Leveraging Energy Data for the Benefit of Society and Consumers

The Georgia Institute of Technology EPICenter Policy Brief

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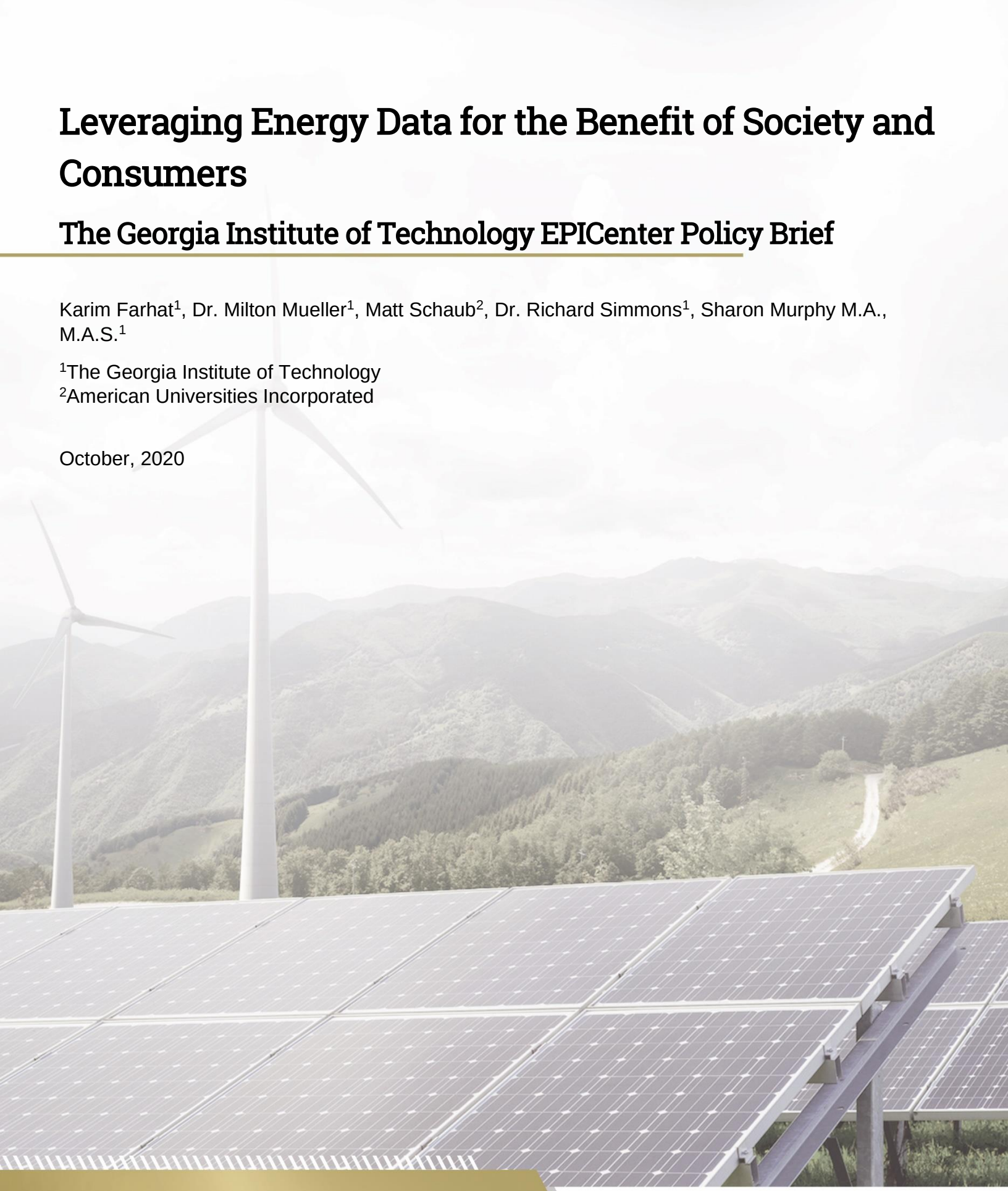


Georgia Tech Energy Policy and Innovation Center

Executive Summary and Key Findings

Industrial data (ID) has the potential to play a key role in finding efficiencies in energy markets and thus lower rates for consumers. The realm of industrial data within the energy sector encompasses a broad ecosystem involving many stakeholders. This policy brief is intended to focus specifically on implications for Investor-Owned Utilities (IOUs), energy service and technology providers including Original Equipment Manufacturers (OEMs), policymakers, and researchers, as well as interactions among them. Within this construct, we find that:

- IOUs could better leverage data analytics to utilize capital, natural resources, and public infrastructure more efficiently;
- ID could lead to better alignment of incentives between utilities and policy/regulation;
- Methods to facilitate market entry for local third-party energy service providers should be explored to benefit the regional economy and to avoid ceding leadership to foreign or out-of-state competition;
- More collaboration within the standards space and during the standards deliberation process is warranted (in particular between OEMs and energy providers);
- ID and energy stakeholders have an obligation and opportunity to improve regulations for Critical Infrastructure Protection (CIP) with future implications on grid cybersecurity;
- Coordination and R&D among utilities, policymakers and research institutions can enhance and accelerate knowledge diffusion and beneficial outcomes for owners, consumers, and the environment.

Challenge and Opportunity

'Big data' is at the heart of an ongoing, industrial paradigm shift often touted as the fourth industrial revolution. Industrial Data (ID) increases efficiency and allows the innovative bundling of products and services. This is no less true in the energy sector than in other domains, yet the unique regulatory, operational, and supply chain structures of electric power providers creates some distinct dynamics. The increasing rate of efficiency by which energy and raw materials are being converted into useful work—while nothing short of revolutionary—has significant implications for the future of the energy sector as business decision-makers continue to leverage ID to drive their firms' competitive advantages. Many user groups in a power utility can benefit from ID: operations, planning, maintenance, asset management, power quality, marketing, environmental compliance, and customer support. More can be done to leverage ID to drive efficiencies thereby reducing energy consumption, emissions and the cost of energy.

Organizational changes are required to profitably leverage ID. The Dynamic Capabilities View highlights the notion that a firm's competitive advantage "depends on a firm's capabilities to adapt, integrate, and reconfigure skills, resources, and functional competencies in a dynamic environment"[1]. Managerial decisions around Industrial Internet of Things (iIoT), notably collaborative arrangements, relate to the strategic supply of tailored services. Turunen and Hakanen's survey of various industrial services markets confirms the strong coupling between specialization in the division of labor and service offerings. Second, they highlight how strongly tailored services depend on mutual information sharing, enabling the co-creation of value. An energy-relevant example of this might be synergies and aligned financial incentives between IOUs and technology OEMs in the operation of large power plants, for instance to maximize uptime, optimize capital utilization, or reduce maintenance costs.

Most importantly, their study of industrial services markets dispels the notion that firms adopt a resource and position-protection perspective. Within this industrial paradigm, data is not about ownership and enforcing property rights on scarce resources but about gaining strategic access to information through collaborative arrangements. For example, Georgia Power has partnered with smart home technology firms in Atlanta to create a "Smart Neighborhood" involving individual rooftop installations and in-home battery energy storage solutions. This arrangement allows Georgia Power to access detailed behind-the-meter energy demand data. Following conventional wisdom, regulated IOUs are expected to leverage their asymmetric data access to promote rate design changes to offset their DER penetration risk [2]. This example highlights a different aspect of strategic firm behavior whereby a regulated IOU gains data access to a previously unmonitored portion of the grid by contractually meting out data-sharing arrangements among participating partners. Given the relationship between ID, information resources and services, it also stands to reason that the ability to provide a service is inexorably linked to the quality of available data

[1] Eloranta, V.; Turunen, T. Seeking competitive advantage with service infusion: a systematic literature review. *Journal of Service Management* **2015**, 394–425.

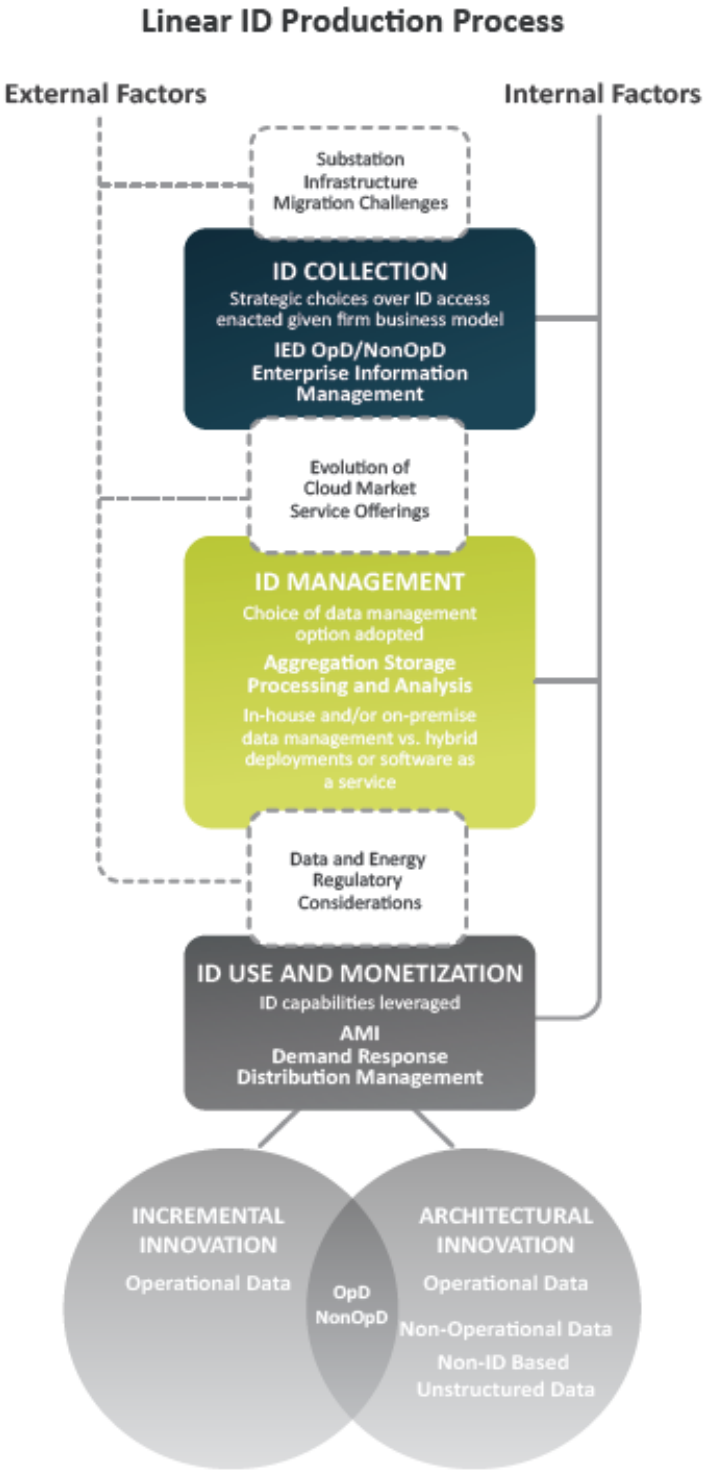
[2] Bentham, P. The Growth of Distributed Energy, Implications for California. *Next10* **2018**, 1–36.

Plan of Action

From the research team's analysis, it was observed that IOUs should better leverage data analytics. Given regulatory constraints, low demand growth, and variable demand-response, IOUs need to better leverage data analytics to more efficiently deliver innovative services. These improvements should foster healthy partnerships with data analytics firms or the creation of in-house capabilities depending on the business case. While IOUs exhibit relatively low rates of organic innovation in the smart grid space, their capacity to fill those knowledge-gaps is contingent on their ability to foster ongoing relationships with large OEMs or third-party energy service providers with proven track-records of providing added business value. That said, most third-party energy service providers are thus far coming from out of state, or overseas.

The current ecosystem is likely to continue encouraging out of state business to engage in repeat contractual engagements with IOUs. Positioning local industry to take advantage of existing knowledge networks requires incentives for entry and can counteract trends that favor outsourcing/offshoring. Policy makers and academic researchers should further explore how to facilitate such market entry to benefit the local economy.

IOUs need to be more involved in the standards space and work with OEMs during the standards deliberation process. IOUs should procure dual-compatible equipment in IEC 61850 and DNP3 to benefit from harmonization efforts led by the NIST Smart Grid Interoperability Panel and future-proof against changing business models. Where possible and as business-cases for DER integration and overall 'smart grid' deployments are possible, cost-benefit analyses should be performed for retrofitting substations with IEC 61850 compliant hardware.



NERC Critical Infrastructure Protection regulation needs better formulation. Current NERC Critical Infrastructure Protection (CIP) audit processes have the unintended effect of discouraging investment in advanced IEDs. Specifically, CIP-005-5 security incentives were misaligned as some utilities tended to either not invest in routable equipment or turn off.

NonOpD data-generating capabilities, thereby reverting to analog capabilities to bypass NERC audits. CIP requirements have, at times, worsened cybersecurity risks[3]. NERC CIP audit processes should be investigated to ensure the grid's critical portions are still compliant with security controls. CIP — 005 should also be revised to include security requirements for all forms of communications not to create incentives to turn 'smart' capabilities off.

The Southeastern energy sector should focus on data science knowledge diffusion. The knowledge spillover and diffusion literature often attribute innovation to a combination of dedicated resources from public research organizations with the responsiveness of private firms. The Tech Square area of midtown Atlanta and the Research Triangle in North Carolina are designed to provide a healthy interdependence between public research organizations and private sector initiatives. These networking hubs provide an essential collaborative structure by which research institutions, firms, and policymakers support the diffusion of domain knowledge in the Southeast. These hubs should continue to be characterized by open regimes of information disclosure. Data science is more than a combination of statistics and computer science; it requires training on how to weave statistical and computational techniques into a contextual framework starting with its subject matter, in this case, power engineering. Based on our research, however, we question the responsiveness of private sector innovation hubs based primarily on incumbent activity.

Therefore, we recommend a collaborative initiative among Georgia Tech Interdisciplinary Research Institutes, e.g., the Strategic Energy Institute (SEI), the Institute for Data Engineering and Science (IDEaS), Georgia Tech Research Institute (GTRI), and other relevant centers housed within the academic units with an explicit focus on data science and energy. If scoped regionally, the initiative could bridge academia and industry by aligning disparate efforts with top-down goals through shared collaboration incentives. The resulting integration would accelerate the adoption of data science technology in the energy sector, allowing it to leapfrog intermittent problem stages, akin to the IT agglomeration economies realized by Silicon Valley, instead of confronting barriers one at a time.

Further empirical work should build on research by the Electric Power Research Institute and Edison Electric Institute to determine how utilities share ID management best practices while operating under different regulatory conditions.

About EPICenter

The Energy, Policy, and Innovation Center operates as a division of the Strategic Energy Institute at Georgia Tech. It was created to provide an unbiased and interdisciplinary framework for stimulating innovation in energy policy and technology for the Southeast region. Although based on the campus of Georgia Tech, the center taps into regional and national expertise within academia, business, non-governmental organizations (NGOs), and research communities.

[3] Clark-Ginsberg, A.; Slayton, R. Regulating risks within complex sociotechnical systems: Evidence from critical infrastructure cybersecurity standards. *Science and Public Policy* **2019**, *46*, 339–346.