

MAKING MARKETS IN POWER

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The why and wherefore behind our organization of energy markets are often invisible, or at least unexamined. This is not to say that energy is unimportant; witness the decision here at RSA, in this first year of the new millennium, to focus the Cantor lectures on the theme of "energy and society." Energy production and delivery constitute huge industries in every developed economy. These energy industries touch the lives of us all, both directly, through heating and lighting, and indirectly, through the provision of everything from apples to zucchini. Even the fashionable so-called "new economy," driven by information, floats on a sea of electrons.

My focus here tonight will be on the case of electric power. Electricity is the most ubiquitous form of energy delivery, with a constantly expanding variety of applications. Electric power provides an interesting topic, appropriate for the confines of an evening's conversation. And the case of electricity and society can be seen as part of a larger tapestry that includes other developments in our economies and societies.

Government and Business

My title summarizes my story. Markets in power, more than most markets, are made; they don't just happen. My goal here tonight is to illuminate the why and wherefore; to give some highlights of this story still unfolding; and to speculate a little on what may yet develop. It is good to have this opportunity in London, a locale that has pride of place in the story, as we shall see.

Where you stand depends on where you sit. I sit in a chair at the Kennedy School of Government at Harvard. Many of you may be more familiar with Harvard's Graduate Business School. As I tell our prospective students, there is at least one simple difference between these schools situated on opposite sides of the Charles River. At the Business School, my colleagues teach their students how to seek out or create advantage, and generally find protection from competition; all this in the interest of maximizing profits. At the Kennedy School, we teach our students how to structure the rules of the game so that these businesses succeed individually in the short run but fail collectively in the long run in avoiding competition; all in the interests of greater efficiency, where competition eats away excess profits while leaving the improvements in products and services.

This tension between public and private, between government and business, between regulation and markets, is the background for my continuing interest in the public policy issues woven through the story of making markets in power. The challenge and the tale continue to fascinate me as each new chapter unfolds.

Technology

In part, this is a story of the role of technology in shaping our economy. New technology has been central to the plot. The information revolution has affected energy and electricity markets in ways that are already significant and yet are only beginning to be exploited. It won't be long before the hyperbole of the Internet will become a commonplace, when you and I will give instructions to our computers at home to manage the purchase of energy while paying our bills and letting out the cat.

Once removed from the revolution in personal computers and wireless communications, the enormous improvement in turbine design has seemingly overnight nearly doubled the energy efficiency of the machines that burn oil and natural gas to produce electricity. With supercomputers and greatly improved seismic analysis, petroleum geologists make it ever more economic to produce the fuel that drives the turbines. The combined effects completely reversed our relatively recent prognostications of scarcity. Not that long ago, in the United States, we forbade the use of natural gas to produce electricity, for fear of running out. Today, in many parts of the United States, it is cheaper to tear down a perfectly functional power plant of an older technology and replace it with a new gas-burning plant. The new plant will be both environmentally cleaner and so energy efficient that the savings in operating costs will pay for early retirement of the old and construction of the new. Hence, new suppliers have shocked the electricity industry.

So technology is important. But from my perspective, new technology only sets the stage for the changes underway in the electricity industry. Furthermore, the most important feature of technology and electricity is more obscure, and, as we shall see, has more to do with the old real world of Thomas Edison than the new virtual world of Bill Gates.

While giving technology its due, the more interesting aspects of the story of making markets in power concern society, ideas, and ideology. From my vantage point, the changes underway in the markets for power derive more from the contributions of the likes of Prime Minister Thatcher than from the contributions of either Edison or Gates.

Electricity Revolution

When we look around the world, we find an amazing and broadly contemporaneous revolution in the organization of electricity markets. Consider a partial list recently in the news: England and Wales, Norway, Germany, Spain, Ukraine; several regions in the United States; Latin America--from Mexico in the north to Chile in the south; Canada, New Zealand, and Australia. Next month Japan will take a first step. Perhaps, someday, even France. Or perhaps not. But even if the French can resist the directives from the European Union, the breadth of the revolution impresses. The rapid

spread of the idea cannot be explained by technology alone. Norway, with its abundance of falling water, is quite unlike England, with its coal and gas. Australia is unlike England, and so on.

There is a big idea here, however, and the big idea has deep roots. The old way we organized the electricity market grew from an old big idea of the century just ended, namely in the development of vital infrastructure under natural monopoly. The idea, probably valid in its time, was that electrification was a strategic asset for an economy and the nature of electricity production made it economic to have one entity build the power plants and develop the network of wires. We did not want multiple sets of wires from different companies running down our streets. And the large investments in power plants would enjoy great economies if we could integrate their development with the expansion of the transmission network; engineers would guide the process and shield us from the complex details. In some countries, like the United States, we fostered large vertically integrated monopolies under government regulation. In other countries, like England, the government took on direct responsibility for managing the electricity industry.

Making and Unmaking Monopolies

This general argument was not restricted to electricity, and the same history, with different details, can be found in telephones, airlines, trucks, rail, natural gas, oil, and more. The results were large monopolies, with government ownership or regulation, and little to challenge the conventional wisdom. And largely this old big idea delivered on its promise. The infrastructure developed and matured. Services expanded and penetrated virtually every sector of the economy. In the case of electricity, the miracle born of Edison became a necessity that we took for granted. When we flipped the switch, the lights went on. Furthermore, as the infrastructure matured and we exploited larger and larger scale, the costs went down. For example, at inflation adjusted rates, the price of electricity in the United States dropped by 60% between 1940 and 1970. More or less the same thing happened in telephones, and so on.

By the 1970s, however, the scene began to change. The great cost reductions began to disappear or even to reverse, at least in the energy sector. Some of this reversal could be explained by turmoil in the oil market (which is another interesting story), with higher costs and greater insecurity. Perhaps a little of the oil-related shock applied to airlines and trucks. But it could not be relevant for telephones. However, what we did see across these diverse industries was a new set of common circumstances. The many years of protection and government regulation had resulted in large, sometimes bloated, slow-moving institutions that were hostile to innovation, they having grown accustomed to the "quiet life" that, as Sir J.R. Hicks famously observed, is one the privileges of monopoly power.

However, the quiet life began to vanish once the hallmarks of large scale and monopoly mutated from the early promise of better service and lower costs to the later experience of arrogance and higher costs. The details were different in different industries. For telephones, the Bell Company determined the one style of phone we could connect, and new technology was delayed or suppressed. In airlines we saw a

growing bureaucratic morass, with competition in the quality of meals, but not in prices. In the case of electricity, the difficulties were compounded by high inflation and seemingly endless delays in construction, particularly for nuclear plants. In the worst cases, huge power plants were built with price tags of billions of dollars and, in the end, produced no electricity.

In countries like England, where the government owned many of the companies, the new mantra became privatization and marketization. Break up the monopolies, sell off the assets, and rely on market forces to drive innovation forward and costs down. In countries like the United States, which already had private companies operating as regulated monopolies, the move was to break up and deregulate, with the common thrust to rely more on the discipline of market forces.

This move to greater reliance on markets is the new big idea that has animated sweeping and sometimes dramatic changes in policy across many industries, in many countries, and all in the same historical period at the end of the twentieth century. The new big idea, extolled by Mrs. Thatcher, was to leave to markets what they do best and narrow the focus of government to the arenas where markets typically fail, and governments may be necessary.

Making Markets

As we now know, this is easier said than done. When the government is in charge from soup to nuts, we avoid the problem of delineating what the market can do and what the government must do. However, seldom do we find that virtually everything should be left to the market, with government simply allowed to recede to familiar tasks such as enforcing the general rules of commerce.

Far more often it is the case that the public retreat is only partial, and a number of critical services, such as setting the rules for air traffic control and access to airports, remain with the government. Certain elements of the old industry, such as the local loop from the central telephone switch to the individual telephones, continue as practical monopolies. In the case of electricity, the most obvious example is the integrated transmission network, of which there is, and generally should be, only one. In theory, some might argue that eventually even this could be subject to competition, but the practical reality is that some form of government oversight is seemingly unavoidable.

This self-evident fact is not a surprise. What surprises is a somewhat subtle problem that follows. Before, government regulators or managers did not have to trouble themselves too much with the details of how the business really worked. To be sure, the regulatory process could be highly intrusive, but most of the time and effort focussed on adding up the total costs of the delivered product or on the often zero-sum battle to allocate the costs among the various "ratepayers," as customers used to be known. The details of designing the production and delivery systems were usually left to professionals, typically talented engineers who honored a high ethic of efficiency and quality, a subject to which I shall return. To a surprising degree, even the senior management in the companies, not to mention the government overseers or regulators, had precious little understanding of critical details of how the pieces fit together.

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In the case of electricity, this meant that the face of the industry was quite simple. There was a socket in the wall; plug in your appliance and the power would flow. Flip on the switch and the lights would go on. You were expected to pay at the end of the month, with a simple bill that was silent on the many steps needed to deliver the power.

However, when marketization arrived, the call was to break up the companies and unbundle the many products and services needed to produce and deliver electricity. Power generation could be separated from the wires, and subject to competition. Likewise, retail services and energy supply could be separated from the wires, and competition could reign. New players emerged, the marketers and brokers, seeking out niches and repackaging services to meet the demands of customers, demands that were more diverse than the monopoly could ever acknowledge, or see.

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As we looked behind the simple face of electricity, we began to recognize that, like the other industries, there was more to the machine than we had realized. We found many moving parts, and control of the gears was being transferred from the hands of one to the hands of many. But especially in the case of electricity, it was not enough that all the gears would be turning. The gears also had to mesh, or the system would not work. We found that a coordination problem, submerged in the old monopolies, surfaced in the new design for a market that relied on competition.

Coordination for Competition

Hence, the immediate challenge for government and everyone else was to undertake a quick study of how the parts worked, and had to work together. At the same time, we had to design new rules for connecting the competitive players with the remaining monopoly elements to promote the efficient outcomes that stood as the principal justification for the inevitable trauma that would accompany massive change.

The collective record suggests that we were unprepared for this new challenge of governance. The transition in most industries has taken longer and been costlier than we expected. In some cases, such as telephones in the United States, we are still waiting for real competition in local service, more than fifteen years after the breakup of "Ma Bell." In the case of electricity, frustration has set in, and there are even rumblings of a counterrevolution.

The electricity problem is especially challenging because of the particular nature of the remaining monopoly services. In the wholesale market, with some leap of faith, we can accept that the generation sector is or could be competitive and largely deregulated. We are unbundling the products and services and separating the companies that provide them. But everyone recognizes that the transmission and distribution wires will continue to be regulated. The task then, is to set the rules and prices for access to the wires.

Given current technology—a collection of machines and networks, much like that designed by Edison and his contemporary Charles Steinmetz—this task is complicated by

at least two features of the electricity system. The first is instantaneous balancing. We are all familiar with the Japanese innovation in automobile manufacturing known as "just in time production." The idea is that closely matching production and use would reduce or eliminate expensive inventories and facilitate changes in design. Of course, in the case of automobiles, this tight scheduling is not without problems for the poor supplier operating on the very short leash, and could never be more than a goal. Manufacturers could reduce but not eliminate inventories.

For electricity, however, just-in-time production is more like a physical law than a management goal. There are very few effective storage media for bulk electricity, and measured over more than a few seconds, it is essentially true that what is consumed must be produced at the same moment. Throughout the entire interconnected grid there must be virtually instantaneous balancing of production and consumption. Any deviations from this rule cause frequency fluctuations that can damage equipment or bring down the entire system, fast.

The second and related feature is in the complex interactions of all the elements of the electric system. Sometimes referred to as the world's largest machine, the interconnected system of electric power plants, wires, and appliances, must operate synchronously within a variety of close tolerances for power flows and voltages. For all but the electrical engineers, the details cause our eyes to glaze over. But the net result is that, more than for most systems, everything affects everything else. It is somewhat like broadcasting many competing video channels with only one volume control, one color control, and one schedule for commercial interruptions. The many hands of the competitive market must work within an environment where changes for one are changes for all.

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The combined effect of the just-in-time production and complex interactions means that coordination is another important necessity of the electricity market. It was always clear that operation of the competitive market would require that generators and customers be able to connect to the wires. There would have to be "Gridcos" and "Discos" that build and maintain the transmission grid and distribution systems, and the access terms should somehow establish a level playing field. But equally important, and far less obvious, was the need for a system operator that would pool or coordinate the actions of the many competitive hands to respect the relatively brittle limits of the electric system. Over short horizons of minutes or hours, where the interactions would be critical, there must be a "Poolco" that provides unavoidable coordination services in support of a competitive market. (Note: this is not the vertical coordination often cited as justification for the firm. This is horizontal coordination across and entire industry, quite another matter.) As counterintuitive as it seems to some, we need coordination in order to support competition. And this need has been there since the time of Edison. For decades, the engineers handled the problem and hid it from view. But the move to markets and separation of the components have exposed coordination services as another essential monopoly.

In every country, and for everyone new to the debate, it takes a while to come to terms with the implications of this reality of the electric system. One of the great

surprises has been how difficult and contentious is the process of designing the coordination services in a way that simultaneously respects the engineering reality and supports the market objectives.

Happily, we know how to do it, and the best working models have enough of a record to be judged as quite good, as in the case of the Pennsylvania-New Jersey-Maryland Interconnection in the United States. Unhappily, there is a vocal segment of the industry that sustains and reinvents campaigns to defeat a sensible design; they even have their own campaign button urging us to "Prohibit Poolco."

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Why is there such opposition and debate? By now the arguments are familiar. An extreme, but not unrepresentative, argument is that central coordination is antithetical to markets, and decisions should be left to the many hands of the competitive market. Were it possible to fully decentralize the decisions, this argument might carry some force. However, as I have outlined, this is simply not possible under current technology. When we look closely at such proposals—through the fog of empty claims about who shows the greater commitment to real markets—we find that there is always a system operator who provides the coordination services. Hence, the debate is not over centralized or decentralized operation; rather the debate is over who exactly will determine the rules for centralized coordination.

We can have good rules, or we can have bad rules. We don't have the option of having no rules.

This presents an immediate challenge for government. On the one hand the government could require a set of rules that would support the public interest, setting the stage for the operation of a competitive market. Or the government could defer to a stakeholder process that seeks the least common denominator in setting the rules. At best, the latter approach is an abdication of responsibility. At worst, defective rules threaten the reliability of the system.

In much of the debate that occurs in various countries, the process of formulating the market rules has some of the elements of "the foxes designing the hen house," with some stakeholders demanding flawed designs. Basically, the best models for organizing the coordination services under the Poolco framework have the feature that they solve the hardest problems and make it easy for small players to enter and participate in the market. Balancing services, provisions for losses, emergency responses, and so on can be handled naturally and efficiently, with market participants bearing the costs of their own actions. There is scope for large aggregators and other middlemen, but a limited need for their services in providing the basic commodity. In retrospect, it should not have been a surprise that some of these middlemen would be unhappy with such an efficient market design. And it should not be surprising that when confronted with the arguments, their usual response is to try to change the subject or denigrate the ancestry of the ideas.

A Poolco By Any Other Name

The debate continues today. The source of much of the early enlightenment on the subject was here in England and Wales. Little more than a decade ago, you were

wrestling with an electricity reform directive from the Thatcher government, with a strict deadline. To make a long story short, nearly two years were spent in a futile effort to avoid the inevitable need for active coordination of the short-run electricity market. In the end, you threw up your hands and in a few months put together a completely different approach that resulted in your "Pool" with explicit responsibilities for such market coordination. The organizing idea was that the market participants would submit bids for producing and using electricity, and the Pool operator would find the balanced equilibrium with its market-clearing price. The Pool would combine the functions of a market exchange with those of managing the complex physics of the electricity system.

It was a brilliant innovation, and the whole world was watching. Or at least the whole world that was close to England in geography or culture. It turned out that reformers in Chile had anticipated the basic ideas by several years. But this is only a quibble. After all, they did it in Spanish, and far away. Yours was a remarkable achievement that included reinventing the idea from commodities markets that, for most business purposes, financial contracts could stand in the place of physical transactions, with only a final settlement at the price revealed in the spot market. And here the essential spot price would be readily available from the Pool.

Soon Norway, New Zealand, Australia, and others adopted and improved on the basic ideas, all the while giving credit to the vanguard in England and Wales. Eventually, even the former colonies in the United States took up the task, and the trade balance in England was helped by the constant parade of visitors on the required tour to see how a market could work and keep the lights on at the same time.

Unfortunately, the underlying debates are never far from the surface, and in every region there has been a long and not always successful process to educate all the parties to the essential facts of the electricity system: government could not recede completely. There are remaining natural monopolies, including the complex requirements of coordination services. There must be a system operator. And in the end there is a natural division of labor. Market competitors can compete, and governments can decide on the rules that will produce a workable market with a level playing field.

Regional Transmission Organizations

The latest round of such conversations in the United States culminated at the end of last year with the Federal Energy Regulatory Commission issuing its "Order 2000," elucidating the need for and design of regional transmission organizations. Chairman James Hoecker gave the millennium signature number to this order as a signal of the importance of the rule and its intent. The subject of this substantial tome is the lineal descendant of the Pool in England and Wales. Order 2000 builds upon that innovation and subsequent experience to craft a framework that recognizes the reality of electricity systems, sets the primacy of public interest in establishing a workable and efficient competitive market, and makes a major contribution to the delineation of the boundary between the public and the private sectors.

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As with the Pool in England and Wales, as I read the Order, it relies on a coordinated spot market, within the limits of security constraints, using the bids of market participants to find the most economic use of the system consistent with a market equilibrium. Learning from one of the few mistakes in the initial Pool design, the broader framework recognizes that market clearing prices can and will be different at every location. Financial contracts of the same type as found in England and Wales play a prominent role, as do financial transmission rights that extend the idea to cover the difference in prices at different locations. Costs for the grid are collected through regional access charges, and investments are pursued in large part through the incentives of the marketplace.

This is a state-of-the-art design, with a clear debt to the work on the Pool in England and Wales and its progeny. Progress has been slower than we might like, but there is progress nonetheless. However, the cost has been high, with the expense compounded by taking the occasional step backwards. And there are no guarantees of success, even now.

The sometime failures in this process illustrate many lessons. First, there is the human failing that it is difficult to learn from the mistakes of others; you have to make the mistakes yourself. England and Wales made a mistake in setting up too few competing generators, so competition was slow in coming through entry. This is still a problem elsewhere, such as in Brazil, Ontario, and parts of the United States. New Zealand has gone through at least two rounds of separation and disaggregation.

Second, paraphrasing a harsher formulation often attributed to Nietzsche, we see the common mistake of forgetting what we are trying to accomplish. We want marketers and brokers to provide new products and simplify the process of capturing the benefits of a competitive market. But we do not want marketers and brokers *per se*. Too often we encounter the argument that with an efficient design of wholesale and retail markets there may be little, perhaps no, need for marketers and brokers who cannot provide real added value. The resulting absence of many traders and much visible trading is often mistaken as a problem, not as evidence of a solution, and the move is then on to break what is not broken, in order to give more middlemen something to fix.

The most extreme form of this syndrome is in the process of setting up subsidies for new competitors to enter the market, particularly in the retail sector. Once the electricity spot market is available, the easiest way for customers to participate in the market is just by taking the spot price and absorbing minute by minute price variations, which average out over a month. This is also the simplest form of default service, as pioneered by England and Wales, and advanced in Norway. But potential retailers complain that they cannot compete with the spot price, and require more "headroom" to enter the market. (If you are new to the argument, headroom is a technical term for imposing a tax on the default service that can be avoided if you switch to a new supplier.) Thus we will demonstrate that we can get as many competitors as we want, if we are willing to pay enough for them. This policy, seriously pursued in the United States, is kind of an infant industry argument on steroids.

Pitfalls on the Road Ahead

As I look ahead, I see a number of other pitfalls along the way. In preparing these remarks, I wondered if I should be so bold as to call attention to the newest reforms proposed here in England and Wales. In the end, I decided the greater affront would be to avoid a sensitive subject. Therefore, consider what follows as in the spirit of a cautionary alarm. Here I walk in the footsteps of others, such as my friend Larry Ruff, who has provided a substantial, eloquent, and constructive critique that I would urge you to read and digest.

For an outsider like me, especially one with such high regard for the contributions to electricity market design, as made in England and Wales, it is painful to read of your recently proposed reforms, which I understand are well along the path to implementation. To be sure, there are problems in your existing wholesale market design, as witnessed by the improvements that have been adopted elsewhere. You have too few competitors in generation. The aggregation to an artificial single market price, rather than the locational reality, creates bad incentives but could be easily fixed.

However, you are about to fix what isn't broken and hide the truly broken gears of the machine, which will continue to grind away and do more damage. Your so-called New Electricity Trading Arrangements appear to have been captured by a romance with a market myth. The proposals enshrine trading and traders as desired ends in themselves, not as mere means. The proposals abandon the singular achievement of the coordinated spot market of the Pool and replace it with reliance on aggregators and middlemen. These intermediaries will be happy to see what I expect will be a sharp increase in transaction costs, which they will be paid to manage.

But how is this in the public interest? I doubt that even my friend Irwin Stelzer, second to none in his respect for and understanding of markets, would think this reform a good idea. Perhaps you will learn from him directly in the next lecture in the Cantor 2000 series.

In any event, despite claims to the contrary, you will not avoid the need for coordination through a system operator. This central coordinator is there in the design. It is buried within the National Grid Company. But rather than fixing the rules to reflect the pricing that would prevail in a competitive market, the new arrangements obscure what is being done through *ad hoc* and costly balancing mechanisms that are at best opaque and at worst unsustainable. If this reactionary reform goes forward, you will take several steps backward. That would be especially disappointing, given your history of leadership. Again the world is watching, and now wondering what has gotten into the water, or the beer.

Perhaps the explanation of the different directions here and across the Atlantic is found in the old adage about two countries divided by a common language. The documents I read that purport to explain the proposed reforms in England and Wales seem to ignore or misperceive the practical experience in the United States and its embodiment in the scripture of Order 2000; not to mention the workings of the markets in New Zealand, Norway, and Australia. And the alleged purpose of the reforms, to reduce market power, is not connected to the analysis through any sustained argument that can persuade. If I were you, or Callum McCarthy, your talented regulator, I would take

charge of the process and go back to basics, subjecting this whole apparatus to the kind of scrutiny where logic and evidence play more visible roles.

In any event, I will do my best to keep the infection from spreading back to the colonies.

It won't be easy, because a major lesson of the electricity reforms echoes my tale of the difference between Harvard's Business School and Kennedy School of Government. The more inefficiencies in the market and the more market power you can find, the greater the opportunity to transfer wealth and make profits above the competitive norm. We count on the ingenuity and innovation of the market participants that follow this lure of profits, which they hope will be huge profits protected from competition. And the counterbalancing responsibility of governments is to set up the rules so that the market participants succeed individually in the short run and fail collectively in the long run in avoiding competition, as each innovation leads ultimately to lower costs and better products. Competition should eventually eliminate excess profits, but only if the rules support true competition, not just more competitors.

However, as with us all, the participants don't really want competitive markets for themselves, just for everyone else. Hence, there is constant pressure on both sides. On the supply side, there are pressures to change the market rules and impose costs that create protected market niches. On the consumers' side there is the constant pressure for regulators to intervene when scarcity and efficient market responses lead to higher prices.

The regulators, as the only group charged with the public interest, don't have it easy. They face a delicate balancing act, and the increased complexity of the unbundled market does not make it any easier. The regulators who are going to do the job well, often new to the task, must quickly learn more details than they ever wanted to know about the electricity grid they regulate. Not only must the regulators ensure that the grid operator does the obvious things to keep the lights on and costs down, but they must do so in a way that uses and maintains a seamless interface with the competitive sectors of the market.

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Nobody asked, but based on my experiences I would summarize a few recommendations for regulators:

1. Focus on the public interest. If you don't, who will?
2. Support competition, not competitors. It is easy to confuse the two.
3. Insist on aggressive failure analysis, before you fail. Market design flaws should be identified as soon as possible; never underestimate the ability of market participants to exploit design flaws; never accept a blithe assertion that the market will overcome the design flaws any time soon.
4. Use the market to reinforce operational reliability. Prices and the profit incentive can and should be consistent with the physical reality and the dictates of reliability.

I could go on, but this is enough to make a difference. There has been a revolution in electricity markets, a revolution facilitated by technology but driven by

ideas and ideology. The new big idea sharply redefines the boundary between government and business, and presents greater challenges for regulators in making a market for power.

Save the Best of the Old Ideas

Finally, there is some urgency to all this, an urgency separate from the high cost of delay. While we dither, we are spending a wasting asset. At the core of the electricity system we typically find a team engineers with broad experience in running electricity networks. The rules they follow are only partly subject to codification and computer programming. There is still a good deal of judgment involved, and we should be grateful that they are there because, in the end, this is what keeps the lights on.

This engineering corps typically developed its rules and its ethic within the framework of the old monopoly, and with reference to the broader engineering profession. The rules were not driven primarily by commercial considerations, not the least because the commercial incentives were so distantly removed. And the engineering ethic to serve the public and keep the system working is worthy of respect and preservation.

However, market reforms are eroding the foundations of this system. Many of the previous functions of the engineers have been unbundled and put in the hands of the decidedly commercial market participants. In the battle over efficient market design, the defeats often appear in the form of restrictions on the operators, to reinforce the profits of the middlemen, rather than to reinforce the reliability ethic of the engineers. If the system operators do not honor a culture that emphasizes the broader public interest, but rather bow to the interests of the most vocal stakeholders, eventually the operators will do not as they know they should, but as they are told, or as they are paid.

We have already seen the early signs of this change in behavior in many places in the United States. The most visible evidence is in the pressure to replace the voluntary rules for reliability coordination with a system of mandatory enforcement. But this policing solution pays far too little attention to the force of the new incentives, or the opportunity to design the markets so that the participants face incentives to cooperate with the engineers and support the public interest, rather than to work at cross purposes.

We know how to do it. A great deal is at stake here. It is a great opportunity for leadership from the public sector. If we don't do it right, we deserve what we get.

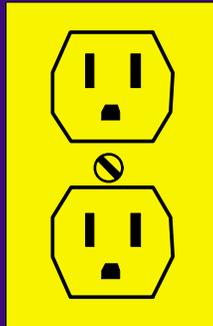
Making Markets in Power

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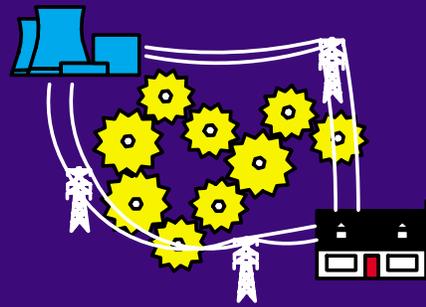
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The Old Face of Electricity

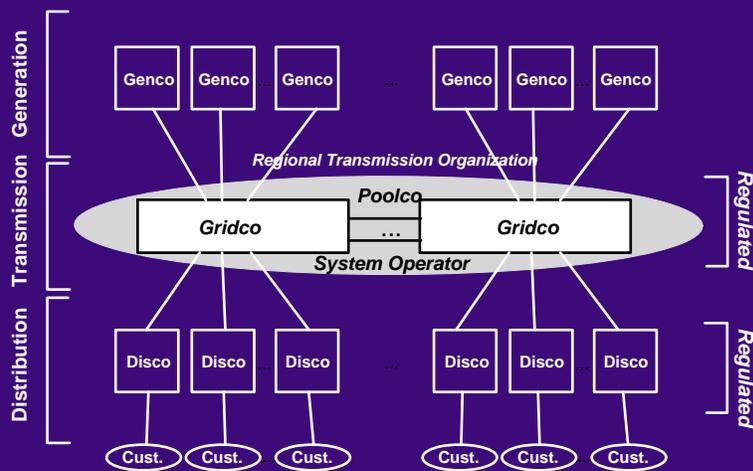


The New World of the Electric Power Market



Many Parts, and the Gears Must Mesh as Well as Turn

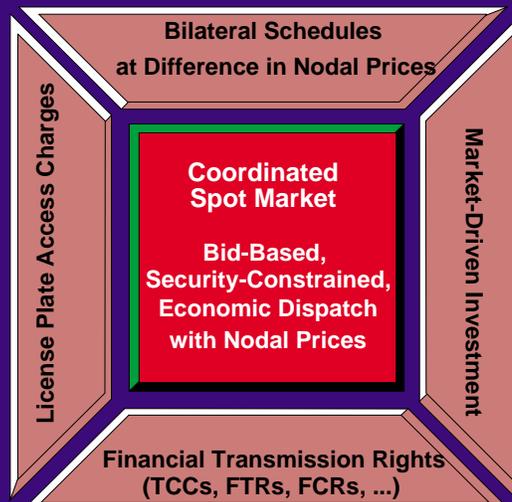
Competitive Wholesale Electricity Market Structure



The Campaign Pin



A Consistent Framework for Electric Power Markets



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Recommendations for Regulators

1. Focus on the public interest.
2. Support competition, not competitors.
3. Insist on aggressive failure analysis, before you fail.
4. Use the market to reinforce operational reliability.

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