

# Energy Technologies Will Make the Difference

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I am not an engineer. I studied economics. But I have spent a lot of time with scientists, engineers and venture capitalists. *First*, I believe that technological change brought about the revolution in the electricity market just as surely as it brought about the industrial revolution.

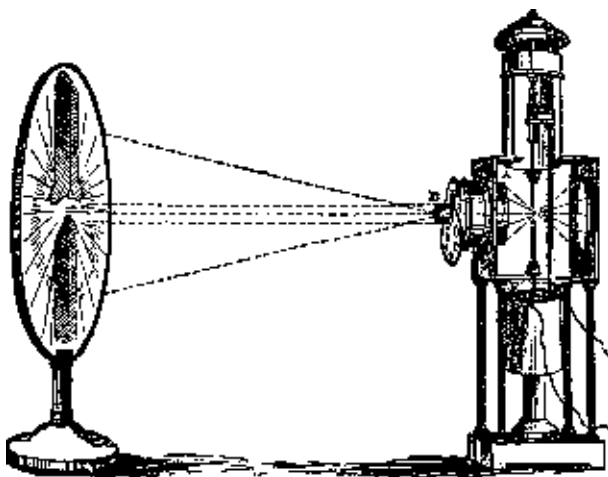


FIG. 262.—Duboscq's Electric Lantern and Regulator.

Electricity is not a low-tech industry. It is a high tech industry with a low-tech managerial mindset. Technological change will play an important role in the rest of the electric revolution, too.

*Second*, the electricity revolution is closer to the beginning than the end of the process. Technology will power the process. And the companies that understand and control the new technologies will win the race.

*Third*, what happened in other deregulated businesses will happen in electricity. The laws of physics will not protect the electricity business from revolution. Electricity is not different.

I'm not always certain that people in the business realize what

is happening. They are too preoccupied with governmental, regulatory and financial issues. They do not want to spend money on their own research and development, they are slow to develop their own new lines of products and they do not realize that venture capital investments can serve a role not only as substitute research and development but also as an aid to the development of new lines of business.

Here, in reverse order, are the three points listed above:

### **Third Point: It Happened Before**

Here's the financial model for deregulation:

- Before: most companies earn high and steady returns, weaker companies earn lower returns.
- During: profitability falls dramatically, becomes erratic and for the weakest companies, it collapses.
- After: companies reduce costs, prices fall, profits rise but are not as consistent as before, weak companies earn low returns, and the industry consolidates.

Public policy reasons led to the deregulation of the railroad, trucking and airline industries, when governments realized that regulation led to higher prices for consumers. In the case of airlines, though, technology enabled the airlines to create a new product, a seat whose price was determined by supply and demand in segmented markets right up until the time of takeoff, and a new service, hub and spoke route service. For some consumers, those developments led to lower prices and better service and for others higher prices and worse service.

On the whole, though, it brought airline prices down and eliminated cross subsidies. The computational powers of the airline reservation systems made possible the new products. Those systems, I would argue, probably have greater value than the airlines themselves. In other words, the information has the real value, not the commoditized airplane seat.

In a similar vein, think about Federal Express. What does it sell? Not package delivery. But a guarantee of delivery, backed up by a

guarantee that Fed Express knows just where that package is. Fed Ex got into business by exploiting an opening in the market created by the post office's slowness and lack of sensitivity to the needs of customers (it was a monopoly, after all), but the development of tracking technology enabled Fed Ex to keep its customers long after the Post office discovered how to deliver the mail promptly. **Fed Ex has moved on to offer logistics, to become the inventory control center in an age of just-in-time delivery.**

The government deregulated large segments of the natural gas industry either because regulation had hurt consumers, or because there was no compelling case to maintain regulation. Yet once regulation was removed, two technological changes revolutionized the business. The first was the introduction of new drilling techniques. The second was the introduction of computer and communications systems that enabled those in the business to keep track of an endless number of transactions. I doubt that many people expected such a transformation after deregulation, but deregulation opened the way to the creation of whole new businesses.

Now, I think that technology opened up the telecommunications business. First, microwave transmission enabled new companies to build long distance telephone networks. Second, digital switching allowed telephone companies to offer new services, and to process the information needed to coordinate traffic from different service providers. Third, using fiber optics, competitors could create competitive local networks. Fourth, wireless lets users bypass any of the traditional services. And, fifth, the Internet could offer all conventional telecommunications plus more.

What has happened, and what will happen, came about as entrepreneurs exploited new technology to create businesses that could take market share from existing carriers. **The incumbent monopolists tried to keep out newcomers, tried to slow the advance of technology, tried to use the regulatory process to protect their markets, BUT THEY DID NOT SUCCEED.**

Now for electricity. What cracked open the North American market? Two events I believe. First, large steam power stations reached the efficiency limits inherent in the Rankine Cycle by the 1960s. Second, the introduction of the gas turbine, followed by a remarkable increase in the efficiency of the gas turbine over time, created a small-scale competitor to the large, utility generator. By the

1990s, the gas turbine ran more efficiently than the utility's big generators, so regulators had no rationale left to protect the utility's natural monopoly in generation. Competition would lead to lower prices.

### **Second Point: Electricity Has More to Go**

So far, **deregulation** looks more like **reregulation**. It has imposed a deregulated bulk power market on a regulated transmission/distribution infrastructure. The generators have demonstrated that they can operate more efficiently. New markets have emerged to handle a multitude of transactions.

But the regulated transmission networks have not responded to the new needs. And the regulated distribution systems have not installed the metering and communications necessary to bring real time market pricing—without which the system will never function efficiently—to consumers.

In addition, the utilities and the new suppliers have to install the information systems that will allow retail consumers to choose and switch suppliers. Going beyond the utility, distributed resources will play a role, but many utilities have resisted or ignored what some see as a threat, but then again, others see as a business opportunity.

Most utilities have concentrated their attention on building up their presence in the bulk power market, or getting out of it, and in making transitional arrangements with regulators. The regulators have decreed various changes in the markets, on a retail basis, without much thought for technological issues. As for transmission, they have rearranged, issued orders, but show no appreciation for technological issues, and that situation does not bode well for system reliability.

Utilities have barely entered into a really competitive marketplace. Oligopolistic trading markets, with inadequate competition able to enter through congested transmission, I think, represents a first stage on the march to commoditization. **The alternative is return to regulation.** Governments will not allow this process to lead to higher prices for consumers. The transmission sector needs new ownership and pricing rules, or it will not attract new investment, and it will not only remain the bottleneck that hinders the development of regulation, but also a threat to reliability.

Sooner or later, governments will allow real change, including

competitive transmission, and I suspect we could move toward something approaching a switched network. The distribution and retail sectors have begun to change, in some places, but they will not turn into real markets until transition plans end, local regulators stop writing the rules, and national or international markets develop. At that point, new players enter the market, some of whom will employ new technologies against the incumbents.

Look at the other deregulated industries. The process continued for years. Once the regulators and the governments remove the old rules, the process goes on and on, as participants work out more ways to take business away from their competitors. Change in the electric business has barely begun. **You can tell because the incumbent monopolists and their affiliates still control most of the business. Don't expect that to continue.**

### **First Point: Technology Will Cause More Revolutions**

I have laid out how technology has helped to bring about the electricity revolution. But that is the past, and you do not make money investing in the past. So let's consider the future, keeping in mind Peter Drucker's oft-repeated (by me, anyway) thought that you cannot predict the future, but that you can predict the consequences of what presently exists.

And to that I would add, you should try to predict the consequences of the introduction of products and services that are in development. That is where venture capital comes in. Those investments give the means to track the progress of technologies that could enter the market within a few years. Here are my candidates for the products or concepts that will continue the electric revolution:

- **Distributed reliability and generation**—In many instances the non-grid solution is more economical. There is no need to rehabilitate the grid to produce the higher quality electricity required for some purposes if a device on the customer's premises will accomplish the same end at a lower cost. The utilities, themselves, in addition, might find novel ways to provide more economical reliability for their network purposes.

The problem is: how does one price the value of reliability? Distributed generation opens the way for a new set of competitors to enter the market, competing against utility or indepen-

dent generators, and offering some customers a way to get off the grid altogether. In some parts of the world, they could provide an analog to wireless telephony. Fuel cells and miniturbines have garnered the most attention, but renewable resources, such as solar cells or wind power could play a role.\*

- **Customer contact, communication, switching and billing**—At the retail level, the utility, the customer and the new retail suppliers need ways to communicate their choices, switch vendors and react to market information. The market aggregators or virtual utilities need the means to take action such as lowering temperatures or turning on auxiliary generators or turning off water heaters at far-flung locations. The consumer will need the means to signal or program usage patterns. **For the moment, of course, most people do not concern themselves with such matters. But they will.**
- **Real time pricing**—In truth, we will not achieve an efficient electricity market without real time pricing, and we will not have real time pricing without economic metering and inter-active communications. Customers have to see and react to prices. The bizarre price spikes, shortages and ability to earn supernormal profits come about, in part, because nobody asks customers what they are willing to pay, and what actions they would take to avoid the payments. **Real time pricing can change the dynamics of the market.**
- **Internet Disintermediation**—Using the Internet, customers can search out the best prices, offer bids, and suppliers can go directly to the customer, thereby eliminating intermediaries who take a profit for the services that they render. **Instead of thousands of overpaid energy traders doing transactions, we might end up with millions of customers doing them, on established Internet energy sites.**

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\*One always hears that you cannot store wind, and wind power will not play a major role until batteries become cheap enough to facilitate storage. But you can store water. Farmers used to pump water by means of wind power. In India, farmers take central station power, transported to them at great cost, primarily to run pumps to provide irrigation for their crops. Would efficient wind turbines combined with water storage serve the same purpose? Does that constitute a business opportunity?

- **Transmission Technology**—Generators that intend to dominate markets want to take advantage of weaknesses in the transmission system that prevent competitors from entering the market, and of the dysfunctional nature of transmission organization, which impedes the ability of the transmission organization to serve new generators or to expand the network. Yet, flexible AC transmission system (FACTS) devices, DC lines, and undergrounding do permit expansion of carrying capacity and construction in difficult places, although at a higher cost than putting up a standard AC line, if one could put up a standard AC line. Superconductors could do more for the transmission (and distribution) systems, but years later.

**The cost of all these technologies will fall when the transmission owners begin to employ them. But transmission owners will avoid any new investment until the pricing mechanism changes, and conflicts of interest are resolved. That will happen.**

- **International Energy Companies**—People say, “Electricity is a local business.” But you can say the same about oil refining, and that has not prevented international petroleum companies from owning the refineries, advertising the same product all over the country, or maintaining one credit card and billing system for the entire country. The North American retail electricity and natural gas market exceeds \$300 billion in sales. Not a single international petroleum, consumer credit, financial or retailing organization has more than a tiny presence in this market. **Those firms have the brand name, billing and customer service capabilities that most existing utilities lack. For how long will they ignore this market?**

Add it up. You get more pressure on large-scale producers of energy, because technology brings into play the small-scale producers who can go into action whenever the big generators try to earn monopoly profits. You will see additional pressures on them when the transmission system can carry more electricity from low cost to high cost regions. You will see new entrants offer services directly to consumers. **Finally, once the dust has settled, and the states, provinces and countries end their peculiar transition plans, huge international companies will enter the electricity business.**

## PUTTING IT ALL TOGETHER

I am painting a picture that shows increasing competitiveness over time, and new ways to contact customers and disengage them from the old utility, but every change requires a firm to initiate the change, and they will do so when they see opportunities to make a profit from change. Existing utilities with the right mindset can initiate change and take advantage of new opportunities.

But consider this: the average utility in North America probably spends less than 0.3% of revenue on research and development. How does a firm with such a passive interest in the future develop new lines of business and reshape itself for the new market? I suggest that as a supplement to collaborative or in-house R&D, the utility could invest in and work with the firms that will produce the products and services that will shape the marketplace. It is not realistic to expect an old-line utility to have in house the speed of execution, risk-taking attitude or technical skills needed to develop the new products.

The utility, though, has the ability to raise capital, reputation, skills to prove out an idea, and to put it out into a large market. In some instances, when a large-scale technology is involved, the utility may have better skills for execution, but I am not so sure about development. In other words, venture capital should help the utility develop needed business opportunities, and the utility should support venture capital efforts that could solve utility problems, too.

Having said that, I have to offer a warning about institutional arrangements. In order for venture capital investments to produce the maximum benefits for the utility, the top management has to buy into the process, and use the information generated by the venture capital arm. I previously participated in EPRI's roadmap effort, which, in my opinion, produced a superb document that would have influenced my business strategy if I were a utility CEO, and if I knew about the document.

Yet, I fear that the roadmap went to the vice president in charge of engineering, and the CEO kept making policy as if technology would not change. If the CEO and the board of directors and the owners of the utility do not appreciate the importance of either R&D or venture capital, I would close down both operations, because the utility will reap only a small fraction of the value inherent in the effort.

Finally, revolutions are exciting, fun and profitable only for the leaders of the revolution. The rest—of the followers—do not shape the events. *Vive la révolution!*

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## ABOUT THE AUTHOR

**Leonard S. Hyman, CFA**, is a senior industry advisor to Salomon Smith Barney. Previously he was managing director of Fulcrum International Ltd., as well as an independent consultant specializing in the economics and finances of energy and telecommunications utilities.

From 1978 to 1994, as head of the Utility Research Group and first vice president at Merrill Lynch, he supervised and maintained equity research on foreign and domestic energy and telecommunication utilities. He was a member of privatization teams for offerings of British, Spanish, Mexican, Argentine and Brazilian utilities and consultant for other restructuring studies. Prior to joining Merrill Lynch, he was a partner at a New York Stock Exchange member firm and an officer at Chase Manhattan Bank.

Author of *America's Electric Utilities: Past, Present and Future*, author of *The New Telecommunications Industry: Evolution and Organization* and editor of *The Privatization of Public Utilities*, he has contributed to other books and to professional journals.

For more than a decade, Mr. Hyman was cited by *Institutional Investor* as one of the leading research analysts in his field. He is a Chartered Financial Analyst (CFA). He holds a BA from New York University, where he was elected to Phi Beta Kappa, and an MA in economics from Cornell University, where he majored in industrial organization and minored in Latin American studies.

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