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Big Data: Opportunities and Constraints for Gas Utilities

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Executive Summary

Big data is changing the game across the economy and could bring significant changes – and opportunities – to the gas utility sector. "Smart" and connected system components can generate massive volumes of both system and customer usage data. Mobile technologies, electronic mapping and even social media feeds could fundamentally change approaches to safety, operations and customer service. Although the possibilities for these data suggest great promise, the pertinent questions for gas utilities are how valuable are the data they could collect and what are the costs and risks of investing in data capabilities. For regulated gas utilities, these questions imply two further inquiries: what is the regulatory case for investing in data capabilities and what are the unregulated revenue opportunities.

Unlike companies in less regulated industries, gas utilities' calculus is not as simple as investing in data capabilities to pursue market opportunities and outpace competitors. Data capability investments must provide value to the regulated business and be justifiable to regulators. Due to the unique safety requirements of gas pipelines, relevant investments may well be justifiable on the basis of safety, incident management and operational improvements. Moreover, a phased approach to data investment holds promise for regulatory approval. With any proposed investments in data capabilities, gas utilities must also address related cybersecurity issues.

Unregulated revenue opportunities may present themselves when gas utilities have data capabilities in place. Use of data for unregulated revenue opportunities raises issues of subsidization and privacy. To avoid criticism that ratepayers are subsidizing unregulated commercial ventures, investment in data capabilities for the regulated business should stand on its own merits. Privacy issues surface mainly in the context of the use of individual customer usage data for unregulated commercial purposes, including selling the data. However, state commission privacy rules primarily address smart meter data, which gas utilities may not collect, and generally include exceptions for aggregated or anonymized customer usage data. Big data is here. If gas utilities can develop the tools, people and culture to capture value from big data, they can be proactive about creating benefits for the regulated business and recognizing new unregulated revenue opportunities, rather than scrambling to catch up with regulatory and public demands.

As discussed in this paper, investment in data capabilities means more than collecting "big data" or buying software. It means investing in the tools, people and culture to drive better business decisions through the use of data. Big data is commonly described in terms of four "V's": massive volumes of data; high velocity at which data can or must be integrated and analyzed; wide variety in the types of data encountered – from raw sensor feed to unstructured

video and audio files; and the costs and ability to trust the veracity of data.[1] Big data can also be thought of as the idea that large data sets can be used to learn interesting relationships not obvious at first glance or unavailable in smaller data sets.[2] Collecting and storing accurate data is a start, but high-performance analytics and data scientists are also needed to deliver value.[3] Business insights come from people who can think about data in new and scientific ways and can connect data insights with business goals and customer needs.[4] Fostering a data-centric culture also requires top-down leadership and bottom-up employee engagement.[5]

Growth of Big Data in the Utility Sector

With the advent of smart components, interconnected systems and mobile applications that can collect mountains of information, gas utilities have entered the age of big data. By one account, connected devices in public utility industries have grown at a compound annual growth rate of 45% in the last five years.[6] Advanced mapping, leak detection and other new techniques create opportunities for gas utilities, but also may create public pressure to meet higher standards driven by the availability of new techniques for data collection and analysis.[7] Social media poses large potential public relations risks, for example when anyone with a smart device can take pictures or video of pipeline operations or incidents, but also provides the potential to guide business decisions.[8] All of these devices and data inputs contribute to big data opportunities, and threats, in the utility industry.

Big data is widely recognized in business circles to provide value, both for a company's internal purposes, such as improved operations, customer service and product development, as well as for sale to advertisers.[9] The media regales us with stories of data's value: big data companies raise massive capital, go public and get acquired for high dollars;[10] the most valuable asset in the bankruptcy of the venerable Caesars casino may be data on players valued at $1

[1] Knowledge@Wharton, "Special Report: Sustainability in the Age of Big Data," September 2014, at 1.
[2] Electronic Frontier Foundation, "Big Data in Private Sector and Public Sector Surveillance," Comments to the White House Office of Science and Technology Policy, Big Data RFI, OSTP-2014-0003-0001, at 1.
[3] Neil Biehn, "The Missing V's in Big Data: Viability and Value," Wired, Community Content, available at: http://www.wired.com/2013/05/the-missing-vs-in-big-data-viability-and-value/.
[4] The Economist Intelligence Unit Ltd. and Teradata, "The Virtuous Circle of Data," 2014, available at: http://s3.amazonaws.com/wavecast-production/wavecast-platform/sites/247/2014/12/The-Virtuous-Circle-of-Data.pdf, at 6.
[5] *Id.*
[6] Anders Quitzau, IBM, "Transforming Energy and Utilities through Big Data & Analytics," May 28, 2014, available at: http://www.slideshare.net/AndersQuitzauIbm/big-data-analyticsin-energy-utilities.
[7] *See e.g.*, Geospatial Corporation, "Geospatial Maps New Natural Gas Pipelines beneath Multiple Waterways," (undated), available at: http://www.geospatialcorporation.com/case-study/geospatial-maps-new-natural-gas-pipelines-beneath-multiple-waterways; GE Oil & Gas and Al Shaheen Joint Venture, "Pipeline mapping from PII Pipeline Solutions," available at: https://www.geoilandgas.com/sites/geog.dev.local/files/ge_pii_mapping_jv_bim-111914.pdf .
[8] Toby Little, "The Data Pipeline: Social Media Analytics at Union Gas," Social Media for Business Performance program at University of Waterloo, Canada, July 1, 2015, available at: https://smbp.uwaterloo.ca/2015/07/the-data-pipeline-social-media-analytics-at-union-gas/.
[9] Rasmus Wegener and Velu Sinha, Bain & Company, "The Value of Big Data: How analytics differentiates winners," 2013, available at: http://www.bain.com/Images/BAIN%20_BRIEF_The_value_of_Big_Data.pdf.
[10] Gil Press, "Big Data Startups News: Funding, Acquisitions and IPOs Q4 2014," Forbes.com, January 30, 2015.

billion;[11] even within the utilities sector we hear that data will likely be more valuable than the commodity used to create it.[12] However, regulated utilities do not operate under the same incentives and opportunities that are prompting relatively unregulated businesses to invest heavily in data capabilities. Gas utilities considering investments in data capabilities must evaluate both the public interest case with respect to regulated activities, and the potential for unregulated activities to be both profitable and permitted by regulators.

Big data is here, whether gas utilities are ready or not. The business decision is whether to leave a potential source of information and revenue inert as the economy and the gas industry transitions to a data-rich future, or whether and how to capitalize on a potential new opportunity. Put this way, having big data capability is not an either/or proposition; it is a crucial investment for the gas business going-forward.

Investments in Data Capabilities: the Regulatory Case

Investment in data capabilities for gas utilities' regulated business likely stands on its own merits, particularly when safety is at stake. Gas pipelines have unique safety requirements, and regulators may find that the public interest justifies data investments that can promote safer operations and better incident response. Investments in the collection of more accurate pipeline and safety data can include global positioning systems (GPS), "smart" sensors, mobile inputs from field crews, new leak detection technologies and even social media feeds from the public. Investments in analytics can draw insights from relationships across many kinds of data to develop more powerful risk assessments. Finally, investments in data accessibility and transmission can enable easy access and multi-directional internal flows of information to improve operations, incident response and public-facing communications. It is a sobering thought experiment to consider whether accurate information, powerful analysis and timely and efficient flows of information could have avoided apparent missteps in past safety failures such as the 2007 explosion of a home in Saratoga Springs, Utah.[13]

The direct connection between data capabilities and pipeline safety is explicit in the 2014 California Public Utility Commission (CPUC) decision approving major spending on data investments for the gas business of Pacific Gas & Electric Company (PG&E).[14] The CPUC emphasized the primacy of safety considerations in its decision: "[a]mong public utility facilities, natural gas transmission and distribution pipelines present the greatest public safety challenges."[15] One major portion of data infrastructure spending in PG&E's request was a

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[11] Kate O'Keeffe, "Real Prize in Caesars Fight: Data on Players," Wall Street Journal, March 19, 2015.
[12] Miles Keogh, Director of Grants and Research, National Association of Regulatory Utility Commissioners, quoted in Perera, David, "Smart Grid Powers up Privacy Worries," Politico, January 1, 2015 [hereinafter "Smart Grid Privacy Worries"], available at: http://www.politico.com/story/2015/01/energy-electricity-data-use-113901.html.
[13] *See* Response of Questar Gas Company, Pub. Svc. Comm'n of Utah, Dkt No. 07-057-04, September 28, 2007 (detailing the uncontested and disputed facts of the incident), available at: http://www.psc.utah.gov/utilities/gas/07docs/0705704/54871Response%20of%20Questar%20Gas%20Company.doc .
[14] 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).
[15] *Id.*, at *27-28.

project to "collect, transport, standardize and electronically archive as-built and gas service paper records," estimated by PG&E to cost $16.2 million.[16] The CPUC approved the full requested cost of the mapping and records project, excluding contingency expense, in part because "accurate maps and records [are] critical to many operational functions, and fundamental to PG&E's ability to characterize the risks of its system."[17] The CPUC specifically noted that inaccurate location data is a significant factor in excavation damage, the largest contributor to PG&E's system risk.[18] The CPUC ultimately approved nearly all of PG&E's requested costs for data and technology capabilities for the mapping and records project and several other projects, over the objections of the ratepayer advocate, using safety as a primary justification.

Despite potential safety benefits, the upfront costs of investing in data capabilities can make regulatory approval challenging, especially where future benefits of the data are uncertain. For this reason, it may be more acceptable to regulatory authorities for utilities to propose a phased investment approach or, as a fall-back, to "lease" rather than buy. In another CPUC decision addressing implementation of a third-party demand response participation rule for electric utilities, the CPUC chose a phased, partial information technology (IT) solution over a long-term IT asset, despite the possibility that the partial solution could become a stranded cost, in part to prevent implementation delay.[19] The CPUC also signaled that it would favor systems that could be "reusable for other future small scale projects or pilots."[20] Phased investments are a relatively common way to mitigate ratepayer risk, and data capabilities and other new technologies are good candidates for a phased approach. To the extent that gas utilities are unable to obtain regulatory approval for including data capability investments in rate base, utilities could follow trends in less regulated industries and shift technology expenditures to a SaaS (software-as-a-service) model, which looks more like leasing.[21] A SaaS (or data- or analytics- as-a-service) model is paid via a monthly subscription, typically without the upfront costs. To the extent that SaaS providers have "off-the-shelf" offerings that can augment utilities' data capabilities related to safety or cybersecurity, regulators may be willing to approve recovery of SaaS expenditures through safety riders.

One potentially compelling rationale for gas utilities to invest in data capabilities is to be proactive rather than blindsided by shifting regulatory expectations with respect to quality and availability of data. For example, when the New York Public Service Commission (NYPSC) discovered that several gas utilities under its jurisdiction were not in compliance with rules related to qualifying persons to perform Polyethylene or plastic fusions, it required re-inspections of all such plastic fusions.[22] The NYPSC addressed quality and availability of data, commenting

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[16] *Id.*, at *6.
[17] *Id.*, at *57-58.
[18] *Id.*, at *58.
[19] Application of Pac. Gas and Elec. Co. (U39E) for Recovery of Costs to Implement Electric Rule 24 Direct Participation Demand Response.; And Related Matters, *Decision No. 15-03-042*, Cal. Pub. Util. Comm'n., Application No. 14-06-001, 2015 Cal. PUC Lexis 156 (March 26, 2015), at *57.
[20] *Id.*, at *58.
[21] Nancy Zambrano, "Why are more CFOs shifting IT investment from CapEx to OpEx?" January 10, 2014, available at: https://www.shoretel.com/blog/why-are-more-cfos-shifting-it-investment-capex-opex-0.
[22] Proceeding on Motion of the Comm'n to Investigate the Practices of Qualifying Person to Perform Plastic Fusions on Nat. Gas Facil., *Order*, N.Y. Pub. Svc. Comm'n, Case No. 14-G-0212, 2015 N.Y. PUC Lexis 223 (May 15, 2015), at *7, *43-53.

that identifying the exact location of plastic fusions, as well as the identity of installers and inspectors, was "absolutely necessary for both compliance and enforcement purposes and so that such information is readily available . . . ."[23] NYPSC staff recommended that local distribution companies (LDCs) be required to use GPS coordinates to record the precise location of each plastic fusion. The NYPSC deferred a decision to implement staff's GPS recommendation until it gathered more information, partly in response to comments from LDCs regarding cost and implementation burdens of a GPS system.[24] However, the NYPSC noted that the location methods being used by LDCs were unclear from their comments.[25] It then ordered each LDC to submit a proposal for electronic records for plastic fusions and to, among other things, describe its proposed electronic record-keeping system, provide detailed information on costs, justify why its chosen system is as effective as a GPS system, explain what implementation problems would prevent the use of a GPS system and explain how easy it would be for NYPSC staff to duplicate locations in an audit.[26] Utilities were not given much time to mull it over. The NYPSC gave utilities just over three months from the decision date to submit proposals for a GPS or other electronic record-keeping system, and just over seven months from the decision date to implement the system.[27] The LDCs not proactively considering GPS records may have been blindsided by the sudden need to implement a new electronic records system.

Generating, collecting and transmitting increased volumes and varieties of data implicates cybersecurity. Despite the operational downsides to antiquated technology, there can be some comfort that paper records and unconnected components ward off cybersecurity vulnerabilities. However, two practical realities undermine a technology resistance approach as a means to address cybersecurity. First, shying away from technology is probably not feasible. Regulatory and public pressures for safety and operational performance combined with developing industry practice (including vendor and supply chain practice) creates a sheer momentum towards data-capable advanced components and systems. Resistance is futile, so to speak. Second, cybersecurity risk is already alarmingly present for gas pipeline industrial control systems.[28] Despite indicators that cyber threats are growing, utility cybersecurity efforts are getting worse, not better.[29] Where customer data is involved, cybersecurity considerations for gas utilities look similar to other sectors of the economy, with cybersecurity necessary to protect privacy and prevent data breaches.[30] Rather than an argument against implementation of data capabilities, cybersecurity considerations may tip the scales in favor. Presenting an investment in data capabilities for regulatory approval may be a window to bundle the investment with cybersecurity upgrades. Such an approach is good technology policy and is more proactive than waiting for a high profile cyber-attack to prompt cybersecurity improvements.

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[23] *Id.*, at *34.
[24] *Id.*, at *35.
[25] *Id.*
[26] *Id.*, at *36-37.
[27] *Id.*, at *35.
[28] Hillary Hellmann, *Acknowledging the Threat: Securing United States Pipeline SCADA Systems*, 36 Energy L.J. 157, 160-65 (2015).
[29] Blake Sobczak, "Power sector slips in cybersecurity 'fundamentals' -- report," E&E EnergyWire, June 1, 2015.
[30] U.S. Department of Energy, Data Privacy and the Smart Grid: Voluntary Code of Conduct (VCC): Final Concepts and Principles, January 12, 2015 [hereinafter "DOE Code of Conduct"], at 11.

Unregulated Opportunities

Investments in big data capabilities have a "build it and they will come" flavor, in that companies may not know what kinds of insights and opportunities they will find in the data until they build the capabilities. Companies in relatively unregulated industries can get comfortable making such investments because they are pulled by the lure of superior data-driven performance and pushed from behind by competitive threat.

Gas utilities don't have the same incentives, at least on the surface. Their upside for unregulated business opportunities is likely to be limited by regulators, who may inhibit data and related capabilities from being fungible across regulated and unregulated business arms. Gas utilities also don't face direct competitive threat for their core business within their service territories. It is hard to imagine an LDC losing its franchise or otherwise being displaced for failure to embrace big data.

Nonetheless, gas utilities do face indirect competition and do have the potential for upside by becoming more data-driven. Gas utilities face competition from other power sources, particularly in new construction within their service territories. Especially because of recent popularity of residential solar power and battery storage, electric power may compete with natural gas as an energy source in new builds or retrofits. Conservation measures are a form of competition, in which someone or some entity (including government authorities) chooses to "buy" reduced use as a substitute for natural gas. In addition, where natural gas competes with other fuels, public perception of safety, cost, ability to manage incidents and customer service can matter to gas utilities' future prospects. Gas utilities may be able to compete more effectively against their indirect competitors through data-driven marketing. They may also be able to enhance customer engagement and manage churn or credit risk through data-driven approaches that combine customer usage data with additional relevant data from third parties such as credit scores or geo-demographic data.[31]

In addition, gas utilities have the potential to create data of great interest to a variety of stakeholders. For example, gas utilities' knowledge and data about their system embeds a tremendous amount of real estate knowledge. Gas utilities know the age of pipelines, as well as recent and expected future upgrades or repairs. They have the potential to collect data related to the soil and subsurface in areas where pipelines are located, and they may have information about locations or events that have drawn significant social attention. As another example, gas utilities have the potential to collect data about aspects of the public's behavior, including behavior related to digging and construction, social media commentary, responses to marketing campaigns and gas usage. These data, individually or in combination with other publicly available data, may provide valuable business insights. Depending on the rules in states where competitive gas supply is available, these insights could provide competitive value or revenue opportunities to LDCs.

[31] IBM, White Paper, "Managing Big Data for Smart Grids and Smart Meters," May 2012, available at: http://www-935.ibm.com/services/multimedia/Managing_big_data_for_smart_grids_and_smart_meters.pdf.

Constraints on Use of Data for Unregulated Activities

When utilities pursue unregulated revenue opportunities related to data, issues of subsidization and privacy arise, and cybersecurity considerations may warrant additional scrutiny. These issues should be addressed in tandem with any data investments. Subsidization is the public policy concern that ratepayers will subsidize the costs of investments that utilities then use for unregulated commercial activities. The issue is not unique to investments in data capabilities. For this reason, data capabilities developed using ratepayer funds can and should stand on their own merits. However, as a result of collecting and analyzing data for regulated purposes, unregulated revenue opportunities, expected or unexpected, may present themselves. In addition, the tools, people and culture that constitute data capabilities in the regulated business may permeate unregulated commercial activities to varying degrees.

Many state regulators have addressed privacy concerns, particularly in the context of smart meters and detailed energy usage data. Much of the attention has been directed to electricity usage, which is perceived to be a "holy grail" to marketers because of its ability to enable detailed inferences about people's daily lives and behavior within the home.[32] Where gas utilities have implemented smart meters, similar privacy concerns apply.[33] In general, state privacy rules prohibit sharing of individual customer usage data without consent, but they often permit or require (when requested) utilities to share aggregated or anonymized customer usage data.[34] The U.S. Department of Energy's voluntary code of conduct related to privacy of smart grid data, which parallels many state commission decisions, also suggests that customer consent should be required for data disclosure unless data is aggregated or anonymized using a methodology that "strongly limits the likelihood of reidentification of individual customers" or their customer data.[35] For example, aggregation of small or heterogeneous data sets can reveal customer identities, and anonymized data can sometimes be combined with third party data to re-identify customers.[36] In addition to disclosure restrictions, state privacy rules often prohibit utilities from using customer usage data for unregulated or "secondary commercial" purposes.[37] Of note, however, is that state privacy rules may not apply where gas utilities have not implemented smart meters.[38] As with data capability investments for the regulated business, gas utilities should build in cybersecurity protections from inception. In brief, state utility commission privacy rules have largely converged with respect to customer usage data, especially where collected by smart meters, and gas utilities must account for those rules when considering unregulated revenue opportunities related to customer usage data.

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[32] Smart Grid Privacy Worries, *supra* note 12.
[33] *See e.g.*, In re Proposed Rules Relating to Data Access and Privacy for Elec. Util., 4 CCR 723-2 and data access and privacy rules for gas utilities, 4 CCR 723-4, *Recommended Decision No. R15-0406*, Colo. Pub. Util. Comm'n, May 1, 2015; Decision Extending Privacy Protections to Customers of Gas Corporations and Community Choice Aggregators, and to Residential and Small Commercial Customers of Electric Service Providers, *Decision 12-08-045*, Cal. Pub. Util. Comm'n, August 23, 2012 [hereinafter "Cal. Gas Privacy Rule"].
[34] *Id.*
[35] DOE Code of Conduct, at 8.
[36] DOE Code of Conduct, at 11-12.
[37] Decision Adopting Rules to Provide Access to Energy Usage and Usage-Related Data While Protecting Privacy of Personal Data, Cal. Pub. Util. Comm'n, Decision No. 14-05-016, Rulemaking 08-12-009, May 1, 2014, at 12.
[38] *See* Cal. Gas Privacy Rule, *supra* note 33, at 2, 41.

Conclusion

Investment in data capabilities appears to hold promise for gas utilities, but utilities must assess the value, cost and risk of such investments. Data capabilities include the technology for the collection, analysis and flows of data, as well as investments in people and culture. Gas pipeline safety probably justifies many data capability investments for the regulated business, and utilities may have success with a phased approach to these investments. Investing in data capabilities can also provide a window to upgrade cybersecurity protections. Unregulated revenue opportunities are likely to arise once data capabilities are in place, though gas utilities must attend to ratepayer subsidy and privacy issues when considering unregulated opportunities.

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