ADRIA E. BROOKS

NSF Doctoral Fellow
Public Service Engineer
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Ph.D. student in electrical engineering studying power markets and energy policy

EDUCATION

M.S. and Ph.D. Electrical Engineering | University of Wisconsin—Madison, Madison WI
College of Engineering, Department of Electrical and Computer Engineering
MSEE December 2017 | PhD May 2020 (expected)

Energy Analysis and Policy Certificate | University of Wisconsin—Madison, Madison WI
Nelson Institute for Environmental Studies
December 2018

B.S. Engineering Physics | University of Arizona, Tucson AZ
College of Engineering, Department of Physics and Atmospheric Sciences
May 2011

RESEARCH AND PROFESSIONAL EXPERIENCE

Public Service Engineer | Public Service Commission of Wisconsin, Madison WI
Division of Energy Regulation and Analysis, Office of Regional Markets
January 2019 – present

- Work with small, interdisciplinary team on transmission planning and wholesale electricity market policies of interest to the State of Wisconsin.
- Participate in transmission system policy development with the Midcontinent Independent System Operator and the Organization of MISO States.
- Team leader on issues related to transmission planning, distributed energy resources, energy storage and electric vehicles.

Graduate Assistant | University of Wisconsin—Madison, Madison WI
Department of Electrical and Computer Engineering
September 2015 – present

- Current graduate research interests include electric power systems, electricity markets, optimal dispatch with variability, microgrids, renewable energy, distributed energy resources.
- Led a student project with the Organization of MISO States to quantify the existence of distributed energy resources within the Midcontinent Independent System Operator territory and to compare the grid interconnection policies of other regional transmission organizations.

Intern | National Renewable Energy Laboratory, Golden CO
Strategic Energy Analysis Center, Forecasting and Modeling Group
May 2018 – August 2018

- Improved the Resource Planning Model, a capacity expansion model used by both the research community and industry to plan electric grid power capacity growth under various renewable energy scenarios. Areas of focus included transmission expansion, wheeling charges, and regional diversity of fuel prices and capital power plant costs.
- Interfaced with electric power utility company personnel to identify their unique system needs and develop model frameworks necessary to address those needs.
- Worked with a diverse scientific team as a self-initiating researcher.

Research Specialist | University of Arizona, Tucson AZ
Department of Physics, Photovoltaic Laboratory
May 2010 – September 2015 (promoted in 2011 from **Research Technician)**

- Designed experiments and associated monitoring equipment to report performance and reliability measures of photovoltaic systems across Southern Arizona.

- Installed and evaluated new PV system technologies throughout southern Arizona. Analyses of system technologies benefited electric utility companies, product developers, and the scientific community.
- Supervised and collaborated with student researchers, guiding experiments, data analysis and paper writing.
- Worked directly with electric power utility companies to understand the barriers to grid integration of solar photovoltaic systems.
- Managed collaborative research projects and maintained productive communication with industry partners.
- Gave frequent laboratory tours and information seminars to the interested public.

Engineering Intern |Semprius, Inc., Durham NC
September 2011 – September 2015

- Performed routine measurements, data collection and periodic maintenance of concentrated photovoltaic (CPV) 2-axis tracker system located in Tucson to aid product development.

Research Fellow | Arizona Research Institute for Solar Energy, Tucson AZ
January 2011 – May 2011

- Advised future commercial energy production for private companies by developing research experiments that met industrial criteria for PV energy consumption at each site.
- Created one semester photovoltaic installer curriculum for Arizona Western College, Yuma, Arizona.
- Developed solar energy education outreach for secondary school students in Tucson, Arizona, including six week photovoltaic curriculum that meets Arizona science standards.

Environmental Conservation Intern | Student Conservation Association, Hawley MA
AmeriCorps
March 2009 – September 2009

- Adopted community leadership role on living/working campus while performing hiking trail construction.

Engineering Research Intern | NASA Marshall Space Flight Center, Huntsville AL
National Space Science and Technology Center
June 2008 – August 2008

- Performed concept trade study for seismometer package on Lunar Lander.
- Conducted materials and electrical engineering experiments on ferroelectric circuit elements of space-compatible computer memory.

Student Deputy Principal Investigator | Lunar and Planetary Laboratory, Tucson AZ
University of Arizona
January 2007 – December 2007

- Managed student team on NASA OSIRIS Discovery Space Mission (Phase A) with $584,000 project budget.
- Wrote sections of Concept Study Report for NASA selection committee.
- Headed cosmic radiation research using solid physics techniques on lithium fluoride crystals and optical image reduction of charged couple devices.

PUBLICATIONS

Textbook Chapters

[T1] **Brooks, A.E.** "Solar Energy: Photovoltaics." *Future Energy, 2nd Ed.* Ed Trevor Letcher. New York: Elsevier, 2014. 383-404. Print.

Journal Articles

[J1] **Brooks, A.E.** Lesieutre, B.C. "The Validity of a Locational Marginal Price on Variable Power Injections." *International Journal of Electrical Power & Energy Systems.* (In Review)

[J2] Zielke, M. Nemet, G. **Brooks, A.E.** "Analysis of the Impacts of Electrical Vehicles on Transmission System Pricing for Policy and Planning Purposes: A Case Study in Wisconsin." *International Journal of Electrical Power & Energy Systems.* (In Review)

[J3] **Brooks, A.E.**, Lesieutre, B.C. "A Review of Frequency Regulation Markets in Three U.S. ISO/RTOs." *The Electricity Journal*, Vol. 32, No. 10 (Dec 2019).

[J4] Barron-Gafford, G.A., Minor, R.L., Allen N.A., Cronin, A.D., **Brooks, A.E.**, Pavao-Zuckerman M.A. "The Photovoltaic Heat Island Effect: Large solar power plants increase local temperatures." *Scientific Reports,* 6, Article No. 35070 (Oct 2016).

[J5] Lonij, V.P.A., **Brooks, A.E.**, Cronin, A.D., Leuthold, M., Koch, K. "Intra-hour forecasts of solar power production using measurements from a network of irradiance sensors." *Solar Energy,* Vol. 97 (Nov 2013): 58-66.

[J6] **Brooks, A.E.**, Allen, N., Lonij, V.P.A., Cronin, A.D. "Evaluation of Four Geomembrane-Mounted PV Systems for Land Reclamation in Southern Arizona." *Journal of Energy and Power Engineering,* Vol. 7, No. 5 (May 2013): 834-840.

Conference Papers

[C1] **Brooks, A.E.**, Lesieutre, B.C. "A Locational Price for Power Injection Fluctuations of Variable Generation and Load." 10th IREP Bulk Power Systems Dynamics and Control Symposium, Espinho, Portugal, August 27-Sep 1, 2017.

[C2] Sehloff, D., Manur, A., **Brooks, A.**, Venkataramanan, G., Lesieutre, B. "Solar Forecast Uncertainty Pricing and Optimal Scheduling with the Simple Electric Utility Platform (SUEP)." MCET Renewable Energy and Sustainable Environment Conference, Pollachi, India, July 20-22, 2017.

[C3] **Brooks, A.E.**, Manur, A., Venkataramanan, G. "Energy Modeling of Aggregated Community Scale Residential Microgrids." IEEE International Conference on Sustainable Green Buildings and Communities, Chennai, India, December 18-20, 2016.

[C4] Lai, T., **Brooks, A.E.**, Potter, B.G., Simmons-Potter, K. "Environmental Aging in Polycrystalline-Si Photovoltaic Modules: Comparison of Chamber-Based Accelerated Degradation Studies with Field-Test Data." SPIE Optics + Photonics for Sustainable Energy, San Diego, CA, August 9-13, 2015.

[C5] **Brooks, A.E.**, Cormode, D., Cronin, A.D., Kam-Lum, E., "PV System Power Loss and Module Damage due to Partial Shade and Bypass Diode Removal Depends on Cell Behavior in Reverse Bias." 42nd IEEE Photovoltaic Specialists Conference, New Orleans, LA, June 14-19, 2015.

[C6] Della-Giustina, D., **Brooks, A.**, St. Germaine, M., Patterson, S., Cronin, A. "Characterization and Use of a Sinton FMT-350 Flash Tester at the Tucson Electric Power Solar Test Yard." OSE Optics for Solar Energy Conference, Tucson, Arizona, Nov 3-7, 2013.

[C7] Cormode, D., Cronin, A.D., Richardson, W., Lorenzo, A.T., **Brooks, A.E.**, DellaGiustina, D.N. "Comparing Ramp Rates for Large and Small PV Systems, and Selection of Batteries for Ramp Rate Control." 39th IEEE Photovoltaic Specialists Conference, Tampa Bay, Florida, June 16-21, 2013.

[C8] **Brooks, A.E.**, DellaGiustina, D.N., Patterson, S.M., Cronin A.D. "The Consequence of Soiling on PV System Performance in Arizona; Comparing Three Study Methods." 39th IEEE Photovoltaic Specialists Conference, Tampa Bay, Florida, June 16-21, 2013.

[C9] **Brooks, A.E.**, Fijal, J. St. Germaine, M.T., Orsburn, S., Greenberg, J., Lonij, V.P.A., Della-Giustina, D.N., Cronin, A.D. "Conversion Efficiencies of Six Grid-Tied Inverters at the Tucson Electric Power Solar Test Yard." 39th IEEE Photovoltaic Specialists Conference, Tampa Bay, Florida, June 16-21, 2013.

[C10] Russo, J.M., Zhang, D., Vorndran, S., Gordon, M., Castillo, J., **Brooks, A.**, Lonij, V., Cronin, A., Kostuk, R. "Method for site characterization of anisotropic diffuse illumination of photovoltaic systems." SPIE Reliability of Photovoltaic Cells, Modules, Components, and Systems V Proceedings, San Diego, California, Aug 12, 2012.

[C11] **Brooks, A.E.**, Allen, N., Lonij, V.P.A., Cronin, A.D. "Evaluation of Four Geomembrane-Mounted PV Systems for Land Reclamation in Southern Arizona." 38th IEEE Photovoltaic Specialists Conference, Austin, Texas, June 3-8, 2012.

[C12] Kopp, E.S., Lonij, V.P.A., **Brooks, A.E.**, Hidalgo-Gonzalez, P.L., Cronin, A.D. "I-V Curves and Visual Inspection of 250 PV Modules Deployed over 2 Years in Tucson." 38th IEEE Photovoltaic Specialists Conference, Austin, Texas, June 3-8, 2012.

[C13] Hidalgo-Gonzalez, P.L., **Brooks, A.E.**, Kopp, E.S., Lonij, V.P.A., Cronin, A.D. "String-Level (kW-Scale) I-V Curves from Different Module Types under Partial Shade." 38th IEEE Photovoltaic Specialists Conference, Austin, Texas, June 3-8, 2012.

[C14] Lonij, V.P.A., **Brooks, A.E.**, Koch, K., Cronin, A.D. "Analysis of 80 Rooftop PV Systems in the Tucson, AZ Area." 38th IEEE Photovoltaic Specialists Conference, Austin, Texas, June 3-8, 2012.

[C15] Russo, J.M., Zhang, D., Gordon, M., Vorndran, S., Castillo, J.E., **Brooks, A.E.**, Lonij, V.P.A., Cronin, A.D., Kostuk, R.K. "Characterization of Diffuse Anistropic Illumination Effects to the Output of Bifacial and Holographic Planar Concentrating Photovoltaic Panel Configurations." 38th IEEE Photovoltaic Specialists Conference, Austin, Texas, June 3-8, 2012.

[C16] **Brooks, A.E.**, Kostuk, R.K., Castillo, J.E., Lonij, V.P.A., Russo, J.M., Zhang, D., Vorndran, S., Cronin, A.D. "One Year of Field Studies of Holographic Planar Concentrators at the Tucson Electric Power Solar Test Yard." ASES World Renewable Energy Forum, Denver, Colorado, May 13-17, 2012.

[C17] Lonij, V.P.A., **Brooks, A.E.**, Greenberg, J., Orsburn, S., Cronin, A.D., Torres, G. "Field Performance Measurements of New and Traditional PV Technologies." ASES World Renewable Energy Forum, Denver, Colorado, May 13-17, 2012.

[C18] Cronin, A.D., Castillo, J.E., Hauser, P., Rosenberg, G.A., Kumar, R., Kostuk, R.K., Zhang, D., Russo, J.M., Vorndran, S., Lonij, V.P.A., **Brooks, A.E**. "Holographic CPV Field Tests at the Tucson Electric Power Solar Test Yard." 37th IEEE Photovoltaic Specialists Conference, Seattle, Washington, June 19-24, 2011.

[C19] Cronin, A.D., **Brooks, A.E.**, Cormode, D., Hardesty, G., Lonij, V.P.A. "Performance Reviews from the Tucson Electric Power Solar Test Yard." 37th IEEE Photovoltaic Specialists Conference, Seattle, Washington, June 19–24, 2011.

[C20] Ghosal, K., Burroughs, S., Lily, D., Gabriel, J., Cronin, A.D., **Brooks, A.E.,** Lonji, V.P.A., Krause, M.F., Lindsey, C., Metzger, S. "On-sun Performance of a Novel Microcell-Based HCPV System Based in Tucson: Comparison with Conventional Systems." 37th IEEE Photovoltaic Specialists Conference, Seattle, Washington, June 19–24, 2011.

Invited Presentations (in addition to conferences listed above)

[P1] **Brooks, A.E.**, "NSF GRFP Workshop Series: Application Overview & Fellows Panel." University of Wisconsin—Madison, Graduate School, Madison WI, September 10, 2018.

[P2] **Brooks, A.E.**, "A Summer with RPM." National Renewable Energy Laboratory, Golden CO, August 13, 2018.

[P3] **Brooks, A.**, Desphande, G., Roa, R., Zielke, M. "Survey of DERs in the MISO Territory." Prepared for the Organization of MISO States. Public Service Commission of Wisconsin, Madison WI, May 3, 2018.

[P4] **Brooks, A.E.**, "Activities of the University of Arizona Photovoltaics Laboratory." University of Colorado Denver, Denver CO, April 1, 2015.

AWARDS AND DISTINCTIONS

Grainger Power Engineering Award | University of Wisconsin-Madison, Madison WI | Department of Electrical and Computer Engineering | *April 2019*

Graduate Research Fellowship Program | National Science Foundation, Washington DC | *March 2016*

Wisconsin Distinguished Graduate Fellowship | University of Wisconsin-Madison, Madison WI | Department of Electrical and Computer Engineering | *August 2015*

Bill of Rights Award | American Civil Liberties Union of Tennessee, Nashville TN | *December 2008*

NASA Motivating Undergraduates in Science and Technology Scholarship | *May 2008*

1st Place in Undergraduate Engineering Research | University of Arizona, Tucson AZ | Graduate and Professional Student Council Student Showcase | *April 2008*

Academic Distinction Award | University of Arizona, Tucson AZ | College of Engineering | *October 2006*

Arizona Excellence Scholarship for Undergraduate Studies | University of Arizona, Tucson AZ | *August 2005*

GRANTS AND CONTRACTS

Photovoltaic Crystalline-Silicon System Field Performance Comparative Study | SunPower Corporation
$150,000 | *2013*

FRV PV Heat-Islanding Monitoring Project of Interest | Fotowatio Renewable Ventures
Collaboration between UA Department of Physics, Arizona Research Institute for Solar Energy and Biosphere 2
$100,000 | *2012*

Photovoltaic System Field Performance Comparative Study | Rosemont Copper
Rosemont Copper Power Proving Ground
$145,000 | *2011*

PROFESSIONAL ACTIVITIES

- Member, IEEE | Power and Energy Society, Women in Engineering, R&D Policy Committee, Energy Policy Committee, eMentor with TryEngineering Together (2019 – present)
- Member, AAAS (2019 – present)
- Invited editor for Elsevier Publishing on papers related to transmission planning, system modeling, energy storage.
- Televised interview with Arizona Public Media for "Metro Week: Solar Energy Advances in the Southwest." June 2015.
- MSHA Part 46 Surface Miner Certification (2011 – 2013)
- Completed Solar Energy International Solar Electric Design and Installation (Grid-Direct) Workshop, Guemes Island, Washington, Oct 10-15, 2011.
- Experience with PROMOD, Julia, GAMS, MATLAB, Altium, PowerWorld, Igor, SQL, Git, Microsoft Office, LaTex.

PERSONAL

Leadership and Community Service Activities

- Teaching Assistants' Association | South Central Federal of Labor Delegate (2018 – present), Co-President (2016 – 2018), departmental steward (2015 – 2016)
- *The WEMPECKER* (departmental annual satirical paper), Lead Editor (2016 – present)
- Mountain Vista Unitarian Universalist religious education Chairperson (2014) and Youth Director (2012 – 2014)
- EON Youth Lounge volunteer (2005 – 2006 and 2011 – 2014)
- Camp Wildcat Vice-Chairperson (2010 – 2011), Secretary (2007 – 2008), member and youth counselor (2005 – 2011)
- One-In-Teen Youth Services Board Member (2003 – 2005)

Skills and Interests

- Previous independent travel through Europe, New Zealand, Central and South America
- Backpacking, hiking, rock climbing
- Education outreach and advocacy for youth

REFERENCES

Dr. Alexander D. Cronin | Program Director, Physics, National Science Foundation, Washington D.C.
acronin@nsf.gov, (703) 292-5302

Dr. Bernie Lesieutre |Professor of Electrical Engineering, University of Wisconsin, Madison WI
lesieutre@engr.wisc.edu, (608) 890-1883

Mr. Randel Pilo | Director, Office of Regional Energy Markets, Public Service of Commission, Madison WI
randel.pilo@wisconsin.gov, (608) 266-3165

Dr. Elaine Hale | Researcher IV – Model Engineering, National Renewable Energy Laboratory, Golden CO
elaine.hale@nrel.gov

Mr. Carmine Tilghman | (former) Senior Director, Energy Supply, UNS Energy, Tucson AZ
carmineatilghman@gmail.com