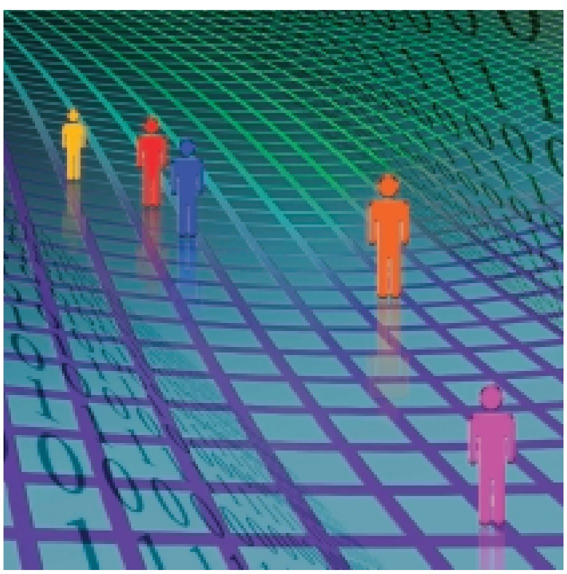
Efficient Regulation, Efficient Grid

Intelligent infrastructure requires an intelligent policy framework.



By Mark A. Gabriel

The current view of the smart grid is as an extension and extrapolation of the existing distribution and transmission networks, bolstered with technologies such as advanced metering infrastructure (AMI) giving visibility and control from buss bar to end-use devices coupling communications and computing into a new web of intelligent infrastructure.

While much of the discussion has been about building out this new grid on today's business model, financing, managing and controlling it will necessitate a new framework—one that may be as dramatic in how it changes the industry as wrought by the technologies themselves. The answer lies in the creation of what might be termed the new grid efficiency framework (GEF). This framework will require a new understanding between utilities and their regulators that will allow the industry to advance its goals of reduced carbon emissions, improved system operations and efficiency, all while maintaining the highest reliability standards.

Too much has been made of use cases and business cases as the industry makes the most dramatic set of changes it's made in the past 50 years. Whether it's the inclusion of renewables and plug-in hybrid vehicles to AMI systems, which place options in the hands of consumers, or visualization and management of the system and its state by control areas, it won't be business as usual for public power, investor-owned utilities, rural electric cooperatives or federal systems. Current regulatory perceptions will have to change as the value chain is fundamentally altered.

Trying to justify and value the smart-grid cost using today's recovery mechanisms is tantamount to valuing the personal computer as a time-saving typewriter and calculator or analyzing the cellular telephone market simply as a replacement for land-line telephony. No use case could have accounted for the ancillary and significant value created by expanded computing through the web or communications such as text messaging (not to mention digital photography) through the cell-phone network.

Recognizing that utilities are motivated to add capital projects to their systems, regulators have found themselves in the role of heavily scrutinizing the reasonableness of large investments to keep costs in check. Their reviews not only compare the proposed capital project to reasonable alternatives, but also consider the technological risk associated with the investment. There are many examples in regulatory proceedings where commissions have disallowed all, or a portion, of investments because the technology was considered experimental, it didn't perform up to standards, or was perceived to be "gold plated" compared to reasonable alternatives. This regulatory environment doesn't foster bold ventures into new uncharted territory, nor does it embrace long-term positive qualitative and quantitative benefits that might not impact ratepayers for years to come.

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Therefore, it's critical that a new regulatory perspective evolve to support and stimulate the massive investments being made in intelligent infrastructure in a way that supports, and does not undermine, financial incentives for the industry.

New Regulatory Framework

This new regulatory framework must take into account the need for rapid change and the altered relationships in the financing and management of infrastructure. In a world where many utility investments and costs have been averaged within a traditional embedded cost-of-service analysis, it's important that policy makers provide regulatory incentives that are robust enough to stimulate needed investments from capital markets, protect the public interest and reward investors (be they shareholders or other investors).

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Transformer purchases are a clear example of the change required. Under the current financial paradigm, utilities buy transformers that meet performance specifications based on the initial cost plus the cost of losses over the estimated life of the transformer. Additionally, from a service and reliability perspective, installed transformers typically are oversized given an estimate of customers' peak load requirements. Current transformers have an acceptable level of efficiency yielding losses that within a cost-of-service analysis are spread across the entire system's customer base. Sizing transformers is often based on past practice and algorithms, and not based on real-time customer usage information. This current approach to purchasing transformers makes perfect sense in a rate-recovery environment in which the utility is compensated (or made whole) for its system losses, rewarded with added return associated with oversized, and therefore more costly, transformers and penalized for performance issues based on outage numbers as opposed to power quality and efficiency. Unfortunately, this type of regulatory environment seriously could hamper the pursuit of shared smart-grid goals.

The transformer market is going to undergo a dramatic change after January 1, 2010, as the new federal efficiency standards are enacted for both liquid and dry equipment. Based on new rules formalized October 12, 2007, all manufactured or imported transformers must meet the need design criteria, which are estimated to push efficiencies upwards of 99 percent and thereby saving nearly 238 million tons of CO_2. The payback associated with these new standards is estimated at between one and 15 years. The real question is whether utilities will (or can) take advantage of the new equipment by placing this equipment in service earlier than planned—and whether the grid-efficiency framework view of the world will allow, and incentivize, them to do so.

The economic analysis supporting a wholesale retrofit of high-efficiency transformers across a utility system may be as simple as a present-value analysis that considers the anticipated avoided cost of producing less power, including the associated environmental cost of carbon, NOx and SOx plus related offsets and energy credits. Yet, under today's regulatory model, there's a disincentive for the utility to purchase the higher-cost equipment since the utility cannot share all benefits with the ratepayer in the near term. In fact, if a utility were to implement a wholesale retrofit of transformers across the system, rates likely would increase substantially in the short run as the utility would be replacing a less-expensive and partially depreciated plant, thereby stranding the investment with a new, more expensive—albeit efficient—plant. Returns and rates would increase substantially. Savings to customers related to lower system losses and potentially less expensive generation would be realized over the long-term planning process. The correlation between the cost and benefit of the new investment largely would be lost to the customers and would present a difficult political challenge to the regulator.

Increasing favorable economics associated with smart-grid technologies, even considering a relatively high price of a carbon tax (in excess of $50 per ton) likely will add to the cost of service resulting in a long series of rate increases piled upon other cost factors (*i.e.*, increasing the utilities' cost of service via reduced load growth, higher operating costs, increasing fuel costs and aging infrastructure).

Even with $4 billion in stimulus funding targeted for the smart grid, the utilities' matching portion of the monies must be added to the utility rate base, again raising rates.

Investment Deferred

Another significant barrier the utility must face is regulatory lag, or the time that elapses between the investment and the utility's ability to recover the investment in rates. In the transformer example, the utility, its lenders and its stockholders are faced with significant financial risk as the large-scale financing of such an endeavor must consider the regulatory risk associated with the investment. If the new high-tech transformer investment is fully or partially disallowed in rate base, investors are left holding the bag. This regulatory conclusion takes time and might lag the investment by up to two years, further increasing uncertainty and risk.

As the current financial model is extrapolated across the "smart grid," an important conundrum arises. The price tag will go up as utilities (understandably) fear their inability to recover the costs. As a case in point, AMI historically has made tremendous sense from a utility operating perspective, yet its greatest advantage may come in the form of customer engagement. However, capturing that value in the current business paradigm is challenging for consumer and utility. While the consumer might be able to reduce consumption (knowledge is power) and save on energy, the dollar savings in most rate schemes may not create sufficient incentive to motivate the majority of customers to do so.

In calculating benefits for systems such as AMI, there are more than 50 value attributes and related cost reductions that can be identified in supporting the investment decision. Yet it's often challenging as utilities and regulators try to balance the operating needs of the utilities with the reality of short-term rate-hike aversion. This often results in the deferral of investments based on exogenous factors such as local politics, social-economic considerations and the fervor and strength of intervention during a rate case. The decision to defer isn't based on the technical assessments or value of the investment, and it's entirely possible that utilities don't believe their own business cases. In effect, the electricity sector's current destiny isn't gated by technical limitations, but rather by limitations of the political system in which it operates.

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The current methodologies for computing smart-grid value rely on business cases anchored in an aging and not necessarily robust business view of this changing world. Traditional business cases look at technologies as they have for 50 years: The cost of the asset is returned over its useful life with an allowed rate of return for investor-owned utilities, and allowed margin and costs spread across the customer base for both municipal systems and cooperatives. This capital-recovery mechanism is added to the assumed operating benefits to determine the go-or-no-go decision on the investment in infrastructure. Nowhere in this model, even in a decoupled world, is value given to customers in terms of utilities increasing efficiency and lowering operating and planning costs. Nowhere are investors rewarded for innovation and risk associated with new technologies compared to alternative traditional options.

Grid Efficiency Framework

The solution to this dilemma is a grid-efficiency framework that, when coupled with regulatory support, creates an answer to resolve the financial disincentives that exists in the system and the lack of rewards delivered to the consumer, the utility and society for technological innovation related to the intelligent infrastructure.

The GEF mirrors the value chain, allowing proper compensation to all participants including investors, customers, utility and society. The basic tenet of the GEF is found in a three-factor formula:

First, the technology-deploying entity is allowed full and/or accelerated cost recovery on assets that are linked to the smart grid and have a proven improvement of performance efficiency over baseline equipment. Utilities can be granted expedited rate hearings outside of the stringent requirements associated with a full-blown rate case. Utilities can be granted rate relief on an interim basis subject to true-up and formal adoption in a rate case, thereby minimizing risk associated with regulatory lag.

Second, the utility is allowed to share a portion of increased profits related to performance improvements with the remainder being passed on to customers in a profit sharing/cost reduction agreement. This is similar to performance-based rate (PBR) theory, where utilities can increase return given satisfactory performance measured against baseline metrics reflecting system operation and performance before and after smart grid.

Third, the utility is allowed to count, bank and then trade the value of the carbon reduction associated with load reduction and improved system losses, *etc*., in the market. Again, this can be shared with customers. By creating the GEF, the decision to invest in the best and latest technology is incented and rewarded.

Looking at the suite of grid-efficiency improvements and granting them the same (or increased) benefit of other capital assets can make a significant difference in moving the nation towards a lower carbon future. Some experts certainly will maintain that utilities today aren't prevented from including any capital item in their rate-recovery requests, yet, in practice, a balancing act occurs in which investments of all kinds are traded off against each other in an effort to trim budgets and win regulatory (as well as internal) approval. Today, in a typical rate case, utilities and investors are rewarded for capital deployment in support of load growth and reliability. In the future, under GEF, utilities and investors will be rewarded for minimal system growth, while maintaining the highest efficiency and reliability across the system.

The new framework will reward utilities for minimal system growth, while maintaining efficiency and reliability.

The GEF allows for a series of checks and balances as the current state of the utility system serves as the baseline with critical performance metrics inserted and revisited on a regular basis. This allows regulators and other governing bodies to monitor performance to insure the value created is properly distributed to customers as well as investors or financiers. Also, the GEF can be factored into the integrated resource planning (IRP) process, for those jurisdictions requiring it, using measures that recognize the full value of these programs, including the carbon, energy and capacity reductions. At the planning level, this will stimulate additional and alternative investments since important inputs into an economic life assessment of a generation alternative will be altered. In order for the GEF methodology to take hold, a different view of utility technology investments will need to be developed. Given the relatively nascent nature of intelligent infrastructure, the next few years will require significant analysis of the benefits of a more efficient grid. Regulatory support is at the heart of moving the entire system ahead. And, as the *quid pro quo* for that support, utilities will need to invest in high levels of monitoring, measurement and verification to justify the investment and near-term rate impacts. GEF will require utilities to make bold moves that will help protect their futures, lower carbon and increase efficiencies. It will require regulatory encouragement and financial support, including all types of utility oversight. Additionally, it will require public education and understanding, and explicit financial certainties including working carbon markets.

Success in the early years of the GEF will require companies to have a deep understanding of electricity markets and the regulatory environment. It will require utilities to bring together all sides in the discussion and thoughtfully balance the interests of all parties. This balancing of interests will require analysis down to the feeder level and back across its smart grid and related investments in order to gain regulatory support for AMI and smart-grid investments.

A new GEF will redefine the way the nation justifies and implements intelligent infrastructure, and this will be the foundation that attracts the capital that will make it happen.