Leverage Lessons Learned in Transformation Planning

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Transformation Planning: A Key to Future Smart Grid Success?

Back in the twentieth century, well before the internet was even conceived, digital computing offered a means to automate transmission planning and tools were invented for all aspects of planning, from design to operations and maintenance to expansions. From those early days, Siemens PTI has grown with the industry as a leading provider of transmission planning software and the tools, familiar to you all, which have become a key foundation of transmission planning worldwide. This article examines the state of the power industry and suggests a provocative proposition: transmission planners, experts in designing and planning a grid using sensory data inputs and scenario building tools, have a vital role to play in charting transformation planning and strategy going forward. As distribution systems begin to more closely resemble their long-distance, high-voltage cousins, distribution planners will benefit by examining lessons learned in the more mature planning environment of transmission. But first, let's take a look at the challenges facing the industry.

Houston, We Have a Problem: Too Much Change, Too Fast

While the words from Apollo 13 were actually, “Houston, we’ve had a problem here,” this phrase has come to signify the understatement of a dramatic problem. The dramatic problem in our industry is too much change, too fast, and it is only beginning to dawn on an industry that has had tremendous success over the past century. The electric utility industry and individual electric utilities find themselves at a crossroads as 2014 ends and 2015 begins. In the next few years, decisions that we make (or don’t make) will have far reaching impacts on our personal and collective futures. An array of external trends are aligning that demand our attention to preserve the grid and all its parts, the engineering marvel that our forefathers designed and built to drive unprecedented economic progress in the twentieth century. While many in our industry argue that energy policy must protect and preserve existing business models by constraining new alternatives, this article agrees on the need to preserve grid and utility functionality, but offers a more proactive alternative to a reactive defense against disruption.

No doubt, defending the status quo is valuable to slow the path of increasing complexity and instability, but alone it is a short-term solution that only delays the inevitable. The only path forward with long-term sustainability is to proactively embrace changes and lead into the future. Incumbents must transform themselves to accommodate new business models that leverage new technologies if they are to keep up with outsiders bringing change to the power industry by offering more value to consumers. A strategy of embracing the future while preserving the best of the past promises a novel value proposition for the twenty-first century. But realizing this potential will require new levels of insight, perception, and courage to drive change against a pervasive conservative culture of risk avoidance, nurtured over four generations into a cultural norm. Executing such a strategy will require regional industry transformations and individual business transformations likely to take decades to accomplish, executed in stages in order to accomplish a managed transition from old ways to new.
A Shift from Defense to Offense: The Transformation Imperative

If it were only a matter of greening the grid, adding renewable energy could be accomplished with some modifications, albeit significant modifications, to business as usual. But the challenge is not limited to merely substituting clean fuels for fossil fuels, as radical as that may be in and of itself. In fact, much more is at stake. A utility today faces an array of challenges and constraints as it contemplates strategy in the face of disruption. Six of these challenges are outlined below. Of all these changes, two are the most destabilizing (threatening) to the current utility business model: decentralization and disintermediation.

1. Accelerating Change and Complexity. Change is accelerating and the environment is growing more complex; the utility environment has been relatively stable throughout its history, so this growing trend represents a monumental challenge for utilities to become flexible and adaptable to a highly dynamic and unpredictable environment.

2. Empowered Buyers, Innovative Solution Providers. A maturing internet economy has empowered buyers, who leverage internet procurement to buy commodities at the lowest price. In response, successful sellers avoid this commodity trap by becoming innovative solution providers, thereby maintaining margins and profitability.

3. From Consumer to Prosumer. New technologies and innovative business models drive the creation of new products and services, which enable consumers with increasing autonomy and control. As consumers mature, they become producers as well, i.e., prosumers.

4. Decentralization. Our modern economy is organized centrally, with distributors serving consumers. But newly empowered consumers benefit from technology change that puts value “out at the edge,” i.e., decentralization. As our economic foundation increasingly leverages on-site elements, decentralized and centralized resources coexist.

5. Disintermediation. As entrepreneurs and large companies outside the electric industry take advantage of new tools and business approaches to insert themselves between existing businesses (incumbents) and their long-term customers, they use value as a wedge to upend long-established relationships, i.e., disintermediation.

6. Supply/Demand Side Equivalence. As utilities (supply) and energy consumers (demand) each seek to optimize their condition, the opportunity for market equivalence emerges. A co-optimization approach begins with each side pursuing their objectives with minimal disruption to the other side, but ultimately seeking synergy and leverage.

Disintermediation and Decentralization have historically acted to create disruption, largely independent of incumbent control. In so doing, these trends have driven progress in a maturing IT world, as we have moved from vacuum tubes to transistors to integrated circuits, then on to a series of information processing devices like calculators, computers, laptops, video games, smart phones and tablets. Understanding cross-industry patterns in technology creation and adoption is vital to understanding disintermediation and decentralization. A review of the history of the digital economy reveals three key capabilities employed to drive progress: 1) research and development (R&D) creates new technologies and new capabilities; 2) innovation crafts new products, services and business models to leverage new capabilities; and 3) marketing commercializes new approaches, educates buyers, stimulates uptake, and achieves economies of scale that drive costs down and market share up. Electric utilities are certainly engaged in such activity today, but as monopolies in a stable industry they have not historically invested in these categories to make them core competencies, certainly not to the degree that their likely market competitors have. This relative difference places utilities at a competitive disadvantage in a time of change.

The telecom industry offers the most cogent example to describe the challenge now facing the electricity world: how to successfully adapt and transform from infrastructure delivery of commodities (i.e., utility) to

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1 Are You Facing a Commodity Trap? Don’t be too quick to blame the economy – you might be the victim of your own complacency, Entrepreneur, December 1, 2009, http://www.entrepreneur.com/article/204192


3 Ibid
creation of value added products and services (i.e., service company). While there are myriad differences in these two industries, from the business model perspective, and this transformation challenge in particular, they are quite similar. In fact, it would not be a stretch to describe power delivered by electric utilities today as “dial-tone” electricity, in so much as reliable, affordable grid electricity delivered to wall outlets so closely resembles the reliable, affordable dial tone delivered to phone jacks and wall phones by telephone utilities 30 years ago. Describing it this way is in no way a knock on grid power – to the contrary, universal access to reliable affordable power, and universal telephone services have each become hallmarks of modern societies and economies around the planet. High reliability and low cost make dial-tone electricity the quintessential commodity of our modern lives.

But this widely accepted definition of the utility value proposition – providing highly reliable, low-cost power – also constrains our collective imagination of what may be possible with new energy technologies; limited to thinking only in terms of low-cost and reliability, we may be blind to the potential of new value added energy services. And if we are to learn from what happened to telecom utilities and apply those lessons to the electric industry, we must start here: imagination is vital to innovation. It would have been a stretch in 1982 to imagine the rapid adoption of the platform/applications economy of the Wi Fi and internet-enabled iPhone or iPad in 2012. Lacking that vision, telecoms learned by painful trial and error, adapting to new technologies and external pressures over the decades, first with mobile telephony and soon thereafter with the internet and data services. In the same vein, while it is nearly impossible from our limited perspective here in 2014 to conceive what the corollary of a future of personalized energy services might be over the coming decades, it’s not hard to see the value in becoming innovative and adaptive in order to manage the transition to that future. It’s not hard to imagine this trend line that someday will transform electricity like it did information and telecommunications. And it’s only good business practice to evaluate how to improve on our predecessors in the face of similar technology changes, rather than learning the same lessons all over again the hard way.

Just as new services associated with mobile and data telecommunications pushed voice telephony to the sidelines, new forms of energy production, delivery, storage and consumption promise to bypass the grid and offer non-grid alternatives to grid plug power for monopoly-bound consumers. The few telephone companies that managed to evolve into telecommunication service providers adapted by replacing declining POTS (plain old telephone service) revenue with new cell phone and internet service provider revenue based on new technologies and value added products and services. In a process that took decades to unfold, the ultimate winners – in the US, that would be ATT and Verizon – swallowed their sisters (i.e., Bell South, Ameritech, NYEX, PacBell, ATT Long Distance, etc.) to create larger, successful, sustainable telecommunications giants. Traditional telecom didn’t go away in the face of technology change; rather, the strongest companies in the sector transformed themselves into something altogether new, shifting from reliable telecom utilities that provided an affordable, universal commodity service – dial-tone voice connectivity – to innovative service companies providing innovative value added services. Notably, many of the less successful telephone companies are no longer around, and therein lies a valuable lesson for electric utilities as industry transformation unfolds: there are no guarantees going forward.

As value added energy products and services mature with new technologies and business model innovations, the electricity industry is most likely to follow a similar path to that experienced by the local and long-distance telephone industry over the last 30 years. Value added product and services revenue will gradually displace traditional revenue that utilities earn through rates for providing reliable kWhs over the grid. Individual rate payers will invest in energy efficiency and third party on site energy solutions to lower their bills. Collectively, such activity erodes utility revenues still needed to support long-term grid investments: greater value for consumers becomes an existential challenge for electric utilities.

What seems like a trickle of innovation today, or a far off phenomenon for utilities in Germany, Hawaii, or California, will in a matter of years develop into a clear and present threat for electric utilities worldwide, as technology advances and scale economies drive myriad distributed energy resources (DER) to become innovative consumer devices and solutions sold in commercial markets at ever-lower prices. These trends, whether they take two years or ten, are clear and distinct. What we choose to do at the industry and company level today will determine whether electric utilities in the future remain relevant with new, more dynamic roles to play, or whether they are relegated to a supporting role, leaving new service
companies to enjoy the major growth in energy services because they are better able to offer innovative value using new technologies and new business models. On the one hand, utilities may react defensively and seek to slow such progress to protect their traditional revenue, gaining time, but not long-term advantage. On the other hand, utilities that choose to emulate the innovation and creativity that new competitors use to protect and/or gain market share will create a more diverse revenue base for long-term sustainability.

In this future of increasing uncertainty, we all have a vested interest in the continued health of the electric utility sector. It is vital that electric utilities acquire the flexibility and adaptability to address emerging threats and seize opportunities as they arise, because we need the grid to remain strong. We will need affordable and widely accessible plug power for decades to come, and industries will continue to need intensive power that is not possible from DER. Electric utilities are ideally designed to provide these types of economic value over their grids. But to stay competitive, electric utilities will need to divide their focus in two directions simultaneously: first, they will need to preserve current grid reliability and meet grid modernization challenges; and second, they will need to acquire the business capabilities required to provide higher value energy services, either by themselves or in partnership with third parties. We call this twin challenge The Transformation Imperative: grid reliability/grid optimization on the one hand, and business model changes to enable emerging DER-based products and services on the other.

New Risks on the Horizon: Transformation Risk Unbundled

A key element making transformation an imperative is a rising Transformation Risk, a broad term that includes at least five subcategories, which take their place alongside such traditional utility risks as reserve margins, system outages, cyber security, market exposure, long-term planning and capital expenses, etc.

- **Operations Risk.** Over the past few years, two studies, the Duck Curve in CA\(^4\) and the Nessie Curve in HI,\(^5\) describe the impact of increasing levels of solar PV on traditional grid operations. These are prime examples of Operations Risk: increasing levels of DER on the edge – where the grid terminates at the customer site – will make the grid increasingly difficult to operate under the current system paradigm, including the new risk of power backflow on heavily loaded circuits.

- **Enterprise Risk.** The introduction of the phrase Utility Death Spiral\(^6\) into mainstream usage in 2012 and 2013 highlights a second subcategory of risk, where rate increases become necessary when sufficient DER penetration reduces utility revenues. But besides making utility financial statements whole, rate increases also accelerate grid parity and enhance the appeal of DER, driving even more penetration, making further rate increases necessary. The end result is a negative self-reinforcing cycle that earns the scary title Death Spiral. Sounds like a Black Hole – stay away! But not so fast, as many still dispute the nature or even possibility of such an outcome. That said, the risk of flat or declining revenues is real, and reduced revenue constrains a utility’s ability to respond to changes by becoming more flexible and adaptable.

- **Organizational Risk.** This next subcategory begins with the well-documented challenge of replacing aging utility workers, but expands when organizational changes in job descriptions, business processes and business model are contemplated. Slow to change, utility organizations find it difficult to mobilize against threats. This challenge is compounded when most utilities have been through reorganizations and budget cuts that have left them with slim resources to manage necessary changes. As workers take on additional tasks, their core job functions face the risk of disruption.

- **Market Risk.** The rise of a more mature energy consumer, adopting new consumption patterns and encouraged by energy service companies to leverage DER, creates this next subcategory of risk. Utilities will have to open up to collaborate with a more empowered energy consumer with more

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demanding expectations of the utility, or risk losing their natural role as local energy subject matter expert to those more willing to engage with energy consumers in new ways, on new terms. And as the utility loses its historic role in the community, loss of revenue opportunities are sure to follow.

- **Regulatory Risk.** Finally, monopoly utilities are still regulated in various degrees, their fates intertwined with regulators as both contemplate transformation. As regulators adjust their thinking and evaluate their options for industry transformation, this subcategory of risk for utilities includes managing business transformation inside their organizations and industry transformation expectations of the regulators who set their rates and guide their investments. Utilities must seek to guide industry transformations to be in alignment with their best interests, or suffer actions or inactions by regulators that confound their plans.

**Looking Both Ways: Mastering Business Transformation**

In the face of such widespread and fundamental risks documented above – adherents of the Utility Death Spiral place this risk at the existential level, while others are more moderate in their projections – electric utilities have an imperative to adjust their strategies and business models, operations, organizations, finances, market relationships, and regulatory approaches to manage risk and prepare for upcoming changes – in short, to transform themselves. Utilities must adjust internally, even as they participate in industry transformation to drive favorable changes in their industry as a whole. Electric utility leaders have an opportunity to shift from traditional passive regulatory compliance – following instructions from regulators and doing at least the minimum to remain in compliance – to a more active role of designing industry transformation so that their interests are addressed proactively. To describe the changes needed to address Transformation Risk at the individual utility level, we use the term *Business Transformation* as distinct from the modest to radical changes at the industry level driven by regulatory and legislative policy. Business Transformation describes the measures a utility takes to address the new risks enumerated above, but also to take advantage of new opportunities to make new types of revenues. Like the Roman’s Janus, the two-faced god of transitions who looks both to the past and to the future, utilities must look to the past to manage their traditional grid-based business, even as they look to the future to prepare for a new type of business that incorporates non-grid products and services.

The art of Business Transformation will involve blending grid reliability/optimization with new value added services and new business models. Business Transformation is closely aligned with technology initiatives, even being driven by technology plans, so it may well begin with a Smart Grid program. Beyond the technology procurement and implementation plans and activities of Smart Grid though, a Business Transformation is a broader exercise, including mobilization of internal stakeholders (organizational change management) and planning for collaboration with external stakeholders (customers, vendors and regulators). Without a focus on these indirect aspects of transformation, technology projects face greater implementation risks.

The methodical process of Business Transformation will involve some version of each of the following steps, as the utility designs a plan for a managed transition to address grid optimization and new business models.

1. **Vision.** Craft a vision of The Utility of the Future to kick off a strategy planning effort, with initial widespread acceptance at the leadership level;
2. **Orientation.** Understand strategic threats and risks from the perspective of the individual utility using analysis and assessments;
3. **Business Model Aspirations.** Evaluate alternatives for new business models to determine the best fit and to understand from a comprehensive level the interactions of channels, product, pricing, etc.; tools such as the *Business Model Canvas* are well suited for this step;
4. **Platform Evaluation.** Consider technical alternatives to create a platform for management of disaggregated DER elements, but also engagement of DER vendors and potential partners;

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5. **Organizational Change Readiness.** Assess the readiness of employees to begin a transformation process, surveying all levels of the organization and using educational tools to ensure widespread awareness of the issues associated with change within the organization;

6. **Strategic Roadmap (Qualitative).** Design a *qualitative* understanding of new business models, capabilities, and aspirations and the integration of technologies to craft a rough draft of a long-term plan; evaluate regulatory challenges and strategy, organizational impacts and readiness, and external stakeholder alignment and mobilization;

7. **Strategic Roadmap (Quantitative).** Craft a detailed *quantitative* assessment of costs and benefits of a transformation program to produce a value-based Business Transformation Roadmap;

8. **Long-Term Partner.** Identify and engage a long-term partner to assist with the transformation;

9. **Program Management Office and Value.** Establish the program management office (PMO) and begin the long-term implementation project, with a focus on consistent value creation and logical, progressive skill attainment; and

10. **Program Refresh.** Plan to refresh the strategic roadmap regularly to accommodate growing organizational maturity (changing strengths and weaknesses) and a dynamic external environment (new opportunities and threats).

**Transmission and Transformation Planning: Common Elements?**

Common elements between transmission planning and transformation planning will be found primarily in the area of Operations Risk and will include such issues as distribution system operations, distribution feeder risk assessment, and scenario development. First, system operations will be stressed by increasing numbers of small generators and energy storage attaching to the grid at its termination points – the “edges.” The planning challenges presented by this influx of new connection points are exacerbated by the independent nature of these systems. These customer owned systems are interconnected without the long lead times of large generation projects, often moving ahead of planners’ ability to plan. Second, risk assessment at the feeder level has to do with the increasing volatility of the distribution grid state with so much variability introduced. This volatility has been seen in Hawaii, where high penetration levels of solar PV have raised the risk of power backflow on individual feeders, placing expensive distribution substation gear at risk. Finally, scenario development will be vital to examine the changing state of the grid when different combinations of variable generation, energy storage and curtailable load are introduced at the feeder level, then upward to medium voltage levels at substations and larger portions of the distribution grid.

A future article will explore the provocative proposition introduced at the beginning of this article: transmission planning holds valuable lessons learned for distribution planning in the face of industry volatility and change. In the meantime, we actively seek your feedback on this proposition pairing transmission planning with the emerging area of transformation planning. Are we on target? Is this too much of a stretch? Please share your opinions with your Siemens PTI colleagues – we encourage active dialogue, as we have much to learn from each other and we should not let hard-earned wisdom lie fallow – we need all lessons learned to be applied to the monumental challenges associated with business and industry transformation.