Final Progress Report

Project Title:	"Innovative Solar Business Models"
Covering Period:	Project (Sep 2011-Aug 2014)
Date of Report:	November 25, 2014
Recipient:	Rocky Mountain Institute
Award Number:	DE-EE0005353
Working Partners:	N/A
Cost-Sharing Partners:	N/A

Contacts:

Virginia Lacy
Phone: 303-567-8640
Email: vlacy@rmi.org

Jon Creyts
Phone: 970-927-7201
Email: jcreyts@rmi.org

Emily Loose
Phone: 303-567-8602
Email: eloose@rmi.org

DOE Project Team:	Contracting Officer	Lalida Crawford
	Project Officer	RoseMarie Holsing
	HQ Project Contact	Christina Nichols

Executive Summary

In support of the SunShot Initiative's goal to enable large-scale deployment of solar energy technologies without subsidies, the RMI project team proposed to leverage funding provided under FOA-0000520, Topic Area 3 (Regulatory and Utility Solutions) to partner with key electricity sector actors and pilot-test new solar business models that harmonize the interests of utilities, ISOs, customers, and distributed resource providers. By creating business models that recognize and create value for multiple stakeholders, this project aimed to considerably increase the potential size of the U.S. solar market, creating a positive feedback cycle of enabling scale and accelerating PV cost reductions.

To address a significant gap in empirically tested models, RMI proposed to work with a select team of advisors to design and create 2-4 innovative, scalable business model pilots in partnership with a combination of partners that could include any combination of utilities, ISOs, customers and distributed resources providers in targeted jurisdictions. To do so, the project team would:

- Assess the costs and values created by distributed solar PV from the perspectives of customers, utilities, and society.
- Identify sources of value and prioritize based on potential size of prize.
- Identify necessary conditions under which that value could be optimized (considering major value drivers: timing, location, reliability, flexibility, predictability, controllability).
- Identify technical and business structures that can unlock value under different regulatory and business environments.
- Disseminate lessons learned and best practices created through pilots with the express intent of replication and scaling.

The project team met many of these proposed objectives, partnering with two utilities and continually working with customers and distributed resources providers, seeking their feedback through interviews, workshops, and focus sessions. At the end of the project, the opportunities to maximize the value of distributed solar PV and possible business models that can capture that value are much clearer, and several project partners have a firmer understanding of the path for moving forward. To disseminate these messages to a broader audience, the project team has actively sought to share these project findings through reports, presentations, and articles, and will continue to share these lessons and best practices past the end of project funding.

Background

As solar PV expands into new markets and regulatory environments, distributed solar market growth (rooftop or community scale) is driving a fundamental shift in the economics and operations across the electricity sector's value chain. Existing business models for U.S. electric utilities in particular, which have evolved on the basis of control, ownership and scale efficiencies from central station electrical supply, transmission, and distribution, are poorly adapted to quantify, capture or optimize the value streams associated with distributed solar PV. Under these institutional constraints, incumbent utilities might evaluate distributed PV negatively, associating PV with increased transaction costs, challenges to system operations, and revenue loss.

While supportive federal, state, and local policies, including tax benefits, renewable energy credits (REC) sales, and net-energy metering have spurred solar PV growth in many U.S. markets over the last decade, these policies are designed for early market support in an emerging technology, not a long-term market solution. Further, as solar costs decline to price targets set by the U.S. Department of Energy's SunShot Initiative and penetration rates grow, policies, such as net-metering, threaten conflict among stakeholders. These conflicts could pose significant barriers to long-term growth of customer and community-sited solar PV.

In support of SunShot solar PV cost reduction and market growth goals, Rocky Mountain Institute (RMI) conducted a collaborative process to identify opportunities and best practices to enable utilities to support widespread adoption of distributed solar resources. This project took a renewed, holistic approach to ensure sustained market growth of distributed solar PV by demonstrating and optimizing its value proposition to utilities, customers and regulators alike.

A growing body of work, including demonstration projects and analyses supported by the Department of Energy (DOE), is providing empirically tested data that demonstrate the technical viability of optimally integrating distributed PV to support the grid and provide energy service to customers. However, the ultimate viability of a growing distributed solar PV market will be won or lost on the demonstrable economic net value to key stakeholders, especially utilities. This project sought to create business models that build the critical bridge between technical insight and the business case and align the interests of utilities, technology providers, regulators and customers.

Objectives

Key project objectives were to:

- Strategically partner with selected utilities and/or technology partners to assess the costs and values created by distributed solar PV from the perspectives of customers, utilities, and society
- Identify sources of value and necessary conditions under which that value could be optimized (considering major value drivers: timing, location, reliability, flexibility, predictability, controllability) such as pairing with demand response, smart inverters, and distributed storage.
- Identify technical and business structures that can unlock value under different regulatory and business environments
- Understand and evaluate regulatory implications in order to communicate barriers and opportunities to regulators
- Disseminate lessons learned and best practices created through pilots with the intent of

replication and scaling

Synthesis of Proposed and Actual Accomplishments

The project team successfully completed key milestones within core components of the project:

Analysis and Analytical Tools

In the first phase of the project, the project team established the analytical foundation to identify distributed solar value drivers. This analysis included the review of 16 distributed solar PV benefits and costs studies and culminated in a report, *A Review of Solar PV Benefits and Cost Studies*. The report summarized study approaches and methodologies and documented key insights for states, regulators, utilities, solar companies, and research organizations conducting new studies.

Additionally, the analytical foundation included developing an alpha version of the Electricity Distribution Grid Evaluator (EDGE) model, a MATLAB-based simulation tool designed to better assess the distributed resource value proposition, starting with solar PV. In addition to providing the analysis to serve in the development of solar business model offers for the ISBM project, the model is intended to fill key electricity industry gaps by providing clearer insights to regulators, utilities, customers, and developers about the system-level technical and economic effects of increasing solar PV at the distribution level.

In May 2013, the ISBM project team held a well-attended technical review session with electricity industry experts in system operations, planning, and economics from Sandia National Lab, National Renewable Energy Lab (NREL), Electric Power Research Institute (EPRI), Lawrence Berkeley National Lab (LBL) and Solar Electric Power Association (SEPA). Attendees were asked to critique current approach and methodologies in order to prioritize next steps for model development to ensure the most value for industry and practical application within the ISBM project. Model testing and improvement continues within the two utility partnerships pursued within the Application phase.

In June 2014, the ISBM project team completed the beta version of the EDGE model, sharing the model on the Rocky Mountain Institute website and providing a summary document of the model's approach and methodologies.

Application

The project team successfully secured partnerships with two utilities–Public Service Company of New Mexico (PNM), a vertically investor-owned utility in the Southwest and Great River Energy (GRE), a generation and transmission cooperative with over 20 member distribution cooperatives in the Midwest–to practically test project hypotheses within contrasting utility business models and regulatory environments.

While the circumstances were unique within each territory, both projects aimed to enable win-win-win solar business models for multiple stakeholders by: 1) establishing a clear foundation of solar value; 2) aligning pricing to reflect value by providing clearer signal to customers and fair compensation; 3) developing models to optimize and capture increased net value either through identified opportunities to a) reduce solar's installed or operational costs or b) increase solar's production value.

PNM Partnership

As part of the partnership with PNM, the project team:

- Investigated the economics for distributed solar PV in PNM's territory for large commercial and industrial customer and the value that distributed solar PV generation creates.
- Explored possible pricing models, such as a Value of Solar Tariff, to translate the benefits and costs of distributed solar PV as well as new business model opportunities to create additional value.
- Worked to develop business model opportunities included the utility and solar project developers partnering to strategically deploy distributed solar at "hot spots" in its distribution system to reduce or eliminate requirements for more costly investments in generation, transmission, distribution or ancillary services. A shared savings model motivates the utility by rewarding shareholders with a portion of the system savings. The project team also sought out feedback from other stakeholders, like solar companies and, on these business model concepts in focus sessions.
- Provided recommendations and a roadmap for moving forward on these pricing model and business model opportunities. These recommendations included: build on and execute solar value calculations as the basis for new rate and business model designs, continue to test proposed solutions using small groups of important stakeholders, and craft a multi-stakeholder engagement campaign to engage the broader community as the best solutions become clearer.

GRE Partnership

As part of the partnership with GRE, the project team:

- Conducted research and analysis to determine the design opportunities for enhancing community solar levers
- Hosted a workshop with participants from GRE and its distribution cooperatives as well as external experts to prioritize opportunities and identify strategies for implementing solutions. The workshop initiated conversations to use community solar as a platform for a broader array of services to create value. Additional insights included the need for pricing models to accurately reflect the costs and benefits of the DPV project (possibly through a value-based compensation mechanism) while also being simple for the customer to understand to enable scaling. Further, optimizing the timing of production and the location of community solar projects could create significant opportunities to increase the value of the community solar project, but will require changes to current planning processes and education for utility staff on existing and new technologies for integrating DPV projects.

Dissemination

In the last phase of project work, the project team published a final report *Bridges to New Solar Business Models: Opportunities to Increase and Capture the Value of Distributed Solar Photovoltaics*. This report discusses largely untapped opportunities for increasing DPV's net value, highlights promising building blocks for business models that create and capture additional value for utilities, solar companies, and customers, and offers recommendations based on key insights throughout the project. In addition, the project team has continually worked to share lessons learned through press releases, presentations, blog articles, and reports.

The project team also encountered challenges and shifted priorities throughout the project around the following objectives:

Successfully creating pilots. As RMI originally conceived the work, the goal of the project was to directly test and build innovative solar business models together with representative utilities. The project team accomplished the overall objectives with PNM and GRE through workshops, joint analysis, and a focus session probing customer receptivity. RMI was not, however, able to reach the point of having bona fide “pilots” being implemented in the market. combination of regulatory and institutional barriers have made this nearly impossible in the timeframe of the engagements, though the project team appears close with both PNM and GRE.

The role of advisors. The project team’s advisory panel has served as an invaluable resource in the creation of the EDGE analytic model and helpful as the project team synthesized key findings in the final report. However, due to the sensitivity within the two organizations we have been working with, outside individuals were not welcomed into the internal debate about alternative business models within management teams. Hence for both PNM and GRE the project team instead relied on internal steering committees to guide the work and progress.

Emphasis of model development. At the beginning of the project, the project team did not see creating a robust model as a critical need, but as the project unfolded, it became clear that the project team needed a solar valuation tool for evaluating business models. As a result, the project team dedicated a significant portion of its resources to building and then seeking feedback on the EDGE model, a key open source analytic tool that has been created to support distributed solar analysis going forward.

Timeline and Details of Major Activities and Outcomes
The following section outlines the major project accomplishments against planned activities from the SOPO, including the timeline for generating these accomplishments.

Task 1 - Establish Frameworks and Structures to Guide Analysis

Task 1.1- Create Analytical Framework of Distributed PV Costs and Benefits	
Q1- FY2012	**Incorporated analysis and reviewed studies** addressing aspects of the costs and benefits of distributed generation, including PV. The project team found that most of these studies have incompatible methodologies, and required more effort to draw out meaningful implications. The project team started to find ways to address this issue.
Q2- FY2012	**Completed literature review database** by incorporating additional analysis and review of studies addressing aspects of the costs and benefits of distributed generation with special focus on distributed PV.
Q2- FY2012	**Produced comprehensive framework of impacts, costs and benefits,** incorporating major insights from the literature review database. RMI created a framework to facilitate discussion among industry experts and move toward a generally accepted approach for considering the impacts of distributed PV integration at current and future levels of penetration. The framework: • Identifies impacts and respective drivers. • Specifies the degree of spatial or temporal granularity that are necessary to evaluate the impacts, especially at higher levels of penetration. • Documents the potential magnitude of the impact based on previous studies. • Assesses to which actors those impacts accrue.
Q2-FY2012	**Engaged with approximately 10 external experts** (Bob Reedy, Florida Solar Energy Center; Snuller Price, E3; Karl Rabago, Austin Energy; Stephen Frantz, Sacramento Municipal Utility District (SMUD); Nadav Enbar and Tom Key, EPRI; Kent Scholl, Xcel Energy; Joel Swisher, Stanford University; Tom Beach, Crossborder Energy; Ben Norris, Clean Power Research) to peer review the framework and, in so doing, improve it.
Q3-FY2013	**Released *A Review of Solar PV Benefits and Cost Studies*** to assess both the "known's" and "unknown's" about the categorization, methodological best practices, and gaps around the benefits and costs of distributed solar PV, and to begin to establish a clear foundation from which additional work on benefit/cost assessments and pricing structure design can be built.
Q3-FY2013	**Conducted Dissemination efforts for *A Review of Solar PV Benefits and Cost Studies***, garnering press mentions on *GreenTechMedia*, *Grist*, and *Utility Dive*. In addition, the report has been submitted in proceedings in several states including in Colorado, Florida, Michigan, Minnesota, and North Carolina.
Outcome	***Reviewed sixteen distributed solar PV benefits and costs studies and released a report that summarized study approaches and methodologies and documented key insights for states, regulators, utilities, solar companies, and research organizations conducting new studies.***

Task 1.2 - Identify or Adapt Financial and Operational Modeling Tools to Support Pilot Design	
Q1-Q2-FY2012	**Reached out to potential modeling collaborators,** including Trieu Mai at NREL and Galen Barbose, Ryan Wiser, Andrew Mills and Peter Cappers at Lawrence Berkeley National Lab (LBNL) to identify related financial and operational modeling tools to complement internal RMI tools.
Q2-FY2012	**Documented methodology of RMI's system dynamics tool and made progress in identifying areas necessary for adaptation**, with the assistance of Dr. Andrew Ford, Professor at Washington State University. The project team determined necessary adaptations to incorporate and focus on distributed PV market growth.
Q3-FY2012	**Added internal modeling capacity that enabled rapid advancement on modeling work**, with the addition of a newly hired associate, James Sherwood, in September.
Q3-FY2012	**Completed transfer of disparate modeling modules**, including electricity dispatch, planning and utility rate-making module, into single MATLAB platform to continue development of now-titled Distribution EDGE model.
Q4-FY2012	**Continued to make significant progress with the Electricity Distributed Generation Evaluation (EDGE) model** including: • Expanding the EDGE model's ratemaking capabilities, adding additional dynamic, time-based pricing structures. • Added functionality to examine financial impact to PV-owning residential customers. This functionality allows for parameterized exploration of alternative PV system configurations and orientations, as well as customer characteristics. • Implemented significant changes to the EDGE model's resource portfolio module, contracting with Mark Dyson, PhD student in UC Berkeley's Energy Resources Group, to perform necessary coding. The resource portfolio module includes a linear programming-based optimization model that performs the tasks traditionally associated with utility planning and procurement, while also considering the potential for mixed resource ownership/control by non-utility stakeholders. The module analyzes the annual resource investment needs of a selected electricity system and attempts to optimize the planned portion of the electricity system by minimizing cost across several dimensions. • Outlined planned implementation of the distribution system module.
Q2-FY2013	**Completed alpha version of the Electricity Distributed Generation Evaluation (EDGE) model** allowing for detailed assessment of solar costs and benefits at the sub-transmission level.
Q2-FY2013	**Conducted extensive outreach and engagement of leading industry thought-leaders** (including Sandia, Lawrence Berkeley National Lab, Georgia Tech, National Renewable Energy Lab, Electric Power Research Institute, Solar Electric Power Association) leading to collaborative information sharing and development of critical model code mutually beneficial for ISBM project and EPRI/ NREL/ Sandia project, Screening Distribution Feeders: Alternatives to the 15% Rule.

Q3-FY2013	**Successfully completed planned refinements to the rates portion of the EDGE model tool.** The model includes a "bill calculator" to evaluate the economics of a solar installation for a specific customers or group of customers in a specific territory. Importantly, the model is able to accurately represent customer bill savings using actual utility rate schedules (including demand charges, volumetric energy charges, customer charges and other charges) as well as actual net metering provisions and incentives.
Q1-FY2014	**Completed updates to RMI's EDGE model,** refining the systems operations and dispatch module and incorporating new tools for assessing benefits of deferring or displacing investments on the utility distribution system.
Q2-FY2014	**Finished updates to RMI's EDGE model.** The project team finalized updates to the EDGE modeling tool to include robust functionality for the core components of the EDGE simulation engine (including integrated power system operations, generation capacity planning, and accrual of total system costs) and a base level of functionality for several additional model components (distribution system operations, utility cost allocation and rates, and stakeholder outcomes). The project team also updated the public ISBM webpage to include an up-to-date methodology and status see: http://www.rmi.org/rmi_sunshot_doe_analysis_and_products.
Q2-FY2014	**Released EDGE model online.** The completed version of the EDGE model has been made available via RMI's public FTP site. It can be downloaded at: https://files.cnihosting.net:510/shares/file/763d7192a86d78/.
Output	***Developed alpha and beta versions of the Electricity Distribution Grid Evaluator (EDGE) model to test value proposition of distributed solar PV and released an open-source version of the model online***

Q2-FY2013	**Held successful and well-attended technical review session of model with industry leaders** to invite critique of current methodologies and prioritize next steps for model development that will ensure most added value for industry and practical application within Innovative Solar Business models project.
Q2-FY2013	**Released Technical Review Workshop Summary**, highlighting key discussion points and feedback from the workshop.
Output	***Hosted workshop inviting advisors and industry thought leaders to evaluate the methodology and approach for the EDGE model and summarized key observations and feedback***

1.3 - Select Team of Advisors	
Q1-FY2012	**Completed initial research of contacts and reached out to contacts for potential engagement** as part of the Solar Business Model working group. Key participants were identified both by personal expertise and industry affiliation. The project team identified 40 possible participants and then determined the most effective level of engagement to focus their efforts.
Q1-FY2012	**Interviewed 35 additional members of the electricity industry** to inform necessary changes in business models to integrate more distributed, renewable generation, such as solar PV. These interviewees represented solar companies, investor-owned utilities, municipal utilities, state regulatory bodies, and environmental advocacy organizations.

Q2-FY2012	**Finalized Working Group Model.** The project team determined optimal size and composition of the working group, including the balance of representatives from different utility regulatory structures. The working group would consist of approximately 20 participants composed of four major segments: technology providers, utilities, regulators, customers/investors. The utility participants would include representatives that mirror the electric utility market segmentation for modeling: vertically integrated IOUs, vertically integrated municipal utilities, and distribution-only cooperatives.
Q3-FY2012	**Worked one-on-one with several core members** of the Working Group/ Advisory Team and potential pilot participants to discuss and consider pilot and partnership opportunities, including: Stephen Frantz, Project Manager, Distributed Solar Program, Sacramento Municipal Utility District (SMUD); Sunil Cherian, CEO, Spirae; Ken Munson, CEO, Sunverge; Karl Rabago, formerly Austin Energy; Tom Brill, Director, Strategic Analysis, SDG&E.
Q1-Q3-FY2014	**Continually engaged advisors during utility partnerships**, reaching out to them with questions on quantitative analysis on solar valuation modeling and approaches, best practices on new business models, and high-level barriers to implementation. However, the project team did not seek out input and feedback on materials, along the lines of presentation slides and other documents, as utility partners required a tight confidentiality agreement as part of the partnership.
Q3-FY2014	**Sent out draft of final document for review,** seeking feedback from advisors on how the project team structured the document and the project team's recommendations for optimizing and capturing the value of distributed solar PV.
Output	***Developed group of advisors, who provided input throughout the project, including for scoping partnerships/pilots, participation in workshops, and review of the final report***

Task 2 – Pilot Design, Selection, and Launch

Task 2.1 - Identify Existing Case Studies and Best Practices	
Q2-2012	**Began work identifying and documenting innovations and best practices** in the U.S. and abroad for business models, efficient incentive programs and rate structures that support the growth of solar. The project team also explored using several different frameworks for evaluating solar business models, including the Solar Electric Power Association's, Sacramento Municipal Utility District's, Laurence Lehmann-Ortega and Jean-Marc Schoettl's, and Bridge Strategy's.
Q2-2013	**Updated the database** after the release of Electric Power Research Institute and Solar Electric Power Association's revised Utility Solar Business Models Database. Given the comprehensiveness of this database, the project team de-emphasized the importance of building a new database as a comprehensive one now existed.
Q2-Q3-2014	**Utilized case studies in research and analysis** as part of both utility partnerships, highlighting what the opportunity space looks like as well as best practices and lessons learned from these business model efforts. In addition, the project team used these case studies in the final report as a backdrop for new opportunities for creating and capturing DPV value.
Outcome	***Created a database for evaluating solar business models and documenting best practices***

Task 2.2 - Scope Pilots **Task 2.3 - Conduct Modeling Analysis to Support Pilot Scoping**	
Q4- FY2012	**Completed the first cut of criteria for strategic partnership selection.** To meet our primary objective for broad application and replication, the project team laid the ground work for a minimum of 2 partnerships that represent broad regional diversity, regulatory structures and utility business models: 1 municipal or cooperative utility that will enable rapid demonstration results and at least 1 investor owned utility (IOU), which will require a longer time investment, but a significant payoff in terms of potential applicability and market share.
Q4-FY2012	**Explored scope with municipal utility pilot partner.** Our team worked with Stephen Frantz, Strategic planner, Distributed Solar Program of SMUD, to secure a commitment with SMUD. SMUD was "exploring strategies for capturing a share of the growing market through solar business models that allow solar to become a win for the utility, a win for the solar industry, and a win for ratepayers and PV customers." RMI proposed a collaborative effort to: 1) use quantitative analysis via the EDGE model to support the construction of viable business models for each of the proposed offers, establishing SMUD's role in each 2) develop a pilot for testing at least one scenario, and assist SMUD with the pilot's set-up and execution. Ultimately, the project team did not go forward with this partnership due to shifts in SMUD's strategy and priorities at the time the project was about to kick off.
Q1-FY2013	**Explored potential partnerships with eight other utilities**. These utilities included Arizona Public Service, Consolidate Edison (ConEd), CPS Energy, Dominion Energy, Duke Energy, Great River Energy, San Diego Gas and Electric, and Xcel Energy. For each utility, the project team leveraged the RMI

	network of contacts to set up phone calls, and then gave information on the Innovative Solar Business Models project, including background context and objectives, and discussed potential partnership opportunities with each utility.
Q1-FY2013	**Developed potential scope of work with ConEdison,** focusing on evaluating the costs and benefits of distributed solar PV, exploring alternative rate options, and analyzing potential technology bundles (incorporating solar with demand response, energy efficiency, and storage, among other technologies). In this case, the timing for when the project team needed to start (mid-FY2013) did not align well with ConEdison's schedule, and the project did not move forward.
Q2-FY2013	**Submitted proposal to PNM** to evaluate community solar PV's value proposition in PNM's grid, develop community solar model options and pricing structures, and then, in a second phase, evaluate the potential value of combining community solar projects with storage. This was the initial scope, but it changed substantially at the beginning of the project as described below.
Q3-FY2013	**Submitted proposal to GRE** to evaluate possible projects and explore pricing models designed to accurately reflect GRE's costs while encouraging customer adoption. As part of this initial proposal, the project team sought to evaluate the solar value proposition in GRE's territory and then develop community solar model options and pricing options. Like the PNM partnership, the scope evolved over time, but the focus of the project always stayed on community solar options.
Q3-FY2013	**Secured written agreements with two utility partners**–PNM, a vertically investor-owned utility in New Mexico, and Great River Energy, a generation and transmission cooperative in Minnesota with 28-member distribution cooperatives–to collaborate and meet project's core objectives. Overviews of each partnership are detailed in the attached supporting documentation
Outcome	***Selected two partners, Public Service Company of New Mexico (PNM) and Great River Energy (GRE), based on organization objectives and system diversity (geographic region, regulatory structure, and utility business model), after detailed partnership explorations and scoping conversations with 9 utilities***

2.4 - Select and Launch Test Pilots

Q3- FY2013	**Developed scope with investor-owned utility partner, PNM,** shifting the focus from community solar to opportunities for another market with little activity in PNM's territory, large commercial and industrial customers. This change in scape occurred because PNM felt it had sufficient resources to pursue a community solar project while there were more questions within the organization about DPV strategies for the commercial and industrial segment. The final project scope included three workstreams: • Workstream 1: Evaluate solar economics for major commercial customers to identify large commercial and industrial customers who could be interested in new types of solar offers and understand the current economics for solar in PNM's territory. As part of this workstream, the project team analyzed the rate and billing history for PNM's largest customer accounts and modeled current and future solar economics under different ownership structures. • Workstream 2: Analyze solar value drivers for several major accounts, investigating the sources of value, including energy, capacity, grid support services, and environmental benefits, and evaluating opportunities to increase the value of solar PV. The project team would assess value drivers for solar in PNM's territory under various scenarios, including penetrations of DPV, additional demand flexibility, and in certain locations. • Workstream 3: Design and test alternative offers for large commercial and industrial customers by creating concepts for value-based offerings and then testing the concept in a multi-stakeholder offering. Final outputs would include a summary of the discussion in the multi-stakeholder meeting and a report for PNM summarizing key project findings.
Q2- FY2014	**Finalized scope with co-op utility partner, Great River Energy,** focusing on developing a community solar options, including: • Workstream 1: Conduct research and analysis to identify opportunities in project design to optimize production value, pricing models, marketing and customer adoption, and ownership and financing and then synthesize findings in a pre-read document • Workstream 2: Host a design workshop with Great River Energy and two of its distribution cooperatives (Dakota Electric and Steele-Waseca) to investigate opportunities for enhancing and implementing community solar models. • Workstream 3: Summarize feedback from workshop and incorporate recommendations for how Great River Energy and its distribution cooperatives can move forward on community solar models in a workshop summary document.
Output	***Scoped partnerships, focusing on developing a value-based offer for large commercial and industrial customers for PNM and an enhanced community solar offer for GRE and its distribution cooperatives.***

PNM Partnership timeline and outcomes:

Q3-FY2013	**Formalized partnership with PNM including PNM's required confidentiality agreement**. The confidentiality agreement "recognizes the ability" of RMI to "acknowledge that PNM is a client… for the purpose of

	pursuing joint research on Innovative Solar Business Models, and that this research is being supported by the Department of Energy. Except with the prior written consent of PNM, [RMI] shall not disclose to any person either the fact that discussions or negotiations are taking place beyond these general facts or the status of such discussions or negotiations."
Q3-FY2013	**Launched the partnership with PNM**, by holding a kickoff meeting at PNM's headquarters in Albuquerque on July 29-30, 2013, to finalize the partnership scope and workplan, introduce members of the collective RMI-PNM project team, establish key milestones, and align on objectives that enable PNM to provide a distributed solar offer to customers in a way that is good for business, customers, and the community: • Increases the deployment of economic solar PV in PNM's territory • Improves customer satisfaction • Provides a solar option to customers that would not otherwise have considered solar due to perceptions of risk (of self-ownership or third party providers) • Provides an exciting renewable option that could attract large customers to PNM's territory for more economic development • Eliminates cross-subsidization among customers through a pricing mechanism that incorporates delivered solar value.
Q3-FY2013	**Held first work session with PNM** on August 22-23, 2013. During the work session, the RMI team interviewed and collected relevant data from PNM staff members who are pertinent to planned analysis and solar offer design. These staff members included members of the transmission and distribution planning, interconnection, pricing and load research, environmental policy, and economic development departments.
Q4-FY2013	**Completed the first workstream and held second work session with PNM team to review results** on October 28-29, 2013. The analysis provides an assessment of the viable potential solar market in PNM's large customer segment, which is not being successfully tapped by existing solar market offers. The work session teed up a discussion on opportunities for PNM to use it's core competencies to add value (by reducing costs or increasing benefits) in the solar market via collaborations with other market players, i.e. local solar developers.
Q4-FY2013	**Presented to Senior Vice President of Public Policy, Ron Darnell, and his leadership team regarding the project.** The presentation and discussion was well-received. Discussions included an open and frank conversation about the number of significant strategic priorities that PNM is facing within the next year. The company's ability and timing in initiating a solar offer pilot will necessarily be contingent on factors and developments outside of this collaboration.
Q4-FY2013	**Started and continued second workstream to analyze value drivers.** While some data challenges were able to be resolved, there were specific challenges around the availability of transmission and distribution data, as well as the ability to calibrate our model outputs with PNM's internal modeling tools that are being used to support their integrated resource plan. To move forward in addressing data gaps and to begin to calibrate initial results, the project team met with PNM team members across generation, transmission, distribution and integration resource planning over the course of two days, December 16-17, 2013.

Q1-FY2014	**Held two working sessions with PNM Resources.** The first of these working sessions was hosted at PNM's headquarters in Albuquerque, NM on January 29-30, 2014 focusing on best practices and opportunities for adapting and developing new pricing and business models. The second working session was held via Webex Web Conferencing on February 14, 2014 to review the analysis of costs and benefits distributed solar PV provides PNM's system. Staff that participated in these working sessions represented several departments including: transmission and distribution planning, integrated resource planning, interconnection, pricing and load research, environmental policy, and economic development departments.
Q1-FY2014	**Hosted successful and well-attended focus session with PNM, New Mexico solar installers, and customers** to receive input on current perceptions of the solar PV market environment and garner feedback on a pricing model, a value of solar tariff, and a conceptual business model, "hot spot" manager.**"** The focus session included local solar companies and diverse group of commercial customers, including schools, real estate, and city government. The project team summarized the focus session in a document highlighting key findings and important discussion points from participations.
Q1-FY2014	**Completed all workstreams for PNM partnership**. The summary of the research, analysis, and results has been compiled in a compendium, titled "Innovative Solar Business Models Project Compendium of Final Results and Analysis", which was attached in the Q1-FY2014 quarterly report.
Q1-FY2014	**Gave two final presentations to PNM team.** The first final presentation was a 2.5-hour presentation on March 10, 2014 in Albuquerque, NM at PNM's headquarters for the core project team, which included staff from the transmission and distribution planning, integrated resource planning, interconnection, pricing and load research, environmental policy, and economic development departments. The second final presentation was held on the following day for 2 hours with the senior executive policy team. Both presentations highlighted key findings from the project, the proposed pricing and business models, and next steps and important questions to resolve for moving forward.
Outcome	***Completed partnerships with PNM and GRE, providing presentations and documents highlighting key findings and offering recommendations for developing pilots.***

GRE Partnership timeline and outcomes:

Q3-FY2013	**Held joint scoping session with co-op utility partner, Great River Energy** at GRE's headquarters in Minneapolis, MN, on September 18, 2013**,** and also three candidate distribution co-ops. Key results of the meeting included a finalized scope focused on a community solar offer, which incorporates the optimized grid value of distributed solar, for residential customers that GRE can provide to any of the 28 distribution-only co-op utilities it serves.
Q1-FY2014	**Held first working session with co-op utility partner, Great River Energy** and two of their distribution co-ops, Dakota Electric Association and Steele Waseca Cooperative Electric, at Dakota Electric Association's headquarters in Farmington, MN, on March 19, 2014**.** Results from the meeting included aligning on project objectives, identifying elements of community solar to test and explore, and investigating key questions on solar PV's production value,

	pricing, and market segmentation.
Q2-FY2014	**Conducted research and analysis for community solar workshop** on design options and best practices for community solar programs. The project team's research focused on four major opportunity areas for community solar: 1) pricing; 2) project design to optimize production benefits; 3) soft costs and customer adoption; and 4) ownership and financing. The project team also gathered information for several "deep-dive" case studies, including Sacramento Municipal Utility District's SolarShares, Holy Cross Energy's Community Solar Garden, Wright-Hennepin Cooperative Electric Association's WH Solar Community, and Lake Region Electric Cooperative's Community Solar program.
Q2-FY2014	**Conducted informational interviews** with Jared Schoch of TurningPoint, Mark Safty of Holland and Hart, Curtis Seymour of SunEdison, Stephen Frantz of Sacramento Municipal Utility District (SMUD), Paul Denholm of NREL, James Tong of Clean Power Finance, Scott Fisher of NRG Energy, Larry Conrad of Conrad Technical Solutions, Stephen Doig of McKinsey, Katie Ellis of National Renewable Cooperative Organization (NRCO), Toni Bouchard of SmartPower, Erica Schroeder McConnell of Interstate Renewable Energy Council (IREC), Jill Cliburn of Cliburn & Associates, Jon Hawkins of PNM Resources, Chris O'Brien of TEL Solar, John Sterling and Mike Taylor of Solar Electric Power Association (SEPA), Tom Beach of Crossborder Energy, Doug Danley and Peter Muhoro of National Rural Electric Cooperative Association (NRECA).
Q2-FY2014	**Developed workshop structure and agenda** in collaboration with GRE and its partner distribution cooperatives, Steele-Waseca and Dakota Electric.
Q3-FY2014	**Completed research and analysis on community solar in pre-read document and shared document with workshop participants**. The document summarized the current landscape and emerging best practices for community solar programs and lays out design options for an enhanced community solar offer in four areas: 1) soft costs and customer adoption, 2) ownership and financing, 3) project design to optimize production value, and 4) pricing.
Q3-FY2014	**Hosted all-day community workshop meeting** at GRE's offices in Maple Grove, MN on July 23, 2014. The workshop objective was to clarify opportunities for Great River Energy, Dakota Electric, and Steele-Waseca that could: provide pricing that enables recover fixed costs and ensures fairness among member; utilize solar as a grid resource, optimizing net value; target soft cost reductions; and encourage high levels of customers adoption. Rocky Mountain Institute acted as facilitators, leading plenary sessions and four breakout sessions throughout the day. Workshop participants included twelve staff at Great River Energy, Steele-Waseca, and Dakota Electric and eleven external experts. Cooperative staff that participated in this workshop represented several different departments including: Business Development, Member Services and Marketing, Member Sales and Contracts, Engineering Services, Regulatory Services, Operations, and Finance and Accounting.
Q3-FY2014	**Finished report summarizing workshop discussions and documenting key findings**. The document synthesizes workshop discussions, including new thoughts and ideas for community solar programs from workshop participants and general themes that emerged throughout the day. The document contains an overview of ingoing assumptions and key insights from

	the workshop. It also highlights major points of discussion in each workshop breakout group.
Outcome	***Completed partnerships with PNM and GRE, providing presentations and documents highlighting key findings and offering recommendations for developing pilots.***

Task 2.5 - Disseminate Progress and Ongoing Lessons Learned	
Q2-FY2013	**Published article, "The Calm Before the Solar Storm," in May 2013, detailing project's need, objectives and progress** on RMI's external blog. Article was most read piece through RMI's website for the month of May, received 20% of all traffic to RMI.org for Q1 (surpassing articles published by RMI founder Amory Lovins) and was republished by over 10 websites, including Renewable Energy World (http://www.renewableenergyworld.com/rea/news/article/2013/05/the-calm-before-the-solar-storm) and CBS News Market Watch (http://markets.cbsnews.com/cbsnews/news/read/24280741/the_calm_before_the_solar_storm
Q3-FY2013	**Published second blog in blog series.** *"Solar Value, What's It All About?"* by Virginia Lacy and Devi Glick. http://blog.rmi.org/blog_2013_09_23_solar_value_whats_it_all_about
Q1-FY2014	**Chartwell webinar presented by Virginia Lacy**. The presentation, titled "New Business Models at the Distribution Edge", summarized how and why new market forces are challenging existing pricing and business models and highlights RMI's work to explore emerging solution set of new business models.
Outcome	***Continually disseminated key findings and lessons learned through conference presentations and blog posts.***

Task 3 - Pilot Implementation and Management

Task 3.1 - Gather and Analyze Data **Task 3.2 - Evaluate** **Task 3.4 - Project Management**	
Q3-FY2014	**Outlined and finished a first draft of the final report** that focuses on: identifying opportunities to maximize the delivered value of distributed solar to customers and the electricity system at large and investigating business model components that enable and incent solar companies, utilities, and customers to optimize solar value and create win-win-win opportunities. The report also includes recommendations for solar companies, utilities, and regulators, based on lessons learned through the project.
Q3-FY2014	**Sent report for review to project advisors.** Reviewers included: Stephen Frantz (SMUD), Alexandra von Meier (CIEEE), Galen Barbose (LBNL), Mike Taylor (SEPA), David Feldman (NREL), James Tong (Clean Power Finance), Jon Hawkins (PNM Resources), Mark Rathbun (Great River Energy), Lori Bird (NREL), and Dan Seif (The Butler Firm).
Q3-FY2014	**Finished report**, *Bridges to New Solar Business Models: Opportunities to Increase and Capture the Value of Distributed Solar Photovoltaics* incorporating reviewer comments and completing layout and graphics.
Outcome	***Completed final report that summarizes and synthesizes key project findings.***

Task 3.3 - Disseminate Recommendations	
Q3-FY2014	**Conducted dissemination efforts**, including sharing the report with reviewers and project partners, issuing pressing releases, writing a blog for RMI's *Outlet*, and posting the report on RMI's website.
Outcome	***Disseminated final report to the project's key audiences, including solar companies, utilities, and regulators.***

Task 4 - Project Administration

Task 4.1 - Reporting Schedule and Breadth **Task 4.2 - Stage-Gate Review, Go/No Go Determinations**	
Outcome	***Submitted quarterly reports on time for all twelve quarters during project and provided updates to DOE project sponsors at the end of Phase 1 and Phase 2 to receive funding for the next project phase***

Products developed under award: N/A

Patents: N/A

Publications and Presentations (Non-Confidential, Publicly Disclosable):

- Hansen, Lena, Virginia Lacy and Devi Glick. 2013. *A Review of Solar PV Benefit and Cost Studies*. Boulder, CO: Rocky Mountain Institute.

- Lacy, Virginia, Mathias Bell, and James Sherwood. 2014. *Bridges to New Solar Business Models: Opportunities to Increase and Capture the Value of Distributed Solar Photovoltaics*. Boulder, CO.
- Rocky Mountain Institute. 2013. *Electricity Distribution Grid Evaluator (EDGE) Model: Technical Review Workshop Summary*. Boulder, CO.
- Rocky Mountain Institute. 2014. *EDGE Model: Progress Update*. Boulder, CO.
- Rocky Mountain Institute. 2014. *Innovative Solar Business Model Focus Session Summary*. Boulder, CO.
- Rocky Mountain Institute. 2014. *Innovative Solar Business Models: Community Solar Workshop Summary*. Boulder, CO.