflexia. International Journal of Systematic and Evolutionary Microbiology 63:4675-4682.

Cole JK, Peacock JP, Dodsworth JA, Williams AJ, Thompson DB, Dong H, Wu G, Hedlund BP. 2013. Sediment microbial communities in Great Boiling Spring are controlled by temperature and distinct from water communities. ISME Journal 7:718-729.

Dodsworth JA, Blainey PC, Murugapiran SK, Swingley WD, Ross CA, Tringe SG, Chain PS, Scholz MB, Lo CC, Raymond J, Quake SR, Hedlund BP. 2013. Single-cell and metagenomic analyses indicate a fermentative and saccharolytic lifestyle for members of the OP9 lineage. Nature Communications. 4:1854.

Peacock JP, Cole JK, Murugapiran SK, Dodsworth JA, Fisher JC, Moser DP, Hedlund BP. 2013. Pyrosequencing reveals high-temperature cellulolytic microbial consortia in Great Boiling Spring after in situ lignocellulose enrichment. PLoS One 8:e59927.

Shrestha, Eleeja, Ahmad, Sajjad, Johnson, Walter, Shrestha, Pramen, Batista, Jacimaria R.(2011), Carbon Footprint of Water Conveyance versus Desalination as Alternatives to Expand Water Supply, Desalination, 280 (1-3): 33-43.

Shrestha,Eleeja, Ahmad, Sajjad, Johnson, Walter, Batista, Jacimaria R., (2011). The carbon footprint associated with water management policy options in the Las Vegas Valley, Nevada, Journal of the Nevada Water Resources Association, 6(1): 2-9.

Shrestha, Eleeja, Ahmad, Sajjad, Johnson, Walter, and Batista, Jacimaria R., (2012). The carbon footprint of water management policy options, Energy Policy 42: 201-212; doi: 10.1016/j.enpol.2011.11.074.

Stave, K.A., A. Beck, and C. Galvan. *In press.* Assessing the Effects of Simulation-Based Learning on Operational Understanding of Accumulation Principles. *Simulation & Gaming*

Stave, K.A. 2012. What can students learn from simple simulations about accumulations? *Proceedings of the 30th International Conference of the System Dynamics Society.* St. Gallen, Switzerland, July 23-26, 2012; .

Stave, K.A, B. Jurand, H. Skaza. 2011. Description and demonstration of a simulation learning environment for discovery learning about accumulations. *Proceedings of the 29th International Conference of the System Dynamics Society.* Washington, DC, July 24-28, 2011.

Skaza, H.J. and K.A. Stave. 2010. Assessing the effect of systems simulations on systems understanding in undergraduate environmental science courses. *Proceedings of the 28th International Conference of the System Dynamics Society.* Seoul, Korea, July 25-29, 2010. 28 p.

Uppapalli, S. and Zhao, H., 2012, The polarization of a diffuse soft particle subjected to an alternating current field, *Langmuir*, 28, 11164-11172.

Zhang CL, Wang J, Dodsworth JA, Williams AJ, Zhu C, Hinrichs KU, Zheng F, Hedlund BP. 2013. In situ production of branched glycerol dialkyl glycerol tetraethers in a great basin hot spring (USA). Frontiers in Microbiology. 4:181.

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.

Presentations: Multiple presentations have been reported in quarterly reports during the entire project period.

- Piechota, Thomas. Presentation on sustainability to freshman civil engineering students (February 22, 2010).
- Piechota, Thomas. Presented an Energy Lecture to the UNLV Osher Lifelong Learning Institute (OLLI) that had approximately 150 senior citizens (November 16 and 18, 2010).

- Zhao, Hui, Excluded Volume Effects on Dielectrophoresis of a Colloidal Particle, 37th FACSS Conference, Raleigh, NC, Oct. 2010.
- Piechota, Thomas. Presentation on sustainability to freshman civil engineering students (October 26, 2010).
- Piechota, Thomas. Presentation to Nevada National Guard on UNLV Sustainability efforts (November 30, 2010).
- Piechota, Thomas. Presentation to professional organization, Solar NV, about educational programs at UNLV (March 3, 2011).
- Piechota, Thomas. Poster presentation at Solar Energy Development meeting in Nye County Nevada (March 17, 2011).
- Piechota, Thomas. Presentation on Palo Verde High School Students (April 14, 2011).
- Piechota, Thomas. Presentation to Department of Energy Facilities Information Management System / RE Workshop in Las Vegas (June 15, 2011).
- Piechota, Thomas. Presentation to UNLV Undergraduate Research Summer Program (June 29 29, 2011).
- Piechota, Thomas. Presentation to UNLV Civil Engineering Students (September 20, 2011).
- Zhao, Hui. The role of hydrodynamic behavior of DNA molecules in dielectrophoretic poloarization under the action of an electric field, American Physical Society, 64th Meeting of the Division of Fluid Dynamics, Baltimore, MD(Nov 2011).
- Piechota, Thomas. Presentation to UNLV Osher Lifelong Learning on Sustainability Programs at UNLV (November 14, 2011).
- Paz, A, P. Maheshwari, P. Kachroo, 2012. Estimation of Performance Indices for the Planning of Sustainable Transportation Systems. Paper to be presented at the Transportation Research Board, (January 2012).
- Piechota, Thomas, Presentation to CEE 110 (Introduction to Civil Engineering) students on sustainability. (March 2012).
- Alvarez, C., and R. Futrell, 2012. New Urbanist Design and Community Health in Las Vegas, presented at *Posters on the Hill,* sponsored by the Council on Undergraduate Research.
- Piechota, T.C. A Different Kind of Green in the Desert – Energy, Water, Recycling, Sun City Anthem Life Lifelong Learning Center. May 15, 2012.
- Piechota, T.C. Let the Sunshine: Renewable Energy, Nevada and UNLV. Presentation to Canyon Springs High School as part of Nevada Science Week. May 2, 2012.

- Piechota, T.C., Presentation to Summer Undergraduate Research program at UNLV. July 23, 2012
- Piechota, T.C., Presentation to the Center for Urban Horticulture on Colorado River water issues. August 22, 2012.
- Harrison, Christian, Presentation at the Western History Association Conference. October 4 -7, 2012
- Coughenour, Courtney, Presentation at the American Public Health Annual Conference. October 26-31,2012
- Uppapalli, S. and Zhao, H., The polarization of a diffuse soft particle subjected to an alternating current field, American Physical Society, 65th Meeting of the Division of Fluid Dynamics, San Diego, CA, Nov. 2012.
- Piechota, Thomas, Presentation at the UNLV STEM Summit. (January 14, 2013).
- Piechota, Thomas, Presentation at the High Performance Home Building Summit. (March 13, 2013).

Travel:

The Principal Investigator and Urban Sustainability Initiatives research awardees traveled to numerous conferences and educational events in order to gain additional knowledge that would assist with increasing sustainable education programs and intensify renewable energy efforts on the university campus. Updates were included in quarterly reports.

Status Summary Tables: Final Excel spreadsheet report completed and submitted for entire project period.