EXHIBIT LIST

Exhibit NHSEA-KRR-1	Resume of Karl R. Rabago
Exhibit NHSEA-KRR-2	Table of Testimony Submitted by Karl R. Rabago
Exhibit NHSEA-KRR-3	Karl R. Rábago, “The Net Metering Riddle”

EXHIBIT 1

Karl R. Rábago

Executive Director, Pace Energy and Climate Center
Elisabeth Haub School of Law
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c: +1.512.968.7543 e: krabago@law.pace.edu

Summary

Nationally recognized leader and innovator in electricity and energy law, policy, and regulation. Experienced as a public utility regulatory commissioner, educator, research and development program manager, utility executive, business builder, federal executive, corporate sustainability leader, consultant, and advocate. Highly proficient in advising, managing, and interacting with government agencies and committees, the media, citizen groups, and business associations. Successful track record of working with US Congress, state legislatures, governors, regulators, city councils, business leaders, researchers, academia, and community groups. National and international contacts through experience with Pace Energy and Climate Center, Austin Energy, AES Corporation, US Department of Energy, Texas Public Utility Commission, Jicarilla Apache Tribal Utility Authority, Cargill Dow LLC (now NatureWorks, LLC), Rocky Mountain Institute, CH2M HILL, Houston Advanced Research Center, Environmental Defense Fund, and others. Skilled attorney, negotiator, and advisor with more than twenty-five years of experience working with diverse stakeholder communities in electricity policy and regulation, emerging energy markets development, clean energy technology development, electric utility restructuring, smart grid development, and the implementation of sustainability principles. Extensive regulatory practice experience. Nationally recognized speaker on energy, environment and sustainable development matters. Managed staff as large as 250; responsible for operations of research facilities with staff in excess of 600. Developed and managed budgets in excess of $300 million. Law teaching experience at Pace University School of Law, University of Houston Law Center, and U.S. Military Academy at West Point. Post-doctorate degrees in environmental and military law. Military veteran.

Employment

PACE ENERGY AND CLIMATE CENTER, PACE UNIVERSITY SCHOOL OF LAW

Executive Director: May 2014—Present.

Leader of a team of professional and technical experts in energy and climate law, policy, and regulation. Secure funding for and manage execution of research, market development support, and advisory services for a wide range of funders, clients, and stakeholders with the overall goal of advancing clean energy deployment, climate responsibility, and market efficiency. Supervise a team of employees, consultants, and adjunct researchers. Provide learning and development opportunities for law students. Coordinate efforts of the Center with and support the environmental law faculty. Additional activities:

- Co-Director and Principal Investigator, Northeast Solar Energy Market Coalition (2015-present). The NESEMC is a US Department of Energy's SunShot Initiative Solar Market Pathways project. Funded under a cooperative agreement between the US DOE and Pace University, the NESEMC seeks to harmonize solar market policy and advance best policy and regulatory practices in the northeast United States.
- Chairman of the Board, Center for Resource Solutions (1997-present). CRS is a not-for-profit organization based at the Presidio in California. CRS developed and manages the Green-e Renewable Electricity Brand, a nationally and internationally recognized branding program

for green power and green pricing products and programs. Past chair of the Green-e Governance Board (formerly the Green Power Board).

- Director, Interstate Renewable Energy Council (IREC) (2012-present). IREC focuses on issues impacting expanded renewable energy use such as rules that support renewable energy and distributed resources in a restructured market, connecting small-scale renewables to the utility grid, developing quality credentials that indicate a level of knowledge and skills competency for renewable energy professionals.

RÁBAGO ENERGY LLC

Principal: July 2012—Present. Consulting practice dedicated to providing expert witness and policy formulation advice and services to organizations in the clean and advanced energy sectors. Recognized national leader in development and implementation of award-winning "Value of Solar" alternative to traditional net metering. Additional information at www.rabagoenergy.com.

AUSTIN ENERGY – THE CITY OF AUSTIN, TEXAS

Vice President, Distributed Energy Services: April 2009—June 2012. Executive in 8th largest public power electric utility serving more than one million people in central Texas. Responsible for management and oversight of energy efficiency, demand response, and conservation programs; low-income weatherization; distributed solar and other renewable energy technologies; green buildings program; key accounts relationships; electric vehicle infrastructure; and market research and product development. Executive sponsor of Austin Energy's participation in an innovative federally-funded smart grid demonstration project led by the Pecan Street Project. Led teams that successfully secured over $39 million in federal stimulus funds for energy efficiency, smart grid, and advanced electric transportation initiatives. Additional activities included:

- Director, Renewable Energy Markets Association. REMA is a trade association dedicated to maintaining and strengthening renewable energy markets in the United States.
- Membership on Pedernales Electric Cooperative Member Advisory Board. Invited by the Board of Directors to sit on first-ever board to provide formal input and guidance on energy efficiency and renewable energy issues for the nation's largest electric cooperative.

THE AES CORPORATION

Director, Government & Regulatory Affairs: June 2006—December 2008. Government and regulatory affairs manager for AES Wind Generation, one of the largest wind companies in the country. Manage a portfolio of regulatory and legislative initiatives to support wind energy market development in Texas, across the United States, and in many international markets. Active in national policy and the wind industry through work with the American Wind Energy Association as a participant on the organization's leadership council. Also served as Managing Director, Standards and Practices, for Greenhouse Gas Services, LLC, a GE and AES venture committed to generating and marketing greenhouse gas credits to the U.S. voluntary market. Authored and implemented a standard of practice based on ISO 14064 and industry best practices. Commissioned the development of a suite of methodologies and tools for various greenhouse gas credit-producing technologies. Also served as Director, Global Regulatory Affairs, providing regulatory support and group management to AES's international electric utility operations on five continents. Additional activities:

- Director and past Chair, Jicarilla Apache Nation Utility Authority (1998 to 2008). Located in New Mexico, the JAUA is an independent utility developing profitable and autonomous utility services that provides natural gas, water utility services, low income housing, and energy planning for the Nation. Authored "First Steps" renewable energy and energy efficiency strategic plan.

HOUSTON ADVANCED RESEARCH CENTER

Group Director, Energy and Buildings Solutions: December 2003—May 2006. Leader of energy and building science staff at a mission-driven not-for-profit contract research organization based in The Woodlands, Texas. Responsible for developing, maintaining and expanding upon technology development, application, and commercialization support programmatic activities, including the Center for Fuel Cell Research and Applications, an industry-driven testing and evaluation center for near-commercial fuel cell generators; the Gulf Coast Combined Heat and Power Application Center, a state and federally funded initiative; and the High Performance Green Buildings Practice, a consulting and outreach initiative. Secured funding for major new initiative in carbon nanotechnology applications in the energy sector. Developed and launched new and integrated program activities relating to hydrogen energy technologies, combined heat and power, distributed energy resources, renewable energy, energy efficiency, green buildings, and regional clean energy development. Active participant in policy development and regulatory implementation in Texas, the Southwest, and national venues. Frequently engaged with policy, regulatory, and market leaders in the region and internationally. Additional activities:

- President, Texas Renewable Energy Industries Association. As elected president of the statewide business association, leader and manager of successful efforts to secure and implement significant expansion of the state's renewable portfolio standard as well as other policy, regulatory, and market development activities.
- Director, Southwest Biofuels Initiative. Established the Initiative acts as an umbrella structure for a number of biofuels related projects, including emissions evaluation for a stationary biodiesel pilot project, feedstock development, and others.
- Member, Committee to Study the Environmental Impacts of Windpower, National Academies of Science National Research Council. The Committee was chartered by Congress and the Council on Environmental Quality to assess the impacts of wind power on the environment.
- Advisory Board Member, Environmental & Energy Law & Policy Journal, University of Houston Law Center.

CARGILL DOW LLC (NOW NATUREWORKS, LLC)

Sustainability Alliances Leader: April 2002—December 2003. Founded in 1997, NatureWorks, LLC is based in Minnetonka, Minnesota. Integrated sustainability principles into all aspects of a ground-breaking biobased polymer manufacturing venture. Responsible for maintaining, enhancing and building relationships with stakeholders in the worldwide sustainability community, as well as managing corporate and external sustainability initiatives. NatureWorks is the first company to offer its customers a family of polymers (polylactide – "PLA") derived entirely from annually renewable resources with the cost and performance necessary to compete with packaging materials and traditional fibers; now marketed under the brand name "Ingeo."

- Successfully completed Minnesota Management Institute at University of Minnesota Carlson School of Management, an alternative to an executive MBA program that surveyed fundamentals and new developments in finance, accounting, operations management, strategic planning, and human resource management.

ROCKY MOUNTAIN INSTITUTE

Managing Director/Principal: October 1999–April 2002. In two years, co-led the team and grew annual revenues from approximately $300,000 to more than $2 million in annual grant and consulting income. Co-authored "Small Is Profitable," a comprehensive analysis of the benefits of distributed energy resources. Worked to increase market opportunities for clean and distributed

energy resources through consulting, research, and publication activities. Provided consulting and advisory services to help business and government clients achieve sustainability through application and incorporation of Natural Capitalism principles. Frequent appearance in media at international, national, regional and local levels.

- President of the Board, Texas Ratepayers Organization to Save Energy. Texas R.O.S.E. is a non-profit organization advocating low-income consumer issues and energy efficiency programs.
- Co-Founder and Chair of the Advisory Board, Renewable Energy Policy Project-Center for Renewable Energy and Sustainable Technology. REPP-CREST was a national non-profit research and internet services organization.

CH2M HILL

Vice President, Energy, Environment and Systems Group: July 1998–August 1999. Responsible for providing consulting services to a wide range of energy-related businesses and organizations, and for creating new business opportunities in the energy industry for an established engineering and consulting firm. Completed comprehensive electric utility restructuring studies for the states of Colorado and Alaska.

PLANERGY

Vice President, New Energy Markets: January 1998–July 1998. Responsible for developing and managing new business opportunities for the energy services market. Provided consulting and advisory services to utility and energy service companies.

ENVIRONMENTAL DEFENSE FUND

Energy Program Manager: March 1996–January 1998. Managed renewable energy, energy efficiency, and electric utility restructuring programs for a not-for-profit environmental group with a staff of 160 and over 300,000 members. Led regulatory intervention activities in Texas and California. In Texas, played a key role in crafting Deliberative Polling processes. Initiated and managed nationwide collaborative activities aimed at increasing use of renewable energy and energy efficiency technologies in the electric utility industry, including the Green-e Certification Program, Power Scorecard, and others. Participated in national environmental and energy advocacy networks, including the Energy Advocates Network, the National Wind Coordinating Committee, the NCSL Advisory Committee on Energy, and the PV-COMPACT Coordinating Council. Frequently appeared before the Texas Legislature, Austin City Council, and regulatory commissions on electric restructuring issues.

UNITED STATES DEPARTMENT OF ENERGY

Deputy Assistant Secretary, Utility Technologies: January 1995–March 1996. Manager of the Department's programs in renewable energy technologies and systems, electric energy systems, energy efficiency, and integrated resource planning. Supervised technology research, development and deployment activities in photovoltaics, wind energy, geothermal energy, solar thermal energy, biomass energy, high-temperature superconductivity, transmission and distribution, hydrogen, and electric and magnetic fields. Developed, coordinated, and advised on legislation, policy, and renewable energy technology development within the Department, among other agencies, and with Congress. Managed, coordinated, and developed international agreements for cooperative activities in renewable energy and utility sector policy, regulation, and market development between the Department and counterpart foreign national entities. Established and enhanced partnerships with stakeholder groups, including technology firms, electric utility companies, state and local governments, and associations. Supervised development

and deployment support activities at national laboratories. Developed, advocated and managed a Congressional budget appropriation of approximately $300 million.

STATE OF TEXAS

Commissioner, Public Utility Commission of Texas. May 1992–December 1994. Appointed by Governor Ann W. Richards. Regulated electric and telephone utilities in Texas. Laid the groundwork for legislative and regulatory adoption of integrated resource planning, electric utility restructuring, and significantly increased use of renewable energy and energy efficiency resources. Co-chair and organizer of the Texas Sustainable Energy Development Council. Vice-Chair of the National Association of Regulatory Utility Commissioners (NARUC) Committee on Energy Conservation. Member and co-creator of the Photovoltaic Collaborative Market Project to Accelerate Commercial Technology (PV-COMPACT). Member, Southern States Energy Board Integrated Resource Planning Task Force. Member of the University of Houston Environmental Institute Board of Advisors.

LAW TEACHING

Professor for a Designated Service: Pace University Law School, 2014-present. Non-tenured member of faculty. Courses taught: Energy Law. Supervise a student clinical effort that engages in a wide range of advocacy, analysis, and research activities in support of the mission of the Pace Energy and Climate Center.

Associate Professor of Law: University of Houston Law Center, 1990–1992. Full time, tenure track member of faculty. Courses taught: Criminal Law, Environmental Law, Criminal Procedure, Environmental Crimes Seminar, Wildlife Protection Law. Provided *pro bono* legal services in administrative proceedings and filings at the Texas Public Utility Commission.

Assistant Professor: United States Military Academy, West Point, New York, 1988–1990. Member of the faculty in the Department of Law. Honorably discharged in August 1990, as Major in the Regular Army. Courses taught: Constitutional Law, Military Law, and Environmental Law Seminar. Greatly expanded the environmental law curriculum and laid foundation for the concentration program in law. While carrying a full time teaching load, earned a Master of Laws degree in Environmental Law. Established a program for subsequent environmental law professors to obtain an LL.M. prior to joining the faculty.

LITIGATION

Trial Defense Attorney and Prosecutor, U.S. Army Judge Advocate General's Corps, Fort Polk, Louisiana, January 1985–July 1987. Assigned to Trial Defense Service and Office of the Staff Judge Advocate. Prosecuted and defended more than 150 felony-level courts-martial. As prosecutor, served as legal officer for two brigade-sized units (approximately 5,000 soldiers), advising commanders on appropriate judicial, non-judicial, separation, and other actions. Pioneered use of some forms of psychiatric and scientific testimony in administrative and judicial proceedings.

NON-LEGAL MILITARY SERVICE

Armored Cavalry Officer, 2d Squadron 9th Armored Cavalry, Fort Stewart, Georgia, May 1978–August 1981. Served as Logistics Staff Officer (S-4). Managed budget, supplies, fuel, ammunition, and other support for an Armored Cavalry Squadron. Served as Support Platoon Leader for the Squadron (logistical support), and as line Platoon Leader in an Armored Cavalry Troop. Graduate of Airborne and Ranger Schools. Special training in Air Mobilization Planning and Nuclear, Biological and Chemical Warfare.

Formal Education

LL.M., Environmental Law, Pace University School of Law, 1990: Curriculum designed to provide breadth and depth in study of theoretical and practical aspects of environmental law. Courses included: International and Comparative Environmental Law, Conservation Law, Land Use Law, Seminar in Electric Utility Regulation, Scientific and Technical Issues Affecting Environmental Law, Environmental Regulation of Real Estate, Hazardous Wastes Law. Individual research with Hudson Riverkeeper Fund, Garrison, New York.

LL.M., Military Law, U.S. Army Judge Advocate General's School, 1988: Curriculum designed to prepare Judge Advocates for senior level staff service. Courses included: Administrative Law, Defensive Federal Litigation, Government Information Practices, Advanced Federal Litigation, Federal Tort Claims Act Seminar, Legal Writing and Communications, Comparative International Law.

J.D. with Honors, University of Texas School of Law, 1984: Attended law school under the U.S. Army Funded Legal Education Program, a fully funded scholarship awarded to 25 or fewer officers each year. Served as Editor-in-Chief (1983–84); Articles Editor (1982–83); Member (1982) of the Review of Litigation. Moot Court, Mock Trial, Board of Advocates. Summer internship at Staff Judge Advocate's offices. Prosecuted first cases prior to entering law school.

B.B.A., Business Management, Texas A&M University, 1977: ROTC Scholarship (3–yr). Member: Corps of Cadets, Parson's Mounted Cavalry, Wings & Sabers Scholarship Society, Rudder's Rangers, Town Hall Society, Freshman Honor Society, Alpha Phi Omega service fraternity.

Selected Publications

"Achieving very high PV penetration – The need for an effective electricity remuneration framework and a central role for grid operators," Richard Perez (corresponding author), Energy Policy, Vol. 96, pp. 27-35 (2016).

"The Net Metering Riddle," Electricity Policy.com, April 2016.

"The Clean Power Plan," Power Engineering Magazine (invited editorial), Vol. 119, Issue 12 (Dec. 2, 2015)

"The 'Sharing Utility:' Enabling & Rewarding Utility Performance, Service & Value in a Distributed Energy Age," co-author, 51st State Initiative, Solar Electric Power Association (Feb. 27, 2015)

"Rethinking the Grid: Encouraging Distributed Generation," Building Energy Magazine, Vol. 33, No. 1 Northeast Sustainable Energy Association (Spring 2015)

"The Value of Solar Tariff: Net Metering 2.0," The ICER Chronicle, Ed. 1, p. 46 [International Confederation of Energy Regulators] (December 2013)

"A Regulator's Guidebook: Calculating the Benefits and Costs of Distributed Solar Generation," co-author, Interstate Renewable Energy Council (October 2013)

"The 'Value of Solar' Rate: Designing an Improved Residential Solar Tariff," Solar Industry, Vol. 6, No. 1 (Feb. 2013)

"A Review of Barriers to Biofuels Market Development in the United States," 2 Environmental & Energy Law & Policy Journal 179 (2008)

"A Strategy for Developing Stationary Biodiesel Generation," Cumberland Law Review, Vol. 36, p.461 (2006)

"Evaluating Fuel Cell Performance through Industry Collaboration," co-author, Fuel Cell Magazine (2005)

"Applications of Life Cycle Assessment to NatureWorks™ Polylactide (PLA) Production," co-author, Polymer Degradation and Stability 80, 403-19 (2003)

"An Energy Resource Investment Strategy for the City of San Francisco: Scenario Analysis of Alternative Electric Resource Options," contributing author, Prepared for the San Francisco Public Utilities Commission, Rocky Mountain Institute (2002)

"Small Is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size," co-author, Rocky Mountain Institute (2002)

"Socio-Economic and Legal Issues Related to an Evaluation of the Regulatory Structure of the Retail Electric Industry in the State of Colorado," with Thomas E. Feiler, Colorado Public Utilities Commission and Colorado Electricity Advisory Panel (April 1, 1999)

"Study of Electric Utility Restructuring in Alaska," with Thomas E. Feiler, Legislative Joint Committee on electric Restructuring and the Alaska Public Utilities Commission (April 1, 1999)

"New Markets and New Opportunities: Competition in the Electric Industry Opens the Way for Renewables and Empowers Customers," EEBA Excellence (Journal of the Energy Efficient Building Association) (Summer 1998)

"Building a Better Future: Why Public Support for Renewable Energy Makes Sense," Spectrum: The Journal of State Government (Spring 1998)

"The Green-e Program: An Opportunity for Customers," with Ryan Wiser and Jan Hamrin, Electricity Journal, Vol. 11, No. 1 (January/February 1998)

"Being Virtual: Beyond Restructuring and How We Get There," Proceedings of the First Symposium on the Virtual Utility, Klewer Press (1997)

"Information Technology," Public Utilities Fortnightly (March 15, 1996)

"Better Decisions with Better Information: The Promise of GIS," with James P. Spiers, Public Utilities Fortnightly (November 1, 1993)

"The Regulatory Environment for Utility Energy Efficiency Programs," Proceedings of the Meeting on the Efficient Use of Electric Energy, Inter-American Development Bank (May 1993)

"An Alternative Framework for Low-Income Electric Ratepayer Services," with Danielle Jaussaud and Stephen Benenson, Proceedings of the Fourth National Conference on Integrated Resource Planning, National Association of Regulatory Utility Commissioners (September 1992)

"What Comes Out Must Go In: The Federal Non-Regulation of Cooling Water Intakes Under Section 316 of the Clean Water Act," Harvard Environmental Law Review, Vol. 16, p. 429 (1992)

"Least Cost Electricity for Texas," State Bar of Texas Environmental Law Journal, Vol. 22, p. 93 (1992)

"Environmental Costs of Electricity," Pace University School of Law, Contributor–Impingement and Entrainment Impacts, Oceana Publications, Inc. (1990)

EXHIBIT 2

Table of Testimony Submitted by Karl R. Rábago, on behalf of Pace Energy and Climate Center, and through Rábago Energy LLC

(as of 25 May 2016)

Date	Proceeding	Case/Docket #	On Behalf Of:
Dec. 21, 2012	VA Electric & Power Special Solar Power Tariff	Virginia SCC Case # PUE-2012-00064	Southern Environmental Law Center
May 10, 2013	Georgia Power Company 2013 IRP	Georgia PSC Docket # 36498	Georgia Solar Energy Industries Association
Jun. 23, 1203	Louisiana Public Service Commission Re-examination of Net Metering Rules	Louisiana PSC Docket # R-31417	Gulf States Solar Energy Industries Association
Aug. 29, 2013	DTE (Detroit Edison) 2013 Renewable Energy Plan Review (Michigan)	Michigan PUC Case # U-17302	Environmental Law and Policy Center
Sep. 5, 2013	CE (Consumers Energy) 2013 Renewable Energy Plan Review (Michigan)	Michigan PUC Case # U-17301	Environmental Law and Policy Center
Sep. 27, 2013	North Carolina Utilities Commission 2012 Avoided Cost Case	North Carolina Utilities Commission Docket # E-100, Sub. 136	North Carolina Sustainable Energy Association
Oct. 18, 2013	Georgia Power Company 2013 Rate Case	Georgia PSC Docket # 36989	Georgia Solar Energy Industries Association
Nov. 4, 2013	PEPCO Rate Case (District of Columbia)	District of Columbia PSC Formal Case # 1103	Grid 2.0 Working Group & Sierra Club of Washington, D.C.
Apr. 24, 2014	Dominion Virginia Electric Power 2013 IRP	Virginia SCC Case # PUE-2013-00088	Environmental Respondents
May 7, 2014	Arizona Corporation Commission Investigation on the Value and Cost of Distributed Generation	Arizona Corporation Commission Docket # E-00000J-14-0023	Rábago Energy LLC (invited presentation and workshop participation)
Jul. 10, 2014	North Carolina Utilities Commission 2014 Avoided Cost Case	North Carolina Utilities Commission Docket # E-100, Sub. 140	Southern Alliance for Clean Energy
Jul. 23, 2014	Florida Energy Efficiency and Conservation Act, Goal Setting – FPL, Duke, TECO, Gulf	Florida PSC Docket # 130199-EI, 130200-EI, 130201-EI, 130202-EI	Southern Alliance for Clean Energy
Sep. 19, 2014	Ameren Missouri's Application for Authorization to Suspend Payment of Solar Rebates	Missouri PSC File No. ET-2014-0350, Tariff # YE-2014-0494	Missouri Solar Energy Industries Association
Aug. 6, 2014	Appalachian Power Company 2014 Biennial Rate Review	Virginia SCC Case # PUE-2014-00026	Southern Environmental Law Center (Environmental Respondents)

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(as of 25 May 2016)

Aug. 13, 2014	Wisconsin Public Service Corp. 2014 Rate Application	Wisconsin PSC Docket # 6690-UR-123	RENEW Wisconsin and Environmental Law & Policy Center
Aug. 28, 2014	WE Energies 2014 Rate Application	Wisconsin PSC Docket # 05-UR-107	RENEW Wisconsin and Environmental Law & Policy Center
Sep. 18, 2014	Madison Gas & Electric Company 2014 Rate Application	Wisconsin PSC Docket # 3720-UR-120	RENEW Wisconsin and Environmental Law & Policy Center
Sep. 29, 2014	SOLAR, LLC v. Missouri Public Service Commission	Missouri District Court Case # 14AC-CC00316	SOLAR, LLC
Jan. 28, 2016 (date of CPUC order)	Order Instituting Rulemaking to Develop a Successor to Existing Net Energy Metering Tariffs, etc.	California PUC Rulemaking 14-07-002	The Utility Reform Network (TURN)
Mar. 20, 2015	Orange and Rockland Utilities 2015 Rate Application	New York PSC Case # 14-E-0493	Pace Energy and Climate Center
May 22, 2015	DTE Electric Company Rate Application	Michigan PSC Case # U-17767	Michigan Environmental Council, NRDC, Sierra Club, and ELPC
Jul. 20, 2015	Hawaiian Electric Company and NextEra Application for Change of Control	Hawai'i PUC Docket # 2015-0022	Hawai'i Department of Business, Economic Development, and Tourism
Sep. 2, 2015	Wisc. PSCo Rate Application	Wisconsin PSC Case # 6690-UR-124	ELPC
Sep. 15, 2015	Dominion Virginia Electric Power 2015 IRP	VA SCC Case # PUE-2015-00035	Environmental Respondents
Sep. 16, 2015	NYSEG & RGE Rate Cases	New York PSC Cases 15-E-0283, -0285	Pace Energy and Climate Center
Oct. 14, 2015	Florida Power & Light Application for CCPN for Lake Okeechobee Plant	Florida PSC Case 150196-EI	Environmental Confederation of Southwest Florida
Oct. 27, 2015	Appalachian Power Company 2015 IRP	VA SCC Case # PUE-2015-00036	Environmental Respondents
Nov. 23, 2015	Narragansett Electric Power/National Grid Rate Design Application	Rhode Island PUC Docket No. 4568	Wind Energy Development, LLC
Dec. 8, 2015	State of West Virginia, et al., v. U.S. EPA, et al.	U.S. Court of Appeals for the District of Columbia Circuit Case No. 15-1363 and Consolidated Cases	Declaration in Support of Environmental and Public Health Intervenors in Support of Movant Respondent-Intervenors' Responses in Opposition to Motions for Stay

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(as of 25 May 2016)

Dec. 28, 2015	Ohio Power/AEP Affiliate PPA Application	PUC of Ohio Case No. 14-1693-EL-RDR	Environmental Law and Policy Center
Jan. 19, 2016	Ohio Edison Company, Cleveland Electric Illuminating Company, and Toledo Edison Company Application for Electric Security Plan (FirstEnergy Affiliate PPA)	PUC of Ohio Case No. 14-1297-EL-SSO	Environmental Law and Policy Center
Jan. 22, 2016	Northern Indiana Public Service Company (NIPSCO) Rate Case	Indiana Utility Regulatory Commission Cause No. 44688	Citizens Action Coalition and Environmental Law and Policy Center
Mar. 18, 2016	Northern Indiana Public Service Company (NIPSCO) Rate Case – Settlement Testimony	Indiana Utility Regulatory Commission Cause No. 44688	Joint Intervenors – Citizens Action Coalition and Environmental Law and Policy Center
Mar. 18, 2016	Comments on Pilot Rate Proposals by MidAmerican and Alliant	Iowa Utility Board NOI-2014-0001	Environmental Law and Policy Center
May 27, 2016	Consolidated Edison of New York Rate Case	New York PSC Case No. 16-E-0060	Pace Energy and Climate Center
June 21, 2016	Federal Trade Commission: Workshop on Competition and Consumer Protection Issues in Solar Energy	Invited workshop presentation	Pace Energy and Climate Center
Aug. 17, 2016	Dominion Virginia Electric Power 2016 IRP	VA SCC Case # PUE-2016-00049	Environmental Respondents
Sep. 13, 2016	Appalachian Power Company 2016 IRP	VA SCC Case # PUE-2016-00050	Environmental Respondents
Oct. 27, 2016	Consumers Energy PURPA Compliance Filing	Michigan PSC Case No. U-18090	Environmental Law & Policy Center, "Joint Intervenors"
Oct. 28, 2016	Delmarva, PEPCO (PHI) Utility Transformation Filing – Review of Filing & Utilities of the Future Whitepaper	Maryland PSC Case PC 44	Public Interest Advocates
Dec. 1, 2016	DTE Electric Company PURPA Compliance Filing	Michigan PSC Case No. U-18091	Environmental Law & Policy Center, "Joint Intervenors"

EXHIBIT 3

ELECTRICITY POLICY
ELECTRICITY DAILY

The Net Metering Riddle

Net metering opponents have done a masterful job in casting the debate around mistaken assumptions. As regulators conduct NEM 2.0 and Value of Solar proceedings, those errant assumptions should be exposed and the real questions addressed.

Karl R. Rábago

Electricity Policy – the website ElectricityPolicy.com and the newsletter Electricity Daily – together comprise an essential source of information about the forces driving change in the electric power industry.

The Net Metering Riddle

Net metering opponents have done a masterful job in casting the debate around mistaken assumptions. As regulators conduct NEM 2.0 and Value of Solar proceedings, those errant assumptions should be exposed and the real questions addressed.

Karl R. Rábago

After 25 years in the electric utility rate-making business, I have come to the conclusion that most rate "fairness" can be better understood if you keep this old math riddle in mind:

> *Three guys walk into a hotel and ask the manager if they can share a single room, none of them being able to afford a room on their own. The manager agrees, and charges them $30. Each man dutifully pays $10. As the men are headed to the room, the manager realizes that he has overcharged them—the room is priced at $25. He gives five $1 bills to the bellboy, and instructs him to refund the men. On the way to the room, the clever bellboy realizes that he will never make the men happy with $5 to divide among the 3 of them. He pockets $2, and gives $1 to each man.*
>
> *How much did each man pay for his share of the room? The answer is easy: $9.*
>
> *And 3 times $9 is $27. Add the $2 in the bellboy's pocket to get $29.*
>
> *Where is the other dollar?*

Spoiler alert: There is no other dollar. The riddle is arithmetic sleight of hand. The $29 is derived by adding where you should have subtracted, mixing up values on opposite sides of the equal sign. The math makes sense as

Karl R. Rábago *is Executive Director of the Pace Energy and Climate Center at the Pace University School of Law in White Plains, New York. Under his leadership, Pace is actively involved in every aspect of the New York Reforming the Energy Vision proceeding. He is also co-director of the Northeast Solar Energy Market Coalition (NESEMC), a US Department of Energy SunShot Project Initiative that works to harmonize solar market policy in the nine-state Northeast region. A former Texas regulator and US Army veteran, Karl has more than 25 years' experience in electricity and energy policy matters.*

$27 minus $2, or $27 plus $3, but not as $27 + $2 + $1.

And so it goes with many rate making debates, especially those about net energy metering. Here is a net metering riddle:

> *The average retail customer consumes 100 kWh of energy. The average solar residential customer generates 75 kWh with her solar system. The bill credits her and charges a net bill of 25 kWh. The utility asserts that it still had 100 kWh of cost for serving the customer. And the utility wants to know, "Where will the 75 kWh worth of lost revenue come from?"*

Spoiler alert: Don't start charging the solar customer or other customers. There is no 75 kWh in lost revenue. The utility fully charged the customer for that 100 kWh—and then the customer earned an offset credit against that charge. The credit reflects a reduction in utility costs that were and will be avoided by the solar energy generation. In cost-plus-based pricing systems, reductions in costs mean reductions in revenue requirements. As with our three hotel guests, the assumptions in the riddle and the ultimate question should be carefully scrutinized, and not simply accepted. Net metering (sometimes called net energy metering) is a rate mechanism that bills or credits customers for their net consumption charges; the net of their consumption charges and their generation-offset credits.

At the heart of solving the net metering riddle is the realization that the net metering credit is not a tool to avoid actual costs that were incurred. It is a mechanism that provides customers an offsetting billing credit for reducing the costs fairly attributed to their use.

This essay addresses a number of assumptions that, like those in the riddle, are either outright false or misleading. These include:

—that net-metering customers avoid being fully charged for their use of the grid;

—that offset credits are a payment for a sale, and that the offsetting process inherent in net metering is a sale for resale;

—that subtracting wholesale prices from retail rates is a fair measure of the full value of solar energy;

—that customers create utility costs by reducing their use of electricity;

—that special charges to customers who reduce their use through solar generation (or any other means, for that matter are the proper treatment for revenue deficiencies and;

—that any discussion of fair rates for customer-generators can proceed without a full and fair evaluation of all the costs and benefits of solar.

Full and fair evaluation of the Value of Solar is an absolutely essential first step in addressing the challenges and issues raised by net energy metering. Indeed, such analysis has been a foundation for all of the meaningful policy initiatives addressing net metering. Where the Value of Solar has been ignored,

the results have been less than satisfactory. Understanding the costs and benefits of solar is central to economically-efficient rate design and distributed generation policy.

Now let's dispose of the false assumptions one by one.

First, how does net metering actually work? A little history is in order. Net metering is a legacy rate design from the analog days. The spinning metal disk meters that utilities once deployed (many are still in place) could only measure the *net* progress of the meter. Even though every unit of consumption applied spin force in one direction, and every unit of self-generation applied opposite force, the analog meter could only tell you the position of the meter on the day it was read. The math of the net metering rate with an analog meter is pretty simple.

> (Gross Consumption – Gross Production) x Retail Rate = Bill

And you will remember from grade school that this formula is exactly the same as:

> (Gross Consumption x Retail Rate) – (Gross Production x Retail Rate) = Bill

This means that every customer-generator with net metering is fully charged for every unit of their consumption. This is true whether the customer generates electricity or not. That is what the function of the meter ensures.

Contrary to the popular understanding, net metering customers do not *avoid* any charges. Rather, they *offset* those charges with self-generation. Opponents of net metering use "avoid" to inaccurately portray the result because it serves their argument. It's just like asking, "Where is the other dollar?" in the hotel room riddle, nothing more than an assertion of a false premise buried in a question.

Words matter. The customer-generator avoids *paying* the amount they would have paid if they had used more, but that doesn't mean that the customer generator avoids paying for a *cost* they *created*. The utility claims, in effect, that it has incurred a cost to serve that customer, and that this is a sunk cost and an obligation of that particular customer. Three points undermine this argument.

First, there is a non-trivial question of whether that sunk cost was prudently and reasonably incurred. Many advocates have long pointed out that energy efficiency and distributed generation markets are growing, and will reduce the need for costly utility infrastructure. There is reason to ask whether some systems are overbuilt and unnecessarily costly.

Second, there is the notion that the customer-generator "uses" the system to sell its excess generation. Customer-generators are not selling electricity into the market. An offset credit is not a payment for a sale. At any rate, the utility takes the customer's excess generation and sells it to other customer at its retail rates, and does so immediately.

Third, there is a fundamental question whether a customer should ever be required to pay the utility for not using the system or not using as much electricity as the utility

believed/hoped/forecasted that she would. There is no legal, regulatory, or policy precedent for this notion, for very good reasons.

Now let's take the case of the utility service provider that has incurred a now-sunk cost, and assume that cost was prudently incurred and deserving of cost recovery. The rate set for that cost recovery is supposed to be allocated according to cost-causation; rate-making assigns those costs to customers according to their use of the system. Absent proof that a customer-generator creates some of that cost through the way she uses the system—and when she uses it—the cost should be assigned only to those customers who do indeed use it.

Costs should be recovered from cost-causers. If a customer takes action on their side of the meter to reduce their use, they will pay less of the total cost allocated to customers in that class. This is true whether that reduction in use results from solar self-generation, installation of energy efficiency measures, changes in occupancy and use, or the unlikely event that the resident teenagers suddenly remember to turn off the lights. Assuming nothing else changes in consumption patterns, remaining customers who do not reduce their use will—like the use-reducing customer—face incrementally higher rates when the projected sales volume is permanently reduced.

Revenue deficits for the utility attributable to net metering are limited to the period between rate cases, and are solely a product of poor forecasting or reduced sales that could not reasonably have been anticipated. In the event of imprudent utility overbuilding, these investments may even be permanently stranded, and never recovered through sales. Future test years and frequent rate cases can help ensure that the financial integrity of the utility—primarily, its access to adequate working capital—is not impaired. Prudent utilities will calibrate their capital spending to market realities.

With this overview in place, it is time to dive into the flaws in anti-net metering arguments in a bit more detail.

Does *not* using electricity create a cost? I say "cost" because utilities operate under cost of service regulation. The answer is "no." In the net metering argument, the utility position that a cost is created arises from the fact that the customer with a solar system is no longer using the average amount of energy for a customer in that class, or that the customer would have needed if she had never generated any for herself. The utility argument is, implicitly, that it had "counted on" collecting an average amount of its fixed costs from all customers through its volumetric energy sales, so customers that use less than they had, or less than the utility assumed, are "not paying their fair share" and "avoiding responsibility" for system costs.

Where's the other dollar?

Deviations from average or assumed consumption levels do not give rise to a cost for which a utility is entitled to recovery, especially not from the customer who failed to meet the utility's expected level of consumption. There is a legal argument

behind this, having to do with the way tariffed service by monopoly providers work. It makes no sense that a monopoly utility should ever be allowed to charge for service that it does not provide.

The idea that the utility could charge a customer for electricity the customer does not use, for whatever reason, evokes a creepy kind of socialism that only a monopolist could support. Three men walk into a hotel. To save money, they ask if they can share a room. The hotel manager says, "Yes, but you each have to pay $25 because we forecast earnings based on a revenue-per-occupant basis."

For services that utilities provide, public policy has established mechanisms for assessing costs. Not selling as much as a utility planned to sell is not proof of a cost, but the utility can perform a cost of service study to assess the cost of net metering customers' use of the system. The utility would have the burden of production and proof, of course.

As Warren Buffet's 2016 letter to shareholders said, "Historically, the survival of a local electric company did not depend on its efficiency. In fact, a 'sloppy' operation could do just fine financially."

When sales do not meet forecasts, some assume that uncollected costs must be collected elsewhere. When customers self-generate with solar (or otherwise permanently reduce their consumption levels), the anti-net metering crowd argues that customers who don't have solar—they always cite the poor, although many customers at all economic levels may not install solar—will be responsible for covering these costs. Alternatively, they may argue that solar customers must pay "access fees" or other charges to ensure their bill payments provide the expected revenue.

But what if the reduction in sales was reasonably foreseeable, and should have been reflected in the forecasts? What if reductions in some sales are offset by increases from others? Even in an average rates system, customers do not bear an individual responsibility for meeting the average sales level that the provider assumed. Automatically adjusting for a revenue shortfall due to decreased sales is not prudent, and singling out customers for special charges for using less is unjustly discriminatory. Automatic recovery of revenue deficiencies resulting from sales shortfalls encourages sloppy forecasting, may encourage overbuilding, and unwisely transfers risks from utilities to customers.

Those that oppose net metering sometimes argue that intermittent generation creates grid management and reliability costs. These costs usually don't justify the anti-competitive charges, fees, and limitations that many solar opponents propose to impose on customer-generators. Most engineers agree that at some high level of solar penetration—far higher than typically exists—intermittent generation may well create such costs. More than a century of regulation has led to processes for quantifying and allocating such costs.

The Value of Solar tariff concept addresses these issues directly. Anti-net metering arguments are seldom accompanied by such proof or full Value of Solar analysis. Ironically, some cost-of-service regulated

utilities have argued boldly that charges must be collected from net metering customers *now* to "get ahead of the game," *before* actual costs are recognized!

Any revenue issue is also an accounting issue—debits and credits—and it is better not to mix them up, as in the hotel room riddle. If the utility bill simply reported gross consumption and gross production separately—something that is now possible with two-channel digital meters—or with the addition of a separate production meter for the solar system on the customer side of the utility revenue meter, utility accountants could address the real issue. Again, this is a feature of the Value of Solar Tariff design. Net billing demonstrates that customer-generators are fully charged for 100% of consumption according to cost-of-service based rates, and also sends a strong energy efficiency message to the customer. With properly presented charges and credits, the issue then is proper allocation of the offset credit, which should be based on what costs the credit helps the utility avoid. This is exactly what Value of Solar studies have demonstrated across the United States.

The kWh that the net-metering customer generates does all of the work that the utility-provided kWh does, plus they are climate-proof, drought-proof, and they reduce wholesale market prices.

Some net metering opponents argue the entire offset credit is a "cost" to the system. Unfortunately, this position is both wrong and common. That position ignores the benefits that the entire system receives from customer-generators. Even more importantly, it ignores that the fact that distributed generation that is excess to the customer-generator immediately serves nearby load, after first being metered for charging to that second customer.

Not only is the offset credit not a cost, it is not even lost revenue to the utility when the generation is excess to the distributed generator's needs. Charging net metered customer-generators when their generation exceeds their use incorrectly and falsely implies that these customers are "using" the system to conduct a sale for resale, especially when it is the utility that immediately "sells" the electricity at full retail to the nearby customer whose load is served with that excess generation.

The premise of the avoided-cost test for purchased power rates under PURPA is cost-effectiveness. PURPA and the Federal Power Act speak to wholesale transactions because interstate wholesale markets are what is within the federal government's jurisdiction. The broader principle is that if utilities are required to buy energy from a non-utility generator, it doesn't make sense to require utilities to pay more than they would save (avoid) by not generating the energy themselves. The avoided-cost test is an economic-indifference test. When all the supply is wholesale, the physical point at which to measure indifference is the power plant busbar.

An offset credit is not payment for a purchase, and the vast majority of customer-generators are not federal jurisdictional sellers. Generation by distribution-sited systems must be measured at a different point in the system, because the costs avoided are different from a wholesale setting. The avoided cost values are different, too. Here is how the anti-net metering position is much like the hotel room riddle:

The classic anti-solar PV opposition view is that the "cost" of net metering is calculated by subtracting the wholesale rate from the retail rate. Instead, the offset value should be calculated by starting with the wholesale value of energy and adding the capacity value, transmission and distribution value, price suppression value, unaccounted-for environmental value, and other benefits. This analysis should take place in an open, transparent Value of Solar methodology development process.

The proper point at which to measure revenue indifference for customer-generators is the customer meter. After all, properly constructed retail rates should reflect the costs of producing and delivering a kWh to the customer meter. A rate of return on investment is added to compensate investors for their risk and profit for deploying their capital for utility use—costs that customer-generators also bear, along with insurance and operational risk.

The kWh that the net-metering customer generates does all of the work that the utility-provided kWh does, plus they are climate-proof, drought-proof, reduce wholesale market prices, and will never cost more to operate. No wonder Value of Solar analysis finds value above the prevailing rate. Net metering avoids all the costs that the utility faces, plus more.

No wonder Value of Solar analysis finds value above the prevailing rate. Net metering avoids all the costs that the utility faces, and more.

There is no missing money. Opponents of net metering are not posing the question in the right way.

As in the hotel room riddle, there is another, better way to ask the question. An answer is available, and can be supported by abundant data.

What would be the cost-of-service utility charge for a kWh of solar or solar-equivalent electricity delivered to the customer meter?

The answer, of course, is generally close to the retail rate plus a value premium, based on environmental and fixed price value. Most value-of-solar studies, which are basically comprehensive avoided-cost studies, arrive at a similar conclusion. □

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