



# Gridonomics: Aligning Energy Policy, Economics and Technology

The electricity industry is at a tipping point where the pace of change and opportunity for disruption is accelerating. Thirty years of energy policy and industry structural changes are combining with accelerating social and technological evolution. This is creating significant pressure for fundamental changes in the design, operation, structure, and regulation of the electric industry. It has become clear that effective business and public policy strategies to enable the transformation of the global electric industry require alignment of policy, economics, and technology. This interrelationship of policy, economics and technology is what Cisco calls Gridonomics™.

Cisco has built its business success by recognizing market transitions. Given the global re-examination of the direction and pace of transformation, Cisco offers Gridonomics as a framework for engaging global energy stakeholders through public-private dialogues on how to achieve a reliable, secure, and clean energy future.

## Smart Grid Investment Analysis

Cisco first addressed these grid modernization questions through a quantitative analysis of the value of smart grid investments in the United States and European Union, in a webcast in January, 2011.<sup>1</sup> The Cisco® Gridonomics quantitative analysis indicates that smart grid investments may yield a 15-year net present value (NPV) in the United States of about \$210 billion.<sup>2</sup> This value analysis is in line with McKinsey's total value estimate of \$130 billion<sup>3</sup> annually by 2019 and other recent U.S. value analysis on a comparative basis.

We also closely examined the value of 12 investment areas that generally define the scope of smart grid deployments, as well as their economic and technology interdependencies. To do this, Cisco developed a reference business architecture to link with our information technology architecture for modern electric grids.<sup>4</sup> Our business architecture is a logical framework that links public policy and business strategy to business models and use cases. Using this framework, we are able to identify critical interdependencies that can yield improved smart grid investment returns and reduce technology adoption risks.

## The Value of Network Convergence

Cisco has been deeply engaged in evaluating the significant impact of customer adoption of distributed energy resources (DER), including onsite generation, dynamic load management, and energy storage. As electric customers adopt DER, they will have opportunities to sell energy and related power services to markets and grid operations. This means a growing number of customers will become producers of energy services, not just consumers. We believe these "prosumers" will play an increasingly important role in the operation and structure of electric networks and wholesale markets. The participation of prosumers will transform the electric industry from a centralized and vertical market to a hybrid, horizontal market. This future grid state will combine large-scale power generation and storage with significant distributed, customer-owned generation, storage, and dynamically controllable load—perhaps 30 percent of system peak by 2025 in several locations globally. We have discussed this view as "A Future History of the Grid."<sup>5</sup>

Three major areas are having a dramatic impact on the physical state of the grid: 1) electrification of energy through the growth of clean and renewable electricity as a primary fuel for economic growth;<sup>6</sup> 2) prosumerization; and 3) the creation of the E-Net<sup>7</sup> resulting from the explosion of supply, demand, and storage resources as well as intelligent energy devices on the grid. ICT networks continue to rapidly evolve and social networks are increasingly having a significant impact on society and culture worldwide. The result of these forces converging is that we are very likely to see a radically different future role of customers and their engagement and participation in electric markets and operations. That is, as Web 2.0 meets Grid 2.0,<sup>8</sup> expect a significant shift in the operation and function of the grid.

## New Business Paradigms

Paradigm shifts often happen slowly, particularly in a 125-year old industry. Also, trying to make sense of the massive global social, economic, and technological change and to envision the future of the electric industry is a daunting task. However, vision is exactly what is needed because the planned \$6.9 trillion capital investment in global electric networks<sup>9</sup> (IEA, 2010) will span a 15- to 25-year period. The current economic climate has many industry sectors, including utilities refocusing on operational excellence strategies to squeeze financial gains from existing core operations. However, as Geoffrey Moore points out in *Escape Velocity*,<sup>10</sup> this strategy works reasonably well "until you expose the enterprise to secular market change." "Secular change" is what the electric industry is undergoing in the transformation underway.



This is why new business paradigms for assessing the opportunities and potential threats are required. These new models should consider the industry sector transitions that have already occurred in financial services, media, telecommunications, and retailing, for example. By understanding these changes better and the evolving Web 2.0 business models, it is possible to create new frames of reference to identify the opportunities in a future electric industry. This future is already occurring on a limited basis in a variety of locations around the world.

## Investing in Your Core Business and in Innovation

The challenge for utilities and services firms now becomes how to invest in both their existing core businesses as well as in new areas of innovation. We believe that many of the smart grid investments today will show that seemingly discrete investments actually have synergistic relationships.

Leading utilities are considering the “core” investment opportunities within the context of “operational excellence” strategies as well as considering “innovation” opportunities and potential synergies. These activities include developing integrated business strategies, technology architectures, and deployment roadmaps to guide these critical investments. Of course, these investments should be deployed reliably and securely and in a way that is consistent with present and future customer needs. The investments must also ensure flexibility to accommodate changes in market structures and customer use of the networks.

One example of this type of investment is field area networks (FAN) that can be used for a) smart meter aggregation and backhaul; b) distributed automation; c) distributed protection; and d) workforce connectivity and productivity. Each of these applications can be considered within a unified communications network that provides significant cost and benefit synergies related to the underlying value. This same network can be used to interface with intelligent distributed energy resources and customer interfaces that enable derivative benefits.

## Conclusion

The change toward distributed energy resources for electric networks and the corresponding rise of prosumerization will create a more horizontal market. Convergence with a sophisticated ICT network linked to energy-aware social networks will create significant value beyond the traditional value chain. As an analytical framework, Gridonomics is a tool to look at the intersection between technological, economic, and policy aspects that will exert influence on the future of the power industry. Cisco’s vision for the future of energy is based on deep experience with transitions in other market sectors that disrupted traditional business models, including entertainment, financial services, telecommunications, government institutions, and today, healthcare and education.

Several global megatrends are redefining industry structure and business models. Now is the time to engage in public-private dialogues on electric industry transitions regarding value creation and shifting value-capture opportunities. Cisco intends to support these industry dialogues as transformations of the electric industry continue in a number of venues around the world.

## Notes:

1. Cisco Gridonomics webcast, <http://event.ciscowebseminars.com/eventRegistration/EventLobbyServlet?target=lobby.jsp&eventid=347726&sessionid=1&partnerref=1&key=A812DE47E861C32A2F9FAD D7036011CD&eventuserid=56031994>
2. \$210 billion is the mid-point in the range estimate of \$145 to 275 billion identified in Cisco’s analysis of 15 year NPV over 2010–2024 using a 10% nominal discount rate
3. McKinsey & Co report., “U.S. Smart Grid Value at Stake”, 2010
4. Taft, IEEE 2010 keynote: <http://host.comsoc.org/livebroadcast/smartgrid10/KeynoteTaft/KeynoteTaft.html>
5. De Martini, UCSB Energy Summit 2011 <http://iee.ucsb.edu/content/summit-2011-video-paul-de-martini>
6. IEA, 2010 World Energy Outlook, World electricity demand is expected to continue to grow more strongly than any other final form of energy.
7. Robert Metcalfe introduced the concept of the Enernet in 2008: <http://mitworld.mit.edu/video/559>
8. EPRI, “Needed: A Grid Operating System to Facilitate Grid Transformation”, July 2011
9. IEA New Policies scenario (\$3.1 Trillion to 2020)
10. Geoffrey Moore, *Escape Velocity: Free Your Company’s Future from the Pull of the Past*, HarperBusiness, 2011

For more information on Gridonomics, please visit [www.cisco.com/go/smartgrid](http://www.cisco.com/go/smartgrid).