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Emerging Electronic Markets at *e*-Business Crossroads: Competitive and Regulatory Issues in the Electricity Industry

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ABSTRACT *Natural history depicts evidence of the dynamics of evolution, while fossil records permit the examination of change over time. Such records inform us also that change is never easy and does not occur without casualties. It seems that parallel observations may be advanced as the Internet and widespread use of information and communication technologies (ICT) have brought about new organizational forms, entirely new ways of organizing, as well as enabling novel processes. One casualty reflective of an evolutionary era is the dot-com firms that have gone bust. As firms are moving along the evolutionary path of understanding and implementing these developments we need to come to grips with their design, management and impact.*

This contribution examines electronic markets and related off-shoots as a coordination form and macro-structure of information and communication systems within the electric power market. The basic notion of 'electronic market' is explored briefly. We recognize several forms in which such markets manifest themselves. The author emphasizes the role of competition in electronic markets, as well as the newly found role of intermediaries.

Electronic markets in the electricity industry are examined in some detail, i.e. the electronic trading of electricity. This market demonstrates nicely the opportunities, but also potential pitfalls of electronic trading of this commodity, especially given relatively recent experiences with the electricity supply situation in the State of California, as well as the demise of Enron. A number of patterns, trading practices and regulatory concerns are highlighted. At the same time though similar underlying problems are applicable in all industrialized nations and selected examples are provided.

Keywords: electronic markets, electronic business, competition, regulation, electricity industry.

Introduction

The electricity industry has a long history since scientists tinkered with the 'mysterious fluid' as far back as the 1600s. In the United States that industry took off with the inventions of Thomas Alva Edison, Nikola Tesla, as well as George

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Westinghouse and their subsequent bitter struggles to control this force of nature, its awesome power and the riches it promised. In the last decade the evolution of the electricity industry in the United States has undergone drastic changes. In its evolution it parallels somewhat the restructured long-distance telephone system in the United States. The underlying premise is that transmission systems are made open-access and the generators of electricity are permitted to sell into the system. The classic utilities, the distributors of electricity, had to sell their generation and transmission assets and would be purchasing electricity in a wholesale fashion on the open market. Brokers, equipped with the most advanced web-based technologies and applications, would take up the roles of key players in the form of intermediaries. This implies that these intermediaries would seek electricity to purchase in locations where it is in surplus and sell it in places where it is needed the most. Enron was of course for many years the shining star among these brokers and for a while this company was obscenely profitable, appeared highly skilled, but also showed its arrogance and supremacy all along. One should note though that even at Enron's peak as a trader, it commanded not more than 18% of the electricity being traded.

Deregulation of the electric power industry created conditions that did not provide encouragement for new investments in its infrastructure. Some argue that deregulation as a policy effort simply has not had enough time yet to work its magic as predicted. A number of fundamental characteristics describe this emerging market and the overall network or grid: energy demand on the grid has grown by 35% in the last decade; on the other hand, money invested on upgrading the grid over the same period of time was merely an 18% increase. At the same time though, wholesale transactions for profit on this grid increased by a whopping 400%. The grid accounts now for 235,000 miles of wires and cables carrying voltage of 230,000 volts and more.[1] Numerous things can go wrong in the transmission and there is no way to guarantee 100% reliable service everywhere. It is precisely this transmission system—a collection of high-voltage networks—that is the focal point of the stalled deregulation of the US power industry. In part this was brought about by the disastrous partial energy deregulation in California and the role of companies like Enron that have slowed down needed changes in the national ability to deliver power. Effectively, this left the national system in a hybrid state comprising the worst of the old and without the best of what is possible today. Overall, the system has become very vulnerable as the handful of major blackouts, but especially the largest blackout of 14 August 2003 showed, when interconnections among the various regions in managing the flow of electricity failed due to inadequate coordination and when cascading failures left 50 million people without power. Again, the system is bogged down with rules, organization and oversight that govern the transmission networks and the North American Electric Reliability Council could not catch and confine the underlying problems in time, which permitted 21 power plants in six states stretching from New York to Michigan and into Canada to crash. There is widespread agreement that more transmission lines and a more modern system for managing delivery of power are needed. But elected officials disagree on whether the federal government, states or some new regional authority should have control in this matter. Today, the excitement, incentives, almost *the* mission, of the system is with the connecting of buyers and sellers seeking the best price, conditions and deal. Geographical and political boundaries and local jurisdictions clearly play a secondary role. For example, large Eastern industrial customers routinely shop for power in neighboring regions such as the Midwest or Southeast.

Table 1. State of New York's electricity industry's structural evolution over time

Structural evolution over time	Power generation	Distribution and transmission	Buyers of electricity power
Structure prior to 1997	**Regulated:** Generating plants supply utilities. Prices set are based on their costs.	**Regulated:** Utilities control transmission and distribution of electricity and maintenance of power lines. Public Service Commission regulates.	**Regulated:** Consumers are served by the utility.
Wholesale model since 1997	**Competitive:** Generating plants compete to supply utilities. Prices are set by the market.	**Regulated:** Utilities control transmission and distribution of electricity and maintenance of power lines. Public Service Commission regulates.	**Regulated:** Small businesses, homes and farms are still served by a single utility. Big businesses can buy from competitive power source.
Retail model since 1998	**Competitive:** Generating plants compete to supply utilities. Prices are set by the market.	**Regulated:** Utilities control transmission and distribution of electricity and maintenance of power lines. Public Service Commission regulates.	**Competitive:** All customers (consumers, farms, all businesses) choose their supplier directly.

In the State of New York, e.g. prior to 1997, a few large utilities supplied electricity to homes and businesses. In 1997, small power producers started selling directly to big companies. By 1998, utilities and small power producers began selling competitively to all consumers and businesses. The evolution of the industry's structure and regulation, reflective of many states, is depicted in Table 1.

The competitive wholesale buying and selling of electricity on the national (including Canada) market has occurred for many years. As Table 1 indicates, competitive buying of power generation, as well as the competitive buying and selling at the retail level within the states, is a relatively recent phenomenon. The New York Public Service Commission has approved some 20-plus firms to sell electricity in New York, including Florida Power & Light Company, capable of producing electricity in Florida and shipping it to New York while being able to sell such electricity cheaper than many firms producing electricity within the State of New York. These dynamics, as can be seen readily, produce instant competition. It is technically possible to buy electricity, e.g. selectively on an hourly basis from the cheapest producer among these competing power generating firms in New York while the buyer chooses the lowest price and best conditions. This results almost in a dynamic market that may be conducted electronically. What then is an electronic market? The following section offers a brief excursion exploring this topic. Subsequently, we will explore what electronic markets mean for the electricity industry and complications that may arise.

The Role of ICT and Electronic Commerce Applications

Newer Information and Communication Technologies (ICT), as well as specific forms of electronic commerce, especially the application of electronic markets, lend themselves very well to the efficient and effective buying and selling of electricity for competitive markets. All buyers of electricity are interested in buying power as economically as possible and only competitive markets as an organizational form will achieve such effects. Markets are extremely efficient, effective and timely aggregators of dispersed and even hidden information.

Newer ICT enable organizational and business processes and are essential tools to create competitive advantage. ICT play an essential role in utilizing markets as a coordination form when conducting business.[2] They make personalization and mass customization possible.[3] The drivers, nature and magnitudes of these developments are the focal points and enablers of electronic commerce (EC). The widespread use of personal computers, together with the proliferation of telecommunications services and networks, the Internet and the WWW, as well as their joint integration, have made EC a reality, even for common citizens. It is in this context that we find suitable business models and solutions for the sale and delivery of electricity and our discussion will explore this.

The bandwidth of EC spans from electronic markets to electronic hierarchies and also includes electronically supported entrepreneurial networks and cooperative arrangements. Market coordination mechanisms are their common characteristic. Services within the finance, tourism, brokerage or insurance industries, but also logistics and customer relationship management are typical fields of application. Delineating among differing forms of electronic markets becomes even more difficult, as:

- organizational boundaries become fuzzy, change or disappear and, as market coordination forms, may also find a place within organizations themselves;
- value-added chains change or entirely new ones appear, and value-added activities are newly distributed;
- suppliers and customers become part of the value-added chain;
- entirely new players become entrepreneurs who would not have entered a market prior to these EC developments;
- disintermediation and reintermediation is frequent, but often the reintermediaries are different players.

The development of the Internet, as well as its special application the WWW, demonstrates business and industry's increasing interest in and recognition of the importance of EC.[4] With the advent of the Internet and WWW, a new medium has emerged whose potential is more dynamic than color printing, radio or television. The appeal of universal connectivity and access is driving firms and individuals to the Internet. Various developments over the last few years seem to suggest that the Internet is *the* universal dial tone for conducting business, including the buy side (suppliers and logistics), as well as the sell side (customers). The aim of most EC efforts is to conduct business electronically with millions of firms of all sizes and millions of customers as well. The WWW has become a focal part of many firms' long-range strategic plans. The Internet phenomenon has indeed become a paradigm shift governing both businesses and consumers.

It may take time and considerable investments, but most observers agree various ICT enabled via the Internet will one day be a two-way window to the world through which we tweak our bank accounts, order office supplies, groceries and books or receive electronic entertainment (such as music and movies) on demand, but also order electricity supply from the cheapest supplier. Most of these things are already possible today, may even exist partially, even though they may not be retrievable yet in a very user-friendly fashion.[5]

Electronic Markets

One particularly intriguing application of EC is electronic markets. Markets are places of exchange where supply and demand meet. At the same time, markets are comprised of people or firms making judgments about values of objects and services. Value depends on individuals' or firms' desires in that the more they esteem an object or service and are at the same time willing to trade for it, the more the object or service is worth. This in essence is the very basis of free-market capitalism.

A market is conceived to consist of goal-seeking firms, government agencies, or individuals producing some commodity or service, as well as all firms, government agencies and individuals purchasing the commodity or service. Within this market, the exchange of goods and services takes place. When the market is competitive, it is characterized by (1) many buyers and sellers, (2) homogeneous products, (3) easy entrance to and departure from the market, (4) low switching costs for consumers who wish to choose among suitable goods from competing firms, and (5) the availability of perfect information.

When the commodity 'electricity' is being bought and sold on the spot market, what is being bought and sold at the moment is 'information about that electricity' and the actual delivery of electricity occurs at a later point in time. The nature of such information and its usage takes on almost a life on its own and deserves some addition exploration.

Information is an essential ingredient for the functioning of any market and is exchanged frequently among buyers and sellers such as when product and price information is exchanged. *Perfect information* denotes that consumers will have all the information, i.e. complete information (e.g. through advertising, news media, personal inquiry) they need to make informed, rational decisions about which goods and services to purchase in the marketplace. Often it would be a massive or highly cumbersome task to acquire perfect information and decision-makers may decide that they have sufficient or 'good enough' information to make a decision, i.e. they then possess *satisficed information.*

One must make, however, a distinction between markets for information and a market for ordinary commodities on at least two counts.[6] On the surface, information can be considered a factor of production. Another perspective enters the picture when information itself (such as with digital products) becomes a commodity and when private markets have formed in which information can be bought and sold as a commodity. Information then takes on a complex role as information has peculiar characteristics in that it is easily copied, transmitted, sold without destroying it and that it is expandable, diffusive, compressible, difficult to establish property rights for at times, and sometimes it is a public good.[7] The value of information is heavily dependent on the context of its use. Indirectly then, information may be defined by a description of its properties:

- Information is an *immaterial good* that does not wear out by use.
- *Distribution* of information can either be done by the transfer on a material storage medium or by transmission over communication networks.
- Compared to physical products, information can be *duplicated and circulated easily*.
- The production of information usually causes *high fixed costs* for the first 'copy' of the information and small or even vanishing marginal costs for every additional copy over a wide range of outputs. Nevertheless, information is not a free good, but a *scarce resource*.
- Information is *indivisible* and useful only in integer amounts.
- Information *requires no exclusivity of use*.
- *The disclosure problem*: the use of information by one individual may reveal the information to others. Consequently, the information is shared in its entirety and unaltered, something that is impossible for physical goods.
- Information can be exchanged and traded as an economic *commodity*.
- Information is *not exclusively transferable*. If the property rights are transformed between producer and user, usually only a copy of the information is sold and the original information can still be kept at the producer.
- Information *cannot be inspected without being revealed*. The true value of information cannot be predicted *ex ante*, which is usually referred to as the *fundamental paradox of information*.[8]
- The *value* of information is closely connected to the user, i.e. it is only of value for the user if it enables him or her to improve decisions or productive activities.
- Information has a *life cycle* from production over dissemination to its terminal use. *Decay* and *lifetime* of information are highly dependent on the type of information.

What then are electronic markets? Electronic markets emerge through the automated mediation of market transactions. Consequently, traditional industry chains lose their relative importance since business can be conducted quicker and often with an increased number of opportunities. Electronic markets are abstract places where (1) exchanges (trade) occur, (2) complete (*satisficed*) information can be found, and (3) transaction costs approach zero.

The market is viewed aside from the hierarchy as the second basic form of market coordination.[9] Between the two poles of 'market' and 'hierarchy' one may recognize a continuum of hybrid organizational forms (e.g. clan and strategic network[10]) that offer—depending on differing task situations—varying degrees of efficiency and, in turn, advantages. Based on efficiency reasons, the coordination form of the market lends itself well to standardized transactions of performance relationships that have little variability and are easily describable.[11] *Electronic markets*, therefore, are one selected institutional and technical platform for electronic commerce. Conceptually and technically, in principle, information and digital products lend themselves very well to be sold via electronic markets.

An electronic market then is a coordination system characterized as follows:

- Coordination mechanisms are electronically supported ranging from simple support (e.g. price information) to complete electronic coordination (e.g. price formation).

- The deployment of information and communication systems simplifies information supply and evaluation activities.
- Information and communication technologies reduce increasingly the importance of time differences and geographic distances.
- Aside from equal opportunities as a market participant and the freedom of participation in that market, it is especially the openness to access the market that constitutes an elementary prerequisite for electronic markets.
- A fundamental characteristic of electronic markets is the participation of human actors and, therefore, the human influencing of market events through their expectations, experiences and the interpretation of market information. Fully automatized processes are, therefore, not electronic markets.[12]

Effects of Information and Communication Technology

Information and communication technologies are essential for a modern firm's optimal performance today, as they augment the firm's capabilities to coordinate business transactions within the firm, but also among firms such as between buyers and suppliers. In this context, Malone *et al.*[13] identified three effects of information technology, to which Wigand[14] added a fourth one. All four effects may lead to reduced transaction and coordination costs.

1. *The communication effect*—advances in information and communication technology allow for more information to be communicated in the same unit of time, thus reducing transaction costs.[15]
2. *The electronic integration effect*—a tighter electronic linkage between buyer and seller is enabled.[16]
3. *The electronic brokerage effect*—an electronic marketplace where buyers and sellers come together to compare offerings.[17]
4. *The electronic strategic networking effect*—information and communication technology (including networks) enable the design and deliberate strategic deployment of linkages and networks among cooperating firms intended to achieve joint, strategic goals which, in turn, enable competitive advantage (such as in regional electric power distribution networks).[18]

From Mediation to Disintermediation and Reintermediation

It is getting more and more complicated to clearly delineate the boundaries of today's firms due to their tight linkages and integration with other firms. In an economy based on the division of labor, trade has the task to compensate spatial, temporal, quantitative and qualitative tensions between processes of production and consumption. Driven by information and communication technologies' ability to produce even cheaper unit costs of coordination and transaction, firms have implemented new links for relating to each other. Geographic distance is often of little concern as modern telecommunication technologies perform at very high speeds. An average credit card transaction takes about 4.5 seconds to secure an approval confirmation for the merchant. During the holidays when many gifts are being purchased and credit card companies' mainframe computers are overburdened, these companies lease computers wherever leasing is the cheapest (typically in India). The credit card transaction process between India and the North American location takes merely a second longer. Distance then does not

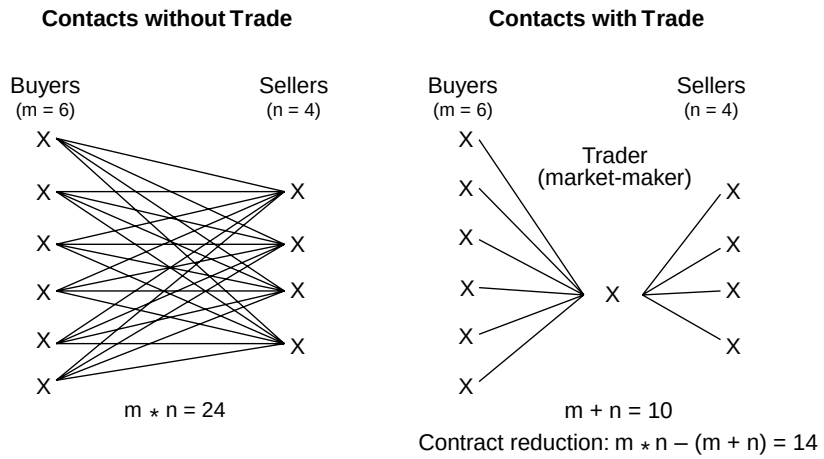


Figure 1. The reduction of necessary contacts through intermediation.

appear to be a major hurdle in such transactions. Tight links among firms take many forms, such as electronic data integration (EDI), just-in-time manufacturing, electronic hierarchies and markets, strategic alliances, networked and virtual organizations, and others. The resulting new organizational forms indicate an ongoing transformation of value chains.[19]

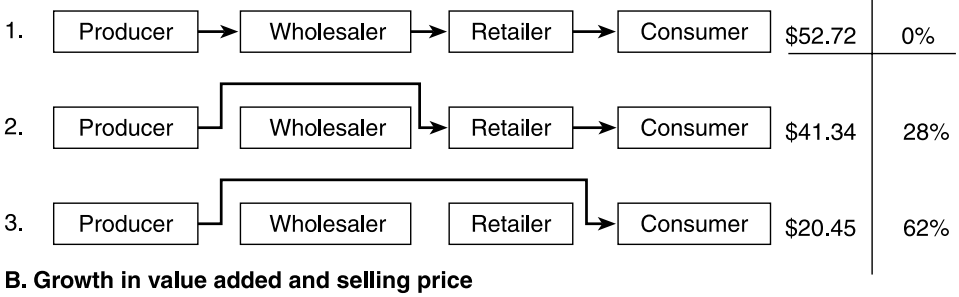
Intermediation (such as with electricity power brokers) is the bridging of incompatibilities between two (market) sides involved in a transaction. An intermediary then is an independent, profit-maximizing economic agent mediating between two market sides. Intermediaries are specialists in performing transactions, and the source of their efficiency is a reduction in the costs of these transactions compared to transactions without an intermediary. Mediation or intermediation has an important efficiency feature in all forms of trade within an economy. The resulting effect has been labeled the Baligh–Richartz effect and is demonstrated in Figure 1.

In a market with six buyers and four sellers a total of 24 contacts are necessary to get complete information. In contrast in the same market with an intermediary (or trader/market maker) great efficiencies are achieved due to this intermediary in that merely 10 contacts are necessary, a saving of 14. Figure 1 also illustrates that any sort of trade would be very costly and cumbersome without the intermediary. Moreover, market hierarchies that depend on intermediaries (e.g. the value chain from manufacturer, to wholesaler, to retailer and buyer) remain defunct if one in this chain drops out. Consequently, reintermediation becomes necessary or nothing happens at all. In general, reintermediaries search for opportunities in supply chains by breaking apart existing relationships into logical components and re-shuffling them to enable more efficiency, choice, or speed.

Traditionally such linkages among firms were enabled through the mediating roles of wholesalers, retailers, agents, distributors, brokers, warehousers, forwarders and 'jobbers'. Today examples abound in which these mediating roles have been leap-frogged, replaced or eliminated. Benjamin and Wigand[20] (see Figure 2) were the first to demonstrate such an example in conjunction with a high-quality shirt acquired in three variants of value chains within the shirt industry. Numerous other examples can be mentioned: brokerage firms, travel agencies, insurance agencies,

Playing electronic market leapfrog

A. Three variants to alternate value added chains



B. Growth in value added and selling price

	Producer	Wholesaler	Retailer	Consumer*
Value added	$20.45	$11.36	$20.91	
Selling price	$20.45	$31.81	$52.72	$52.72

*Consumer Transaction costs are not considered.

Figure 2. Reconfiguring industry value added chains.

grocery delivery services, as well as real estate agents.[21] Similarly, one may refer to leap-frogging (disintermediation) of traditional brick and mortar stores when buyers decide to buy their products directly from web-based firms.

These developments have been labeled *disintermediation*. Disintermediation is the displacement or elimination of market intermediaries, enabling trade with buyers and sellers without the middle person. Often suppliers and their customers are linked directly today without any intermediaries. Previous intermediary roles, sometimes called middle professions, of brokers, agents, etc. between manufacturers and buyer/consumer may be replaced by an electronic market maker or by value networks (e.g. common carriers, on-line market places), which, in turn, enable *reintermediation*. In that sense one might argue that the middle person is not *dead*, as was predicted in the early days of EC, yet one must realize that these reintermediaries are often very different players than the original intermediators. Electronic markets allow firms to reach potentially very large customer groups at relatively low costs.[22]

Value chains have been viewed traditionally as a linear, step-wise and linked phenomenon.[23] Rayport and Sviokla,[24] however, differentiate between the physical and virtual value chain and refer to the latter as *marketspace*. Today, it may make more sense to view the virtual value chain as being linked to a matrix or web (the *Value Web*) that is accessible at each point and freely configurable. A *Value Web* in this sense is a temporary web of independent companies, has no hierarchy, no vertical integration, and enjoys fluid, flexible, and dynamic relationships. An example is the electricity spot market where firms may purchase electricity 24 hours per day at the best price possible. Buying and selling in such a value web is dynamic and highly interactive. Within the electricity industry context, this concept applies as well: value webs work especially well for information goods when, e.g. a buyer enters a value web to find the best price, e.g. an amount of electricity to be produced and delivered at a future point in time. The buyer enters the value web of his/her choice, searches, and buys the electricity and leaves the web. The very

same web constellation is available next time around when the need for another electricity purchase arises.

A high degree of automated *interactivity* in EC transactions has always been a major goal to achieve. It appears also that the higher the degree of interactivity, the more perfected the electronic market might be. Nevertheless, one needs to consider the buyer's individual willingness and desire to be interactive in these settings. Such interactive services have changed fundamentally how businesses connect and interact with buyers and suppliers. Over 100,000 electricity customers in Great Britain, for example, switch their electricity suppliers each week.[25] Interactive services can personalize the information users need and use it in a manner suiting them best. Interactive services are usually easy-to-use telecommunications-based services designed for information exchange, communication, transactions and entertainment. Such services ought to encompass four essential features in order to ensure their acceptance: (1) the device or service must replace a process that is inefficient, costly or boring; (2) users must not be asked to choose between competing technologies; (3) users must not feel 'tracked' or that their privacy seems threatened; and (4) users must perceive that the use of the service (and information or communication technology) is relatively easy, user-friendly and non-complex.

The role of the market maker varies considerably with the various forms and types of electronic commerce. The market maker's most prominent role is evident when the market maker is the driver of the electronic market and can offer single-source channels, as is the case with teleshopping, electronic shopping, or the full-fledged EC setting through the use of an interactive website or set-top box.

The Electricity Industry as an Electronic Market

In the beginning of the utility monopolies electricity was generated and sold to customers at prices set by state regulators. Many of these monopolies have been deregulated and today private firms in 24 states compete in selling electricity at market prices evolving by supply and demand. The State of California is joined by other states in a broader western market in which electricity is routinely purchased and sold across state and even national boundaries. Actually, the trading of electricity surfaced relatively late in the United States, as it has been practiced in the UK, New Zealand, Norway, Chile and several other countries for some time.

California's Energy Nightmare

The State of California's deregulatory scheme triggered soaring electricity prices resulting in rolling blackouts. A brief synopsis of these events will refresh our memories.

- June 2000: Electricity prices spike. Blackouts occur in San Francisco and rates rise in San Diego.
- November 2000: Federal regulators refuse to offer refunds for ailing electricity utilities. Gas prices spike.
- December 2000: Electricity generators briefly stop power sales.
- January 2001: Rolling blackouts continue. Electricity utilities suspend payment. California State government starts buying of power.

- March 2001: More blackouts continue. State of California signs long-term electricity contracts. State increases retail electricity rates.
- May 2001: Last blackouts are reported.
- June 2001: Electricity and gas prices fall. Federal regulators set price caps across Western US states.

Wholesale electricity suppliers exercised market power by increasing prices above competitive levels during the summer of 2000, as well as after the restructuring. The very design of California's electricity market made it possible for individual wholesale electricity suppliers to exercise market power. Once these prices rose, the design of that market was ineffective in returning prices to truly competitive levels, i.e. they remained at very high levels or rose yet higher. Many economists, market design and industry experts seem to agree that two principal market design flaws increased wholesale suppliers' incentive and ability to raise prices above competitive levels: (1) retail prices were frozen and (2) the California Public Utilities Commission generally prohibited or discouraged long-term contracts between utilities and wholesale suppliers.

How did this fiasco ever come about? A typical example explaining these events is the following account that occurred on the night of 11 November 2000. PG&E's National Energy Group concocted a series of power trades that changed hands five times while the price more than tripled.

1. National Energy Group purchases electronically 50 megawatts of power for $3,500 from the Imperial Irrigation District at a trading hub in Arizona.
2. National Energy Group sells this quantity of power to the Los Angeles Department of Water and Power (LADWP) at the Arizona trading hub for $3,500.
3. LADWP moves the power just purchased to the California–Oregon border region and sells it back to the National Energy Group for $4,750.
4. The National Energy Group sells the power to the Constellation Energy Group Inc. for $7,500.
5. Constellation Energy sells the same power to the California Independent System Operator for $12,500.

In October 2001 *Wall Street Journal* reporters discovered several odd partnerships created by Andrew Fastow, Enron's chief financial officer. It turned out that these were moves by the company to shift debt off its public books and to enhance its publicly reported profits. These partnerships were enormously profitable, especially to Fastow personally, and they were the financial triggers bringing about Enron's collapse. This collapse alerted regulators and other watchdogs who deeply scrutinized not only the company itself, but the entire energy trading industry. Energy traders themselves, i.e. firms that buy and sell electricity and gas contracts in over-the-counter, i.e. off-exchange, markets, were the first to be carefully examined. These contracts are purely financial instruments, not actual electricity, but figuratively speaking information about electricity, and functioning as derivatives reflecting the price of electricity while hedging against future losses as prices fluctuate. Investigators discovered quickly that some of the best known firms in the business, including Reliant Energy, Dynegy, CMS Energy and others, had conducted fake transactions, called round-trip or 'wash' trades.

About a decade ago California restructured the buying and selling of electricity. It was hoped that this effort would cut the electricity purchasing costs of the states' biggest users. Surprisingly and instead, the state stumbled into blackouts and a financial crisis to the tune of $100 billion. Historically this became a critical turning point in the endless struggle between free markets and government regulation. Although the entire situation in California is indeed a most nested and complicated one, it may be reduced to the following: government had created a complex market with features ready for exploitation. Ever-growing demand and short supplies permitted energy sellers to dictate—even manipulate in some cases—prices. The circumstances arose and were left largely unchecked by half-hearted and overmatched regulators. Numerous times when regulators tweaked the rules, the sellers of electricity found new ways and means to exploit the devised system. State government barely survived this crisis via very costly interventions forcing it into the power business for the foreseeable future.

Regulation of Electronic Markets: the Case of the Electricity Industry

During the fall of 2002 the electricity business seemed to look like a WWII battlefield, i.e. the casualties included: the public–private California Power exchange, Enron, the energy-trading unit of Dynegy, AES, Calpine, numerous utilities such as Allegheny Energy, Reliant Energy, CMS Energy, plus the California-based very large electricity distributors Pacific Gas & Electric Company and Southern California Edison, and also the Arthur Andersen accounting firm. Unquestionably, other than power companies themselves, everyone is interested in the generation and acquisition of electricity at its lowest cost. Although it may sound flippant, selling electricity is easy but then comes the hard part. This hard part has, partially, to do with the very nature of this particular commodity. Based on Kirchoff's law, electricity simply follows the path of least resistance while, at the same time, even though an electricity transaction is scheduled over another utility's transmission lines, some of that flow may happen on the focal utility's network or lines. As this description shows, such a transaction does indeed complicate the relation between the buying and selling parties vis-à-vis the physical reality. More specifically, the transaction or trade between power firms A and B cannot be fully specified in the sense that the path the shipped electricity will follow is not fully determinable. Accordingly, the financial transaction does not parallel the physical process. This deviation and complication surfaces with certain commodities and services: they are absent, e.g. in the shipping industry (parcels) or in the airline industry; they are present in the railroad, oil and gas pipelines industry. One realizes that in these latter industries, electricity included, we are dealing with certain externalities that will have to be recognized and adapted to by encompassing all parties involved in the transaction.

The buying and selling of electricity happens mainly on the spot market. In that situation fixed and avoidable costs create special problems that spot markets cannot resolve. In order to overcome these problems forward contracts are required to avoid a degree of free riding that otherwise would weaken incentives to expand or shrink capacity efficiently. Accordingly, given the nature of the technology, marginal cost pricing in electricity generation could not solve this problem.

There is agreement that the New Energy Trading Arrangement (NETA) in Great Britain has been a breakthrough towards a fully competitive electricity generation market, resulting in a 20–25% drop in wholesale electricity prices and

an even larger drop (30%) in retail electricity prices since 1990. The market is truly competitive with 38 rival companies trying to compete at the wholesale and retail levels. Over 100,000 electricity customers now switch electricity suppliers each week.[26]

In the United States for more than a decade the electricity industry has been struggling in its move from the old regulation to the new marketplace described above. Some have said that this shift was driven by the view of 50 years of state regulation and had generated power prices that were too high and clearly too varied among the states. Many manufacturing companies moved factories and jobs from a state with high energy costs to those with lower prices. There also seems to be an increasing understanding that the electricity industry is probably not even half way there in its transition from regulation to the marketplace. The California experience has brought regulators back to the drawing board and rethinking conditions to make competitive markets work. At the present time it is not clear at all how potential investors would make a profit. The underlying principle that must be followed in this effort is that ultimately the nation and customers must be served. Accordingly, one needs to rethink the national transmission network in the sense that the whole is greater than the sum of its parts. Moreover, electricity generated needs to be moved. There is no other choice, but to trade in order to bring this movement about. In order to make such trade work, tighter regulations are needed that enable transparent and honest trading.

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