The Energy Industry stands at an inflection point. By learning from the modernization journeys of Software, Financial Services, and Healthcare, Utilities can thoughtfully accelerate their transition to open, resilient, and collaborative ecosystems.

A Blueprint to Navigate the Modernization of the Energy Industry

by **Matt Schnugg**

The utility sector within the energy industry is undergoing a significant transformation. As the energy landscape worldwide shifts towards a more complex operational environment and a potential tripling of electricity demands by the year 2050, utilities are forced to prepare for grid complexity due to distributed generation, changing weather patterns, and aging grid infrastructure, all while balancing cost-effectiveness and customer needs.

The convergence of these challenges necessitates a complete rethinking of how utilities plan, build, operate, and maintain their grids, while continuing to elevate end-customer experience. Much of this rethinking will require a new approach to the convergence of the customer's IT environment with its operational solutions (OT) within a utility's lines of business – enabling not only openness and resilience, but also intelligent operations powered by AI and automation.

Fortunately, there is precedent for this. In learning from IT modernization patterns of other industries, such as Financial Services, Healthcare, and in particular, Software, Utilities can confidently adapt with more interoperable solutions and have the flexibility to respond to evolving requirements of their grid's needs. Looking forward further in these modernization patterns, it becomes apparent that interoperability needs to be extended into the historically walled gardens of operational systems deployed in Utility control rooms.

While controls in mission critical systems such as the ADMS must remain carefully managed, this operational data can and should be made available to additional entities, i.e. other legacy software vendors, new start-ups, and even developers within the utility itself, to ensure that integrated planning and operations can be done in as efficient and flexible manner as possible. These data transactions can be managed through IT solutions colloquially referred to as "platforms" which provide standardized frameworks for integrating applications, enforcing security policies, and orchestrating complex workflows across diverse ecosystems. In doing so, platforms enable a more dynamic grid environment where operational (and other) data and workflows are no longer siloed, but instead become a shared resource for innovation, resilience, and improved decision-making.

This article explores a practical framework for how the energy sector can navigate this shift. Beginning with forces reshaping utility needs, it draws lessons from adjacent industries, examines how platform-based approaches are reshaping operational models, and outlines the organizational and technological actions needed to accelerate this modernization journey.

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Utility Needs as Drivers of Evolution

Historically, utilities have managed the electric grid in separate segments (generation, transmission, distribution and retail), leading to disparate islands of investment planning and operational execution. These incongruities create scenarios of mismanagement wherein focus on localized constraints throttle more ambitious integrated planning and operations. As the grid evolves further with increased load and higher adoption rates of distributed energy resources (DERs), traditional operational models and solutions will become less efficient due to the complexity of applications and data. In the most recent report by Total Grid Orchestration Alliance, a utility-led collaborative forum, four key needs that are foundational for holistic grid management have been identified:

- **System-wide Coordination** implies ensuring that all segments of the electric grid (generation, transmission, and distribution) work together seamlessly. The goal is to balance supply and demand in real-time, which is crucial for maintaining grid stability and efficiency. By coordinating system-wide operations, utilities can respond more effectively to fluctuations in energy demand and supply, integrating renewable energy sources and distributed energy resources (DERs) more efficiently.

- **Holistic Situational Awareness** refers to the ability to monitor and understand the current state of the grid. This involves using advanced monitoring tools and data analytics to gather real-time information about grid conditions. Utilities can predict future conditions and potential issues by analyzing this data, allowing them to make informed decisions and take proactive measures to maintain grid stability and reliability.

- **Elevated Risk Management** is about identifying and mitigating potential issues before they impact the grid. This includes assessing risks related to equipment failures, cyber threats, natural disasters, and other factors that could disrupt grid operations. By implementing robust risk management strategies, utilities can enhance the resilience of the grid and ensure a reliable supply of electricity to customers.

- **Integrated Planning and Operations** bridge the gap between long-term planning and day-to-day operations. This capability ensures that investment decisions and operational strategies are aligned and optimized. By integrating planning and operations, utilities can make more strategic investments in infrastructure, technology, and resources, leading to a more efficient and reliable grid.

These new capabilities are essential for modernizing the electric grid and addressing the challenges posed by increased load, severity and frequency of major events, and the adoption of DERs. In addressing these challenges, utilities can create a more holistic and efficient approach to grid management, ultimately benefiting both the utility and its customers.

To implement this new approach, utilities will need to move from traditional, siloed operational models. Perhaps the best example of IT modernization is the first one, in Software itself; the evolution of this industry offers a compelling blueprint for how to make this leap successfully.

Other industries, such as financial services and healthcare, have also undergone similar transformations, offering additional insights on how to overcome structural, regulatory, and operational challenges. We will review these in the sections below.

Lessons from the Software Industry: A Model for Platform Transformation

Over the past 50 years, the software sector has evolved from coding basic commands onto a single machine, into integrated platforms and vibrant ecosystems – enabling greater interoperability, faster innovation cycles, and more resilient operations. As platforms matured, they also began to embed intelligence, with artificial intelligence and machine learning powering real-time insights, adaptive automation, and personalized assistance that spanned across systems.

Stage	Focus	Technology Environment	User Experience	Integration Approach	Utility Parallel
Machine-Level Programming	Solving isolated, specific tasks	Siloed; manual coding; no standards	Expert only; complex	Manual integration between systems	Legacy grid systems (DMS, SCADA) operating independently
Operating Systems	Enabling scalable, user-friendly environments	Standard interfaces; basic integration	Improved usability; difficult procurement & configuration	Integrated, but often limited to a single vendor	Movement towards integrated operations (GIS + ADMS + DERMS)
Ecosystems	Empowering dynamic collaboration and innovation	Open platforms & APIs; shared data models & security frameworks	Highly configurable experience; rapid innovation & 3rd party participation	Seamless interoperability across multiple vendors and services	Utility Platform ecosystems enabling modular apps and data sharing

Table 1: Evolution of Software Modernization and Its Relevance to Utility Transformation

It's helpful to look at this evolution in stages, to benchmark where many utilities are today and to understand what will likely be the form factor for the next stages of modernization for Energy. This modernization can be roughly broken down to three stages: Machine Level Programming in the 1960's and 1970's, Operating Systems in the 1980's through 2000's, and Ecosystems in the 2010's through today.

Machine Level Programming

Initially, Machine-Level Programming involved literal 1's and 0's instructing single machines, purpose built to accomplish a specific task, with no system integration or scalability. This scenario is similar to the current grid environment: systems are siloed, built on legacy technology stacks, and require significant effort for simple integrations. Current grid software solutions have also been tailored to address specific, crucial elements of operation, but generally as standalone environments that require significant manual effort to integrate more broadly.

Operating Systems

The subsequent stage in software development, Operating Systems, was popularized by beginning to address scalable integration. Allowing users to operate in a single, standardized environment also introduced more structural security capabilities and common user-friendly interfaces. However, procurement remained complex; software had to fit hardware requirements and was difficult to acquire and deploy. So, while Operating Systems offered a foundation for a more robust IT environment, they did not fully realize the potential for seamless integration and scalability. An analog for Grid Management includes integrated systems such as ADMS, GIS, and Demand Response solutions, and potentially broader "system of systems" that manually integrate these technologies.

Ecosystems

To date, the most advanced stage in this example is the Ecosystem applicable to the software industry. This is best exemplified by the software capabilities enabling smartphones, where third-party applications enhance user experience within a secure, collaborative environment. These third-party applications allow each user to customize their device with applications that suit their unique needs, with applications utilizing shared data, accessed the data uniformly, and benefiting from a security guarantee governed by the Ecosystem provider. This environment thrives on partnership and collaboration; this Ecosystem approach is the best means of embracing the many different software solutions within the Utility's IT footprint.

This evolution illustrates a clear pattern: industries move from isolated, hard coded solutions to integrated platforms, and finally to open ecosystems that utilize embedded intelligence to accelerate innovation and resilience.

Utilities, facing similar pressures today, must likewise continue beyond siloed systems towards architectures that enable shared data and flexibility in vendor and application deployment. Further, they must have the freedom to seamlessly leverage the reliability of on-premises deployments, the minimized latency of workloads at the edge, and the massive scalability of the cloud.

As we have seen in Software, and increasingly in other critical industries, this shift is no longer optional – it is foundational to future success.

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Healthcare and Financial Services: Structuring Resilient Ecosystems

Beyond Software, industries like Healthcare and Financial Services demonstrate that even in highly regulated, risk-averse sectors, the shift toward integrated ecosystems has proven both possible and necessary.

The maturity of Ecosystems within Financial Services and Healthcare can be particularly instructive for design patterns that go beyond the existence of an Ecosystem alone. **These industries succeeded not just by modernizing systems, but by shaping ecosystems with different structural elements: strong governance models, mandatory interoperability, trust through compliance frameworks, embedded approaches to managing risk and resilience, and transforming their cultures to embrace this ecosystem approach.**

Each of these features holds critical lessons for how the Energy Industry must approach its own transition.

The modernization paths of Financial Services and Healthcare make one thing clear: successful ecosystems are not accidental – they are architected through deliberate choices about openness, trust, interoperability, and resilience. The challenge now lies in translating these proven ecosystem principles into solutions built specifically for the complex demands of the grid.

Marketplace	Industry	Size (Apps/Integrations)	Adoption (User/Customer Reach)
Epic Showroom	Healthcare	~400+ certified apps	250M+ patient records touch Epic systems
J.P. Morgan Payments Partner Network	Financial Services	~100+ integrations & APIs	J.P. Morgan processes ~$10T/day
Apple App Store	Consumer Tech	1.8M apps worldwide	1B+ iPhone users

Table 2: Popular Ecosystem enablers across Healthcare, Financial Services, and Consumer Tech industries

Ecosystem Principles for Building the Future of the Grid Today

To support a modern, resilient energy grid energy system, platforms must be designed with ecosystem principles at their core. These principles ensure that data, applications, internal stakeholders, and partners can interact seamlessly – ensuring scalability, flexibility, and operational excellence. The following capabilities are foundational to any future-ready grid platform:

Building Open and Interoperable Foundations: A modern grid platform must prioritize openness – using shared data models, standardized APIs, and interoperable true hybrid-cloud architecture to support AI-driven operations and allow utilities to make the most of their current IT/OT investments and partners to integrate flexibly without further lock-in.

Frictionless Availability of Platform Experiences with Native Product Interoperability: Product-level interoperability is the key to accelerated adoption and thoughtful chance management. As such, platform capabilities should be natively embedded into the software utilities already use – enabling them to govern workloads seamlessly without needing to procure and integrate standalone platforms.

Embedding Resilience and Risk Management at the Core: Through advanced cybersecurity, robust data protection, and adaptive response mechanisms, grid platforms must help operators confidently manage uncertainty, maintain uptime, and safeguard critical infrastructure – all while supporting continuous delivery

Enabling Ecosystem Collaboration Through Strategic Partnerships: Open platforms thrive through collaboration. Designing for third-party extensibility allows partners to co-create solutions, expand value propositions, and drive faster innovation across the grid landscape.

Simplifying the Growth of the Ecosystem: By employing modern "Infrastructure as a Code" technologies, platform-based grid systems can automate deployment processes that were once slow and manual. This allows for faster integration of new applications, easier updates to existing services, and more consistent operations – making the ecosystem both more efficient and more resilient.

Together, these five principles form a foundation for modern grid platform design, built around the core outcomes utilities need most: reliability to withstand complexity, flexibility to adapt to evolving demands, and simplicity to accelerate innovation. These are no longer aspirational features – they are baseline expectations for any future-ready energy ecosystem.

A Call to Action: What the Energy Industry Must Do Today

The blueprint is clear. Moving forward requires bold commitments to rethink operational solutions, forge ecosystems, and prioritize speed over tradition. The path ahead isn't about waiting for perfect conditions; it's about thoughtfully acting now, utilizing the tools, insights, and frameworks already available. Reassuringly, this blueprint is no longer speculative; industries like software, healthcare, and financial services have demonstrated remarkable transformation progress, especially where open, intelligent platforms have been thoughtfully empowered to navigate this substantial ambiguity.

To begin on their own journey, here is what Utility leaders can do to deliver the future of energy today:

1. **Embrace Platform Thinking**
   Utilities must think beyond isolated solutions, and begin building around open, interoperable, AI-enabled platforms designed to evolve with accelerating grid complexity.

2. **Build Ecosystem Partnerships Early**
   Future success will not be achieved in isolation; it will be a team sport. It demands collaboration across utilities, technology providers, innovators, and new entrants.

3. **Prioritize Data Portability and Interoperability**
   The resilience and adaptability of tomorrow's grid will depend on the seamless movement and governance of data across systems, applications, and stakeholders.

4. **Treat Flexibility, Innovation and Speed as Core Outcomes**
   Reliability remains foundational – but success in a rapidly shifting environment will require increased agility, faster innovation with thoughtful AI enablement, and significantly reduced time to implementation.

5. **Invest in Continuous Learning and Workforce Transformation**
   As technology platforms evolve, so must the people who operate, maintain, and innovate on them. The industry must invest in upskilling, cross-disciplinary training, and culture shifts that empower everyone to thrive in an open, ecosystem-driven future.

The opportunity to modernize is not a future hypothetical, it's a present imperative. The industry is now at an inflection point -- defined by exponential demand, unrelenting weather, and aging infrastructure – forcing Utilities to move from reactive mitigation to proactive innovation at scale.

Stakeholders who embrace the blueprint outlined in this paper – and the lessons learned from other industries - will not only shape a grid that is more resilient, flexible, and sustainable today, they will dictate the direction of tomorrow's energy landscape.

Structural Element	Philosophy	Description	Lessons for Utilities
Centralized Governance, Distributed Participation	Govern the core, unlock the ecosystem	In both industries, ecosystems evolved by establishing clear governance over core standards (e.g. data formats, security protocols), while enabling distributed innovation by third parties	Customers and Platform owners must tightly govern core operational and planning systems (ADMS, GIS, DERMS), but encourage broad participation for innovation to flourish
Data Portability and Interoperability as Non-Negotiables	No data stranded, no participant trapped	Financial Services & Healthcare succeeded by making data portability and interoperability mandatory – customers could with services without losing access to critical information	True ecosystems must treat data portability and interoperability as foundational, not optional features
Trust through Compliance and Certification	Trust accelerates ecosystem growth	Ecosystem growth in these industries was accelerated by introducing certification and compliance frameworks (e.g. HIPAA, PCI-DSS) that built trust among participants without stifling innovation	Strong compliance and certification mechanisms, such as NERC-CIP will be essential to build ecosystem trust without locking down flexibility
Embedding Risk Management into Ecosystem Design	Resilience and Security are native to the core	In Financial Services and Healthcare, risk management (e.g. fraud detection, cybersecurity, patient data protection) became a built-in, continuous function of the ecosystem – not an afterthought or external layer	Lesson for Utilities: Successful ecosystems must embed real-time monitoring, risk detection, and resilience into the Platform itself
Transforming Organizational Culture to Sustain Ecosystem Growth	Platforms enable ecosystems, people make them thrive	In these two industries, technology modernization was not enough. Successful ecosystems required cultural shifts: more cross-functional collaboration, greater openness to external partnerships, and new approaches to managing change	Recognize that ecosystem success depends on evolving not just systems, but mindsets and skills

Table 3: Key learnings from Financial Services and Healthcare Industries (transform the 5 structural elements above)

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