

Jeffrey R. S. Brownson

Associate Professor
Energy & Mineral Engineering
Materials Science & Engineering

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Research Interests

- Transdisciplinary investigations of solar energy conversion systems
- Sustainability in energy systems planning and integrative design
- System-Integrative Photovoltaics (SIPV): design for building integration
- System scale transient energy simulations for built structures and solar technologies
- Geographical Information Science (GIS) for simulation & solar resource assessment
- Thin film materials synthesis for photovoltaic devices

Education

Ph.D. Environmental Chemistry & Technology, University of Wisconsin, Madison. August 2005.
"Photoreactive anatase consolidation: UV hardening and surface chemistry of alcohol-modified TiO₂ films" Advisor: Prof. Marc A. Anderson.

M.S. Geology, University of Wisconsin, Madison. December 2001.

B.S. Geology, University of North Dakota, Grand Forks. May 1999.

Awards and Distinctions

2014	Wilson Award for Excellence in Teaching
2012	Faculty Marshal, EMS College Graduation
2010	<i>Gladys Snyder Education Grant</i>
2009	CAUSE: <i>Center for Advanced Undergraduate Study and Experience</i> Penn State Award supporting innovative research experiences
2002	Mineralogical Soc. of America: E. H. Kraus Grant for Research in Crystallography
1999, 2000	Lewis G. Weeks Graduate Research Fellowship
1999	<i>Magna cum laude</i> : University of North Dakota

Professional Appointments

Associate Professor of Energy & Mineral Engineering

Pennsylvania State University, University Park, PA (July 2013-present)

- Dutton Institute for e-Education: Solar Option Lead; online Master of Professional Studies in *Renewable Energy & Sustainability Systems* (March 2011-present)
- Dept. of Materials Science & Engineering: courtesy appointment (2011-present)
- Member of the Penn State Graduate Faculty (2007-present)

Assistant Professor of Energy & Mineral Engineering

Pennsylvania State University, University Park, PA (July 2007-June 2013)

- Dutton Institute for e-Education: Program Officer for online BA *Energy Sustainability & Policy* (2009-2011)

Post-Doctoral Researcher

University of Wisconsin, Madison, WI (September 2006-June 2007)

- Collaborated with Cardinal Glass CG (Spring Green, WI).
- Synthesized nanostructured metal oxides for inorganic solar cell devices.
- Assembled and characterized quantum dot sensitized solar cell devices.

Post-Doctoral Researcher

Institut de Chimie et Matériaux de Paris-Est, Centre National de la Recherche Scientifique (CNRS); Thiais, France (September 2005-August 2006)

- Synthesized metal chalcogenide thin films by electrochemical methods.
- Synthesized inorganic fullerenes by ultrasonic spray thermolysis.

Research Publications

Books and Invited Commentaries

1. Brownson, J. R. S. ***Solar Energy Conversion Systems***. Elsevier-Academic Press. 468 pp. **2013**
Textbook that redefines the field of solar energy conversion in design and engineering in terms of solar utility for the stakeholders in a given locale, making it more accessible to the emerging broad audience of scientists, engineers, architects, planners, and economists.
2. Brownson, J. R. S. *The Rise of the Sun Informing Design*. Dominic Mercier (Ed). Context: The Journal of AIA Philadelphia. **Summer 2013** Issue: Tapping into Energy.
3. Brownson, J. R. S. "System Integrated Photovoltaics (SIPV)" In: Franca Trubiano (Ed.) **Design And Construction Of High Performance Homes: Solar Technology, Innovative Materials And Integrated Practice**. London, England: Routledge. pp. 127-138, **2012**.

Refereed Publications

4. Bayrakci, M., Choi, Y. **Brownson, J. R. S.** *Temperature Dependent Power Modeling of Photovoltaics*. *Energy Procedia*. **2014**, 57, 745-754; DOI:10.1016/j.egypro.2014.10.282.
5. Banai, R. E., Burton, L. A., Choi, S. G., Hofherr, F., Sorgenfrei, T., Walsh, A., To, B., Cröll, A., **Brownson, J. R. S.** *Ellipsometric characterization and density-functional theory analysis of anisotropic optical properties of single-crystal α -SnS*. *J. Appl. Physics*. **2014**, 116, 013511; DOI: 10.1063/1.4886915.

6. Nieto, A., Bai Y., **Brownson, J.** *Combined Life Cycle Assessment and costing analysis optimization model using multiple criteria decision-making in Earth-resource systems.* *Nat. Resources J.* **2014**, 5(8), 351-358; <http://dx.doi.org/10.4236/nr.2014.58033>.
7. Yan, X., Michael, E., Komarneni, S., **Brownson, J. R. S.**, Yan, Z.-F. *Microwave-Hydrothermal/Solvothermal Synthesis of Kesterite, an Emerging Photovoltaic Material.* *Ceramics Intl.* **2014**, 40(1B), 1985-1992, <http://dx.doi.org/10.1016/j.ceramint.2013.07.108>.
8. **Brownson, J.R.S.** *Framing the Sun and Buildings as Commons.* *Buildings* **2013**, 3, 659-673. <http://dx.doi.org/10.3390/buildings3040659> (special issue: Environmentally Conscious Architecture; invited author)
9. Michael, E., Norcini, D., Komarneni, S., and **Brownson, J. R. S.** *Nanocomposite synthesis and characterization of Kesterite, Cu_2ZnSnS_4 (CZTS) for photovoltaic applications.* *Ceramics International* **2013** 39(7) 7935-7941. <http://dx.doi.org/10.1016/j.ceramint.2013.03.057>.
10. Banai, R. E., Lee, H., Motyka, M. A., Chandrasekharan, R., Podraza, N. J., **Brownson, J. R. S.**, Horn M. W. *Optical Properties of Sputtered SnS Thin Films for Photovoltaic Absorbers.* *IEEE J. Photovoltaics* **2013** 3(3) 1084–1089. DOI: 10.1109/JPHOTOV.2013.2251758.
11. Yan, X., Michael, E., Komarneni, S., **Brownson, J. R. S.**, Yan, Z.-F. *Microwave- and conventional-hydrothermal synthesis of CuS, SnS and ZnS: Optical properties.* *Ceramics International* **2013** 39 4757–4763. DOI: 10.1016/j.ceramint.2012.11.062.
12. Rayl, J., Young, G. S., **Brownson, J. R. S.** *Irradiance co-spectrum analysis: Tools for decision support and technological planning.* *Solar Energy* **2013** 95, 364-375, <http://dx.doi.org/10.1016/j.solener.2013.02.029>.
13. Hara, Y., **Brownson, J. R. S.**, Anderson, M. A. *Fabrication of Thin-Films Composed of ZnO Nanorods Using Electrophoretic Deposition.* *Intl. J. Applied Ceramic Tech.* **2012**, 9(1), 115. DOI: 10.1111/j.1744-7402.2011.02638.x
14. Choi, Y., Rayl, J., Tammineedi, C., **Brownson, J. R. S.** *PV Analyst: a new tool for coupling GIS with solar energy simulation models to assess distributed photovoltaic potential in urban areas.* *Solar Energy.* **2011**, 85(11), 2924. <http://dx.doi.org/10.1016/j.solener.2011.08.034>.
15. lulo, L. D., Blumsack, S. A., **Brownson, J. R. S.**, Kimel, R. A. *Potential and implementation strategies for renewable energy in the planned world.* *Interdisc. Themes Journal* **2010** 2(1), 54.
16. Blumsack, S. A., **Brownson, J. R. S.**, Rayl, J. *Matching Photovoltaic Orientation to Energy Loads* **2010**, *Proc. 43rd Hawaii International Conference on System Sciences*, Kauai HI.
17. Blumsack, S. A., **Brownson, J. R. S.**, Witmer, L. *Efficiency, Economic and Environmental Assessment of Ground-Source Heat Pumps in Central Pennsylvania* **2009**, *Proc. 42nd Hawaii International Conference on System Sciences*, Waikoloa HI.
18. **Brownson, J. R. S.**, Lévy-Clément, C. *Electrodeposition of nanostructured cobalt hydroxide and cobalt layered double hydroxide thin films.* *Electrochim. Acta* **2009**, 54(26), 6637.
19. Hara, Y., **Brownson, J.**, Anderson, M. *Solvothermal Fabrication of ZnO nanorods using ethanolic quantum dot precursors.* *Phy. Stat. Sol. (a)* **2009**, 206(4), 711.
20. **Brownson, J. R. S.**, Lévy-Clément, C. *Electrodeposition of α - and β -Cobalt Hydroxides Thin Films via Dilute Nitrate Solution Reduction.* *Phys. Stat. Sol. (b)* **2008**, 245(9), 1785.
21. **Brownson, J. R. S.**, Georges, C., Larramona, G., Jacob, A., Delatouche, B., Lévy-Clément, C. *Chemistry of tin monosulfide (δ -SnS) electrodeposition: Effects of pH and temperature with tartaric acid.* *J. Electrochem. Soc.* **2007**, 155(1), D40.

22. **Brownson, J. R. S.**, Georges, C., Larramona, G., Lévy-Clément, C. *Chemistry of δ -SnS: New Tin Monosulfide Polymorph Thin Films from Galvanostatic Electrodeposition*. *ECS Transactions*, **2007** 6(2), 587.
23. Hara, Y., **Brownson, J. R. S.**, Anderson, M. A. *Electrophoretic Deposition of Template-Free ZnO Nanorod Films*. *ECS Transactions* **2007** 6(2), 423.
24. **Brownson, J. R. S.**, Georges, C., Lévy-Clément, C. *Synthesis of a δ -SnS polymorph by electrodeposition*. *Chem. Materials*, **2006** 18(26), 6397.
25. **Brownson, J. R. S.**, Tejedor-Tejedor, M. I., Anderson, M. A. *FTIR study of methanol and ethanol interactions with anatase surfaces with respect to UV irradiation*. *J. Phys. Chem. B*, **2006** 110(25), 12494.
26. **Brownson, J. R. S.**, Tejedor-Tejedor, M. I., Anderson, M. A. *Photoreactive anatase consolidation characterized by FTIR spectroscopy*. *Chem. Materials*, **2005**, 17(25), 6304.
27. **Brownson, J. R. S.**, Lee, T. J., Anderson, M. A. *Reesterification and photo-sintering of titania xerogel thin-films*. *Chem. Materials*, **2005**, 17(11), 3025.

Conference Publications

28. Banai, R. E., Lee, H., Tanen, N. J., Urena, R. E., Cordell, J. J., Horn, M. W., **Brownson, J. R. S.** Investigation of RF-sputtered tin sulfide thin films with in situ heating for photovoltaic applications. In: Proceedings of the 40th IEEE Photovoltaic Specialist Conference, Denver, CO. June 8-13, **2014**. 290-294. DOI: 10.1109/PVSC.2014.6924916.
29. **Brownson, J. R. S.**, Taylor, A. H. *Open Educational Resource Model in Solar Energy through e-Education*. In: Proceedings of the 43rd American Solar Energy Society Meeting, San Francisco, CA. July 7-9, **2014**.
30. Srikrishnan, V., **Brownson, J. R. S.**, Young, G. S. *The All-Seeing Eye: Using Multi-Pyranometer Arrays And Neural Networks To Estimate Direct Normal Irradiance*. In: Proceedings of the 43rd American Solar Energy Society Meeting, San Francisco, CA. July 7-9, **2014**.
31. Ranalli, J., **Brownson, J. R. S.** *Sensitivity of Shading Calculations to Horizon Measurement Accuracy*. In: Proceedings of the 43rd American Solar Energy Society Meeting, San Francisco, CA. July 7-9, **2014**.
32. Kim, D., Witmer, L. Braun, J. E., **Brownson, J. R. S.** *Impact of Solar Estimation on MPC Performance of Multizone Buildings*. In: 3rd International High Performance Buildings Conference at Purdue, West Lafayette, IN, USA. July 14-17, **2014**
33. Bayrakci, M., **Brownson, J. R. S.** *Using Avoided Cost Metrics to Communicate Present Value in PV Systems*. In: Proceedings of the 42nd American Solar Energy Society Meeting, Baltimore, MD. April 16-20, **2013**.
34. Ranalli, J., **Brownson, J. R. S.** *SAGE-ly solar: Online math tools to teach solar energy*. In: Proceedings of the 42nd American Solar Energy Society Meeting, Baltimore, MD. April 16-20, **2013**.
35. Witmer, L., Poerschke, A., **Brownson, J. R. S.** *Retrocommissioning a Small Commercial Building to Achieve Net-Zero Energy*. In: Proceedings of the 42nd American Solar Energy Society Meeting, Baltimore, MD. April 16-20, **2013**.
36. Yates, K., Witmer, L., **Brownson, J. R. S.** *Graphical Analysis of Real Skies with the Clear Day Index: Using Penn State SURFRAD Data*. In: Proceedings of the 42nd American Solar Energy Society Meeting, Baltimore, MD. April 16-20, **2013**.

37. Burger, S., Witmer, L., **Brownson, J. R. S.** *Irradiance Modeling Variance on Vertical Plane of Array Surfaces*. In: Proceedings of the 42nd American Solar Energy Society Meeting, Baltimore, MD. April 16-20, **2013**.
38. Banai, R. E., Lee, H., Lewinsohn, M. A., Motyka, M. A., Chandrasekharan, R. Podraza, N. J. **Brownson, J. R. S.**, Horn, M. W. *Investigation of the Absorption Properties of Sputtered Tin-Sulfide Thin Films for Photovoltaic Absorber Layers*. In: Proceedings of the 38th IEEE Photovoltaic Specialist Conference, Austin, TX. June 3-8, **2012**. 164-169.
DOI:10.1109/PVSC.2012.6317592
39. Chandrasekharan, R., **Brownson, J. R. S.** *Reducing Thin Film PV Manufacturing Costs With Tin-Based Modules*. In: Proceedings of the 41st American Solar Energy Society Meeting, Denver, CO. May 13-17, **2012**.
40. Flagg Díaz, R., B.,* **Brownson, J. R. S.**, Stewart, S. W. *Use of Concentrated Solar Thermal Energy System to Enhance Sea Salt Production in Southern Spain*. In: Proceedings of the 41st American Solar Energy Society Meeting, Denver, CO. May 13-17, **2012**.
41. Hippenstiel, R,* **Brownson, J. R. S.** *Computing Solar Energy Potential of Urban Areas Using Airborne LIDAR and Orthoimagery*. In: Proceedings of the 41st American Solar Energy Society Meeting, Denver, CO. May 13-17, **2012**.
42. Hott, R.* **Brownson, J. R. S.** *GIS-based Spatial Analysis for Large-scale Solar Power and Transmission Line Issues: Case Study of Wyoming, U.S.* In: Proceedings of the 41st American Solar Energy Society Meeting, Denver, CO. May 13-17, **2012**.
43. Rayl, J.* Young, G., **Brownson, J. R. S.** *Climate-Regime Cospectrum Analysis: Shortwave Solar Irradiance for Regionally Spaced Locales*. In: Proceedings of the 41st American Solar Energy Society Meeting, Denver, CO. May 13-17, **2012**.
44. Shultz, J.* Witmer, L., **Brownson, J. R. S.** *Impact of Shade on HVAC Energy Consumption in Buildings: A Residential Case Study*. In: Proceedings of the 41st American Solar Energy Society Meeting, Denver, CO. May 13-17, **2012**.
45. Zhang, Q.* Stewart, S., **Brownson, J. R. S.**, Witmer, L. *Geyser Pump Solar Water Heater System Modeling Design Optimization*. In: Proceedings of the 41st American Solar Energy Society Meeting, Denver, CO. May 13-17, **2012**.
46. Witmer, L.* Bayrakci, M., Idrisu, B., **Brownson, J. R. S.**, Blumsack, S. A. *The Actual Value of Solar Electricity (Photovoltaics) in Urban Settings: Real-time Pricing, SRECs, and Tax Credits*. In: Proceedings of the 41st American Solar Energy Society Meeting, Denver, CO. May 13-17, **2012**.
47. Choi, Y., Rayl, J., Tammineedi, C., **Brownson, J. R. S.** *Coupling ArcGIS with TRNSYS to Assess Distributed Photovoltaic Potential in Urban Areas*. In: Proceedings of the 40th American Solar Energy Society Meeting, Raleigh, NC. May 17-21, **2011**.
48. Witmer, L.* **Brownson, J. R. S.** *An Energy Balance Model of Green Roof Integrated Photovoltaics: A Detailed Energy Balance Including Microclimatic Effects*. In: Proceedings of the 40th American Solar Energy Society Meeting, Raleigh, NC. May 17-21, **2011**.
49. **Brownson, J. R. S.**, Iulo, L. D. *Upsetting the Balance-Beam: System Integrative Photovoltaics as purposeful manipulation of energy demand and microclimate in the built environment*. In:

* (Presenting author if other than self)

Proceedings of the 39th American Solar Energy Society Meeting, Phoenix, AZ. May 17-22, **2010**

50. Iulo, L. D., **Brownson, J. R. S.** *Seed vs. Catalyst: How the beanstalk reached beyond the clouds—sustainability ethic in the Pennsylvania Solar Decathlons.* In: Proceedings of the 39th American Solar Energy Society Meeting, Phoenix, AZ. May 17-22, **2010**.
51. Rayl, J., **Brownson, J. R. S.** *Integrative Photovoltaic Awnings in the Natural Fusion Home: Solar Decathlon 2009 Prototype Analysis.* In: Proceedings of the 39th American Solar Energy Society Meeting, Phoenix, AZ. May 17-22, **2010**.
52. Tammineedi, C., **Brownson, J. R. S.** *Modeling Improved Behavior in Stand-Alone PV Systems with Battery-Ultracapacitor Hybrid Systems.* In: Proceedings of the 39th American Solar Energy Society Meeting, Phoenix, AZ. May 17-22, **2010**.
53. Witmer, L., **Brownson, J. R. S.** *System Integrative Design in the 2009 Penn State Solar Decathlon Net-Zero Energy Home.* In: Proceedings of the 39th American Solar Energy Society Meeting, Phoenix, AZ. May 17-22, **2010**.
54. **Brownson, J. R. S.**, Rayl, J., Blumsack, S. A. *Matching Photovoltaic Systems to Energy Loads.* In: Proceedings of the 38th American Solar Energy Society National Conference, Buffalo, NY, May 11-16, **2009**.

Patents

55. WARF P07105US02: *Self-Hardening, Self-Cleaning and Photo-Active Glass Coating.* Anderson, M., Leonard, K., **Brownson, J.** Sanfilippo, J., **2011**.
56. French patent 06 03206: *Dispositifs photovoltaïques tout solides comprenant une couche d'absorbeur à base de sulfure de bismuth ou de sulfure d'étain.* Larramona, G., Jacob, A., Lévy-Clément, C., Georges, C. D. S., **Brownson, J. R. S.** April 11, **2006**.

Invited Lectures

1. **Solar Utility: A common framework for transdisciplinary energy research and innovation.** 2iE International Institute for Water and Environmental Engineering, Laboratory for Solar Energy and Energy Savings (LESEE), Ouagadougou, Burkina Faso. Feb. 3, **2015**.
2. **Integrative design in solar energy: Pattern with a purpose.** Paul Smith's College, North Country Sustainability Speaker Series. Paul Smiths, NY. Apr. 25, **2014**.
3. **The curious chalcogenide: Photovoltaic explorations with tin sulfide.** PSU Materials Research Institute: Millennium Café, Summer 2013 Series. University Park, PA. July 2, **2013**.
4. **Power Quest: Are we solving the sustainable energy puzzle?** PSU Research UnPlugged, Spring 2013 Series. State College, PA; Schlow Centre Region Library. Mar. 28, **2013**.
5. **SIPV: Systems Integrated Photovoltaics.** 1st Residential Building Design and Construction Conference. Bethlehem, PA. Feb. 20-21, **2013**.
6. **Sensitive façades: Necessary innovations for building energy management systems.** Workshop: Center for High Performance Building Systems. University Park, PA. Oct. 17-18, **2012**
7. **Assessing solar on multiple scales for distributed power.** Forum: Strategic Distributed Generated Values from Photovoltaics. 41st American Solar Energy Society Meeting, Denver, CO. May 13-17, **2012**.

8. ***Thin film photovoltaic materials: Exploring tin chalcogenides.*** Penn State Dept. of Materials Science & Engineering Seminar Series. Dec. 1, **2011**.
9. ***2011 World Materials Summit: Buildings and lighting panel.*** Forum for international decision makers and energy experts to focus on materials research needs for our emerging energy economy. *Materials Research Society, the European Materials Research Society (E-MRS) and the Chinese Materials Research Society (C-MRS)*. Washington, D.C. Oct. 9-11, **2011**.
10. ***REE Applications and demand in innovative systems technologies.*** Presented at TEREM 2011—International Workshop on Technology and Economics of Rare Earths and Metals. Beijing, China. May 24, **2011**.
11. ***Systems Integrated PhotoVoltaics: Distributed PV systems that go beyond the building.*** *Forum: Strategic Distributed Generated Values from Photovoltaics*. 40th American Solar Energy Society Meeting, Raleigh, NC. May 17-21, **2011**.
12. ***I've got sunshine on a cloudy day: Diversified energy systems and the influence of the Sun.*** Penn State Donor Retreat: *For the Future Campaign*. Palm Beach, FL. Feb. 11-13, **2011**.
13. ***Green building strategies: Integrative design processes for materials science and solar energy conversion systems.*** 3M Center Invited Seminar. St. Paul, MN. July 27-28, **2010**.
14. ***Renewable sources: Why are we doing this?*** Greenbuild International Conference. Session R09: *"Living with Sustainable Energy in a Global Society"*. Phoenix, AZ. Nov. 11-14, **2009**.
15. ***People-Planet-Profit: How the Solar Decathlons are reshaping the way we develop solar technology.*** World Environment Center Roundtable (co-hosted by Bayer Materials Science and the Natural Resources Defense Council). *"Implementing Sustainable Development in the Building Industry: Green Design and Business Strategy"*. National Press Club in Washington, D.C. May 11, **2009**.
16. ***Power from the Sun: Solar 101.*** NE Renewable Energy Conference. University Park, PA. August 27, **2008**.
17. ***Third generation photovoltaic devices: Inorganic-sensitized ETA-solar cell design and research.*** UW Madison: Environmental Chemistry & Technology Program. September, **2006**.
18. ***Surface-enhanced signals in mesoporous anatase: surface modification and photoreactive consolidation.*** CNRS: *Institut des Matériaux Jean Rouxel*. Nantes, France. March, **2006**.
19. ***Nanoparticle synthesis in solution and the advantage of ultrasonic spray microreactors.*** Seminar. CNRS: *Institut de Chimie et Matériaux de Paris-Est*. Thiais, France. December, **2005**.

Presentations[†]

20. **Brownson, J. R. S.,** Witmer, L. *Sensitive Facade Metrics*. Presented at the Intelligent Building Operations Workshop, Univ. of Colorado Boulder, June 20-22, 2013.
21. **L. Witmer,** J. R. S. Brownson. *Solar Irradiance on Vertical Surfaces: A Building 101 Case Study* Presented at the Intelligent Building Operations Workshop, Univ. of Colorado Boulder, June 20-22, 2013.
22. Macht, G. A.* , Chandrasekharan, R., **Brownson, J. R. S.** *Sustainable Materials Selection in Thin Film Photovoltaics: The Potential of Tin Chalcogenides as Light Absorbing Alternatives to CdTe and CIGS*. Presented at the 40th American Solar Energy Society Meeting, Raleigh, NC. May 17-21, **2011**.

[†] Excluding conference papers from above.

23. **Brownson, J. R. S.**, Tsang, E., Anderson, M. A. *Coarsened TiO₂ nanoparticles generated from basic titanate precursors*. Presented at the 233rd ACS National Meeting, Chicago, IL, Mar. 25-29, **2007**.
24. **Brownson, J. R. S.**, Georges, C., Larramona, G., Jacob, A., Delatouche, B., Lévy-Clément, C. *Chemistry of tin monosulfide (δ -SnS) electrodeposition: Effects of pH and temperature with tartaric acid*. Presented at 211th ECS Meeting, Chicago, IL, **2007**.
25. **Brownson, J. R. S.**, Tejedor-Tejedor, M. I., Anderson, M. A. *Photoreactive anatase sintering characterized by FTIR spectroscopy*. The Tenth International Conference on TiO₂ Photocatalysis: Fundamentals & Applications, Chicago, IL. Presented by Dr. Walter Zeltner, **2005**.
26. **Brownson, J. R. S.**, Lee, T. J., Anderson, M. A. *Nanoparticulate metal oxides in thin film development for photocatalytic waveguides*. Presented at the 2003 Clay Minerals Society Convention; Athens, GA, **2003**.

Grants

1. "Community Solar on State: A Living Laboratory Framework for Outreach, Education, and Research" Funding: PSU Sustainability Institute. PI: Brownson. Amount. \$55,000. 3/1/2014—2/28/2015.
2. "The Solar Energy Network: Transdisciplinary Environmental Research (the SENTER)" Funding Agency: PSIEE Seed Funds. PI: Brownson. Amount: \$7,300. 1/2013 – 4/2016.
3. "A Public-Private-Academic Partnership to Advance Solar Power Forecasting" Funding Agency: University Corporation for Atmospheric Research (DOE). PI: David R. Stauffer (Brownson Investigator). Amount: \$102,500 05/06/2013 – 03/31/2014.
4. "Greater Philadelphia Innovation Cluster for Energy Efficient Buildings" (GPIC EEB HUB) Funding Agency: U.S. Department of Energy. PI: Anthony A. Atchley (Brownson Investigator). Amount: \$10,558,000. 02/01/2011 – 1/31/2014.
5. "Eco-Commercial Center Building Research" Funding Agency: Bayer MaterialScience, LLC: \$75,000. PI: Brownson 8/1/11 – 7/31/12.
6. "Materials Sustainability and the Environment: Delivering the Tool of Life Cycle Assessment to Undergraduate Students" Gladys Snyder Education Grant. Funding Agency: College of Earth and Mineral Sciences. Co-PIs Brownson and R. A. Kimel. Amount: \$5,650. 2010-2011.
7. "Natural Fusion: Solar Decathlon 2009" Funding Agency: U.S. Department of Energy. Amount: \$100,000. PI: Brownson 12/31/07 – 1/1/10.
8. NASA Space Grant. Amount: \$2500. PI: Brownson 12/31/07 – 1/1/10.

Teaching

Courses Developed and Taught at Penn State University

- Graduate
 - **EME 810 Solar Resource Assessment and Economics (online)** Methods, economic criteria, and meteorological background for assessing the solar resource with respect to solar energy conversion technologies. (Fall 2013, Summer 2014, Fall 2014)
 - **EGEE 597B Solar Energy Conversion** A review of fundamental concepts and systems dynamics simulations in solar energy conversion including photovoltaic and solar thermal systems. (Spring 2010-2011, Fall 2011-12)
 - **EGEE 597D Advanced Photovoltaics** Integration of Materials and Systems. Students evaluate materials used in thin film photovoltaic (PV) devices and discuss resource implications for large-scale deployment. (Fall 2009)
- Undergraduate
 - **EGEE 437 Design of Solar Energy Conversion Systems** Examines principles of solar energy conversion to build a foundation for explaining the basic concepts and practical implementation of solar technology systems. Reviews the properties and availability of solar irradiation and geometric relationships of sun/collector, principles of photovoltaic conversion and properties of materials used in PV systems, designing PV systems, procedures for solar thermal engineering calculations, and thermal power plants for electricity generation. [*Currently enrolls 50-60 students each semester, required course for Energy Engineering degree.*] (Spring 2008 – present, Fall 2011– Fall 2013)
 - **EGEE 455 Materials for Energy Applications** Covers key principles for materials in modern energy technologies (photovoltaics, fuel cells, batteries, magnetic technologies, spinning power, and thermal storage). Students are exposed to the role of material properties in performance, energy flows in Energy Conversion Devices (ECDs), as well as the systems perspective, and sustainability constraints. Students evaluate modern thermodynamics and irreversible processes in ECDs, and develop skills in sustainable materials selection using LCA tools to make decisions. (Fall 2008, 2009)
 - **EM SC 474W Living with Sustainable Energy in a Global Society** Multidisciplinary transformative course that explores the relationship between energy sources, energy usage, and community, and instills a sense of global responsibility for the individual. The principles, technologies, and impact of renewable energy systems are investigated at multiple scales—from materials, to systems, to buildings, to planning—in the interest of understanding the interrelationships and the necessity for broader policy and planning thinking necessary for achieving a sustainable habitable environment. [*Co-taught with Dept. of Architecture (L. Iulo) and Dept. of Materials Science & Engineering (R. A. Kimel). Included field trip to Germany/France to evaluate cross-cultural perspectives in energy approaches.*] (Spring-Summer-Fall 2009)
 - **EGEE 494A Research Project** Supervising research in energy science and engineering and preparation of written and oral presentation of the research results. The primary objective of the course is to expose students to supervised independent research and presentation of results. Students will embark on an independent research project under a faculty member. (Fall 2009-present)
 - **EM SC 420 Energy in Modern Society** Discussion-based course focused on the sustainable energy transition. Course focus is on the technical, social and regulatory challenges associated with the large-scale transition away from a fossil fuel based energy system. [*Co-taught with S. A. Blumsack*] (Fall 2008)

- **EGEE 101 *Energy and the Environment*** Energy utilization and technological development, energy resources, conversion and consequences on the local and global environment, and future energy alternatives. The main objectives are to provide basic understanding and appreciation of energy and environmental concepts and interconnectedness; analyze energy consumption patterns; discuss various energy resources that power the modern society; examine the energy conversion processes; explore interrelationships between energy use and industrial progress and environmental consequences; discuss future energy alternatives. (Fall 2007)

Post-graduate Course Development

- Collaborated on web-course with PSU Center for Sustainability for practical installation of photovoltaic systems in residential/commercial buildings. (2008-2009)
- Lead Instructor: *Exploring Renewable Energy Technologies and the Materials that Make it Happen. Science Workshop for Educators.* NASA's Pennsylvania Space Grant Consortium. [Co-taught with Dept. of Dept. of Materials Science & Engineering (R. A. Kimel, M. Hickner)] (June 2008, June 2009)

Advising

Graduate Research Advisor (6 M.S. and 2 Ph.D. graduated)

Vivek Srikrishnan, Energy & Mineral Engineering (Ph.D. candidate)
Balaji Raman, Energy & Mineral Engineering/ M.S. student (co-advised with A. Kleit)
Rona Banai, Materials Science & Engineering / Ph.D. student (co-advised with M. Horn)
Mesude Bayrakci, Energy & Mineral Engineering (M.S. 2011) / Ph.D. student
Lucas Witmer, Energy & Mineral Engineering (M.S. 2010) / (Ph.D. 2014)
Rebecca Hott, Energy & Mineral Engineering (M. S. 2012)
Elizabeth Michael, Materials Science & Engineering (awarded 2012 NSF Graduate Fellowship and Student Fulbright) (M.S. 2012)
Jeff Rayl, Energy & Mineral Engineering (M.S. 2012)
Dr. Ramprasad Chandrasekharan, Energy & Geoenvironmental Engr. (Ph.D. 2012)
Charith Tamineedi, Energy & Mineral Engineering (M.S. 2011)

External M.S. and Ph.D. Advisor/Committee Member

Kevin Carbonnier, Architectural Engineering, Penn State University (Ph.D. 2014)
Tyler McCandless, Ph.D. Student, Meteorology, Penn State University
Dr. Luna Rodriguez, Meteorology, Penn State University (Ph.D. 2012)
Mahzad Tashakori, Architecture, Penn State University (M.S. 2012)
Dr. Ke Xu, Architectural Engineering, Penn State University (Ph.D. 2012)
Gretchen Macht, Industrial Engineering, Penn State University (M.S. 2010)
Sarah Klinetob, Architectural Engineering, Penn State University (M.S. 2009)

Dr. Brownson advises 3-4 Energy Engineering Undergraduate students in independent research every semester, and has advised Undergraduate Honors Theses in the Energy Engineering, Electrical Engineering, Mechanical Engineering, and Chemical Engineering Programs.

Undergraduate Research Advisor (partial listing)

Steve Patrick (**Honors Thesis**/Energy Engineering) Summer 2012-2013
Gregory Morozzi (**Honors Thesis**/Electrical Engineering) Fall 2012-Spring 2013
Scott Burger (**Honors Thesis**/Energy Engineering) Summer 2012- Spring 2013
Denzel John (Energy Engineering) Summer 2012-Fall 2013 (SROP Scholar)
Megan Ferguson (Energy Engineering) Spring 2012
Jerry Song (Energy Engineering) Spring 2012
Adam Phoebe (Energy Engineering) Spring 2012
Jeff Manns (Energy Engineering) Fall 2011
Justin Shultz (Energy Engineering) Fall 2011
Qi Zhang (Mechanical Engineering) Summer 2011-Fall 2011 (McNair Summer Scholar)
Josh Ettinger (Energy Engineering) Spring 2011-Fall 2011
Andrew Poerschke (Energy Engineering) Fall 2010-Spring 2011
Danielle Norcini (Physics) Fall 2009-2012
Katherine Nicol (**Honors Thesis**/Chem Engr/Energy Engr) Fall 2009-2012
Jonathan Perez-Blanco (**Honors Thesis**/Mechanical Engr) Spring 2009-Spring 2010
Jeff Rayl (Electrical Engineering) Summer 2008-Spring 2010
Joelle Buczynski (Materials Science & Engr.) Summer 2008-Spring 2010 (SROP Scholar)

Leadership & Administration

Option Lead: Renewable Energy & Sustainability Systems, Solar Option (Mar. 2011-present)

- Co-creator of interdisciplinary, intercollegiate on-line graduate degree/certificate program addressing renewable energy project management. Intercollegiate Master of Professional Studies
- Supervision of course proposals for the Solar Option (6 courses) and the Sustainability Management & Policy Option (2 courses). Author for three of the eight:
 - **EME 810 Solar Resource Assessment and Economics** Methods, economic criteria, and meteorological background for assessing the solar resource with respect to solar energy conversion technologies.
 - **EME 811 Utility Solar Thermal and Industrial Solar Process** Technical and theoretical background for utility scale solar thermal technologies used for district heat and industrial processing.
 - **EME 812 Utility Solar Power and Concentration** Technical and theoretical background for utility scale solar energy conversion technologies to generate electric power.

Founder & Faculty Advisor: Penn State Student Chapter of the American Solar Energy Society. (2010-present) <http://www.clubs.psu.edu/up/ases/>

- 20+ student research presentations at annual ASES conferences (2009-2013)
- Developed “Solar on State” initiative to deploy large scale PV or solar hot water on campus

Chair: Inaugural Young Professionals in Renewable Energy Conference, Solar 2013.

42st American Solar Energy Society Meeting held April 16-20 in Baltimore, MD.

ABET Communications Strategic Review Committee, Energy Engineering Program, Penn State. (2012-2013)

Co-Founder, Solar Energy Network Transforming Environmental Research (the SENTER)

(2012-present) with Ute Poerschke—PSU Architecture, Elizabeth von Hauff—Fraunhofer ISE

- Research, education, and practice dealing with a practical, integrated vision supporting sustainable metropolitan (residential and commercial) integrated photovoltaics (PV) on a global scale for a renewable energy economy.
- Team: participants (USA, Germany) with complementary, transdisciplinary, and international expertise. integrate international expertise in architecture, materials science and technology, engineering, environmental and health sciences, and industrial relations.
- The SENTER combines research in photovoltaics from the various lenses of: technology, life cycle, recyclability, aesthetics, toxicology, criticality, feasibility, and social acceptance.
- Proposals submitted for international collaborative research in alternative inorganic thin film PV materials and building integrated organic PV systems.

Penn State Representative, Council of Energy Research and Education Leaders (CEREL), in National Council for Science and the Environment (NCSE) (2012 – 2013)

- Multidisciplinary membership organization made up of heads of academic energy research and education centers, institutes, and programs.
- Provides the means for leaders in energy research, education, and communication to collaboratively use knowledge about energy to improve education, decision-making, and, more generally, the well being of society.

Solar Energy Design and Research (SEDaR) Working Group (2011-2012)

- Participants engaged in interdisciplinary dialogue between those who develop materials and building integration strategies for solar energy systems; those who conceptualize, design, and plan systems for use in society; and those who study the sociological implications of technology shifts to solar energy strategies.

EME faculty lead for Biennial Seminar of Graduates of Earth & Mineral Sciences (GEMS):

“Energizing Society—A collaborative approach to resource management” (Sept. 22, 2011)

Program Officer: Bachelor of Arts in Energy & Sustainability Policy (Oct. 2009-July 2011)

- **Awarded 2012 Outstanding Online Program, Sloan Consortium (Sloan-C)**
- Authored full program proposal for on-line degree.
- Supervised seven course proposals new to the ESP degree.
- Program enrolled >80 students within first two years.
- Prepared and monitored annual academic program budgets, reported annual program performance to the College administration, faculty and program advisory board.
- Assisted the Penn State World Campus marketing team in developing marketing strategy and supporting materials.
- Co-author for three of the seven proposals:
 - **EME 444 *Global Energy Enterprises*** Industry perspective on the resources, technologies, engineering approaches and externalities involved in satisfying worldwide energy demand profitably and sustainably.
 - **EME 466 *Energy and Sustainability in Society*** Capstone course in energy technology and policy options for reduced-carbon communities; covering agent/stakeholder relations, sustainability, communication and public engagement.
 - **ENGR 312 *Sustainable Energy Entrepreneurship*** Three interrelated modules guiding students through technical, global/business, and entrepreneurial aspects of sustainable energy.

EME Representative: Fixed-Term and Research Faculty Committee (Fall 2008-Spring 2013)

Faculty Director: Solar Decathlon 2009 Natural Fusion House (Nov. 2007-Jan. 2010)

- 3rd Engineering, 3rd Lighting Design: Decathlon 2009 Competition on National Mall
- Culmination of a two-year non-profit, volunteer enterprise between university students, industry mentors, and faculty collaborators
- Supervised research/education/outreach for the Penn State team of 160+ students in architecture, materials science, engineering, and communications majors, transforming ideas of energy and the built environment
- Developed >\$400,000 in funds and in-kind support for two-year enterprise

- Included bringing Ed Begley Jr. to Penn State as invited speaker on behalf of sustainability practices and renewable energy
- Sold home to Bayer MaterialScience in 2010.
Rebranded: **EcoCommercial Conference Center**, and received “Green Power: Turn It On” award from Citizens for Pennsylvania's Future (PennFuture).
<http://www.bayermaterialsciencenafta.com/news/index.cfm?mode=detail&id=45C5841E-049D-DFBC-15B6F52E0EAD4D99>
- Home continues to be point of research collaboration with the Brownson team and Bayer MaterialScience

Recruiting & Outreach Coordinator: EME undergraduate studies (July 2007-June 2014)

- Served as primary point of contact to discuss student recruitment for 6 EME degree programs among our EME industrial advisory committee members, and *Graduates of Earth & Mineral Sciences* (GEMS) board members.
 - B.S. Energy Engineering
 - B.S. Environmental Systems Engineering
 - B.S. Mining Engineering
 - B.S. Petroleum & Natural Gas Engineering
 - B.S. Energy Business & Finance (non-engineering)
 - B.A. Energy Sustainability & Policy (on-line degree)
- Engage potential students and families that visit or call Penn State, and engage our alumni in Departmental events.
- Coordinate speaking engagements with respect to EME with faculty and staff members of EME.
- Coordinating EMS College efforts for recruiting with staff members of EME.
- Founder & Faculty Advisor: **EME Energy Club** (Dec. 2007-July 2011)
 - Forms a unifying social structure for the five residential EME majors
 - Supports student interaction with candidates in annual recruiting events

Media

STEM Documentary, “Innovate: Fueling Change” (Nov. 2010):

- Faculty collaborator, participating with **Women Working** (nonprofit group), and **Creative Expansions, Inc.** Project involved the Penn State Solar Decathlon student team (Natural Fusion) and EME students. Intended to inspire and educate high school students about the possibilities in science, technology, engineering and math (STEM).
- Video shown in high schools across the nation, released on YouTube:
<http://www.youtube.com/watch?v=Z7M19OmUS-M>
<http://www.wqed.org/education/teachers-innovate-fueling-change.php>

Professional Experience

Board Member: American Solar Energy Society. (Apr. 2013-present)

Board of Advisors, Solar Campus Initiative (August 2012-present)

- *SCI serves as both liaison and catalyst, to rapidly increase the number of solar photovoltaic systems installed on college, university, and K-12 campuses across the nation.*

Consultant: Sauer, Inc. (2010); Solargystics, LTD. (2009); Octillion Corp. (2007, advisory board)

R&D Liaison Corporate-academic collaborative research projects:

- Cardinal Glass CG (2003-2005, 2006-2007)
- IMRA—Europe (2005-2006)
- Nestlé-Purina Golden Products (2002-2003)

R&D Scientist Cardinal Glass CG (Spring Green, WI: Summers 2004, 2005).

- Investigated prior art claims to corporate patents.
- Developed air-sampling modules for impact of environment on TiO₂-coated windows.
- Characterized thin films by SEM and Atomic Force Microscopy.

R&D Scientist Nestlé-Purina Golden Products (St. Louis, MO: Summer 2003).

- Developed protocol for adsorption capacity in high surface area clays.
- Tested oxide-modified clays for enhanced odor removal properties in pet litter materials.

Professional Affiliations and Activities

American Solar Energy Society (Energy Economics and Solar Electric Divisions)

International Solar Energy Society

Society for Building Science Educators

Center for High Resolution Electron Microscopy Winter School, Arizona State University. (Attended Jan. **2002**)

Languages

English (native) / French (conversational and reading skills)