



Rhode Island Commerce Corporation Renewable Energy Fund

Renewable Energy Fund

Project Inspector

June 17, 2014

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Authorized Applicant's Signature and Acceptance Form

The undersigned is a duly authorized representative of the applicant listed below. The Applicant has read and understands the Solicitation requirements. The undersigned acknowledges that all of the terms and conditions of the Solicitation are mandatory.

The Applicant understands that all materials submitted as part of the application are subject to disclosure under the Rhode Island's Access to Public Records Act, as explained in Section IV.5 of the Solicitation, and acknowledges and agrees that the REF has no obligation, and retains the sole discretion to fund or choose not to fund the application set forth herein, and that REF's receipt of the application does not imply any promise of funding at any time.

The Applicant understands that, if selected by the REF and approved by the Rhode Island Commerce Corporation Board of Directors, the Applicant and the REF will detail and execute a contract that outlines the respective roles and responsibilities of the parties.

I certify that the statements made in this application, including all attachments and exhibits, are true and correct to the best of my knowledge.

Applicant: Cadmus

By: 

Dave Korn
Vice President
Cadmus: Energy Services Division
June 17, 2014

Prepared by:
Sandra Brown
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Matt Piantedosi
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Executive Summary

Cadmus is pleased to offer this response to the Rhode Island Commerce Corporation's (Commerce RI) request for proposals for a Renewable Energy Fund (REF) Project Inspector for solar photovoltaic (PV), solar hot water (SHW), and commercial renewable energy projects, and to support the REF's programs through special projects and trainings directed to program administrators, installers, and inspectors. For more than a decade, Cadmus has provided technical assistance in support of the renewable energy industry, encouraging growth in the PV and SHW industries.

Four Reasons to Select Cadmus

- Cadmus completes nearly 1,000 PV and SHW system design reviews, inspections, audits, and fatal flaw assessments *annually* for clients in New York, Massachusetts, and other northeastern states. Our inspections are comprehensive—including a thorough review of the system's components from the array to the grid interconnection, ensuring instances of noncompliance with the National Electrical Code (NEC) located on a roof, in an attic, or elsewhere are identified and resolved. We have long assisted first-time installers and engineers to identify and rectify the common mistakes found in residential and commercial PV and SHW installations.
- Over the past decade we have identified many thousands of instances of noncompliance with the NEC and local code and program requirements, as well as corrupt data reported either from data acquisition systems (DAS) or system owners and other safety, performance, and data quality assurance issues. We have a reputation for being thorough but fair in resolving issues with installers, DAS vendors, Renewable Energy Certificate (REC) aggregators, and other parties.
- Cadmus is a recognized leader in solar PV code, regulations, and safety guidance and training provided to industry experts and entrants alike. Recent presentations include:
 - **Photovoltaic Systems and the National Electric Code**, Solar Energy Business Association of New England (SEBANE), forthcoming June 2014.
 - **Solar PV Changes to the 2014 National Electrical Code (NEC)**, International Association of Electrical Inspectors, Paul Revere Chapter, April 2014.
 - **Solar PV Fire Safety**, Fire Prevention Association of Massachusetts, April 2014.
 - **Grounding and Labeling: Solar Photovoltaic Installation Best Practices Webinar**, New York State Energy Research and Development Authority (NYSERDA), March 2013.
 - **Understanding and Investigating Solar Photovoltaic Systems**, International Association of Arson Investigators, January 2013.
 - **PV Safety: Measure and Manage for Continuous Improvement**, Solar Power International 2012 Conference, Orange County Convention Center, September 11, 2012.
- Cadmus' renewable energy experts are skilled at performing comprehensive, efficient inspections and audits to confirm system configuration and quality assurance of energy production. Cadmus staff recently drafted an update of the International Performance

Measurement and Verification Protocol for renewable energy systems—a benchmark for projects supported by the Federal Energy Management Plan. Cadmus is also a qualified independent third-party verifier to the New England Power Pool Generation Information System (qualified by the Massachusetts Department of Energy Resources [MA DOER]).

The Cadmus Team

Cadmus combines extensive renewable-energy technical and economic expertise with more than a decade of experience helping clients to develop and support renewable-energy projects in New England. Since 1983, Cadmus has provided high-quality, multidisciplinary consulting, research, and technical support services to government, non-profit, and corporate clients. Headquartered in Waltham, Massachusetts, Cadmus is an employee-owned company staffed with approximately 400 full-time professionals in offices across the United States. Cadmus' renewable energy practice has supported local, state, and federal government clean-energy projects and programs for more than 10 years. Representative clients include the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), MA DOER, the Massachusetts Division of Capital Asset Management and Maintenance (DCAMM), and the Massachusetts Clean Energy Center (MassCEC).

As dedicated renewable-energy-industry experts, Cadmus is at the forefront of relevant technical and policy issues. To meet obligations to various clients, we stay on top of emerging technologies such as alternating current (AC) modules, 1kV inverters, and the latest grounding methods. We routinely author industry articles on new technology and installation practices, including a recent presentation at Solar Power International and quotations in articles by *SolarPro* magazine. Cadmus plays an active role in guiding, evaluating, and implementing net metering, incentive, and financial policies from government and utility agencies.

To complete the work covered under this request for proposals, Cadmus will contract with **Leo Bedard**, a MassCEC solar thermal energy auditor and inspector based in Barnstable County. Mr. Bedard brings more than 20 years of experience evaluating the quality of SHW installations, and providing training in SHW design and installation.

Technical Proposal

Based on our decade of field experience, we first provide a brief synopsis of safety, performance, and data quality assurance issues commonly encountered at renewable energy installations. Thereafter, we summarize the ways Cadmus' approach and experience contributed to solving these issues in the past and can mitigate these issues going forward.

Task 1. Inspection of Small-Scale Solar Projects

Cadmus has performed more than 2,500 quality assurance inspections for MassCEC and NYSERDA. Given our decade of experience, we believe no other contractor matches our ability to provide quality inspections and technical support for the Rhode Island REF.

Our experience has shown that the highest level of improvement to PV designs and installation practices is achieved when a comprehensive approach is applied to the inspection process. Our aim is to provide the industry with the insight and know-how to ensure every installation is high-quality and meets local code and program requirements. During our inspections we:

- Work closely with installers to ensure they have the background and knowledge to address any identified corrective actions.
- Provide local electrical inspectors who attend our inspections with guidance on how to inspect PV systems in the safest, most efficient manner.
- Work closely with program administrators to identify and target training and outreach to address common issues identified during our inspections.

Highlights include:

- At about one-quarter of residential inspections and one-half of our small to medium-sized commercial PV inspections, we identify grid interconnection issues (e.g., NEC articles 705.12 and 690.8).
- About 30% of inspected sites were missing or had an insufficient grounding electrode system (NEC 690.47), while 20% had issues with equipment grounding.¹
- Overall, at about 60% of inspections, we identify one or more compliance issue with the NEC or program requirements that require rewiring of some part of the PV system.

Task 2. Inspections of Small-Scale Solar Hot Water Projects

Cadmus has inspected hundreds of SHW systems and understands the unique challenges that this technology presents. For example, unlike solar PV, most SHW systems do not include metering to provide a simple visual indicator of system performance. Instead, our experienced inspectors rely on a deep understanding of SHW technology to identify pressure problems, controller malfunctions, missing

¹ Relevant NEC articles include 110.3 B, 690.43, 690.45, 690.46, 250.4 A5, and 250.80–250.86.

tempering valves, and other common installation problems that will affect SHW longevity and effectiveness.

During a typical SHW inspection, our inspectors investigate:

- Domestic hot water system valves and connections.
- SHW system controller settings and installation.
- Solar storage tank installation, valves, and connections.
- Solar loop installation.
- Collector array and racking installation.

Task 3. Inspections of Commercial-Scale Projects

Cadmus is experienced in the evaluation and quality assurance of commercial-scale renewable energy technologies and systems. Our experience includes the quality assurance of solar PV, wind, anaerobic digestion, small hydro, and waste-to-energy facilities.

Large- and commercial-scale renewable energy projects present an added level of complexity to design considerations. Proper attention to electrical system design and execution, from the array to the grid interconnection, is critical to ensuring the safe installation and reliability of a system. In the case of most commercial PV systems, an electrical diagram stamped by a Professional Engineer (PE) is obtained for the utility interconnection application—but the PE is not required to have PV design experience.

Highlights include:

- The city of Waltham, Massachusetts, called on Cadmus to inspect its fleet of commercial-scale PV systems after a small fire occurred at one of the sites. Cadmus worked with the city, installer, and the local electrical inspector to identify and address concerns emanating from the fire. Cadmus inspected PV systems owned by the city to identify existing code violations, working with the installer and local electrical inspector to address the concerns, and oversaw the repairs required to bring the facilities into compliance.

Approach to Quality Assurance Inspections

Cadmus employs a holistic approach to performing quality assurance inspections, working in close collaboration with program administrators and participants. For quality assurance inspections, we recommend the framework detailed below.

Detailed onsite inspection:

- Qualified Cadmus inspectors will conduct a comprehensive, onsite evaluation of each system selected for inspection.
- Cadmus recommends that system installers attend each inspection. In our experience, installer attendance improves the speed and quality with which corrective actions are made.

- During the inspections, Cadmus’ inspectors will provide *ad hoc* guidance to system installers and identify preliminary issues requiring corrective action to ensure compliance with NEC.

Identification of issues and resolution:

- Cadmus’ inspector will provide a comprehensive Corrective Actions List to the installer and REF program administrators. The list will include detailed review of issues requiring resolution within a week of the initial inspection.
- To confirm issues are resolved, Cadmus recommends that system installers provide photographs of resolutions made for simple or isolated corrective actions. If comprehensive corrective actions that impact a larger portion of the system are identified, such as wire management or insufficient ampacity, Cadmus recommends a re-inspection. In our experience, a re-inspection is more cost-effective and provides greater surety that all issues are resolved.

Outcomes:

- Cadmus staff will track reoccurring technical issues identified during inspections. Using Cadmus’ quality assurance and data tracking capabilities, described in more detail under Task 4, we are able to efficiently identify and provide technical support to specific installers, or to the industry, on common issues identified that require corrective action.
- Cadmus staff will work with REF program administrators to identify areas and topics for additional guidance and outreach, with the aim of improving the overall quality of REF-funded systems.

Task 4. Special Projects

Cadmus provides guidance to program implementers at the federal, state, and utility levels throughout the Northeast and United States in support of renewable energy projects and programs. Our collective experience in support of renewable energy programs includes projects undertaken on behalf of the U.S. Department of Energy, the National Renewable Energy Laboratory (NREL), the Connecticut Clean Energy Finance and Investment Authority (CEFIA), MA DOER, the Massachusetts Department of Public Utilities, Puget Sound Energy, PacifiCorp, Pennsylvania Power and Light, Efficiency Maine Trust, and National Grid, in addition to our work with NYSERDA and the MassCEC. Additionally, Cadmus contributes to efforts to standardize and improve the reliability of energy generation and quality of PV installations by participating in the development of:

- International Performance Measurement and Verification Protocol: Renewable Energy Framework.
- International Electrotechnical Commission Renewable Energy Systems PV Quality Assurance Task Force.
- NREL PV Quality Assurance Task Force.
- Sandia Operations & Maintenance Working Group.
- TrueSolar Scorecard®.

Below we outline our capabilities in regards to specific task identified in the REF's request for proposals. In addition, we provide details on some efforts which may prove of interest to Commerce RI's objectives for the REF.

Design Reviews

The goal of design reviews and inspections is to address the design and design process, and eliminate any issue that may lead to non-compliance and performance problems. Cadmus staff have performed nearly 200 design reviews under the MassCEC installer prequalification program, and 450 in support of NYSERDA programs. By evaluating the 1-line or 3-line diagram of a proposed system, we are able to identify issues prior to installation, saving installers both the time and money required to resolve such errors.

Cadmus staff also evaluate the total solar resource factor (TSRF) of proposed facilities. PV and SHW systems depend on the quality of the site to realize a quick and reasonable payback. By confirming the TSRF of proposed facilities prior to installation, we are able to confirm systems will perform to expectations.

Program Guidance

At the request of our clients, Cadmus staff can provide detailed guidance on program execution and documentation requirements. We will work with REF staff to identify practices and documentation that are key to improving the overall quality of applications and proposed systems. To date, our staff support the development of program documentation for the following programs:

- NYSERDA:
 - Program Opportunity Notices for PV and SHW.
 - Solar Hot Water Inspection Manual.
- MassCEC:
 - Commonwealth Solar, Commonwealth Wind, Commonwealth Solar Hot Water, Small Renewables Initiative and the Micro-Wind Initiative incentive programs.
 - At the request of MassCEC, Cadmus reviews changes to NEC and Massachusetts Electric Code and provides suggested revisions to the Commonwealth Solar Minimum Technical Requirements for the 2008, 2011, and 2014 updates.

Currently, Cadmus also supports the MA DOER's development of program documentation and procedures for the forthcoming Solar Renewable Energy Certificate (SREC)-II Residential Solar Loan Program.

Quality Assurance and Data Tracking Systems

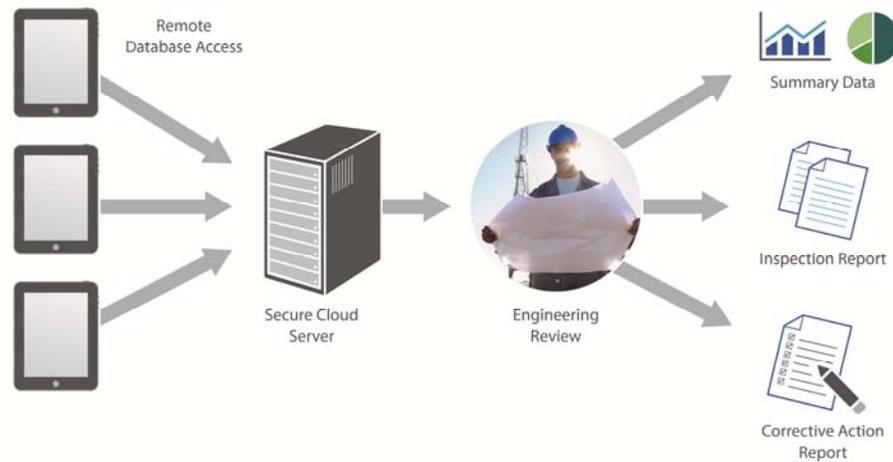
Conducting inspections and generating inspection reports is an important part of the quality assurance process, but analyzing quality assurance data for trends can provide REF with several important benefits:

- Identifying common code compliance or other installation issues that may require installer training or clarification of program requirements.
- Tracking installer quality assurance progress to identify installers needing further support or disciplinary action.

Cadmus developed a sophisticated online database tool for conducting solar inspections. Using tablet computers, our inspectors can conduct inspections and generate dynamic reports in real-time, as illustrated in Figure 1.

Figure 1: Cadmus' Online Inspection Tool

1. Each inspection is conducted on up to 600 individual code (electrical, building, mechanical, and plumbing) violations and includes flexible equipment verification tools to confirm program data for equipment installed, tilt, azimuth, and design factor. Once the



inspection is complete, the report is uploaded to a master database for engineering review and later analysis. Within this master database, Cadmus can readily analyze inspection results and trends and the live dynamic nature of the database allows inspectors to send e-mail alerts for inspection issues like safety shutdowns. We can even provide client-facing portals for outside entities to view inspection results, download reports, and run data summary reports. Using Cadmus' online solar quality assurance database provides several advantages over manually generated inspection reports:

- **Greater consistency:** Using pre-approved code citation language for many of the most common code violations minimizes the variability between inspectors' explanations and reduces installer confusion.
- **Faster report turnaround time:** In many cases, the inspector can submit a completed draft inspection report before leaving the site, or within the same day, because the report is created in real-time as the inspector completes the inspection and uploads photographs.
- **Online data tracking and summarization:** With every inspection completed, the database grows and can offer new insights to help program staff provide rapid feedback and training to address recurring quality assurance issues.

Energy-Generation Verification and Performance Audits

Cadmus is uniquely qualified to conduct performance audits of renewable energy facilities. Cadmus has performed hundreds of audits on behalf of the MassCEC, NYSEERDA, and PPL Electric to verify the performance and program compliance of incentivized renewable energy systems. During the audits, we confirm that equipment is installed as specified in applications, and that production is aligned with energy-generation expectations. We are also approved as an independent third-party verifier of energy reported to the New England Power Pool Generation Information System by MA DOER.

In addition to our experience conducting onsite audits of systems, Cadmus designed and administered the MassCEC's renewable energy Production Tracking System (PTS) from 2002 to 2010. As a part of this effort, Cadmus developed the quality assurance methods used to evaluate the renewable energy generation of MassCEC-funded systems reported into the PTS. Cadmus continues to provide assistance to MassCEC's production tracking team, providing technical guidance on metering requirements, renewable energy system design and production considerations, and the verification of SRECs generated under the Massachusetts Renewable Energy Portfolio Standard Solar Carve-out program.

Development of Technical Bulletins and Training Materials

While inspection reports provide valuable feedback on individual installations, once common quality assurance issues are identified, it is more cost-effective to address these issues through a program-wide training effort than on a project-by-project basis through continuing inspections. Cadmus is well-versed in providing these kinds of trainings, which can include:

- **Onsite trainings:** Inviting installers to attend inspections with their installation crews can be an effective way to help high-volume installers understand quality assurance requirements and ask the inspector(s) questions.
- **Webinar:** A webinar can be a very cost-effective means of conveying quality assurance results and requirements to a wide audience of installers and Cadmus has delivered webinars on a variety of topics, such as labeling, grounding, common quality assurance issues, and interconnection. Webinars can even be recorded and made available online for installers to download and review at their convenience.
- **Technical bulletin:** A technical bulletin is generally a short technical document (three to five pages in length) covering a single quality assurance issue. These documents can be distributed to installers and are useful for clarifying gray areas in the quality assurance process. Cadmus has developed technical bulletins on labeling, metering for battery backup systems, use of cross-linked polyethylene (PEX) for temperature and pressure valves in plumbing (SHW), and bonding of grounding electrode conductor (GEC) systems.

Task 5. Trainings

In support of our efforts as quality assurance inspectors of renewable energy projects and programs, Cadmus experts speak on behalf of our clients throughout the northeast. Frequently, Cadmus staff are asked to provide updates updated on revisions to NEC requirements (2008, 2011, 2014) and issues

commonly observed in quality assurance inspections. A summary of recent presentations given by Cadmus staff is provided in Table 1, below.

Table 1. Trainings Provided by Cadmus

Training	Client	Date
Photovoltaic Systems and the National Electric Code (NEC)	Solar Energy Business Association of New England	June 2014
Solar PV 101	Massachusetts Clean Energy Center	June 2014
Solar PV Fire Safety	Fire Prevention Association of Massachusetts	April 2014
Spring Training with the Pro's – Solar Installations, An In-Depth Code Based Look	International Association of Electrical Inspectors Paul Revere Chapter	June 2013
Spring Training with the Pro's – Solar Fire Safety	International Association of Electrical Inspectors Paul Revere Chapter	May 2013
Grounding and Labeling - Solar Photovoltaic Installation Best Practices Webinar	New York State Energy Research and Development Authority	March 2013
PV/ST – What Works? What Doesn't?	ACI Regional Home Performance Conference	February 2013
Understanding and Investigating Solar Photovoltaic Systems	International Association of Arson Investigators	January 2013
Solar Photovoltaic Systems – The Basics, Inspection Techniques, and Fire Safety	Town of Winchester, Massachusetts	November 2012
PV Safety – Measure and Manage for Continuous Improvement	Solar Power International 2012 (Conference)	September 2012
The Do's and Don'ts of Wiring Solar PV Installations	Massachusetts Department of Energy Resources	June 2012
The Specifics of Solar	International Association of Electrical Inspectors Paul Revere Chapter	March 2012
Solar PV Codes, Laws, Regulations and Safety Guidelines	Solar Energy Business Association of New England	February 2012
MassCEC PV Inspection Process	Massachusetts Municipal Electrical Inspectors Association, IBEW Local 103	March 2010

Cadmus will work with REF staff to identify training needs, and provide detailed training materials, guidance, and presentations as requested by program implementers.

Qualifications and Experience

The Cadmus team comprises highly qualified staff to serve the Rhode Island REF.

Matt Piantedosi, a Cadmus senior associate and Master Electrician (MA #21036-A), will lead Cadmus' efforts for the inspection of small scale solar and commercial scale projects. Mr. Piantedosi will inspect and review each system design for REF program requirements and Rhode Island State Electrical Code compliance, output power verification, and system component verification. His specific experiences and credentials related to this request for proposals (RFP) include:

- Mr. Piantedosi has completed over 100 design reviews and inspected over 2 megawatts of residential and small commercial solar PV installations throughout Massachusetts for the MassCEC Commonwealth Solar Program.
- Mr. Piantedosi provided Owner's Agent Technical Assistance consulting services to Massachusetts municipalities. Prior to construction, he performs a detailed electrical design review of selected bidders' proposed solar design and communicates any necessary changes to the installer until the design documents meet MEC requirements. After installation, he performs a detailed inspection to confirm that the installation meets the NEC requirements and the town's desired design preferences.
- Mr. Piantedosi serves on the executive board for the Boston Paul Revere Chapter of the International Association of Electrical Inspectors, where he works with electrical inspectors and electricians to organize educational events, identify the latest electrical industry products, discuss various issues during electrical inspections, and help educate inspectors and installers about solar PV system electrical code requirements and common violations.

Leo Bedard, an independent Massachusetts Master Plumber with 41 years of experience, will lead Cadmus' inspection of SHW projects. His credentials related to this RFP include:

- Since 2011, Mr. Bedard has inspected SHW projects installed under MassCEC's Solar Thermal Rebate Program. For this effort, Mr. Bedard evaluates installed projects for rebate approval and compliance with Massachusetts plumbing and electrical code requirements, while working closely with installers, homeowners, and local building inspectors.
- During the initiation of the Solar Thermal Rebate Program, Mr. Bedard provided detailed guidance and education to Massachusetts plumbing inspectors on domestic SHW systems. Over 150 inspectors attended his presentations on solar thermal system installation.
- Mr. Bedard speaks widely on solar thermal technology and installation practices. Previously, he wrote and administered grants to provide education to solar thermal system installers and served as a member of the Advisory Council for the Northeast Solar Heating and Cooling Instructor Training Project at Kennebec Valley Community College in Maine.

- Mr. Bedard holds a bachelor of science degree in technical education and was a Master Plumber for over 41 years. Having been a technical educator for 30 years, he first introduced solar thermal system installations as an ancillary part of his curriculum in 1985.

David Beavers, Shawn Shaw, William Atkinson, Robert Lamoureux, and Glenn Burt, have collectively completed over 1,000 PV inspections, design reviews, and audits for MassCEC and NYSERDA. Their resumes are included in Appendix C of this proposal. Per the RFP, the REF is requiring PV inspectors to be licensed electricians and SHW inspectors to be licensed plumbers. If necessary to meet expected work load, Cadmus will hire and train additional licensed electricians for onsite inspections. As Rhode Island law does not require any license for residential PV design, reviewing PV designs, or providing other PV related technical assistance to the Commonwealth Solar Program, and we have thousands of hours of direct experience with design reviews, inspections, and PV systems training—as well as engineering degrees at accredited universities—our engineers have excessive experience and credentials to provide design review services to the REF.

Sandra Brown, an associate, will lead Cadmus’ response to requests for technical guidance and special projects received under Task 4. Ms. Brown currently coordinates the MassCEC PV design review and inspection process. In addition, Ms. Brown has also provided training on the review and qualification of renewable energy production reports. She drafted portions of Cadmus’ proposed updates to the International Performance Measurement and Verification Protocol renewable energy systems evaluation framework, providing guidance on establishing a baseline for the review and qualification of renewable energy generated by a fleet of systems.

We proposed to use **Danielle Poulin**, a senior analyst, for overall project coordination and day-to-day management. Ms. Poulin is an energy and environmental policy professional with four years of experience in providing services to state and local governments related to environmental and energy affairs. Currently, Ms. Poulin provides owner’s agent technical assistance consulting services to Massachusetts cities and towns pursuing solar PV projects.

Past Experience

The following projects highlight our comprehensive role in applicable efforts to support the PV and renewable energy industry.

Renewable Energy Quality Assurance Inspection Services (MassCEC)

For more a decade, Cadmus has provided the MassCEC with technical consulting and quality assurance inspection services. During this time, Cadmus conducted more than 500 verification audits, detailed system inspections, and design reviews of solar PV, wind, and SHW systems. As a long-time inspector for MassCEC, Cadmus has been a leader in the evolving program requirements for solar PV and wind installations in Massachusetts. As a part of this effort, Cadmus has:

- Completed numerous monitoring and verification efforts and troubleshooting in support of systems installed with support from the MassCEC’s rebate programs.

- Provided detailed trainings on solar PV installations, including common installation mistakes, code compliance updates for the 2008, 2011, and 2014 NEC updates, and fire safety considerations to industry trade associations and electrical inspections.
- Cadmus provides ongoing technical guidance to MassCEC in support of its programs, including updates to the Commonwealth Solar Program’s Minimum Technical Requirements.

Solar PV and Solar Thermal Field Inspection Services (NYSERDA)

Cadmus has provided quality assurance inspection and design review services to NYSERDA’s small wind, solar PV, and solar thermal programs for more than six years. During this time, we have conducted thousands of system design reviews and inspections, identifying and resolving technical issues ranging from missing labels to shock and fire hazards. Typical quality assurance inspections include compliance with National Electric Code (NEC), confirmation of system design elements, verification/testing of system operation, resource assessment, and performance modeling. As part of this project, we developed a unique online database tool with over 600 individual code violations and installation issues, providing a dynamic and rigorous data collection and reporting process. The results of field inspections are then analyzed to identify quality assurance–related trends, track installer progress, and target specific trainings such as webinars and technical bulletins. Cadmus’ installer training materials have included topics such as labeling, grounding, metering for battery backup systems, installation best practices, and NEC-compliant interconnection methods.

References

Table 2. List of References and Associated Projects

Client	Contact	Project Description
MassCEC Commonwealth Solar Program	Elizabeth Kennedy Program Director 63 Franklin St, 3rd Floor Boston, MA 02110 Tel: (617) 315-9321 E-mail: ekennedy@masscec.com	In support of the Commonwealth Solar Initiative, Cadmus provides: <ul style="list-style-type: none"> • In-depth design reviews of proposed solar PV installations prior to installation. • Onsite inspections of renewable systems to confirm compliance with NEC and other program requirements. • Support for the development of program technical requirements, including the Commonwealth Solar Minimum Technical Requirements.
NYSERDA	Mark Mayhew Program Manager 17 Columbia Circle Albany, NY 12203 Tel: (518) 862-1090 E-mail: msm@nyserda.org	Cadmus performs: <ul style="list-style-type: none"> • In-depth design reviews of proposed solar PV installations prior to installation. • Onsite inspections of renewable systems to confirm compliance with NEC and other program requirements. • Installer training and outreach.

Examples of Prior Work

Examples of our work are included in Appendices A-D of this proposal, as summarized below:

Appendix A.	Additional Representative Projects
Appendix B.	Training Outlines
Appendix C.	Example Reports
Appendix D.	Staff Resumes

Cost Proposal

Table 3 shows the rates for Cadmus staff assigned to this project. These are the same rates that we use for our work with Massachusetts state and local entities. These rates cover work through June 30, 2015.

Table 3. Rates

Title	Staff	2014 Hourly Rate
Vice President		250
Principal		220
Senior Associate II	David Beavers Matt Piantedosi	183
Senior Associate I	Shawn Shaw	165
Associate II		157
Associate I	Bill Atkinson Robert Lamoureux Glenn Burt Sandra Brown	141
Senior Analyst	Danielle Poulin	108
Analyst		98
Research Analyst		80
Engineering Technician II		75
Engineering Technician I		65
Editor		80
Admin		65

Costs incurred by Mr. Bedard under Task 2. Inspection of Small Scale-Solar Hot Water Projects will be passed on directly to the REF. Mr. Bedard’s hourly rate will be \$90 through the contract period.

Appendix A. Additional Representative Projects

Evaluation of Solar Renewable Energy Certificates (MassCEC)

Working together, MassCEC and Cadmus initiated a program to verify and evaluate SRECs generated under the Solar Carve-Out program. In their role as the independent, third-party verifier of generation qualified under the Solar Carve-Out, MassCEC is required to verify accuracy of generation reported to the MassCEC Production Tracking System and that requirements of the Solar Carve-out program are met by participants.

Owner's Agent Technical Assistance Consulting to Massachusetts Municipalities

Over the past decade, Cadmus has provided owner's agent consulting services to over 35 Massachusetts communities to support the installation of renewable-energy systems. The projects range in capacity (from 40 kW to 5 MW), site types, desired financial benefits, and planning complexity. We offer our clients a suite of services ranging from site feasibility and RFP/request for qualifications (RFQ) development to economic feasibility studies and bid evaluations through contract negotiations. Each municipality's requirements are highly variable, and we are able to adapt our scope of services to fit our clients' needs in a cost-effective manner. To date, we have helped facilitate the development of over 22 MW of capacity for communities in Massachusetts.

Regional Solar Initiative Technical Consultant (Metropolitan Area Planning Council)

Cadmus is currently advising the Metropolitan Area Planning Council (MAPC) on the procurement of a regional solar emergency management system (EMS) provider for 17 communities participating in MAPC's Regional Solar Initiative. Assisted by Cadmus, MAPC released a RFQ to developers interested in implementing solar EMS projects on publicly owned buildings and/or land within participating municipalities.

Solar Rooftop Challenge: Community Solar Garden (MA DOER)

In 2012, Cadmus was selected by the Massachusetts Department of Energy Resources to assess the barriers and opportunities to implementing community shared solar (CSS) projects in Massachusetts. Through a comprehensive review of existing projects and discussions with municipal representatives and private citizens, Cadmus identified CSS business models that are best suited for Massachusetts and meet the needs of its communities, residents, and businesses.

Solar Hot Water Program Evaluation (National Grid)

In early 2010, Cadmus was contracted by the eight Massachusetts program administrators—the electric and gas distribution companies and municipal aggregators providing efficiency programs to Massachusetts customers—to conduct a three-year Massachusetts-wide evaluation (2010 to 2012) of the Residential Retrofit and Low Income Program Area. As part of this effort, Cadmus is evaluating a SHW pilot program. This evaluation includes performance modeling using T*Sol, customer surveys, billing analysis, and system inspections.

Solar PV Hybrid Power System Design, Specification, and Oversight (MA Department of Conservation and Recreation)

As a subcontractor to the American Development Institute (ADI), Cadmus provided conceptual design, project specifications/costing, RFP creation, bid evaluation, and construction oversight services to the Massachusetts Department of Conservation and Recreation for a renewable-energy project on George's Island in 2008. George's Island, located in Boston Harbor, was formerly powered using diesel generators. Cadmus, working in conjunction with ADI and the rest of the design team, created a conceptual design and bid specification for a 31.5 kW solar PV system, with 300 kWh of battery backup storage and a sophisticated control system to balance loads and incorporate solar PV, batteries, and backup diesel generators. Cadmus reviewed electrical load data and projections due to planned construction, using this data to customize the control sequence to take full advantage of available PV system output and reduce generator runtime. Cadmus is conducting follow-up and construction supervision to ensure that the installed solar PV and battery systems meet all design requirements.

Various Clients: Evaluation Standards Developed by Cadmus

As a recognized leader in the program evaluation field, Cadmus staff members have played an integral role in the development of renewable energy and energy-efficiency standards used by local and state governments as well as by the federal government. We will leverage our experience developing the following internationally recognized evaluation standards to help awardees accurately characterize the performance of their technologies:

- International Performance Measurement and Verification Protocol, which is the gold standard for evaluating energy-efficiency programs. Cadmus staff recently participated in the revision of Volume III, which provides guidance on evaluating renewable energy projects.
- Program Impact Evaluation Guide for the public-private collaborative National Action Plan for Energy Efficiency.
- Impact Evaluation Guide for the Electric Power Research Institute.
- World Resources Institute Greenhouse Gas Protocol.

Appendix B. Training Outlines

Solar PV Systems: 2014 NEC Key Changes and Best Practices

Solar PV System Overview

This section will introduce the audience to the basic components of a standard solar PV system. Matt Piantedosi, the instructor, has presented to hundreds of industry professionals, inspects solar PV systems, and is a valuable resource for many code officials. Overview system photos will be presented as well as the relationship between solar PV and standard electrical wiring methods. NEC article 250 (grounding) will be reviewed and we will show how it relates to solar PV systems. The instructor will also show basic layouts and system types of the PV systems installed in Massachusetts today and explain the new 2014 NEC changes that apply to the specific systems.

In-Depth System Analysis and 2014 NEC Changes

After the introduction to solar PV systems, we take the audience through an in-depth simulation of a typical solar PV inspection with a state rebate PV inspector. Along the way, we will show them what to be aware of, why it is a concern, and how it should comply with the code. This section will focus heavily on the 2014 NEC and the key changes that apply to new installations in Massachusetts today, such as:

- DC AFCI protection
- Rapid shutdown of PV systems on buildings
- Labeling requirements
- Interconnection requirements

Conclusion / Final Remarks

We will conclude the training with a recap of key changes and best practices. The audience will receive valuable information on how to do their jobs better, regardless of their individual occupations. The floor will also be opened to final questions, concerns, and discussion of their own experiences.

Spring Training with the Pro's: Solar Basics and Fire Safety

An Introduction to Solar PV Systems

This section will introduce first-responders to the basic components of a standard solar PV system. Overview system photos will be presented as well as the correlation between solar PV and standard electrical systems. We will show basic layouts of the PV systems installed in Massachusetts today as well as the identification of various system types. We will then walk the audience through a typical solar PV inspection, while touching upon best/worst practices observed in the field today. We will conclude the introduction by identifying the labeling requirements intended to assist first-responders.

PV Fire Safety and Disconnecting Techniques

As we enter the core section of this presentation, we will briefly recognize the many concerns from first-responders. Code and solar PV experts will then address the primary concern of every first-responder: How do we turn it off? We will show a detailed analysis of exactly what happens with the opening of every disconnect switch, fuse, and connector. Photos and diagrams will illustrate how the system reacts to various interruptions.

PV Fire Tactics and Hazards

This section is heavily based on UL's Firefighter Safety and Photovoltaic Systems online interactive training module. John Cangemi of UL will discuss many topics, such as:

- Hose stream
- Firefighter personal protective equipment
- Other light sources
- Electrical and other hazards

Case Study / Final Remarks

We will finish the training with a case study of a local PV system fire. An in-depth analysis will identify what exactly went wrong and what can be learned to improve future designs and inspections. The floor will then be opened to final questions, concerns, and discussion.

Solar Installation: An In-Depth Code-Based Look

An Introduction to Solar PV Systems

This section will introduce the audience to the basic components of a standard solar PV system. Matt Piantedosi, the instructor, has presented to hundreds of industry professionals, installs solar PV systems, and is a valuable resource for many code officials. Overview system photos will be presented as well as the relationship between solar PV and standard electrical wiring methods. NEC article 250 (grounding) will be reviewed and we will show how it relates to solar PV systems. The instructor will also show basic layouts of the PV systems installed in Massachusetts today.

The Wrong and Right Way

After the introduction to solar PV systems, we take the audience through an in-depth simulation of a typical solar PV inspection with a state rebate PV inspector. Along the way, we will show them what to be aware of, why it is a concern, and how it should comply with the code. We will work our way through a system, end to end, explaining every aspect of the inspection in great detail. Accompanying this exercise will be a handout of the most common PV violations encountered today, as well as an industry-leading expert from UL to assist with specific code and standard requirements.

An In-Depth Analysis of Specific Code Requirements

After focusing on the inspection process, we will dive into specific topics of significant interest and relevance. These topics will include but are not limited to:

- PV voltage and current calculations
- Understanding NEC 690.47: grounding electrode system
- PV system labeling
- New equipment and systems

Conclusion / Final Remarks

We will finish the training with a recap of inspection techniques and best practices. The audience will receive valuable information on how to do their jobs better, regardless of their individual occupations. The floor will also be opened to final questions, concerns, and discussion.

Appendix C. Example Reports

PV SYSTEM INSPECTION REPORT

Application ID: XXXX

Inspection Date:	4/22/2014 1:30 PM	System Inspector:	Bill Atkinson
Report Date:	5/30/2014 1:33 PM	System Quality Assurance Score:	3

Site Information	
Customer Name:	Redacted
Company:	Redacted
Site Address:	Redacted
City:	Hobart
State:	NY
ZIP:	13788
Phone:	Redacted
Email:	

System Installer Information	
Installer Name:	Redacted
Contractor:	Redacted
Phone:	Redacted
Email:	Redacted
Inspection Conducted With:	Installer Other: Redacted

PV Installation Photograph (Curb View)



The following QA inspection report identifies all non-conformances found during the field inspection. For a comprehensive checklist of all evaluated elements, please visit NYSERDA's PartnerPortal. When NYSERDA seeks specific corrective action, a separate Corrective Action Response (CAR) will be provided with the QA report. The CAR will identify only the non-conformances requiring corrective action.

Equipment Verification / Array

	Program Records	Observed
Array Module Quantity	136	Verified
Array Module Manufacturer	Evergreen Solar	Verified
Array Module Model Number	ES-A-210-fa2	ES-A-210-fa3
Array Azimuth (degree)	25	205
Array Tilt (degree)	1010	Verified

Equipment Verification / String Inverter

	Program Records	Observed
Inverter 1 Quantity	1	Verified
Inverter Manufacturer	Advanced Energy Industries	REFUsoI
Inverter Model Number	AE_3TL-23_6-08	REFUsoI 024K

Program and Code Compliance / *Array : Corrective Action Required*

ID#	Defect Category	Deficiency Description	Inspector Comments
A_EL11	Minor	Circuit conductors are sagging in contact with the roof and/or not supported and secured at least every 4.5' and within 12" of every outlet box, junction box, cabinet, or fitting (NEC 338.10(B)(4) and 334.30)	



Program and Code Compliance / *String Inverter : Corrective Action Required*

ID#	Defect Category	Deficiency Description	Inspector Comments
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SI_EL3 Incidental

Inverter 1 DC grounded conductors are not correctly identified as white or grey per NEC 200.6

transformerless inverter, DC ungrounded conductors re-identified with white tape



SI_EL36 Incidental

Inverter 1 GFDI warning label is missing
 Label:
 WARNING
 ELECTRIC SHOCK HAZARD
 IF A GROUND FAULT IS INDICATED
 NORMALLY GROUNDED CONDUCTORS
 MAY
 BE UNGROUNDED AND ENERGIZED

missing

Program and Code Compliance / *Supply Side Connection : Corrective Action Required*

ID#	Defect Category	Deficiency Description	Inspector Comments
SSC_EL1 5	Minor	Conduit is missing approved internal sealant at penetrations between conditioned and unconditioned spaces to prevent condensation per NEC 300.7(A)	



ID#	Defect Category	Deficiency Description	Inspector Comments
SSC_EL3 0	Incidental	Permenant plaque or directory denoting location of all power sources and location of disconnects on permise at each service equipment location is missing, violating NEC 705.10	missing



Appendix D. Resumes

Education, Certifications, and Affiliations

M.A., Environmental Studies, Brown University

B.S., Mechanical Engineering, Washington University in St. Louis

B.A., Physics, Grinnell College

OSHA 10-Hour Certification

National Electrical Code Course for PV Installations

National Fire Protection Association, Electrical Section Member

Certified Energy Manager, Certified Sustainable Development Professional, Association of Energy Engineers

Professional Experience and Qualifications

David Beavers, CEM, CSDP, a senior associate at Cadmus, has more than 15 years of field and consulting experience in engineering and energy. For the past eight years, he has led Cadmus' work on behalf of both public and private clients for project solar development and quality assurance, and monitoring and verification. His current work includes serving as the sole third-party meter reader for tracking and verification of energy generated from photovoltaic (PV) sources used to claim Massachusetts Solar Renewable Energy Certificates (SRECs); inspecting systems installed by new installers for compliance with electrical and building codes and other technical requirements; and serving as an owner's agent for communities wanting to install PV systems.

Before joining Cadmus, Mr. Beavers worked on the design, development, and implementation of various electromechanical technologies (both domestically and internationally), including solar PV power sources; windmills; portable diesel generators; submersible, jet and centrifugal pumps; programmable logic controllers; system logic controllers; and mechanical, magnetic, and optical-based signal devices.

Examples of Relevant Experience

Project Management

Renewable Energy Production Tracking System, Massachusetts Clean Energy Center (MassCEC). The MassCEC developed and now administers a program performance tracking system called the Production Tracking System (PTS), which tracks more than 1,000 systems (ranging in size from less than 1 kW to more than 4 MW) that were installed with the support of one of a dozen incentive programs. The PTS now serves as the third-party meter reader for SRECs claimed from PV generation.

System and program performance results are reported quarterly and include new installations and capacity by technology type and grant program; energy production by technology type and grant program; emissions offsets; system performance (e.g., average capacity factors for PV); average equipment and other project costs by technology type; incentives paid to each grantee; and

maintenance histories. Annual audits with on-site inspections are performed on 10% of registered systems for data quality assurance.

At the client's request, Mr. Beavers inspects renewable energy systems for compliance with the Massachusetts Electrical Code and other program requirements.

Owner's Agent, Massachusetts Department of Energy Resources (DOER). On behalf of the DOER, and in support of the Energy Efficiency and Conservation Block Grant program, Mr. Beavers provides owner's agent services for PV projects at communities. This work includes conducting financial and technical feasibility assessments, identifying funding opportunities, generating bid documents, and representing cities and towns at meetings with prospective developers. This work also includes ensuring the technical viability and code compliance of proposed designs.

Other Projects

Analysis of State Clean Energy Policies, U.S. EPA Energy Supply Industry Branch. Mr. Beavers supported EPA's new Clean Energy-Environment State Partnership Program by developing renewable energy focused sections of a clean energy guide.

Electricity Policy Outreach and Analysis, U.S. EPA Energy Supply in Industry Branch. Mr. Beavers provided technical support to the EPA in conducting research, analysis, and outreach on existing and planned electricity regulatory policies that level the playing field for energy efficiency, renewable energy, and distributed generation.

PV-Powered System Design, Installation, and Repair. Mr. Beavers designed, installed, and repaired PV and wind-powered pumping systems at rural locations in Morocco. To manage the project, he coordinated with three levels of local government, UNICEF, and the U.S. Peace Corps.

Presentations and Publications

- "Clean Energy Center PV Inspections," IBEW Local 103, March 3, 2010. Training for Massachusetts electrical inspectors on common PV installation electrical code violations.
- "Renewable Energy: A Hedge Against an Uncertain Energy Future," ACEEE Summer Study, Niagara Falls NY, July 31, 2009. Paper and presentation.
- "MRET PV Inspection Findings," Solar Energy Business Association of New England Board Meeting, Westborough MA, June 2009.
- "Potential for PV at Mass Hwy and Pike Rest Areas Scoping Analysis," Findings and recommendations presented to Massachusetts Department of Energy Resources and Massachusetts Highway Department.
- "Tracking and Verification of Distributed Generation and RECs," 9th National Green Energy Marketing Conference, Albany, N.Y., October 2004. Co-presentation with Sam Swanson of the Pace Energy Project.
<http://www.eere.energy.gov/greenpower/conference/9gpmc04/beavers.pdf>.

Education and Certifications

B.S., Applied Physics, Rensselaer Polytechnic Institute

Renewable Energy concentration, Environmental Economics, Values, and Policy minor

Graduate Coursework in Solar Energy Applications, University of Massachusetts, Lowell

Training in photovoltaics and the National Electrical Code

New York State Energy Research and Development Authority Small Wind Installer Training Workshop

Wind Energy Center Meteorological Tower Installation Training Program

Professional Experience and Qualifications

Shawn Shaw, a senior associate with Cadmus, has a decade of experience in renewable energy and energy efficiency. This work has included site assessments, economic feasibility studies, wind resource data analysis and collection, turbine performance studies, and clean energy program evaluations. Mr. Shaw performs technical analysis and review of solar and wind energy project proposals, ranging from residential scale wind turbines to multi-turbine wind energy facilities. He has given numerous talks and presentations on wind energy benefits, impacts, and siting. Mr. Shaw is recognized as an expert in siting considerations and performance estimation, particularly for distributed wind energy projects.

Examples of Relevant Experience

Wind Energy Project Feasibility

Mr. Shaw has conducted a number of studies related to wind energy projects. These studies typically include factors such as site assessment, turbine selection, installation considerations, permitting, wind resource data analysis, economic projections, and public outreach components. Mr. Shaw also reviews system designs for distributed wind energy projects for the New York State Energy Research and Development Authority (NYSERDA) and the Massachusetts Clean Energy Center (MassCEC).

Wind Project Owner's Agent Services

Mr. Shaw managed an independent review of a proposed 6MW wind energy facility in North Stonington, Conn. This review included wind resource, economics, site layout, environmental impacts, aesthetic impacts, and equipment selection. He presented the results of the review, along with recommended changes and next steps, to the Board of Selectmen.

Evaluation of Renewable Energy Programs

Mr. Shaw has conducted numerous evaluations of clean energy funding programs. These evaluations have included monitoring and verification (M&V) of solar PV, wind turbines, and other technologies to verify program benefit estimates. Mr. Shaw has also conducted detailed studies of renewable energy system performance trends in the northeast, presenting findings at conferences of the American Wind Energy Association, International Energy Program Evaluators Conference, and the Midwest Renewable Energy Association. Mr. Shaw is currently leading evaluation of programs funding solar PV, solar thermal, wind energy, biomass, and fuel cell projects funded through ARRA grants.

Solar PV System Design, Specification, and Owner Support

Mr. Shaw designed an off-grid power system for George's Island using solar PV, battery storage, generators, and a flexible control system that allows staff on the island to minimize generator run-time during daylight hours, when the island is open to visitors. Mr. Shaw provided the technical design, consulting, RFP development, and contractor selection on the project. The project was completed in summer 2010.

Wind Energy Project Development and Testing

Mr. Shaw is currently managing a project to install and conduct detailed monitoring on small wind generators in Connecticut. He is managing this effort from site evaluation and selection through final installation and data collection (wind resource, temperature, and turbine electrical output) for analysis in real time. This data will be used to inform potential incentive programs; the data will also provide feedback to manufacturers and installers regarding turbine efficiency, durability, and operational feasibility.

In addition, Mr. Shaw has worked collaboratively with the National Wind Technology Center (NWTC) and others on wind turbine siting and performance issues.

Renewable Energy Site Inspections and Field Work

Mr. Shaw conducts on-site inspections of renewable energy systems and pre-installation resource assessments across Massachusetts. During more than 100 on-site inspections, he has performed troubleshooting, resource assessment, code compliance verification, customer training, and data validation, and he has performed desktop analysis to support his on-site work.

Wind and Solar Energy Performance Tools

For use with technologies ranging from solar concentrators to residential and community-scale wind turbines, Mr. Shaw has developed comprehensive tools for predicting the energy output of solar and wind energy systems. The Massachusetts Renewable Energy Trust (MRET) is currently using one such tool for wind energy systems in support of the Commonwealth Wind Initiative.

Mr. Shaw is also leading the development of an online wind resource estimation and site analysis tool for the U.S. Department of Energy.

Clean Energy Outreach

Mr. Shaw has been called upon to speak at numerous town meetings, conferences, and similar venues regarding appropriate installation practices, siting, and the benefits/impacts of wind energy. He has dealt with many of the most difficult issues facing wind project siting, such as noise, shadow flicker, avian impact, and aesthetics, giving him a great deal of experience in addressing public concerns and responding to technical inquiries.

Education, Certifications, and Advanced Training

B.S., Electrical Engineering, Western New England College, Springfield, Massachusetts

Licensed Master Electrician in Massachusetts and New Hampshire

Licensed Journeyman Electrician in Connecticut and Massachusetts

OSHA 10-Hour Certification

National Electric Code, Solar Photovoltaic (PV) Training

Professional Experience and Qualifications

Matt Piantedosi, an associate with Cadmus, specializes in evaluation of solar PV designs, inspection of solar installation, metering on-site power use, and analyzing electrical loads. Mr. Piantedosi has more than 12 years of experience in the electrical field and more than five years of experience providing energy conservation solutions and consulting. As a member of Cadmus' Energy Services Division, he is a valuable resource on the National Electric Code, both internally and to PV system installers and designers. A member of the executive board for the Boston Paul Revere Chapter International Association of Electrical Inspectors, Mr. Piantedosi educates inspectors and installers on solar PV system electrical code requirements and common violations.

Examples of Relevant Experience

Renewable Energy Site Inspections and Field Work

Since 2009, Mr. Piantedosi has inspected, audited, and reviewed solar PV systems and designs throughout New York state and Massachusetts. To date, he has inspected over 300 solar PV systems. He also provides training to Cadmus staff on solar PV technical issues and inspection techniques.

- Mr. Piantedosi has inspected over 2 MW of residential and commercial solar PV installations on behalf of the MassCEC Commonwealth Solar Program. During inspections, he reviews each system design for Massachusetts Electrical Code compliance, generation estimates, and verified system component. Post inspection, Mr. Piantedosi works closely with installers and local electrical inspectors to resolve any issues discovered during the inspection.
- Mr. Piantedosi reviews 1- and 3-line diagrams of proposed systems on behalf of MassCEC, working with the installer to ensure the design comply with the Massachusetts Electrical Code, Commonwealth Solar Minimum Technical Requirements, and manufacturer's requirements.
- Mr. Piantedosi is a lead solar PV system inspector for NYSERDA. During inspections, he verifies energy production estimates and ensures installations are compliant with NYSERDA, federal, state, and utility requirements and regulations.
- For various cities and towns in Massachusetts, Mr. Piantedosi provides guidance throughout the solar PV procurement process, providing assistance during the early design stage through the final inspection. He works with the installer to ensure the system meets Massachusetts Electrical Code and other requirements outlined in the proposal documentation.
- On behalf of the MA DOER, Mr. Piantedosi provided owner's agent technical assistance to eight

municipalities receiving American Recovery and Reinvestment Act funds to install solar PV systems. He performed a detailed electrical design reviews of selected bidders' proposed solar design and specified changes required to meet NEC requirements and the town's preferences. Upon the completion of the installations, he performed a detailed inspections.

- For a local elementary school in Massachusetts, Mr. Piantedosi inspected a post-fire solar PV system. He was able to identify a probable cause and other electrical code compliance issues throughout the system, and on other public buildings where solar was installed. Mr. Piantedosi shared these findings with local authorities in an effort to identify and eliminate future hazards.

Presentations and Publications

- ***Solar PV Changes to the 2014 National Electrical Code (NEC)***, IAEI Paul Revere Chapter, Dormition of the Virgin Mary Church, April 11, 2014
- ***Solar PV Fire Safety***, Fire Prevention Association of Massachusetts, UMass Amherst, April 9, 2014
- ***Spring Training with the Pro's – Solar Installations, An In-Depth Code Based Look***, IAEI Paul Revere Chapter, Holiday Inn, Peabody, MA, June 1, 2013
- ***Spring Training with the Pro's – Solar Fire Safety***, IAEI Paul Revere Chapter, Holiday Inn, Peabody, MA, May 31, 2013
- ***Grounding and Labeling - Solar Photovoltaic Installation Best Practices Webinar***, NYSERDA, March 28, 2013
- ***Understanding and Investigating Solar Photovoltaic Systems***, International Association of Arson Investigators, Florian Hall, Dorchester, MA, January 17, 2013
- ***Solar Photovoltaic Systems – The Basics, Inspection Techniques, and Fire Safety***, Town of Winchester, MA, Winchester Town Hall, November 7, 2012
- ***PV Safety – Measure and Manage for Continuous Improvement***, Solar Power International Conference, Orange County Convention Center, September 11, 2012
- ***The Do's and Don'ts of Wiring Solar PV Installations***, MA Department of Energy Resources, Massasoit Community College, June 15, 2012; Greenfield Community College, June 5, 2012
- ***The Specifics of Solar***, IAEI Paul Revere Chapter, Malden Moose Lodge, March 2 & 3, 2012
- ***Solar PV Codes, Laws, Regulations and Safety Guidelines***, Solar Energy Business Association of New England (SEBANE), DoubleTree Westborough Hotel, February 29, 2012
- ***MassCEC PV Inspection Process***, MA Municipal Electrical Inspectors Association, IBEW Local 103, Boston, MA, March 3, 2010

Technical Skills

Mr. Piantedosi is proficient in the use of various types of lighting design software, as well as ICAPS (Spice), MATLAB, MathCAD, SolidWorks, and Microsoft Office.

Professional Memberships and Associations

IAEI Executive Board Member, Paul Revere Chapter
National Fire Protection Association (NFPA)

Education and Certifications

B.S. Technical Education, Fitchburg State College
Master Plumber’s License, Massachusetts (42 years)
Technical Instructor Certificate, Mass. Career & Tech Ed. Dept. (30 years)
Certificate in Special Needs Education, Fitchburg State College
Introduction to Solar Energy, Cape Cod Community College
Solar Hot Water by Tom Lane, IREC Conference, NY
Solar Domestic Hot Water with Richard Lawrence, Blackstone Valley Tech

Professional Experience and Qualifications

Since 2011, Leo Bedard has provided inspection and audit services for solar hot water systems to the Massachusetts Clean Energy Center's (MassCEC) Solar Thermal Rebate Program. For the effort, Mr. Bedard evaluates plans of proposed projects; inspects installations for rebate approval; and works with installers, homeowners, and appropriate local building authorities to ensure compliance with MassCEC’s program requirements and local plumbing code.

During the initiation of the Commonwealth Solar Thermal Rebate Program, Mr. Bedard developed education materials and provided training to plumbing inspectors from across Massachusetts in domestic solar thermal hot water systems. Over 150 inspectors attended his presentations on solar thermal system installation.

Mr. Bedard’s enthusiasm for the solar thermal industry has led to many invitations to speak on the topic in Massachusetts, as well as in 5 other states. Previously, he wrote and administered grants directed for the education of solar thermal system installers, and served as a member of the Advisory Council for the Northeast Solar Heating and Cooling Instructor Training Project at Kennebec Valley Community College, Maine. He installed his first system in 1977, and having been a technical educator for thirty years, he first introduced solar thermal system installations as an ancillary part of his curriculum in 1985. Mr. Bedard advocates the most effective way to move the solar thermal industry forward is with qualified installers installing high quality systems, with the safety as their top priority.

Examples of Relevant Experience

Teaching Experience

Upper Cape Cod Technical High School, Bourne, MA	1990 – 2006
Bay Path Regional Vocational Technical High School, Charlton, MA	1976 – 1990

- *Wrote first solar thermal curriculum in 1985.*

Supervisory and Solar Experience

- Solar System Auditor and Inspector, BEAM Group, Boston, MA 2011-2013
- Cotuit Solar Advisor and Consultant, Cotuit, MA 2006-2010
Responsibilities included assisting with installations and dealing with inspectors on close to 24 solar thermal projects including domestic water and radiant heat.
- Supervisor of Construction Trades, Upper Cape Cod RVTHS 1990-2006

- President & Treasurer of Woodside Plumbing & Heating, Barnstable, MA 2004 to 2006
- Lead Teacher, Construction Trades, Bay Path RVTHS 1991 to 2004
- Plumbing Instructor, Bay Path RVTHS 1976 to 1990
- Master Plumber for various firms, Worcester Area 1967 to 1990

Solar Thermal Workforce Training Experience

- Instructor and auditor, MassCEC Commonwealth Solar Thermal Rebate Program 2011-present
- Administrator and co-writer, Clean Energy Workforce Training Capacity Building Grant; MassCEC and the Commonwealth Corporation, 2009-2010
- Consultant, Solar Workforce Training Grant; Brocton Area Workforce Investment Board 2010-2011
- Consultant, Connecticut Tech Schools LCEI-TECH Program, Connecticut Clean Energy Fund 2009
- Consultant/Advisor, Solar Thermal Installations; Cotuit Solar, Cotuit, MA 2006-2010
- Instructor, Solar Thermal Train the Trainer; Massachusetts Clean Energy Technical School Task Force, Blackstone Valley Tech High School 2007

Technical Presentations

- 2010 Green Jobs – Swiss Consulate
- 2010 IREC Conference, NY
- 2009 NESEA Conference, Boston
- 2008 GreenBuild International Conference, Boston
- 2008 New Ideas Conference, Hudson Valley Community College, NY
- 2007 PETE Conference
- 2007 NAWI Conference

Professional Memberships and Associations

Member of the Advisory Council for the Northeast Solar Heating and Cooling Instructor Training Project (NSHCITP) at Kennebec Valley Community College, Maine.

Education and Certifications

B.S., Community and Regional Planning, and Appropriate Technology (double major); minor in business, GIS certificate, Appalachian State University, Boone, North Carolina

WNC Renewable Energy Initiative: Photovoltaic (PV), solar thermal, wind energy system design, and installation workshops

FCC license, NABCEP (photovoltaic certificate) CEM (Certified Energy Manager)

Professional Experience and Qualifications

William Atkinson, a Cadmus associate, specializes in clean-energy technology. He brings a broad knowledge of building sciences, sustainable construction techniques and processes, LEED, and ENERGY STAR programs. He is also familiar with federal (NEPA), state (SEPA), county, and municipal governmental organizations, functions, policies, and procedures. In addition, he has conducted renewable energy resource assessments for solar (PV and thermal), wind, and hydro projects, and he has analyzed the economic feasibility of various renewable energy projects.

His responsibilities at Cadmus include:

- Performing technical system designs reviews of proposed renewable energy projects and installations.
- Conducting solar/wind resource and system energy yield calculations including on-site solar and wind resource measurements, assessments, and system modeling.
- Installing field monitoring equipment, conducting resource assessments, and performing energy output studies confirming expected results, benefits, and savings.
- Performing energy-use characterization and energy-efficiency studies for commercial and residential facilities.
- Conducting on-site inspections of solar electric, solar thermal and wind energy conversion system installations to ensure compliance with various state renewable energy program technical requirements.
- Providing project management, long-term data collection, performance analysis, and information display systems for renewable energy projects.
- Conduct hydropower feasibility studies, assessing site resource, energy production potential, economic viability, potential environmental issues, and regulatory/legal requirements.

Examples of Relevant Experience

Renewable Energy Project Analysis and Field Work

Before joining Cadmus in November 2008, Mr. Atkinson worked at Appalachian State University's Small Wind Research Facility and the Western North Carolina Renewable Energy Initiative providing solar,

wind, and microhydro site resource assessment consultation, project feasibility analysis, and renewable energy program support.

This work included:

- Providing solar, wind, and micro-hydro site resource assessment reports utilizing GIS software.
- Installing renewable energy systems for grid tie and standalone wind turbines, PV systems, and small hydro systems; and assessing the environmental impact of the installed systems.
- Performing data collection and analysis, system testing, and failure mode analysis of wind turbines.
- Identifying land parcels with significant hydropower potential utilizing GIS modeling and various geospatial datasets, as well as providing a contact list of parcel owners.
- Conducting public outreach and education workshops clarifying governmental energy policies and incentive programs, anemometer loan programs, and site consulting assistance.

Small Wind Turbine Testing

At Cadmus, Mr. Atkinson assisted three towns in Connecticut with installing small wind systems as part of the Connecticut Clean Energy Fund's Small Wind Turbine Demonstration Project. In support of this effort, Mr. Atkinson developed, installed, and maintained an automated data acquisition system to display and evaluate the power, safety, and acoustic performance of all the project test turbines.

Renewable Energy Systems Design Review, Monitoring and Verification, and Inspection

Mr. Atkinson conducts wind and solar system design reviews and code compliance inspections for the Massachusetts Clean Energy Center (MCEC) and the New York State Energy Research and Development Authority (NYSERDA). He also provides small wind system performance monitoring and verification services for both the MCEC and NYSERDA, and has evaluated the technical and safety aspects of small wind turbine designs for determining eligibility for statewide incentive programs. In addition to state level programs Mr. Atkinson conducts solar thermal system monitoring and verification services for multiple federal organizations.

Wind and Solar Project Design and Performance Tools

Mr. Atkinson has developed and maintained comprehensive tools for solar project design analysis to estimate project performance and determine system design electrical code compliance for NYSERDA. He also assisted with the development, maintenance, and user training for the Commonwealth Wind Evaluation and Siting Tool, which provides users with site wind resource availability and wind turbine system performance estimates in support of the MCEC Wind Initiative programs. Mr. Atkinson is also a member of the development team for a national online wind resource estimation and site analysis tool for the US Department of Energy.

Technical Skills

Mr. Atkinson is adept with ArcGIS, ArcScene, ArcSDE, Idrisis, DBMS management, geocomputational programming, ERDAS Imagine-digital satellite image processing and analysis, Retscreen, SAM, Hoboware, SunEye, SunPathfinder assistant, PV-watts, Loggernet, Windographer, and WindPro.

Education and Certifications

NABCEP Certified PV Installer
NABCEP PV Entry Level Certificate holder & Instructor
DOE Solar Instructor Training Network Instructor
OSHA 10h and OSHA Competent Person Trained
NFPA 70E Hazard Trained
Advanced PV System Design & Installation class by Brooks Eng.
Installing and Inspecting PV Systems by Brooks Engineering
Photovoltaic Power Systems and the NEC by John Wiles
SOL PV Design & Installation course
SEI Design & Installation of PV course

Professional Experience and Qualifications

Glenn Burt, an associate with Cadmus, specializes in reviewing solar PV designs and performing solar installation inspections. Mr. Burt has more than 30 years of experience in the electrical field and seven years of experience inspecting and installing PV systems. As a member of Cadmus' Energy Services Division, he is a valuable resource for questions and issues pertaining to solar PV and the National Electric Code, both internally and to PV system contractors and designers. As an adjunct instructor at Hudson Valley Community College (HVCC), Mr. Burt educates other college instructors and installers about solar PV system electrical code requirements, common violations as well as industry best practices.

Prior to joining Cadmus, Mr. Burt worked as a Technical Specialist for Renewable Power Systems (RPS), Alteris Renewables, and Real Goods Solar, where he designed, installed, and inspected residential and commercial PV systems and solar hot water systems. He also performed ongoing training to staff on latest products and installation practices.

Mr. Burt has also worked under Department of Energy's Sunshot Program, developing and presenting PV training to instructors across the Northeast through the Solar Instructor Training Network and Hudson Valley Community College. While an Adjunct Instructor at Hudson Valley Community College (Workforce Development), Mr. Burt developed and presented curriculum covering the NABCEP Entry Level certificate programs, as well as courses in Advanced PV.

Examples of Relevant Experience

Renewable Energy Site Inspections and Field Work

Since 2006, Mr. Burt has been inspecting, auditing, and reviewing solar PV systems and designs. He has completed dozens of solar PV system inspections and commissionings, and is very familiar with all major equipment and inspection techniques. As an adjunct instructor at HVCC, Mr. Burt has experience performing PV training for students, installers, inspectors, and other college professors.

Solar System Design Review, Monitoring & Verification, and Inspection

Mr. Burt has experience designing residential and commercial PV systems as a Technical Specialist for Alteris Renewables/Real Good Solar. Over the past few years, he has been providing service and troubleshooting support for commercial projects in New York, New Jersey, MD, PA and elsewhere. In addition, Mr. Burt is an expert in data acquisition systems (DAS) for solar PV systems and has experience working with a wide variety of systems from major vendors such as Fat Spaniel, Heliotronics, Locus, DECK, SMA, Sunpower and others.

Solar System Training Instructor

Mr. Burt has experience conducting training on PV systems for a wide range of audiences. As an adjunct instructor at HVCC, Mr. Burt has experience performing advanced PV trainings for students, as well as separate trainings for college professors throughout the Northeast. He also educates Cadmus staff on various solar PV technical issues and inspection techniques.

Presentations and Publications

Technical Bulletin – NEC Labeling Requirements

Webinar – PV & Utility Interconnections

Technical Bulletin – Metering a PV with Battery Backup System to meet NYSERDA PON Requirements

Technical Bulletin – Grounding Electrode Conductor; Bonding and Connections

Memorandum – PV Installation Best Practices

Briefing – 1kV PV Systems

Briefing – Supply Side Connections

Technical Skills

Mr. Burt is adept with residential electrical wiring, Residential Construction (carpentry, plumbing, masonry, roofing), Industrial Wiring AC & DC, AutoCAD, DesignCAD, Visio, Electro-Mechanical Design (wiring, components, BOM, installation), Prototype & Panel Assembly, Applications Engineering, Technical Training Developer/Presenter

Professional Memberships

North American Board of Certified Energy Practitioners (NABCEP) Certified PV Installer

Microsoft Certified Professional (MCP)

Institute of Electrical & Electronics Engineers (IEEE)

Amateur Radio Relay League (ARRL)

New York Solar Energy Society (NYSES)

American Solar Energy Society (ASES)

Education and Certifications

B.S., Electrical Engineering, Worcester Polytechnic Institute

Professional Experience and Qualifications

Robert Lamoureux, an associate with Cadmus, has more than 10 years of professional experience in energy and design engineering. Mr. Lamoureux reviews solar photovoltaic (PV) designs, audits solar PV and solar hot water systems, and inspects solar PV and small wind turbine systems. Mr. Lamoureux has conducted on-site demand-side management evaluations of energy-efficiency projects. He is also experienced at time-of-use metering for electrical power, light usage, and gas consumption. His metering experience spans residential, commercial, and industrial applications. Technologies evaluated include lighting, lighting controls, HVAC, air source heat pumps, ground source heat pumps, WI-FI programmable thermostats, pumps, motors, variable frequency drives, refrigeration controls, residential building envelope, and residential appliances.

Before joining Cadmus, Mr. Lamoureux worked at Raytheon Company, where he performed senior activities relating to digital hardware design and software design for large, complex projects. Among his projects was the Terminal Doppler Weather Radar program, which automatically detects microburst and low-level wind shear conditions. There are more than 40 installations of this technology throughout the U.S.

Examples of Relevant Experience

Renewable Energy Site Inspections and Field Work

Since 2009, Mr. Lamoureux has inspected, audited, and reviewed solar PV systems and designs on behalf of the MassCEC and the NYSERDA. He has also inspected small wind turbine installations. This work has occurred on projects throughout Pennsylvania, New York, and Massachusetts including:

- Inspecting over 110 kW of residential and commercial solar PV installations throughout Massachusetts for the MassCEC Commonwealth Solar Program. His inspections include reviewing each system design for Massachusetts Electrical Code compliance, output power verification, and system component verification. He then works with the installers to correct any issues discovered during the inspection process.
- Inspecting over 70 kW of residential and commercial solar PV installations throughout New York for NYSERDA. His inspections include reviewing each system design for National Electrical Code compliance, output power verification, and system component verification.
- Auditing over 2771 kW of commercial solar PV installations throughout Pennsylvania for PPL, New York for NYSERDA, and Massachusetts for MassCEC. The audits include reviewing each system design for output power verification and system component verification.

- Inspecting over 105 kW of small wind turbine installations throughout Massachusetts for MassCEC. His inspections include reviewing each system design for Massachusetts Electrical Code compliance, output power verification, and system component verification.
- Measurement and verification of a NYSERDA commercial solar hot water project to verify the energy savings through the metering temperature, flow, energy use, and solar radiation.
- Auditing of residential solar hot water projects for National Grid in Massachusetts and Rhode Island. The audits include reviewing each system design for production verification and system component verification.

Energy Efficiency Field Work

Mr. Lamoureux has served as the lead field engineer for energy-efficiency measurement and verification (M&V) tasks on behalf of several significant entities in 15 states, such as Ameren, a consortium of Arkansas Utilities, Avista, California Public Utilities Commission, Efficiency Maine, EmPOWER Maryland, a consortium of Massachusetts Utilities, National Grid, a consortium of New Hampshire Utilities, NIPSCO, NYSERDA, PacifiCorp, PPL Electric, Santee Cooper, and Western Mass Electric Company. This work has included:

- Conducting commercial lighting and lighting control evaluations through site visits to determine wattage savings, hours of usage, and kWh savings. He has installed light meters to measure time-of-use data of random light fixtures.
- Conducting residential CFL program evaluations through site visits to determine inventory of the style, wattage, and usage of all lighting fixtures. He installed light meters to measure time-of-use data for a random sample of CFL light fixtures.
- Conducting site visits to businesses and residences to inspect and verify system components for ground source heat pump, air source heat pump, heat pump water heater, and other energy-efficient appliance installations.
- Determining the efficiency of residential washers and dryers through site visits, which involved installing equipment to measure energy consumption as well as the temperature and volume of washers' hot and cold water.
- Verifying savings of commercial energy efficient heating installations by installing time-of-use equipment onto gas meters.
- Conducting business and residential site visits to inspect and measure central air conditioning equipment. This entailed installing metering equipment to provide time-of-use data regarding the amount of energy used, indoor and outdoor temperatures and humidity, and air conditioner duct temperature and humidity. He used the data to calculate the efficiency and peak load demand of the new units.
- Conducting residential site visits to support the evaluation of building envelope energy-efficiency measures. This included infrared camera analysis to grade wall and ceiling insulation.

Education and Certifications

B.A., Economics, Emory University

Certified Verification and Measurement Professional, Association of Energy Engineers

Graduate Coursework: Sustainable Building Design and Architecture and Environmental Economics, Harvard University; Environmental Systems Management and Statistics, Boston University

Professional Experience and Qualifications

Sandra Brown, an associate with Cadmus, has seven years of experience conducting quantitative analysis and providing technical support to renewable energy stakeholders and energy-efficiency evaluations. Ms. Brown managed and provided technical expertise to impact and process evaluations for solar photovoltaic and thermal; home energy performance; and heating, ventilation, and air conditioning programs, including conducting field studies on the performance of ground and air source heat pumps. In addition, Ms. Brown manages efforts in support of the Massachusetts renewable energy industry, including the System of Assurance of Net Metering Eligibility (MassACA.org); the Massachusetts Clean Energy Center's (MassCEC) Design Review and Inspection process, which provides quality assurance to wind and solar installations in Massachusetts; and the Department of Energy Resources Clean Energy Connection events held in 2012, which brought together industry stakeholders to determine best practices for energy efficiency and renewable energy development and investment, post-American Reinvestment and Recovery Act.

Examples of Relevant Experience

MassCEC Performance Audits for MA RPS Solar Carve-Out Participants

In support of the MassCEC's role as the independent third party verifier of SRECs generated under the Massachusetts Renewable Energy Portfolio Standard Solar Carve-out program, Cadmus conducts performance audits of facilities participating in the program. For the effort, Ms. Brown manages staff conducting onsite verifications of facility components and an evaluation of the performance of sampled facilities, including analyzing up to 2 years of historical generation. Data from the verification effort will be summarized in a final report and establish realizations rates for the program and an estimate of confidence in SRECs reported to New England Power Pool GIS.

MassCEC Design Review and Inspection Process

Ms. Brown manages the design review and inspection process for MassCEC-funded solar PV and wind systems. She works with system owners, installers, and the MassCEC to ensure systems are reviewed thoroughly and in a timely manner. Ms. Brown coordinates the reviews of proposed systems for National Electrical Code compliance and MassCEC requirements prior to installation, and conducts post-inspections to ensure compliance and system performance. Ms. Brown also performs design reviews for proposed solar PV systems on behalf of the MassCEC and the New York State Energy Research and Development Authority (NYSERDA).

MassCEC Renewable Energy Production Tracking System Administration

Ms. Brown administered the PTS between 2008 and 2010, and provided technical assistance to PTS users, industry stakeholders and MassCEC staff. Ms. Brown developed the quality assurance analysis of energy generation reported to the PTS, which included QA of Renewable Energy Certificates minted under the Massachusetts Renewable Energy Portfolio Standard, and is used currently by MassCEC staff to evaluate generation qualified under the Solar Carve-out.

System of Assurance of Net Metering Eligibility

Ms. Brown leads Cadmus' team implementing the System of Assurance of Net Metering Eligibility. The System facilitates the allocation of Net Metering Services to qualifying distributed generation facilities under Massachusetts' Net Metering Caps based on the Massachusetts Department of Public Utilities (MA D.P.U.) order 11-11-D. Working closely with the MA D.P.U. and Massachusetts' investor owned utilities, Ms. Brown is responsible for monitoring the availability of Net Metering Services, qualifying proposed facilities, and providing ad hoc regulatory guidance to stakeholders. For the effort, Ms. Brown managed the 40-day development of the online software platform located at <http://www.MassACA.org>, and established the workflow, policy and procedures for the ongoing management of the System and qualification of facilities under MA DPU 11-11-D. Ms. Brown authored and provided trainings to stakeholders and staff, including the development of detailed user guidance. Currently, Ms. Brown oversees the review of Applications for Cap Allocation, maintenance of Cap Reservations, and ad hoc user assistance provided via the MassACA helpline and help@MassACA.org.

MA DOER SREC II Development Support

Ms. Brown managed Cadmus' evaluation of the Massachusetts Renewable Portfolio Standard 400 MW Solar Carve-out program and comparative analysis of policy options for the upcoming SRECII regulation. For the effort, Cadmus provided a detailed analysis of regional economic impacts of solar ownership and financing alternatives, and supported a sensitivity analysis conducted for the evaluation in conjunction with Sustainable Energy Advantage, Meister Consulting Group, and La Capra Associates.

MA DOER SREC II Residential Financing Program

Ms. Brown manages Cadmus' contract to advise DOER on the development of programs to increase solar financing options for direct-ownership of residentially sited solar PV in Massachusetts. Ms. Brown led the effort to evaluate current market loan offerings available within the Massachusetts market, and elsewhere in the United States, quantifying loan underwriting criteria as well as qualitative requirements identified by lenders.

Quantitative Analysis for Energy-Efficiency Evaluations

Ms. Brown has contributed to the impact and process evaluations of numerous utility programs, including conducting field studies to establish energy savings, surveying program implementers and participants, and evaluating freeridership and spillover. Recent evaluations include:

- *Indiana Power and Light Evaluation of Renewable Energy Programs.*
- *Ameren Illinois HVAC, Demand Response, and Home Energy Performance Programs.*
- *United Illuminating Company Heat Pump Water Heater (HPWH) Pilot.*

Energy-Efficiency Evaluation Training

Ms. Brown provided training on residential energy-efficiency verification for the DTE Energy and Commonwealth Edison Michigan baseline evaluations. Training topics included residential applications for HVAC, insulation, and energy-efficiency measures. Additionally, Ms. Brown provided training on single and multifamily residential lighting verification for the California Public Utility Commission and Ameren Missouri. She provided instructions on the field installation of lighting loggers, including the Dent Smartlogger and Hobo U12 lighting loggers.

Professional Memberships and Associations

Association of Energy Engineers; New England Women in Energy & The Environment

Technical Skills

Ms. Brown is proficient in the use of Microsoft Office, Microsoft Project, Microsoft Enterprise Manager, SQL, SAS, Filemaker, Adobe Creative Suite, HTML, and CSS.

Education and Certifications

M.A., Economic and Social Development of Region, *expected*, University of Massachusetts

B.A., Environmental Analysis and Policy, *magna cum laude*, Boston University

National Incident Management System (NIMS) Certification

Professional Experience and Qualifications

Ms. Danielle E. Poulin, a Cadmus Senior Analyst, is an energy and environmental policy professional with four years' experience in providing services to state and local governments related to environmental and energy affairs. In addition, Ms. Poulin also has experience in supporting the United States Environmental Protection Agency (EPA), particularly EPA's Drinking Water Protection Division, with drinking water regulatory affairs.

Ms. Poulin has supported EPA's Capacity Development Program, EPA Region 1 training programs, EPA's Drinking Water State Revolving Fund (DWSRF), the American Recovery and Reinvestment Act (ARRA), and implementation of the Underground Injection Control Class VI Geologic Sequestration Rule and Revised Total Coliform Rule. Other notable work performed includes execution of the Effective Utility Management project in EPA Region 1, in which Ms. Poulin worked directly with water and wastewater utilities in New England.

Previously, Ms. Poulin worked for a third-party firm analyzing claims against the Commonwealth of Massachusetts petroleum storage tank funds to determine whether charges claimed were technically and financially eligible according to state regulations and agency policies. Ms. Poulin has also worked at various organizations on a part-time basis, including the Environmental League of Massachusetts and the Encyclopedia of Earth.

Relevant Experience

- **Owner's Agent Technical Assistance to Massachusetts Municipalities (2012-2014).** Ms. Poulin provided assistance for a multiyear contract with the Massachusetts DOER to provide owner's agent technical assistance consulting services to eight Massachusetts cities and towns pursuing solar PV projects. Ms. Poulin continues to provide owner's agent assistance to additional Massachusetts municipalities as well. Her work includes conducting reviews of procurement documents, performing bid evaluations, assessing municipalities' risk associated with solar contracts, and assisting with meetings of prospective developers and local officials.
- **Massachusetts System of Assurance of Net Metering Eligibility (2013-2014).** Ms. Poulin is part of a team that administers and maintains the Massachusetts System of Assurance of Net Metering Eligibility (www.MassACA.org), an important incentive program in Massachusetts that gives renewable energy stakeholders the assurance that their renewable energy project will be eligible to sell electricity back to the utility. Ms. Poulin reviews applications of cap allocations and for their eligibility and completeness, and monitors quarterly reporting requirements for program participants.

- **Massachusetts Clean Energy Center Design Review and Inspection Process (2013-2014).** Ms. Poulin assists in the design review and inspection process of MassCEC-funded solar PV and wind systems, working with system owners, installers, and the MassCEC to ensure renewable energy systems are in compliance with MassCEC's Minimum Technical Requirements.
- **Rhode Island Clean Water Infrastructure Plan Review (2012-2013).** Ms. Poulin provided support to the State of Rhode Island in developing a process for reviews of required water system plans, called Clean Water Infrastructure Plans. Ms. Poulin assisted in the development of an Excel-based review form to facilitate plan reviews. Ms. Poulin then performed reviews of plans using the form, with special attention to infrastructure needs in the 5- and 20-year timeframes. Water system-specific summary reports and a final report of recommendations were then produced.
- **EPA Region 1 Training Services (2012-2014).** Ms. Poulin provides project management support and assists EPA Region 1 with the execution of various training events for drinking water and wastewater utilities, including both webinar and in-person trainings. Ms. Poulin is involved with all aspects of planning and execution of these events, including preparation, registration, presentation development, logistics planning, webinar execution, and post-training evaluation. Ms. Poulin serves as EPA's primary point of contact for this project and oversees the project's budget and staffing.
- **EPA Region 1 Effective Utility Management Project (2011).** Ms. Poulin provided facilitation support to operators and superintendents of approximately 10 drinking water and wastewater utilities in New England that were interested in learning about Effective Utility Management. These utilities were then provided with implementation tools based on the needs identified during the site visit, which Ms. Poulin had a significant role in identifying and developing into a tailored implementation plan. Ms. Poulin provided extensive logistical support, including scheduling, setup, note taking, and follow-up, as well as acting as a facilitation lead.
- **EPA Office of Ground Water and Drinking Water State Program Reviews and Protocol (2011-2013).** Ms. Poulin provided support to EPA's Office of Ground Water and Drinking Water in conducting review of state Public Water System Supervision (PWSS) programs. Support activities included preparing review forms, conducting reviews at state offices, and asking follow-up questions to state staff, as necessary. Conducting these reviews required Ms. Poulin to have knowledge of all drinking water regulations, and how states and water systems comply with them. In 2013, Ms. Poulin helped revise the Program Review Protocol, which EPA and EPA Regions can use to conduct state PWSS reviews.
- **EPA American Recovery and Reinvestment Act (2010-2011).** Since 2010, Ms. Poulin has assisted EPA with various aspects of implementation and review of the American Recovery and Reinvestment Act (ARRA). Efforts included supporting document development, assisting in the scheduling of over 175 site inspections across the U.S., and providing note-taking support for annual regional reviews (in EPA Regions 4 and 10). In addition, Ms. Poulin performed an ARRA state file review in Frankfurt, Kentucky in October 2011 to gather ARRA program data.