CVPS SmartPower:

A Smart Grid Collaboration in Vermont

Institute for Energy and the Environment
Vermont Law School

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Vermont's Center for Energy Transformation and Innovation (CETI) is a partnership between Sandia National Laboratories and a broad array of Vermont stakeholders. With the active participation of the state of Vermont, the electric utilities, private sector companies and academic institutions, including the Vermont Law School, CETI is driving innovation in a broad spectrum of areas including technology development and integration, consumer engagement, public policy, and education and workforce training. CETI supports the development and dissemination of smart grid best practices to move the nation toward a 21st Century energy infrastructure.

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SMART GRID PROJECT OVERVIEW

The United States electric transmission and distribution system is on the verge of a transformation to a smart electric grid. At the center of this evolution is the introduction of new technology at the customer meter as well as the distribution and transmission system level. Unsurprisingly, the introduction of this new technology has presented new legal, policy, and regulatory challenges for state and federal regulators. The federal government has added additional momentum to this technological evolution by making a smart electric grid a central component of the US clean energy agenda and awarding $3.4 billion in smart grid investment grants to utilities and other entities as part of the American Recovery and Reinvestment Act.

THE SMART GRID CASE STUDIES SERIES

Vermont Law School's Institute for Energy and the Environment Smart Grid Project was initiated in 2010 through joint funding of the United States Department of Energy, with the support of Vermont Congressman Peter Welch, and Vermont Law School. Utilizing case study analysis of smart grid program implementation, the research project is examining the question: what legal, regulatory, and other policy changes can best ensure that Smart Grid implementation in the U.S. improves reliability, enhances consumer value, and meets our clean energy goals?

Our Smart Grid Case Study Series Includes:

- ✓ Central Vermont Public Service (Vermont)
- ✓ Commonwealth Edison (Illinois)
- ✓ Pecan Street Project (Texas)
- ✓ Sacramento Municipal Utility District (California)
- ✓ Salt River Project (Arizona)
- ✓ San Diego Gas and Electric (California)

PROJECT FOCUS 2012 AND BEYOND

FERC Chairman John Wellinghoff has noted that climate change and a smart electric grid are both key issues for the energy industry and the federal government, but rarely are these two issues linked in policy debates. The focus of the Institute for Energy and Environment's Smart Grid Project is to help better define this important link, and to promote smart policies that benefit both the climate and the electric grid. Research such as that conducted by Pacific Northwest National Laboratory (PNNL) and the Electric Power Research Institute have identified that a smarter grid is likely to be a significantly greener grid, which could lead to significant reductions in both energy usage and carbon emissions. PNNL's research suggests that a smart grid can lead to a 12% reduction in carbon emissions alone by 2030. Building on our case study research during the second phase of our project, we are producing up to five smart grid policy reports. These reports will examine best practices, lessons learned, and policy issues related to:

- Legal and regulatory challenges to smart grid implementation, including customer data privacy;
- Integration of electric vehicles into the grid;
- Supercharging efficiency and expanding demand response;
- Integration of clean distributed generation and storage; and
- Distribution optimization and conservation voltage reduction.

More about the Institute's Smart Grid Project is available at: www.vermontlaw.edu/smartgrid

INTRODUCTION

The Institute for Energy and the Environment's smart grid case studies focus on utilities representing a variety of sizes and approaches to implementing smart grid technology in their service territories. For two reasons, Vermont's smart grid partnership, focusing on CVPS, presented a relevant case to study. First, CVPS's project is part of a statewide effort to install smart grid technology across as much of the state as possible. Second, CVPS is the largest electric utility in Vermont[1] and the first, under the Vermont smart grid partnership with U.S. Smart Grid Investment Grant funding, to begin installing smart meters.[2] With this set of circumstances, the Vermont experience should be informative for other utilities and policymakers across the country.

Central Vermont Public Service ("CVPS") is an investor-owned electric utility. Serving more than 160,000 customers, CVPS is the largest electric utility in Vermont and is responsible for approximately 40% of Vermont's electricity sales. Not surprisingly, CVPS is also a key partner in the state's smart grid partnership–eEnergy Vermont.

In 2008, CVPS began working to implement smart grid infrastructure. At that time, CVPS proposed an Alternative Regulation Plan, which committed it to implementing advanced metering

[1] Green Mountain Power, Vermont's second largest utility, and Central Vermont Public Service have a proposed merger agreement under review by the Vermont Public Service Board. Under the proposal, both utilities support the acquisition of CVPS by GMP's parent company Gaz Metro under which CVPS and GMP will be merged into one utility, which will be called Green Mountain Power.

[2] Vermont Electric Cooperative, which is also a member of the Vermont smart grid partnership, has previously installed smart meters for their customers.

infrastructure ("AMI") as fast as reason and cost would permit.[3] At the same time, CVPS joined a collaboration of utilities, state agencies, and public interest organizations to develop a regulatory framework that Vermont utilities could follow as individual utilities developed their smart grid plans. CVPS used this collaboration to develop its CVPS SmartPower program to implement AMI and other technology to improve electric service.[4] In 2009, the partners agreed to a Memorandum of Understanding (MOU) defining specific details related to Vermont utilities' AMI Plans.[5] The MOU included an agreement on "functional requirements, telecommunications, cost recovery, and other elements."[6]

CVPS and other utilities jointly applied for a Smart Grid Investment Grant offered by the U.S. Department of Energy with funds from the American Reinvestment and Recovery Act of 2009.[7] The application sought reimbursement of 50% of the total estimated cost of statewide smart grid investments[8] and proposed a statewide program, eEnergy Vermont, to coordinate smart grid investment efforts. In October 2009, the Department of Energy awarded eEnergy Vermont a Smart Grid Implementation Grant for $69 million.[9] The grant will allow the installation of approximately 300,000 smart meters covering nearly 85% of all Vermont electric customers. CVPS's share of the Smart Grid

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[3] Vt. Pub. Serv. Bd., Order Approving Advanced Metering Infrastructure Plan, Docket No. 7612 (Aug. 6, 2010) [hereinafter "AMI Approval Order"].

[4] Press Release, CVPS, State, CVPS Announce New "Smart" Grid Plans (Aug. 1, 2008), http://www.cvps.com/AboutUs/news/viewStory.aspx?story_id=190.

[5] *See* Vt. Pub. Serv. Bd., Proposal for Decision Recommending Approval of Memorandum of Understanding, Docket No. 7307 (Aug. 3, 2009) [hereinafter "MOU Order"]; Press Release, CVPS, MOU in Hand, CVPS Moves toward "CVPS SmartPower" (Feb. 2, 2009), http://www.cvps.com/AboutUs/news/viewStory.aspx?story_id=210.

[6] Press Release, CVPS, MOU in Hand, CVPS Moves toward "CVPS SmartPower" (Feb. 2, 2009).

[7] Press Release, CVPS, Vermont Seeks $66 Million in Stimulus Funds for "Smart Grid" (Aug. 7, 2009), http://www.cvps.com/AboutUs/news/viewStory.aspx?story_id=232.

[8] *Id.*

[9] CVPS, 2009 ANNUAL REPORT: USHERING IN A NEW ERA OF OPPORTUNITY 8 (2009).

Investment Grant exceeded $31 million.[10] In total, CVPS expects to spend more than $63 million to implement CVPS SmartPower.

In 2010, the Vermont Public Service Board ("Board") approved CVPS's implementation plan.[11] With regulatory approval and support from a network of utilities and Vermont policymakers, CVPS began implementing CVPS SmartPower. CVPS expects to have installed nearly 180,000 meters by the end of 2012. Meanwhile CVPS is testing rate designs, in-home displays, and customer communication methods, and collaborating with eEnergy Vermont to develop new time-of-use and dynamic rate designs to offer to all customers.

As CVPS implements CVPS SmartPower, three important factors contribute to its success. First, CVPS has collaborated with other Vermont utilities and interested parties at every step of the process. The eEnergy Vermont Project involved the collaboration of 20 publicly-owned and investor-owned utilities, as well as the statewide energy efficiency utility, Efficiency Vermont. Chuck Ross, at the time state director for Senator Patrick Leahy's office, worked with the group of utilities applying for the Smart Grid Implementation Grant and said, "The level of coordination from the utilities was frankly inspiring."[12] This collaboration has helped reduce potential regulatory hurdles and enabled shared analysis to reduce the need for duplication in reviewing and selecting particular equipment, rate designs, and policies. Furthermore, this collaboration will help to ensure that utilities manage customers' expectations collectively. Once advanced meters are installed, CVPS plans to continue collaborating with Vermont's energy efficiency utility, Efficiency Vermont, and other entities to expand demand side management opportunities. Without this coordination, CVPS SmartPower, and other smart grid

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[10] *Id.*

[11] *See* AMI Approval Order, *supra* note 3.

[12] Terri Hallenbeck, *Vermonters Feel Boost from Stimulus*, BURLINGTON FREE PRESS, Aug. 16, 2009, at 1A.

investments across Vermont, might cost more, deliver fewer benefits to customers, and take longer to implement.

Yet this collaboration has also come at some expense. While the end result of state-wide collaboration might have been beneficial, CVPS has described the collaboration as "very time-consuming." For example, CVPS had already developed a positive business case and plan for AMI investments when the opportunity to apply for federal funding arose. Later, the Public Service Board ruled that the utility consider alternatives with increased social benefit. The resulting collaboration with other utilities in Vermont slowed the decision-making and implementation process. In the end, however, the collaboration led to a successful application for a Smart Grid Investment Grant.

Second, Vermont's energy policy and regulatory agencies have developed a clear record of supporting cost-effective smart grid investments. In 2007, well before the grant opportunity from the U.S. Department of Energy, the Vermont Public Service Board initiated Docket 7307: Investigation into Vermont Electric Utilities Use of Smart Metering and Time-Based Rates. Meanwhile, the Vermont Legislature passed Act 92, the Vermont Energy Efficiency and Affordability Act, which asked the Public Service Board to investigate smart meters and time-of-use rates. Importantly, regulatory policy in Vermont has balanced flexibility for investments in fast-developing smart grid technology with measures to ensure that decisions about major investments are prudent.

Third, CVPS has developed a detailed employee and customer outreach program. This early and ongoing education will help accelerate customer acceptance, reduce confusion and skepticism, and ensure that customers are able to benefit from smart grid technology as soon as possible. These outreach programs will also enable the utility to collect feedback from customers and adapt processes and services as necessary.

CVPS SmartPower will be the "largest non-capital investment [CVPS] has ever made."[13] Collaboration, effective state policies, and customer education and research are three integral components to ensuring that this investment occurs without significant delay or expense, while maximizing customer benefits.

SMART METER INITIATIVES

Installing advanced metering infrastructure is the central pillar of the CVPS SmartPower program. CVPS plans to upgrade roughly 180,000 meters.[14] CVPS expected to begin exchanging 2,200 meters per week in early 2012 and complete the project by the end of 2012.[15] Due to some delay in selecting a network provider to transmit meter data, CVPS amended the program schedule in late 2010 in order to explore an opportunity to collaborate with the development of Vermont's 4G broadband system. As a result, CVPS delayed its first meter installation and accelerated the pace of meter installations to complete the installation sooner than originally expected.[16] Altogether, purchasing and installing AMI equipment throughout its service territory will cost CVPS more than $35 million. Perhaps in part for that reason, the Vermont Department of Public Service ("DPS") acknowledged that choosing the best metering equipment poses "a formidable undertaking."[17]

Vermont's 2011 Comprehensive Energy Plan reports that "[a] statewide smart grid initiative is well underway" to deploying advanced meters in over 85 percent of the state within the next few

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[13] ANNUAL REPORT, *supra* note 9, at 4.

[14] Nancey Remsen, *State Wins $69 Million "Smart Grid" Grant*, BURLINGTON FREE PRESS, Oct. 28, 2009, at 1A.

[15] CVPS, SMARTPOWER PLAN 24 (April 2010).

[16] *See* Vt. Pub. Serv. Bd., Order Approving Updated Business Case, Docket No. 7612 Order (Sept. 1, 2011), at 7 (describing the utility's intent to complete the installations within thirteen rather than eighteen months).

[17] Vt. Pub. Serv. Bd., Order Approving CVPS SmartPower Plan, Docket No. 7612 (Aug. 6, 2010), at 14 [hereinafter "SmartPower Order"].

years.[18] The State's policy is that all eEnergy Vermont investments must involve coordination and collaboration among utilities.[19] In order to ensure that CVPS makes the best long-term investment in AMI and can take advantage of cost efficiencies, CVPS collaborated with Green Mountain Power to procure an AMI system. CVPS and GMP released a joint request for proposals and began reviewing AMI proposals in 2010. Their goal was to take advantage of cost efficiencies from sharing network equipment and vendor services.[20]

This collaboration should help ensure that CVPS and other utilities select equipment that can provide common benefits to all Vermont ratepayers and support interoperability among systems used by different utilities, including Efficiency Vermont, and other third parties. Early on, CVPS hosted a meeting to discuss interoperability and system design among the different partners in eEnergy Vermont.[21] The DPS acknowledged CVPS's leadership in working with partners across the state to promote a system of open architecture.[22] According to CVPS, interoperability enabled by equipment that uses open communication standards whenever possible, will encourage creativity in the development of applications that may benefit consumers.[23]

CVPS indicated that the AMI system it selected must include several features that will enable the utility to expand services for customers. The list of factors includes:

- two-way communications;
- hourly interval data;

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[18] VT. PUB. SERV. DEPT., 2011 COMPREHENSIVE ENERGY PLAN, Vol. 1, at 11 (2011) [hereinafter CEP].

[19] SMARTPOWER PLAN, *supra* note 15, at 82.

[20] SmartPower Order, *supra* note 17, at 6–7.

[21] SMARTPOWER PLAN, *supra* note 15, at 83.

[22] SmartPower Order, *supra* note 17, at 14.

[23] SMARTPOWER PLAN, *supra* note 15, at 28.

- meter data management system integration;
- power outage notification;
- tamper detection alerts;
- remote upgrades;
- direct load control;
- web presentment integration;
- whole house service switch;
- home area network communication chip in meter; and
- end of line voltage recording.[24]

CVPS also sought a system that could support load control, outage management, and be accessible to third parties.[25] CVPS recognized that these features will help maximize the benefits enabled by AMI equipment for individual consumers and the electric grid as a whole.

Some of these features will enable new services as part of the initial AMI implementation, while other features will unlock opportunities for future services. For example, CVPS will present customers' hourly use information online via a secure customer web presentment portal to all residential and small commercial customers. This web presentment will display customer electricity use data online so that customers can access their own data. With this feature, customers who do not purchase in-home displays will still be able to take advantage of the data the meters collect. The web presentment will provide analytic tools that allow customers to see their consumption patterns over time and to perform "what if" scenarios to determine if there are utility rate options that might be more cost-effective for them based on these patterns. Initially, as a dynamic pricing option for all customers, CVPS will promote its newly refined, existing time-of-use rate,[26] which 76 customers currently use.[27] The new time-of-use rate (Rate 17) is an optional rate where all service is taken through one meter. The time-of-use rate is divided into

[24] *Id.*

[25] *Id.*

[26] *Id.* at 21.

[27] Amanda Beraldi, CVPS, Presentation at the 2010 Renewable Energy Vermont Distributed Generation Northeast Conference: Introduction to CVPS Smart Grid Project (May 19, 2010).

three pricing periods that are designated as peak, intermediate, and off-peak hours. Efficiency Vermont may also provide programs to help customers acquire and use in-home displays.[28] Moreover, customers will have flexibility to choose devices from third party suppliers that enable them to take advantage of understanding their real-time electric use.

As part of the eEnergy Vermont project funded by the U.S. Department of Energy, CVPS and Vermont Electric Cooperative are both conducting consumer behavior studies of a targeted subset of customers. The CVPS study focuses on testing the effectiveness of dynamic pricing and rebates, supported by information feedback to customers through the AMI enabled features, on lowering peak demand and total electricity usage. This research is scheduled to occur in Rutland, Vermont and will test a variety of means of communicating with customers to signal them to reduce their load, including but not limited to blinking lights on an in-home display, text messages, and email messages.[29] As one example of a new feature, customers can use in-home displays that show, in near real time, electricity use, prices, and other signals to help allow customers to reduce load.[30] In-home displays are one particular technological application that will compliment advanced meters and help consumers manage electricity use. As part of its consumer behavior study, CVPS will provide free in-home displays to roughly 600 Rutland customers who have agreed to participate in the research project. In addition, CVPS will offer an in-home display at no charge to an additional 250 customers who sign up for its refined "beta" time-of-use rate (previously Rate 9).[31]

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[28] SMARTPOWER PLAN, *supra* note 15, at 37.

[29] Remsen, *supra* note 14.

[30] SMARTPOWER PLAN, *supra* note 15, at 13.

[31] *Id.* at 21.

The CVPS consumer behavior study will explore dynamic pricing alternatives, including a study of 1,500 customers using Peak Time Rebate ("PTR") and Critical Peak Pricing ("CPP"). Under the PTR, customers will continue to pay the standard flat rate for electric service, but will be eligible for a rebate for reducing electric service during declared peak events. Under the CPP program, CVPS will offer customers a slightly discounted flat rate with substantially higher prices during a limited number of declared peak events. CVPS and its partners are offering financial and technical support for in-home displays as part of these initial research pilots to determine if it is cost-effective to offer ongoing financial assistance to customers for in-home displays. The consumer behavior study, which will continue into 2014, will provide CVPS and other eEnergy Vermont participants with valuable information about how best to design and implement future dynamic pricing alternatives and how best to combine these rates with appropriate means for customer feedback, including home technology alternatives. CVPS has been working with the Vermont Department of Public Service and other utilities to discuss new rate designs that are enabled by advanced meters.[32] CVPS has also developed an initial draft rates roadmap identifying the new rate offerings that may be introduced in the next several years.

LEGAL, REGULATORY, STRUCTURAL, OR OTHER INSTITUTIONAL BARRIERS

VERMONT POLICYMAKERS AND REGULATORS ENCOURAGE SMART GRID INVESTMENTS

In general, CVPS does not appear to have faced many significant legal or regulatory barriers in implementing CVPS SmartPower. Although CVPS has faced some hurdles, Vermont's policymakers and regulators have encouraged utility investments in smart grid infrastructure.[33]

In 2007, the DPS petitioned for, and the Board opened, an investigation into the potential use of advanced meters and time-of-use pricing.[34] In 2008, the Vermont Legislature also signaled an interest in

[32] SmartPower Order, *supra* note 17, at 8.

[33] One Public Service Board Order describes that the Department of Public Service "recogniz[es] that government policy-makers have been encouraging rapid development of smart-metering systems." MOU Order, *supra* note 5, at 34.

developing smart grid infrastructure.[35] The Legislature enacted the Vermont Energy Efficiency and Affordability Act ("Act 92"), requiring the Board to continue investigating opportunities for utilities to install advanced meters capable of sending two-way signals and enabling time-of-use pricing.[36] This legislation required the Board to compel utilities, in areas where the Board determined that it would be cost-effective, to file plans for deploying advanced metering equipment and advanced pricing programs.[37] The Board had to report its findings by December 31, 2008.[38] In 2009, the Legislature authorized public investments in integrating electric vehicles into the smart grid[39] and time-of-use rate schedules.[40] Finally, PSB Chairman James Volz has served on a Smart Grid Collaborative chaired by the National Association of Regulatory Utility Commissioners and the Federal Energy Regulatory Commission. This collaborative is facilitating state and federal cooperation on smart grid implementation.

The nature of statewide collaboration to date also reflects policymakers' general support for smart grid investments in Vermont. For example, as a condition of receiving the Smart Grid Investment Grant funds, several utilities had to commit to supplementing the grant with their own investments.

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[34] *See* Vt. Pub. Serv. Bd. Docket No. 7307, *supra* note 5.

[35] Vermont Energy Efficiency and Affordability Act § 10, Act 92 (2008).

[36] *Id.* § 10 (Requiring the scope of the Board's investigation to include: current status of implementing AMI in VT; experience from other states; opportunities for pilot programs and sharing experience in VT; analysis of cost/benefits; opportunities to reduce rates or mitigate rate impact; analysis of supporting/ancillary equipment and efficiency programs needed.).

[37] *Id.*

[38] *Id.*

[39] An Act Relating to Renewable Energy §13b, Act 159, 30 V.S.A. § 8008(b)(2)(F) (Amending the state's legislation regarding renewable energy programs and authorizing the Board to invest revenues from the transfer of certain renewable energy certificates in integrating electric vehicles into Vermont's smart grid infrastructure.).

[40] An Act Relating to the Vermont Recovery and Reinvestment Act of 2010, Act 78, 30 V.S.A. § 218(b)(3) (Providing, "an applicant may propose and the board may approve or require an applicant to adopt a rate design that includes dynamic pricing, such as real-time pricing rates").

CVPS and several other utilities petitioned the Board for permission to pledge corporate assets as required in the grant agreement.[41] A few days later the DPS recommended to the Board that it approve the petition without further study.[42] The Board promptly approved the petition, enabling the grantees to receive the funds from the U.S. Department of Energy without significant delay.[43]

Smart grid investments also fit nicely into the state's energy policy.[44] The Legislature has made clear that reliability, affordability, and efficiency are among the state's top energy priorities.[45] The utility's collaborative approach is expected to deploy advanced metering infrastructure across 85 percent of the state,[46] giving utilities the tools to respond to outages faster. Together, these initiatives suggest that, rather than impeding investments in smart grid equipment, Vermont's energy policy encourages and supports smart grid investments.

IMPACTS OF REGULATORY COST RECOVERY

Despite regulators' general encouragement of smart grid investments, the issue of cost recovery has posed some concerns for Vermont utilities, including CVPS. The utility's obligation to implement advanced metering infrastructure "as fast as reasonably possible,"[47] along with the rapid development of advanced metering technology, has raised concerns that some costs might be disallowed if cheaper

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[41] *See* Vt. Pub. Serv. Bd., Order Authorizing VT Utilities to Pledge Assets for a Smart Grid Investment Grant, Docket No. 7610 (Aug. 13, 2010) (approving Vermont utilities' petition to pledge assets in order to supplement funding from a Smart Grid Investment Grant from the U.S. Dept. of Energy.).

[42] *Id.* at 2.

[43] The Board granted the petition within four days.

[44] 30 V.S.A. § 202a.

[45] 30 V.S.A. § 202a(1).

[46] CEP, *supra* note 18, at 11.

[47] SmartPower Order, *supra* note 17, at 2.

prices or better technology emerged after the utility had already made its investment.[48] CVPS and other utilities attempted to address this concern in their Memorandum of Understanding with regard to smart grid investments.[49] Specifically, they proposed a ruling that would have required interested parties to object to investments only at the time those investments are made. The Board, however, declined to issue that ruling.[50]

The Board acknowledged, however, that investments in advanced metering infrastructure present special concerns with regard to whether they will be found to have been "used-and-useful" upon subsequent review.[51] Specifically, the Board noted that smart meters are an "evolving field" and "any early adoption has some risk" that the investment will soon be obsolete.[52] Understanding that smart grid infrastructure poses unique circumstances, the Board announced that advanced metering infrastructure made as part of an approved implementation plan "should be treated *as if* they are economically used-and-useful."[53] This declaration that advanced meter investments are, per se, used and useful demonstrates the Board's willingness to provide some accommodation to encourage investments in smart grid technology.

Nevertheless, the Board admonished utilities that its "determination that a Plan is acceptable will not shield a utility from a subsequent investigation and potential disallowance based upon the economic

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[48] MOU Order, *supra* note 5, at 34.

[49] *Id.*

[50] SmartPower Order, *supra* note 17, at 17–18. CVPS's SmartPower plan proposed that any material changed to the plan that had the support of the Department of Public Service would be filed with the Board and take effect 30 days later unless the Board took action. The Board rejected CVPS's proposed based on four rationales: it would create additional reviews; complicate annual reviews; lack a clear benefit to the utility; and the utility can protect itself by proposing modified plan if subsequent changes occur.

[51] MOU Order, *supra* note 5, at 35.

[52] *Id.* at 35–36.

[53] *Id.* at 36.

used-and-useful principle if events following approval should have led to an alteration of the AMI deployment."[54] The Board's determination, however, did not alleviate the utilities' concerns. In fact, the utilities requested clarification of the meaning of the Board's final caveat.[55] They argued that rapid changes in technology and the developing market for smart grid technology put important factors for satisfying the used-and-useful test outside of their control.[56] As a result, utilities feared that they could be penalized and denied cost recovery due to factors outside of their control.[57] The Board agreed, confirming that investments that are prudent at the time they are made and comply with an approved implementation plan will not be disallowed for not being used-and-useful due to circumstances beyond the utilities' control.[58]

Despite the Board's special concession regarding used-and-useful analysis for smart grid equipment, CVPS must undergo advanced review for specific investments in order to "have some greater guarantee of cost recovery."[59] CVPS's Implementation Plan describes that the utility will seek the DPS's review prior to each "major milestone financial commitment."[60] This review adds another layer of protection to guarantee that investments are prudent. However, it also adds to the cost of implementation and might slow implementation of major projects.

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[54] *Id.*

[55] Vt. Pub. Serv. Bd., Order Clarifying the "Used and Useful" Test for Smart Grid Investments, Docket No. 7307 (Nov. 16, 2009), at 2.

[56] *Id.*

[57] *Id.*

[58] *Id.* at 3.

[59] SmartPower Order, *supra* note 17, at 17.

[60] SMARTPOWER PLAN, *supra* note 15, at 79 (identifying major milestone financial commitments, including: Backhaul System, Meter Data Management System, Advanced Metering Infrastructure and Meters, and Master Station and Meter Install.).

CVPS does not appear to face significant regulatory barriers to cost recovery. The Board has balanced flexibility for investments in fast-developing technology with measures to ensure that decisions about major investments are prudent.

ENHANCING CUSTOMER VALUE FROM THE SMART GRID

One rarely reads an article or hears a story about smart grid investments that does not immediately refer to the potential benefits the smart grid may generate for electric utility customers. CVPS also advertises that a smart grid will be good for customers insofar as they can take advantage of additional information regarding their energy use and the price they are paying.[61]

Total smart grid investments in Vermont are expected to exceed $133 million.[62] CVPS alone expects to spend $60–65 million to implement CVPS SmartPower.[63] In its CVPS SmartPower Implementation Plan, CVPS makes clear its intention that "all benefits of the Plan accrue to customers."[64] Furthermore, CVPS believes that customer benefits from SmartPower will be "compelling"[65] and that these benefits could not be achieved without the smart grid.[66] Although CVPS warns that not all benefits will be quantifiable, or immediately perceptible, it plans to monitor several factors to assess whether expected benefits are realized until new metering equipment is in place and the costs are recovered.[67] For this reason, CVPS is extremely cautious about overselling the potential cost-

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[61] CVPS, ANNUAL REPORT, *supra* note 9, at 6.

[62] U.S. DEP'T OF ENERGY, OFFICE OF ELEC. DELIVERY AND ENERGY RELIABILITY, SMART GRID INVESTMENT GRANT PROJECT DESCRIPTION: VERMONT TRANSCO, LLC (2011).

[63] CVPS, ANNUAL REPORT, *supra* note 9, at 8.

[64] SMARTPOWER PLAN, *supra* note 15, at 81.

[65] *Id.* at 6.

[66] *Id.* at 29.

[67] *Id.* at 35, 81.

saving benefits for consumers, and the utility rarely, if ever, publicly predicts that customers will reap any financial benefits. Rather, CVPS markets additional control over electricity use as the primary benefit to consumers.

As evidence that some of the benefits may not be easily quantifiable, CVPS's proposal revealed a discrepancy regarding the timing of expected benefits from SmartPower.[68] This discrepancy reduced the Net Present Value of expected benefits by $280,000 to $500,000.[69] Nevertheless, CVPS expected the plan to yield a positive benefit and later clarified that the value of the benefit should be $1.41 million or $1.63 million, depending on the use of certain assumptions.[70] The DPS responded to this discovery and asked that CVPS use a more detailed process to measure and verify that benefits had accrued.[71] Later, in 2011, CVPS updated its business case for the CVPS SmartPower project. In this update, CVPS incorporated the cost and benefits associated with distribution automation into the plan and identified additional cost savings. These changes increased the Net Present Value of the project to roughly $7 million.[72]

CVPS is confident that deploying new meter technology, along with new services and customer education, will enhance customers' experience and give them opportunities to save money. The next section reviews some of the challenges CVPS faces in ensuring that CVPS SmartPower enhances value, the new and improved services CVPS plans to offer, and how CVPS is addressing the issue of privacy.

CHALLENGES

[68] SmartPower Order, *supra* note 17, at 3.

[69] *Id.*

[70] *Id*.

[71] *Id.* at 4.

[72] Vt. Pub. Serv. Bd., Order Approving Updated Business Case, Docket No. 7612 (Sept. 1, 2011), at 8 [hereinafter "Updated Business Case Order"].

Several factors make it difficult for CVPS to ensure that the smart grid enhances value for customers. As previously mentioned, the fast pace of technological development for smart grid equipment means that better or less expensive technology could emerge after investments have already been made. As a result, CVPS had to predict which investment would provide the greatest long-term value.

In addition, the scale of the investments needed to realize new benefits requires careful planning and deliberation. In order to realize the full benefits of the advanced metering infrastructure, a backhaul network and meter data management system must be installed.[73] These investments will be costly. CVPS has selected Siemens Energy, Inc. to install the company's meter data management system, which it expects to cost more than $5 million.[74] This expense is also identified as a major milestone financial commitment, demonstrating its cost and importance. As a major milestone, the selection of the management system was subject to the review process described in the SmartPower Implementation Plan.[75]

In late 2010, CVPS filed a modified plan and business case that explained the company's difficulty in finding a suitable intermediate network vendor. In order to fill this need, CVPS proposed to investigate whether it was feasible to take advantage of the Vermont Telephone Company, Inc.'s ("VTEL") investments in a 4G "Long Term Evolution" broadband network.[76] Using VTEL's broadband network to satisfy the communication needs that SmartPower presented would help reduce the cost of the SmartPower program by maximizing the use of existing or developing infrastructure. Using VTEL's

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[73] SMARTPOWER PLAN, *supra* note 15, at 5, 18 (CVPS sees these investments as "necessary prerequisites to the introduction of a fully functional Smart-Metering system.").

[74] *Id.* at 41.

[75] SMARTPOWER PLAN, *supra* note 15, at 79.

[76] Updated Business Case Order, *supra* note 72, at 2.

existing frequency, this collaboration will involve expanding the broadband network to unanticipated areas in order to accommodate the needs of CVPS's SmartPower plans.

In July 2011, CVPS, Green Mountain Power, and VTEL entered into an agreement to share the Company's 4G network to relay meter data.[77] Funding from the U.S. Department of Agriculture's Rural Utilities Service has enabled the development of the broadband system.[78] Funding from the utilities' smart grid investments will also allow VTEL to expand the network into areas where it might not have otherwise. VTEL expects the network to be complete by early 2013, only shortly after CVPS expects to complete installing the smart meters.[79] The leadership of Vermont Governor Peter Shumlin was instrumental in facilitating agreement among the parties.

As a result of the agreement, CVPS proposed a two-phase network implementation. To begin, CVPS will use a backhaul network composed of existing fiber, cellular, and land-line telecommunications infrastructure to serve CVPS SmartPower's digital communication needs until CVPS is satisfied that VTEL has developed a "Vermont-electric-utility-appropriate" network.[80] In part due to this concern, CVPS "stated that its decision to [use] a two-phased backhaul network approach involves 'significant risks' associated with the technological advances needed for deployment."[81] CVPS has described its position as being "on the bleeding edge of technology."[82] Indeed, relying on VTEL's 4G network will make CVPS and its partners the only utilities in the country to rely on a commercial 4G

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[77] Press Release, State of Vermont, GMP, CVPS and VTel Reach Smart Grid-Broadband Operating Agreement (July 20, 2011).

[78] *Id.*

[79] *Id.*

[80] *Id.* at 3.

[81] *Id.* at 8.

[82] Interview with Amanda Beraldi, Manager, Market Research & Strategic Planning; Jeff Monder, Chief Information Officer; et al., CVPS, in Rutland, Vt. (March 17, 2011) [hereinafter "CVPS Interview"].

Long Term Evolution network to convey smart grid data. While this collaboration could ultimately result in project cost savings and additional functionality for CVPS SmartPower, CVPS notes that some contemplated benefits could not materialize until the network, and equipment to interface with it, is ready and usable.

Another factor that could pose a challenge for ensuring customer value is the extent to which the benefits from CVPS SmartPower depend on how customers interact with the new technology and respond to price signals. For example, in May 2010, CVPS reported that only a quarter of its customers were familiar with the term "smart meter."[83] Representatives from the CVPS SmartPower team describe the majority of their customers as "cautiously optimistic" with regard to smart grid technology.[84] In addition to this majority, some customers are eager to experience the new smart meters, while others are skeptical about the changes. The effort required to educate more than 160,000 customers, and train them to manage their energy consumption for maximum benefit, poses a substantial challenge. However, early and ongoing customer education will help CVPS to integrate new smart grid equipment as seamlessly as possible by creating a foundation for customer acceptance.

EDUCATIONAL EFFORTS

Recognizing the important role that customers' actions will play in the success of the smart grid, CVPS has committed to provide early and ongoing education.[85] In early 2011, CVPS began to provide customer education as part of a detailed communication plan.[86] CVPS began educating customers about all new products and services released in conjunction with CVPS SmartPower.[87] This education and

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[83] Beraldi, *supra* note 27, at 10.

[84] CVPS Interview, *supra* note 82.

[85] SMARTPOWER PLAN, *supra* note 15, at 20.

[86] *Id.* at 24.

[87] *Id.* at 29.

outreach campaign included surveys, focus groups, and a well-developed print, radio, television, and social media campaign. CVPS has coordinated its surveys and focus groups with utilities across the country in order to learn from the responses and feedback other utilities have received. Marking a major increase in commercial advertising, CVPS's marketing campaign is intended to educate consumers and minimize potential concerns over new smart meters. Educational and outreach programs include presentations in communities and communication with customers through a variety of traditional and digital media. CVPS continues to conduct market research to gauge customer's awareness and expectations.

Importantly, CVPS's education and outreach campaigns began with educating its own employees. For example, CVPS has deputized specific CVPS SmartPower representatives, which the utility sends out into the community to give presentations, field questions, and serve as ambassadors for the utility in their own neighborhoods, religious groups, and other community associations.[88] CVPS also designated specific call-center employees to field questions related to CVPS SmartPower. In order to enable these call-center representatives to answer questions from experience, rather than just from a set of canned responses, CVPS is equipping the representatives with their own in-home displays to test, use, and experience. In addition, CVPS recognizes that customer education must be a collaborative process so that customers throughout the eEnergy Vermont partners' service territory will not have differing expectations.

IMPROVED SERVICES

Through SmartPower, CVPS will offer new and improved services, making the company's operations more efficient and providing customers new opportunities to manage their energy

[88] CVPS Interview, *supra* note 82.

consumption.[89] As noted previously, CVPS tends to be cautious in describing the potential benefits of SmartPower, preferring to "under-promise and over-deliver."[90] According to the SmartPower Plan, improved and expanded services will include new customer billing and rate options; direct and active load control; integration with in-home meter displays, distributed generation, and plug-in electric vehicles; automated meter reading; remote rate changes; web presentment; and tamper detection.[91] Additionally, CVPS's outreach materials cite benefits including improved power quality and better outage management.

Distributed automation offers one of the key benefits that CVPS expects to provide. Distributed automation will allow the utility to segment the grid remotely, which could aid in managing and minimizing the extent of power outages. Additionally, this functional control will enable the utility to maintain a consistently reliable quality of power. While customers might not necessarily see the benefits that distributed automation could provide, CVPS expects that customers will experience the benefits through better reliability and improved power quality.

With new billing and rate options, customers will have expanded opportunities to control energy consumption in a way that reduces expenses. Specifically, customers may choose to participate in direct load control programs. Load control often involves the utility remotely shutting- or cycling-down a customer's electrical equipment such as a water heater.[92] In exchange for voluntary participation in a load control program, a customer typically receives a reduction in their bill. CVPS already operates a

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[89] SMARTPOWER PLAN, *supra* note 15, at 6.

[90] CVPS Interview, *supra* note 82.

[91] SMARTPOWER PLAN, *supra* note 15, at 30–34.

[92] CVPS, Glossary of Terms, http://www.cvps.com/CustomerService/Glossary.aspx.

direct load control program through which it controls 18,600 water heaters.[93] Roughly 6,000 are already dynamically controlled.[94] Customers on CVPS's direct load control program are enrolled in Rate 3. This rate is for off-peak water heating and is available roughly 15 hours each day. Rate 3 charges consumers roughly $0.08/kWh.[95] Those already enrolled will eventually undergo dynamic load control. Eventually, CVPS intends to introduce active load control. Through active load control, a customer would agree to allow CVPS to turn pre-determined appliances on or off based on real-time prices.[96]

Although CVPS already provides online bill viewing and payment, advanced metering infrastructure will enable CVPS to provide electricity use data at more frequent intervals in its online presentment. Specifically, the web presentment will include actual electricity use data "as near to real time as is practical."[97] At the very least, all CVPS customers will be able to access their electricity use data online the next day.[98] This increased access to information is the cornerstone of potential customer benefit, giving customers the information to manage their electricity use. The additional data will also help inform energy efficiency service providers like Efficiency Vermont and give them additional information to provide more useful efficiency measures for Vermont ratepayers.

Furthermore, the new equipment will streamline CVPS's operating procedures. For example, advanced meters will give CVPS the capability to use automated meter reading, remote meter voltage detection, and remote meter rate change, allowing CVPS to detect outages sooner and respond to customer needs more quickly. The ability to read and communicate with meters remotely may also help

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[93] Beraldi, *supra* note 27, at 8.

[94] CVPS Interview, *supra* note 82.

[95] CVPS, General Service Rates, http://www.cvps.com/CustomerService/BusRates.aspx.

[96] SMARTPOWER PLAN, *supra* note 15, at 32.

[97] SmartPower Order, *supra* note 17, at 8.

[98] *Id.*

reduce the 300,000 service calls CVPS makes per year.[99] These changes will reduce operating expenses as automated technology makes some staff positions obsolete. In fact, CVPS has already started reducing meter reading staff positions "in anticipation of CVPS SmartPower operational efficiencies."[100]

PRIVACY

The more frequent and granular data that advanced metering infrastructure will provide creates a double-edged sword. As noted previously, this information will enable customers, CVPS, and Efficiency Vermont to understand how best to reduce electricity use and manage load. However, this same information could also risk exposing customers' information to unintended recipients. In other parts of the country, privacy concerns are generating opposition to some smart grid project rollouts and causing regulators to approach smart grid investments somewhat cautiously. Recently, those expressing such concerns in Vermont have become more vocal.[101]

The eEnergy Vermont partnership incorporates privacy among its guiding principles. Specifically, the guiding principles state that "[c]ustomer billing and usage data will not be shared with any third party without the consumer's consent except as required by law."[102] Still, the CVPS SmartPower implementation plan includes efforts to share customer electricity usage data with

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[99] Stephen S. George et al., MWConsulting, Final Workshop on Benefit-Cost Analysis for Advanced Metering and Time-Based Pricing (Jan. 15, 2008), slides at 30.

[100] SMARTPOWER PLAN, *supra* note 15, at 24.

[101] Opponents to smart meters in Vermont launched a campaign in January 2012 under the name "Wake Up, Opt Out!" This campaign warns CVPS customers of privacy and other concerns related to smart meters. The campaign aired radio advertisements challenging CVPS's trustworthiness in securely managing customers' data. Bruce Edwards, *Smart Meter Opponents Take to the Air*, RUTLAND HERALD, Jan. 30, 2012, *available at* http://www.vermonttoday.com/apps/pbcs.dll/article?AID=/RH/20120130/BUSINESS/701309949.

[102] EENERGY VT., GUIDING PRINCIPLES, https://www.burlingtonelectric.com/ELBO/assets/smartgrid/Guiding%20principles.pdf.

Efficiency Vermont.[103] CVPS has made clear, however, that as it shares information with Efficiency Vermont, it will protect the confidentiality of customer information.[104]

CVPS, which has historically followed practices to protect consumer data, is aware of the new privacy concerns that smart grid technology raises, although it has not yet published additional privacy policies specific to the smart grid. As a result, CVPS is moving forward with the continued protection of its customers' data, while considering how best to meet the new challenges of the smart grid. The DPS has proposed a "Statement of Principles Relative to Privacy" that is being discussed with the Vermont utilities and other parties as a possible supplemental memorandum of understanding.[105] One of the principles would require each utility to adopt a privacy policy consistent with the DPS's Statement of Principles that would be readily available to customers.

OPT-OUT POLICY

Controversy has arisen in states from California to Maine over various concerns with smart meter installation, such as health concerns associated with radio frequency radiation from meter communication devices. Recognizing this concern, CVPS has proactively implemented a smart meter opt-out policy for customers who choose to have the company provide a meter that does not use wireless communications.[106] The customer simply has to notify CVPS by telephone of their desire to opt-out.[107] If a customer opts-out from a meter at their premises, all meters associated with that premise must opt-

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[103] SmartPower Order, *supra* note 17, at 7.

[104] SMARTPOWER PLAN, *supra* note 15, at 37. In addition, the Public Service Board has previously noted that its contract with Efficiency Vermont requires that all customer data be kept confidential and prohibits the use of the data "for purposes other than providing Board-approved energy efficiency utility services. Vt. Pub. Serv. Bd., Order In Re Village of Hyde Park Electric Department, Docket No. 6379 (June 23, 2000), at 1.

[105] Hallenbeck, *supra* note 12, at 1A.

[106] CVPS & GMP, Jt. Reply Cmts., Investigation into Vermont Electric Utilities' Use of Smart Metering and Time-Based Rates, docket No. 7307 (Dec. 16, 2011), at 15.

[107] CVPS, The Facts: Answers to Your Questions, http://cvps.com/ProgramsServices/smartpower/TheFacts/AnswersToYourQuestions/index.asp#answerSix.

out. Additionally, that customer would no longer be able to use time-of-use rates with the wireless meters that serve as the time-of-use communication device. Customers who choose to opt-out must pay an additional service charge of $10 per month for each meter.[108]

IMPROVING RELIABILITY

CVPS has suggested that its CVPS SmartPower program should improve reliability. For example, Bruce Bentley, leader of CVPS's Transmission Tariff, Integrated Planning, and Regulatory Team, has written that using smart meter technology to help integrate distributed generation, monitor electric loads, and assess and implement demand side management options can help improve reliability.[109] In addition, automatic distribution switches could enable CVPS to repair problems sooner and avoid loss of power.[110]

MEETING CLEAN ENERGY GOALS

These rooftop SunPower solar panels are delivering clean energy into the CVPS grid.

Both the State of Vermont and CVPS have viewed clean energy as an important component of meeting the state's electricity needs. For example, in 1999 the Vermont legislature created an energy efficiency utility, Efficiency Vermont, which achieves enough electricity savings to make it "Vermont's second largest power plant."[111] In addition, Vermont offers a net metering program and a

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[108] CVPS & GMP, *supra* note 106, at 15.

[109] SCUDDER PARKER & BRUCE BENTLEY, USING THE SMART GRID INTELLIGENTLY, 2010 ACEEE SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS 7, eec.ucdavis.edu/ACEEE/2010/data/papers/2057.pdf.

[110] *Id.* at 3.

[111] *Id.* at 5.

feed-in-tariff to support distributed renewable energy generation. CVPS has also been active in renewable energy through its CowPower™ program, which generates energy from methane digesters on several dairy farms, and through solar and wind investments. Although Vermont's 2011 Comprehensive Energy Plan calls for a smart grid that will help expand renewable energy projects, the CVPS SmartPower program was not developed in pursuit of a particular clean energy goal.[112]

Nevertheless, CVPS expects that advanced metering infrastructure might play a role in expanding the deployment of renewable resources. In particular, this benefit would likely take the form of distributed automation facilitating group net-metering projects. SmartPower could also benefit renewable energy deployment by providing more intricate data to inform load forecasting and, therefore, stabilize intermittent resources and improve reliability. In addition, Bruce Bentley has described other means by which advanced metering infrastructure could expand renewable energy generation.

Smart Meters on Net Metered distributed generation will provide CVPS and the customer with more detailed information on renewable energy generation than this conventional meter.

Specifically, Bentley notes that the cost of connecting and metering new distributed resources have barred some smaller projects. However, advanced meters with heightened communication capability will reduce the cost of measuring and reporting data for electricity generation. Additional data regarding generation from distributed resources may also inform interconnection studies and help utilities avoid "burdensome analyses and expensive interconnection system changes."[113] Moreover,

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[112] CEP, *supra* note 18, at 3.

[113] *Id.* at 10.

integrating distributed generation output data with other information, such as weather data, can improve forecasting generation from intermittent resources like wind and solar.

In addition, Bentley notes that time-of-use rates, which CVPS already employs and which will be easier to implement after advanced meters are installed, could make some renewable energy options more attractive. For example, rate designs with higher peak costs could spark increased interest in solar photovoltaic systems by increasing net metering rates during the day. Solar thermal systems could also see increased interest if electric rates made the investment a more cost-effective option for offsetting hot water during the day.

The data and hardware necessary to reap these benefits, however, will not come overnight. Bentley and his colleagues are careful not to oversell how smart grid technology might benefit renewable energy. They acknowledge its possibility but note that it will take time to install the necessary equipment and acquire the data to help integrate additional renewable energy generation. In fact, CVPS does not plan to incorporate distributed generation until 2014.[114]

INTEGRATING ELECTRIC VEHICLES

Plug-in electric vehicles such as this Chevrolet Volt are for sale locally now.

Similarly, CVPS expects that smart grid technology will eventually help integrate electric vehicles and help schedule charging cycles appropriately.[115] It is important to note, however, that integrating electric vehicles through smart grid applications will not occur until customers become familiar with advanced meters and associated rate

[114] SMARTPOWER PLAN, *supra* note 15, at 34.

[115] *Id.* at 4; PARKER & BENTLEY, *supra* note 109, at 11.

designs. As a result, although CVPS recognizes both that the smart grid can enable broader use of electric vehicles and that electric vehicles might be used to help stabilize intermittent resources down the road, it is not focusing on vehicle to grid applications at this stage. Nevertheless, CVPS intends to use its newly refined existing time-of-use rate as a separate rate for electric vehicles.

CONCLUSION

Vermont has long been known for innovation and forward-thinking in the field of energy efficiency. The statewide smart grid investments taking place will help keep Vermont in the front of the pack in this and related areas. The following are several notable lessons learned from Central Vermont Public Service's smart grid implementation planning:

STATEWIDE COLLABORATION IS SPURRING PROGRESS AND INNOVATION

Collaboration is arguably the most important lesson that the CVPS study provides. Collaboration has made developing and implementing CVPS SmartPower, as well as other utilities' smart grid investments, more efficient, cost-effective, and technically sound. As part of the statewide smart grid effort, CVPS has been able to share analysis with other utilities, like Green Mountain Power, which reduced costs in selecting AMI equipment. This collaboration also likely made eEnergy Vermont's Smart Grid Implementation Grant application more attractive to the U.S. Department of Energy. As one of the only statewide grant applications, the Vermont collaborative model provided a unique feature for the Department of Energy to nurture. As previously noted, the former state director for U.S. Senator Patrick Leahy called the level of coordination from the utilities "frankly inspiring."[116] In particular, leadership, innovation, and collaboration evidenced by partners in Vermont were key factors in moving toward the dual goals of universal broadband coverage and a smart electric grid. This effort is likely worth studying and replicating elsewhere. To date, this collaboration makes CVPS and Green Mountain

[116] Hallenbeck, *supra* note 12, at 1A.

Power the only utilities in the country to rely on a commercial 4G LTE network to communicate smart grid data. This coordination is expected to result in both increased coverage for VTEL's network and cost savings for the utility customers.

CLEAR POLICIES SPEED SMART GRID RESULTS

Vermont's energy policy and regulatory agencies have developed a clear record of supporting cost-effective smart grid investments. Since 2007, Vermont's Legislature and Public Service Board have been inquiring into the development of smart grid infrastructure and dynamic rate options. This effort has effectively balanced flexibility for investments in a rapidly developing field of technology with measures to ensure those investments are prudent.

CONSUMER OUTREACH AND RESEARCH LEADS TO MORE EFFECTIVE IMPLEMENTATION

With their efforts at consumer outreach and consumer behavior research, CVPS is laying the groundwork for a smooth transition in its smart grid implementation. From training call center technicians to answer and properly route smart grid questions and deputizing staff members as smart grid ambassadors in their community to developing print and web-based educational materials, CVPS has moved forward quickly with efforts to educate customers. Building awareness, encouraging customers to accept the new technology, and demonstrating the advanced meters' benefits should help CVPS ease the transition and acclimate customers to advanced meters and the additional services they enable. In case some customers are concerned about issues such as radio frequency radiation from wireless meters, CVPS is prepared with a streamlined smart meter opt out policy. The CVPS consumer behavior study should provide CVPS with valuable information on how to both structure dynamic pricing tariffs and encourage the utilization of technology that will unleash the capabilities of the smart meters, which will lead to more efficient utilization of energy.

One area where more work needs to be done is formalizing a customer data privacy policy. Vermont's utilities and regulators have both expressed a strong interest in protecting the privacy of the

more granular customer data that the smart meters collect. The Vermont Public Service Board, through recent workshops and filings, is reviewing the establishment of privacy principles. These principles would include the development of a clear utility smart grid privacy policy that would be available to customers. The imminent rollout of new meters makes it important for CVPS and Vermont regulators to complete the development of a transparent smart grid privacy policy to clearly inform customers about their privacy rights and responsibilities.

Finally, these efforts mark a starting point, rather than an ending point, for CVPS and Vermont in establishing a truly Smart Grid. To be sure, the implementation of smart meters and related AMI investments represent an important step in smart grid implementation. Yet, in many ways it is only the first phase. The Electric Power Research Institute has estimated that, nationally, fully implementing a smart electric grid will cost between $1.3 and $2.0 trillion, with benefits likely exceeding costs by a factor of three or more.[117] This represents a significant amount of additional investment compared to the $3.4 billion of Smart Grid Investment Grants from the U.S. Department of Energy. The additional investments will need to be made in future years and will involve ongoing negotiation with regulators and other parties.

Research from Pacific Northwest National Laboratory has estimated that with full implementation of a smart electric grid by 2030 U.S. energy consumption and carbon emissions could be reduced by 12 percent.[118] A smart electric grid allows utilities to expand energy efficiency and demand response services to all customers, and the results of the CVPS consumer behavior study will assist in expanding these services. Yet, as noted previously, it will take time to develop and offer additional technologies and rates to customers. In some areas, however, the smart grid will likely spur

[117] Elec. Power Research Inst., Estimating the Costs and Benefits of the Smart Grid 1–4 (2011).

[118] Pacific Northwest Nat'l Lab., The Smart Grid: An Estimation of the Energy and CO2 Benefits 3.3 (2010).

greater electricity use, such as smart charging of electric vehicles, in order to achieve efficiencies in total energy use across the economy.

Continued investment in automation of the utility distribution system will offer future opportunities for improving reliability and optimizing energy use. In order for electric vehicles to reach the levels of consumer adoption included in PNNL's analysis, there will need to be significant new policies at all levels of government and the build-out of new infrastructure. Furthermore, as renewable energy reaches higher levels of development across the utility service territory, greater investment in smart grid technologies will be needed in order to reliably and cost-effectively manage these resources.

At CVPS and across Vermont, smart grid implementation is off to a productive start. Ongoing policy refinements, project development, and infrastructure investment will be needed in order to achieve the smart grid's full, long-term potential.

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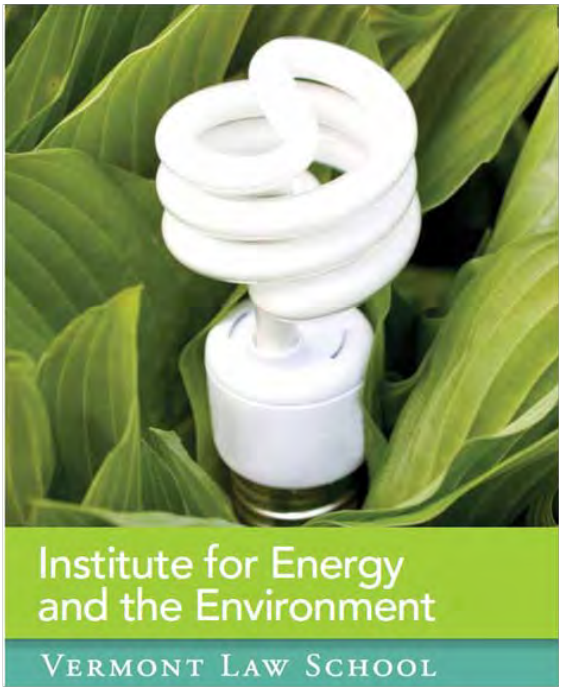

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