Energy Companies Are Facing a Decade of Deep Redesign and Need Strong CIO Leadership

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Initiatives: Energy and Utilities Digital Transformation and Innovation

Between 2020 and 2030, the energy industry will pass an inflection point that will demand new business models, new operating models, new organization designs and new technology deployments. CIOs can use Gartner’s insights to lead their energy companies through this decade of deep redesign.

Overview

Impacts

- A shift in power toward customers — and away from incumbent providers and regulators — will drive energy companies to create and deliver new premium energy products and services.

- The need to add new capabilities like customer centricity and agility — while retaining efficiency and reliability — will force an extensive replatforming of operating models.

- The race to discover and deploy game-changing energy innovations will compel companies to create composable organizations that easily span company boundaries.

- A new breed of cyber-physical assets will dominate future energy markets, requiring companies to completely rethink their energy products, technology management and asset design practices.

Recommendations

CIOs driving digital transformation in energy and utilities:

- Drive alignment of IT requirements among the many teams developing new products and services by leading the creation of a corporate narrative for your company’s new business model.

- Accelerate the migration to automated and autonomous processes by leading the design of new operating models and committing IT resources to a multiyear transition program.

- Enable a composable organization by leading the transformation of enterprise architecture and migrating internal and external partners into the new architecture.
Maximize the business potential of new energy assets by leading the creation of a design authority that ensures digital and physical capabilities are deeply integrated and optimally simplified.

Strategic Planning Assumptions

- By 2030, 70% of the business value created by energy companies will come from new digital-first energy products and services that do not yet exist.
- By 2030, 60% of energy transactions among energy companies and their customers will be completed autonomously.
- By 2030, 90% of game-changing energy innovations will arise from collaborative development and operations among multiple parties; and many will include innovations from end-user energy customers.
- By 2030, leading energy companies will be defined by their ability to design business assets that deeply fuse digital and physical capabilities.

Analysis

The energy transition has been reshaping energy markets for more than a decade, but progress has been surprisingly slow. The International Energy Agency (IEA), for example, estimates that the production of green energy has grown by just 1.6% over the past decade, and now represents 14.1% of the world’s total energy supply.¹ This is not insignificant, but it doesn't yet represent a disruptive force. We're now at an inflection point, and the next decade will be very different, marked by rapidly accelerating change and massive market disruption. The IEA also expects the use of renewables to double by 2050, to become at least 30% of worldwide energy supply. However, more will change than just the growth rate for renewable energy. Four disruptive forces — passionate customers, autonomous commerce, game-changing innovation and the dominance of new asset designs — are placing intense pressure on energy companies (see Figure 1).
Any one of these forces would be enough to drive massive transformation, but they’re happening simultaneously. They’re happening fast, and they’re interacting with each other in complex and unpredictable ways. Incremental change is no longer an option because these forces have now pushed energy markets to an inflection point. Turbulent, disruptive change will be the hallmark of energy markets during 2020-2030, a period Gartner has designated as the decade of deep redesign (see Figure 1). By 2030, energy leaders will have — and must have — new business models, new operating models, composable organizations and cyber-physical asset designs.

A growing number of energy companies have already recognized the urgency of this moment. Oil and gas companies like BP, Equinor and Shell are broadening their capital portfolios with the clear goal of becoming diversified energy companies. Utilities like Enel X and ENGIE North America now offer information-centric products and services. Even players from outside the sector are getting into the game. Illustrative examples include: Google’s Nest thermostat and Apple Energy, as well as digital dragons probing opportunities in energy markets.

Energy incumbents, like power and gas utilities and oil and gas companies, are starting from a point of significant disadvantage. The typical information and computing landscape of these companies wasn’t designed to facilitate the sort of deep redesign that is now required. In fact, technology debt, legacy resources and entrenched methodologies may be some of the most challenging barriers that energy companies must overcome to successfully transform. Changing the digital landscape won’t be easy for energy companies, which are traditionally conservative, highly regulated, risk-averse and fundamentally resistant to change. As energy companies go through the decade of deep redesign, strong CIO leadership is more important than it was ever before. Among other reasons, their familiarity with the current technical landscape positions them to lead a safe and rapid transition. Table 1 offers a set of recommended actions that CIOs are best suited to implement, which will increase their company’s chances of emerging as an energy leader in transformed energy markets.
These changes couldn't have come at a worse time. Oil and gas companies are already overwhelmed by cash-flow collapses, driven by market conditions resulting from the lessons learned from the pandemic and the resulting subsequent economic downturn. And power utilities worldwide are distracted by complex negotiations with regulators to create sustainable investment strategies for renewable energy generations and storage. Many new market entrants are having a hard time finding reliable business models that deliver both near-term profitability and longer-term sustainable growth. This is why we're taking an in-depth look at the forces driving the decade of deep redesign, and making practical recommendations that CIOs can begin implementing now.

Table 1: Impacts and Top Recommendations for Energy Companies

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Recommendations</th>
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<tbody>
<tr>
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Source: Gartner (December 2020)
Energy assets are core assets used to generate and manage energy production and commerce. In today’s markets, this would include power plants, oil rigs and liquid natural gas trains. In future markets, this will include a broader range of assets.

Impacts and Recommendations

A Power Shift Will Create and Deliver New Premium Energy Products and Services

One of the most important forces driving fundamental transformation in energy markets is what might be called the awakening of the energy customer. This represents a truly dramatic change. Energy customers in developed countries have historically been comfortable with their existing energy suppliers. They’ve had abundant, reliable and affordable energy working in the background, keeping their homes comfortable, their cars running and their workplaces productive.

But customers are now becoming increasingly passionate about the nature of the energy they get and who provides it. Customers who are passionate about climate want green energy. Leaders of dynamic global organizations want flexible energy supply chains that keep up with their business adaptations. And governments are becoming customers, not just regulators. Governments in developing countries want partners that can help them shape all aspects of new cities (for example, construction and transportation) for optimal energy provisioning to power economic growth. As Figure 2 shows, the net effect is that passionate customers are demanding a wider range of options for energy products and services, and the freedom to choose who provides them. Indeed, many are looking to provide their own energy. In some ways, this is not a new phenomenon, as power utilities have noted a trend toward energy democratization for many years. What is new, however, is the broader scope (i.e., all forms of energy) and the greater emphasis on premium marketing to passionate customers.
Current energy business models — whether electric, fossil fuel or other — are designed around large-scale, long-term investment in production facilities that push commodity energy (i.e., electrons or molecules) to customers through shared (or monopolistic) distribution grids/facilities. There's little opportunity for significant premiums in these models. As customers gain control, the business model for energy providers is turned upside down. Providers can capitalize on customer demands by crafting customized products and services (for example, a shared loyalty program for customers who own both electric and internal combustion engine automobiles). It can be difficult for incumbent energy leaders, who have viewed their core product as a commodity for their entire careers, to conceptualize the vast universe of premium value opportunities that become possible once regulatory barriers are lowered. But overwhelming examples exist in other industries. Laptops were becoming commodity items until Apple introduced high-end models. Cars were becoming commodities until Mercedes and BMW. We're now seeing similar shifts in global-scale energy players, like BP, that are redesigning their business model in pursuit of premium opportunities. As illustrated in Figure 2, to design and deliver premium services, energy companies will need new business models that are customer-centric (not producer-centric), premium-oriented (not commodity-oriented) and dynamic (not stable). Premium margins will drive rapid growth. Gartner predicts that by 2030, 70% of the business value generated by energy companies will come from products and services that do not exist today.

The first half of the decade of deep redesign will be a turbulent time for energy products and services. Customer demands aren't well-developed, and they're even less well-understood. Companies will attempt an enormous number of experiments to sort out the best opportunities for premium margins. Energy CIOs are expected to maintain lean, efficient IT operations and the mad scramble of multiple business units independently chasing their own visions could place unmeetable demands on IT to support too many simultaneous experiments. As shown in Figure 2, CIOs need some mechanism to narrow demand for IT resources by focusing experimentation by multiple business teams distributed across the company. The mechanism must be strong enough to produce effective prioritization, or IT will simply be overcome by demand and unable to support business-originated technology investments that should be
backed. But it can't be overly detailed and rigid (a complex strategic plan and roadmap, for example) because critical lessons flowing from successful experiments must be allowed to reshape the vision. And the approach must be something that CIOs are capable of implementing across multiple business units.

One promising approach is the use of corporate narratives. Corporate narratives are stories that connect the future of the industry with the company's role in creating that future. And these stories can be shared. This is what gives corporate narratives their power. Because a common story can be shared among a large number of independent teams. As long as the work of each team is aligned with the context of the shared narrative, the composite effort of all the teams will remain in alignment. This affords each team with significant freedom to experiment and optimize their specific vision — which increases buy-in to the composite solution. In addition, narratives can be easily updated with new lessons as they emerge. Lessons can be disseminated like “news” in social media. Natural human instincts take over and are prewired to seek out news and quickly incorporate it into their narratives to avoid being out of date.

The existence of shared corporate narratives will obviously be of great benefit to CIOs because they contain a common set of priorities that IT can leverage for allocating resources. Synchronizing IT strategy with the shared narrative eliminates the need for copious amounts of painful coordination meetings and governance negotiations that would be required in their absence.

But there's another benefit, one that's perhaps even more significant. CIOs are exceptionally well-positioned to lead the development of corporate narratives for their companies. IT leaders will be deeply engaged with each of their internal business partners working on plans to enable new energy products and services. This makes it very easy to offer an initial corporate narrative to start a conversation. People will be very interested in the narrative, and will naturally engage to make edits and improvements. By working a draft narrative with multiple groups over time, CIOs can collaboratively create a power set of corporate narratives that strongly influences your company’s journey through the decade of deep redesign.

**Recommendations:**

- Develop a draft corporate narrative to describe your company's new business model(s).
- Ground the narrative in your company's history, culture and values.
- Engage business partners, solicit feedback and continuously update your narrative.
- As the narrative takes shape, leverage it as the foundation for your IT strategy.

**Adding New Capabilities While Retaining Efficiency and Reliability Will Force an Extensive Replatforming of Operating Models**

The second force driving the decade of deep redesign is occurring worldwide and across all industry sectors, impacting virtually every enterprise: intense, constant and rapidly accelerating change.
Businesses everywhere are responding by developing more agile and autonomous processes that enable them to reconfigure their operations more often and more rapidly in response to changing market and environmental conditions.

Energy companies are no exception. For many years, companies have been increasing efficiency and automating internal workflows to drive down costs. It is hard to conceive of any energy company that has not yet seen dramatic improvements in business performance through automation. But energy markets are now shifting from producer centricity to customer centricity. As energy customers look to optimize their own energy supply chains, producers can expect premium customers to require their providers to have as much adaptability as they possess themselves. As shown in Figure 3, energy providers will need to automate their operations from the customer perspective inward. And to capture premium margins, they will need new capabilities to accommodate artificial-intelligence-driven commerce via mechanisms like smart contracts. But the typical energy company operating model is highly rigid, because it was built to deliver producer-centric efficiency, reliability and safety. Although reliability and safety will remain as entry tickets to the game, energy companies will be required to deeply transform their operating models to become more customer-oriented and agile.

**Figure 3: Agile and Customer-Centric Business Models Require a New Operating Model**

The amount of change required is enormous. Energy companies’ business models typically provide a substantial amount of producer-centric stability. One example: Oil and gas companies create stability via long-term contracts with gas utilities for liquified natural gas or with airlines for jet fuel. Similarly, electric utilities create stability via persistent tariff rates created by complex processes with current operating models depending on this stability. Typically, they are built to support isolated organizational silos (such as plant operations, engineering and maintenance) where each silo is optimized in isolation, allowing dominance by a small number of niche vendor solutions. A thin layer of integration is built on top of the vendor solutions, but it has limited capabilities and is expensive to change.
Gartner predicts that by 2030, 60% of all energy transactions will be completed autonomously. Creating internal capabilities to enable this presents serious challenges for CIOs, who will be tasked with designing, constructing and operating new operating models with vastly different capabilities. The new operating models must enable essential business capabilities already in place, such as the ability to operate reliably, safely and with strong cybersecurity. But they must also enable new and flexible capabilities like hyperefficiency (automated and autonomous), agile delivery (real-time optimization in response to shifting demand patterns) and low-friction adaptability (the ability to add, modify or remove value streams quickly with little cost).

This represents a historic rebuild of an operating model to support a new business model that is not yet fully defined. Significant investment will be required and strong executive support will be essential. Perhaps the greatest risk going into the decade of deep redesign is a plan for operating model transformation that can't deliver required capabilities because it isn't sufficiently comprehensive, is overly complex/expensive or is implemented too incrementally.

Recommendations:

- Assess the current operating model’s ability to deliver essential new business capabilities.
- Build a strong business case — grounded in efficiency — for the transition to new capabilities.
- Plan now and begin using design thinking methods to develop new architecture.
- Invest time in developing agile product methodology because priorities will change.

Companies Will Be Compelled to Create Composable Organizations That Easily Span Company Boundaries

The third driving force Gartner has identified as critical to the industry through 2030 is the inevitable discovery of game-changing energy technologies. The pace of energy innovation will increase over the coming decade, and the discovery of new game-changing technologies will alter the basis of competition among firms. Environment, social and governance (ESG) funds, which have already exceeded $1 trillion, will shift the focus for innovation from consortia to collaborative partnerships.

Companies in other industries, even conservative, asset-intensive industries like mining, are embracing collaborative innovation models. This means partnering with other companies — even companies outside their industry sectors, and sometimes even direct competitors — to develop and apply innovative technologies. A helpful example is the approach gold miners like Resolute Mining have taken to developing fully autonomous mines. These companies formed partnerships with companies offering potentially useful technologies. These include telecom companies with expertise laying out fiber networks in rugged environments, sensor companies, AI companies that could analyze data and build controlling algorithms, vendors selling self-driving vehicle technologies and heavy equipment manufacturers specializing in mining equipment. The partners shared their respective technologies and
conducted numerous experiments aimed at the objective. And they achieved their goal on time and under budget. This approach to innovation has worked well in other industries, and will attract significant ESG capital for energy innovation. But it’s not consistent with the well-established approach used among utilities to innovate within consortia and trade organizations like EEI, IEEE, EPR and CIGRE.

Energy companies will need this sort of collaboration during the decade of deep redesign. To succeed, they’ll need to expand and evolve their procurement practices, which were designed for component and service acquisition, not experimental innovation. As illustrated in Figure 4, energy innovators need practices that welcome technology companies to share their technologies for experimentation purposes similar to those used during the development of the fully autonomous Gold Mine. While trust is essential, flexible cross-licensing terms similar to those used by high-tech firms like Google and Apple will also be required. In addition, energy companies need to significantly improve their capabilities for managing intellectual property (IP). Many companies are too lax about formally protecting their internal best practices, putting their rights to the value created by a partnership at risk. At the same time, companies need nuanced IP policies that ensure innovation partners that they will be fairly rewarded for their innovation contributions. Getting technology sharing and IP management right is critical, because Gartner predicts that 90% of game-changing energy innovations will come through collaborative innovation with other firms and even with customers.

Figure 4: The Rise of Collaborative Innovation and Composable Organizations

The Rise of Collaborative Innovation and Composable Organizations

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<th>Game-Changing Innovation</th>
<th>Maintain Robust Collaborative Innovation</th>
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<tr>
<td></td>
<td>Shared Technologies</td>
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<td>Curated IP</td>
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<tr>
<td>Composable Organizations</td>
<td>Continuously Narrow Gaps</td>
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<td></td>
<td>Create Novel Capabilities</td>
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<td>Fully Leverage Digital</td>
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By 2030, 90% of game-changing energy breakthroughs will come from collaborative R&D.

Source: Gartner

The role of digital technologies in game-changing innovations requires special attention. In fact, many game changers may consist primarily of novel digital elements that string together existing physical technologies (once again, similar to the autonomous mine example above). Consequently, it is essential to have adequate IT participation on collaborative innovation teams. To succeed, CIOs need to develop the right sort of talent (with the right temperament) to participate in collaborative innovation. And they need to draw IT technology vendors into the conversation.

Recommendations:
New Cyber-Physical Energy Assets Will Require Companies to Rethink Technology Management and Asset Design

The final force driving energy company transformation in the decade of deep redesign is the emergence of new forms of energy assets capable of outperforming traditional assets. It’s appropriate to begin this section by acknowledging that energy companies have built some of the most amazing machines operated by mankind. These assets can, for example, autonomously build and operate oil production factories on the seafloor, five miles underwater. They can operate under extraordinary conditions — from the subzero Arctic, to a scorching desert and raging storms. And, they can sustain extremely high levels of reliability under these incredibly demanding conditions.

Although current energy assets are engineering marvels, they share a common design flaw, which is a 100-year engineering legacy that preceded digital. Their cyber and physical capabilities were never integrated during their design to enable a broad range of business capabilities. Consequently, the fundamental design of energy assets will change over the coming decade and the new breed of energy assets that will emerge will outperform existing assets, which will be software defined from inception.

An aerospace analogy will help clarify this point. NASA’s space shuttle was an amazing machine. It had extraordinary capabilities and, considering the dangerous nature of its work, it had a strong reliability record. But it was also extraordinarily complicated, and therefore very expensive to operate and maintain. By contrast, SpaceX’s Falcon rocket is simpler and less expensive. Nine Falcon launches can be completed for the same cost as one shuttle launch. And yet it possesses remarkably superior capabilities. After assisting the lifting of its payload into near orbit, its booster rockets fly back to earth, communicate with a drone platform roving in the sea, autonomously coordinate an intercept and then perform a propulsive vertical landing. The rocket can achieve these superior capabilities because of its cyber capabilities (like sensing location, managing flight parameters and optimally negotiating landing locations). Another factor is its cyber capabilities’ deep integration with its physical capabilities (like simple landing struts and navigation panes, simple flight navigation vanes and multiuse engines).

During the coming decade, the energy industry will develop and deploy its versions of these highly competent assets. As Figure 5 shows, a compelling force for designing these assets will be the superior software-driven capabilities they provide, especially when operating within connected networks of other energy assets. In addition, their elegant designs will drive down their cost of operations and maintenance. The performance of these new forms of assets will be so revolutionary that Gartner predicts that leading energy companies will be defined by their ability to design business assets that deeply fuse digital and physical capabilities.

- Develop new commercial practices that foster partnering and experimentation.
- Take a leadership role over the digital elements of innovation.
- Take responsibility for protecting the digital IP of your company.
- Develop IT talent capable of sparking novel innovations.
Once again, CIO leadership will be critical because such assets won't simply happen on their own. Leadership is required during the design phase to use digital capabilities to minimize the requirements for physical elements. This is the opposite of the traditional approach. Due to their enormous cost of construction, energy assets are typically created via a stage-gate process. During each phase, elements of the overall design are decomposed and matched to offerings from component manufacturers. Additional elements are added to the design to provide defined interoperability among the components. This is similar to the methodology used to create the complex and costly space shuttle. A design authority in some form is required from the very inception of design to fully integrate the digital physical elements. The genius of SpaceX’s design authority is its ability to envision elegantly disruptive design that can be practically implemented — for example, the choice to land on a drone platform, instead of a traditional splashdown. In addition, the design authority needs to control the tendency to increase complexity. Indeed the design authority must drive the design team to use digital capabilities to simplify physical requirements — making them more adaptable and cost-effective.

Recommendations:

- Champion establishment of a culturally acceptable design authority for your company.
- Elevate IT’s participation in the early stages of asset design.
- Work with the design authority to use digital capabilities to minimize physical requirements.
- Ensure that asset capabilities can be enhanced via easy, secure software upgrades.

Acronym Key and Glossary Terms
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<th>AI</th>
<th>artificial intelligence</th>
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<tr>
<td>EEI</td>
<td>Edison Electric Institute</td>
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<tr>
<td>EPRI</td>
<td>Electric Power Research Institute</td>
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<tr>
<td>ESG</td>
<td>environmental, social and governance</td>
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<tr>
<td>IEA</td>
<td>International Energy Agency</td>
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<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
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Evidence


2. [Sustainable Investment Funds Just Surpassed $1 Trillion for the First Time on Record](#). CNBC.

3. [Syama Gold Mine Fact Sheet](#). Syama.

Recommended by the Authors

Succeeding in a World Where the Future of Energy Disrupts Everything

Ignition Guide to Building A Corporate Narrative And Supporting Tools

Case Study: Strategy Teaching Workshops (Direct Energy)

CIOs: Use a Grassroots Approach to Redesign the Enterprise Operating Model for Digital Business

Scaling Digital Business Requires an Enterprise Operating Model Perspective

Tech CEO’s Guide to Co-creation: Discovering Unmet Needs

Defining Trust in Global R&D

Tool: Intellectual Property Protection Checklist

Focus More on the Realities of Cyber-Physical Systems Security Than on the Concepts of IoT

Implement a Design Authority to Deliver Improved Asset Value Supported by an Asset Management System