A Good Time to Double Down on Data Analytics and Network Capabilities

Now is an opportune moment for electric utilities to consider investments in big data collection, analytics, and networking capabilities. In particular, one high-profile policy driver has the attention of nearly every utility in the country: the Clean Power Plan put forward by the U.S. Environmental Protection Agency (EPA). The ability to collect, prioritize and analyze relevant data will be vital for utilities' responses to the Clean Power Plan—from advocating at the state and federal level to proving compliance to profiting from carbon emissions trading.[1] Equally as important as the Clean Power Plan, but grabbing fewer headlines, are underlying trends in the flows and use of energy and data. Distributed energy resources and shifting load profiles mean that grid operators need increasingly sophisticated and timely data analysis for reliability purposes. That data is increasingly available from smart and interconnected grid sensors, meters, and other components. However, utility information technology (IT) and operational technology (OT) systems face a hefty challenge to keep pace with the networking, cybersecurity, and data analytics issues raised by these multi-directional torrents of data.

Those on the front lines implementing IT and OT networks often know how utility networks could be improved to meet business objectives and close security vulnerabilities. However, expenses for data analytics and network upgrades compete with other utility spending priorities. The Clean Power Plan offers one catalyst for IT, OT, and data analytics investments, and those same investments can be useful to address the broader networking and security challenges of an interconnected grid. Furthermore, if architected correctly up front, such investments have the potential to address a host of other industry pressures: improving efficiency, safety, and customer operations; providing reliable service despite aging infrastructure and flat loads; and addressing lurking and evolving cyber threats. Insights from big data may even lead to non-regulated revenue opportunities if utilities can monetize valuable data assets with appropriate privacy and cybersecurity safeguards.

Data and the Clean Power Plan

EPA released the final Clean Power Plan on August 3, and savvy use of data will likely underpin successful utility responses. In simplified terms, the Clean Power Plan sets carbon emissions reduction goals for existing power plants, both on an emissions rate basis (lb/MWh) and on a total mass basis (short tons of CO_2).[2] EPA has set interim and final emissions reduction goals for each state, to be achieved by 2022 and 2030 respectively.[3] States are to develop and implement multi-state plans to achieve the emissions reduction goals, choosing either an emissions rate approach or a mass-based goal.[4] States' final plans are due by September 2016, with extensions available to September 2018.[5] If EPA determines that a state has not submitted a compliant plan, it will impose a federal plan on that state. The proposed model federal plan contemplates carbon emissions allowance trading between power plant owners.[6] There will be winners and losers in a carbon emissions trading scheme, and utilities that can buttress their positions with serious big data analysis may gain an upper hand. The ability to collect, organize, and archive that data for analysis will require significant IT and OT firepower.

Solid data analysis may lend credibility to utilities' requests for funds, allowances, credits, waivers, and other resources related to the Clean Power Plan. For example, the final Clean Power Plan's CO_2 emissions reduction targets favor renewable energy sources over natural gas-fired generation much more strongly than the proposed rule released in 2014.[7] Whether utilities are supportive or skeptical, they will need to collect and analyze granular data to assess how variable generation at the levels contemplated by the Clean Power Plan will affect system assets and grid reliability. Utilities will need to marshal sophisticated data collection and analysis to support requests for resources to meet projected reliability needs. In addition, as states ponder their

By Mark Wiranowski

Continued on page 40

Data Analytics and Network Capabilities

Continued from page 39

state plan requirements, utilities will almost certainly want to weigh in, including on how emissions allowances will be allocated. Utilities' ability to advocate can be buttressed by detailed analysis of reliability, power plant cycling, line losses, and other factors affecting total carbon emissions.

In addition to advocacy, compliance and profitability will require data collection and analysis. For example, for emissions allowance trading, the devil will be in the measurement and verification details to prove how many or how few allowances have been used or generated. Analysis of grid operations and customer data could also identify energy efficiency measures (by customers or on the grid) that are profitable under a trading regime but might not otherwise be sufficiently incentivized. For example, a 1 percent fuel savings across the U.S. in natural gas-fired power generation would provide fuel cost savings of $66 billion over 15 years, but utilities typically can't capture that savings under regulatory regimes.[8] However, utilities' ability to sell unused emissions allowances at a profit might change the equation. Additionally, the Clean Power Plan includes a safety valve and other flexibility mechanisms to address reliability concerns.[9] This means that utilities may get a free pass for some emissions that are related to reliability under discrete sets of circumstances. Making that case will require timely data analysis to identify and verify the reliability need and quantify the related CO_2 emissions.

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Underlying Trends in Energy and Data

Aside from the Clean Power Plan, other changes in energy flows and use are also impacting utilities' needs for data. Renewable energy resources, especially increasing penetration on the distribution grid, raise important grid operation questions.[10] Utilities can and should advocate for the resources to assess and mitigate reliability concerns. For example, distributed solar raises questions about the effects of "high saturation" solar, effects on peak demand and distribution system line losses, and differential effects across heavily and lightly loaded circuits.[11] Battery storage is another technology development that utilities are closely watching. Battery storage has the potential to provide similar services to demand side resources but can potentially be included in rate base. Identifying profitable opportunities for battery storage and integrating this new technology onto the grid have significant IT and OT implications. There are plenty of additional ways to profit from better data collection and analysis, including reduced energy theft or asset maintenance and replacement costs, as well as improved operations, emergency response, product offerings, and credit risk management from integrating outside data sources such as granular weather data, social media feeds, geodemographic data, and credit scores.[12]

Data relevant to all of the above are already being collected, but stronger capabilities are needed to harness the data for business and policy imperatives. Smart and connected grid components have proliferated at a compound annual growth rate of 45 percent in the last five years, yielding small mountains of system and customer data.[13] This includes smart meters measuring customer usage, as well as sensors throughout the grid such as phasor monitoring units that collect voltage, current, and digital status 30 times per second.[14] At present, utilities are collecting much more data from smart grid components than they are analyzing.[15] In part, this may be a capability problem. Many state-of-the-art utility IT systems cannot analyze the massive volumes of data, link the data to the state of the grid at the time of collection, or even archive the data sensibly.[16] To address the monumental challenges of carbon regulation under the Clean Power Plan, along with a host of other industry-wide issues, utilities will need to make sense of the terabytes of data flowing into utility data centers.

Software defined networks (SDN) and other agile structures will be particularly important to meet moving policy and business targets. It is likely that new sources of data on the grid—sensors, smart components, and control systems—will continue to develop, so networking and data

analytics priorities may shift rapidly. SDN technologies can increase the capabilities that IT and OT have at their disposal to increase automation, optimization, and control. SDN can also prevent having to approach regulators time and again for new system overhauls. All of this will require plenty of behind-the-scenes wizardry from IT and OT administrators.

Cybersecurity

It almost goes without saying that an increasingly interconnected grid with growing access points and variously sourced components implicates very real cybersecurity concerns. Unfortunately, it may need to be said more. Despite large increases in cyberattacks and cyber threats, public utilities actually took *fewer* precautions last year as compared with the previous year according to a PricewaterhouseCoopers report.[17] Although the North American Electric Reliability Corporation sets enforceable cybersecurity standards for critical infrastructure protection, those standards only apply to the bulk power grid, potentially leaving unaddressed the protection of the distribution grid and customer usage data. Moreover, compliance with standards does not necessarily mean greater security; evolving cyber threats necessitate a risk management approach, significant technical operations, and continuous improvement.[18] The threat from outsourced components that include an IT or communications technology element has also grown rapidly as utility supply chains have evolved.[19] Moreover, as organizations adopt new data capture and analysis techniques, they must be mindful of both endpoint security (i.e., Internet of Things) as well as software assurance. The energy industry is often fond of open source software projects, which have their place but require significant risk management to mitigate common vulnerabilities in design, process, and implementation.

Whereas responding to the Clean Power Plan is currently a "top of mind" issue for utility executives, cybersecurity could be described as a "pit of stomach" issue. The vulnerabilities and threats are uncertain, rapidly evolving, and highly technical, and the motivations of groups interested in chaos or compromising national security through attacks on the electric industry are an ominous question mark. Vendors, contractors, and customers don't want to shoulder the risks, so utilities may be left holding the bag. Furthermore, both critical infrastructure and the privacy of increasingly detailed customer energy usage data are at stake in cyberattacks. Attacks on industrial control systems are not theoretical. Since Stuxnet, several advanced threats have been identified, and the cyberattack on a German steel mill destroyed an actual blast furnace.[20] In addition, highly sensitive personal data has been swiped from the likes of JP Morgan Chase, Anthem, and the IRS, among many others.[21] Customer energy use data is extraordinarily revealing of activities in the home or building, and it may only be a matter of time before an enterprising hacker group targets this data gold mine.[22] Furthermore, failing to safeguard customer data adequately could also result in Federal Trade Commission enforcement under its broadened cybersecurity authority.[23]

The Data Investment Opportunity

The environmental policy challenges are making headlines, utility regulators are becoming accustomed to approving data collection, analysis, and networking expenditures, and the need is real.[24] Now is a very good time to think about bundling investments in networking, cybersecurity, and big data analytics. Data and networking capabilities may help formulate utilities' responses to the Clean Power Plan and may help utility executives concerned about cybersecurity and a host of other industry pressures sleep better at night. Such investments, and a willingness of utilities to become more data-driven organizations, may also be key to addressing changing utility business models. As a National Association of Regulatory Utility Commissioners staff person put it, "I think the data is going to be worth a lot more than the commodity that's being consumed to generate the data."[25]

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Continued on page 42

Data Analytics and Network Capabilities

Continued from page 41

NOTES

1. This article takes no position on the legality of the final Clean Power Plan. Instead, this article assumes either that the Clean Power Plan survives inevitable legal challenges in whole or in part or that utilities may need to plan for such survival.
2. "Factsheet: Overview of the Clean Power Plan: Cutting Carbon Pollution from Power Plants," U.S. Environmental Protection Agency, at 3-4 [Clean Power Plan Factsheet]. Available at http://www.epa.gov/airquality/cpp/fs-cpp-overview.pdf.
3. The final rule includes step-downs over the 2022 to 2029 interim period, providing a glidepath for compliance with the final emission reduction goals.
4. Id. at 5-6.
5. Id. at 8.
6. "Federal Plan Requirements for Greenhouse Gas Emissions from Electric Utility Generating Units Constructed on or Before January 8, 2014; Model Trading Rules; Amendments to Framework Regulations," Proposed Rule, U.S. Environmental Protection Agency, August 3, 2015, at 250. Available at http://www.epa.gov/airquality/cpp/cpp-proposed-federal-plan.pdf
7. Scott Detrow and Elizabeth Harball, "Final Clean Power Plan shifts toward renewables and away from natural gas," E&E ClimateWire, August 4, 2015.
8. Knowledge@Wharton, "Special Report: Sustainability in the Age of Big Data," September 2014.
9. Clean Power Plan Factsheet, at 7-8, supra note 1.
10. "Innovations Across the Grid, Volume II: Partnerships Transforming the Power Sector," The Edison Foundation, Institute for Electric Innovation, December 2014 [Innovations Across the Grid], at 13.
11. See e.g., id. at 26-27.
12. See Oracle, "Utilities and Big Data: Accelerating the Drive to Value," July 23, 2013 [Drive to Value]; Karnad, Ravi Murali Chandrahasan, Tata Consultancy Services, "Building the Future Smart Utility through IT OT Integration: Leveraging on Asset Information Management Framework," October 1, 2014; Innovations Across the Grid at 37, supra note 8; Ray, Sumit Kumar and Somenath Kundu, Tata Consultancy Services, "White Paper: Reimagining Customer Care for Utilities during Storms," March 25, 2015; IBM, "White Paper: Managing Big Data for Smart Grids and Smart Meters," May 2012.
13. Quitzau, Anders, IBM, "Transforming Energy and Utilities through Big Data Analytics," Slide deck, May 28, 2014.
14. McMahon, Jeff, "Utilities Dumbstruck by Big Data from Smarter Grid," Forbes.com, September 25, 2013 [Big Data from Smarter Grid]. Available at http://www.forbes.com/sites/jeffmcmahon/2013/09/25/utilities-dumbstruck-by-big-data-from-smarter-grid.
15. Drive to Value, supra note 10.
16. Big Data from Smarter Grid, supra note 12.
17. Blake Sobczak, "Power sector slips in cybersecurity 'fundamentals'—report," E&E EnergyWire, June 1, 2015.
18. Miles Keogh and Christina Cody, "Cybersecurity for State Regulators 2.0," National Association of Regulatory Utility Commissioners, February 2013, at 9.
19. Nadya Bartol, "Cyber Supply Chain Risk Management for Utilities: Roadmap for Implementation," Utilities Telecom Council, April 2015. Available at http://www.utc.org/sites/default/files/public/UTC_Public_files/SupplyChain2015.pdf.
20. Del Rodillas, "Spotlight on Advanced Persistent Threats in Industrial Control Systems," Palo Alto Networks, July 15, 2015. Available at http://researchcenter.paloaltonetworks.com/2015/07/spotlight-on-advanced-persistent-threats-in-industrial-control-systems/.
21. See "Latest News," Data Breach Today, www.databreachtoday.com.
22. Lee Tien of Electronic Frontier Foundation, quoted in Perera, David, "Smart Grid Powers up Privacy Worries," Politico, January 1, 2015 [Smart Grid Powers up Privacy Worries]. Available at: http://www.politico.com/story/2015/01/energy-electricity-data-use-113901.html.
23. Katie Bo Williams, "Appeals court rules FTC's authority extends to cybersecurity," The Hill, August 24, 2015. Available at: http://thehill.com/policy/cybersecurity/251803-appeals-court-ftcs-authority-extends-to-cybersecurity.
24. See e.g., Application of Pac. Gas and Elec. Co. for Auth., Among Other Things, to Increase Rates and Charges for Elec. And Gas Serv. Effective on Jan. 1, 2014 (U39M); And Related Matter, Decision No. 14-08-032, Cal. Pub. Util. Comm'n, Application No. 12-11-009, 2014 Cal. PUC Lexis 395 (August 14, 2014) (approving substantial investments in data infrastructure spending).
25. Miles Keogh, Director of Grants and Research, National Association of Regulatory Utility Commissioners, quoted in Smart Grid Powers up Privacy Worries, supra note 19.