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Generating the Benefits of Competition:

Challenges and Opportunities in Opening Electricity Markets

Timothy J. Brennan

In this issue...
The move from regulation to competition in different parts of the economy is one of the great success stories of the past 30 years. And more competition in the electricity sector could offer lower consumer prices and improved stability of supply. So why has market deregulation in electricity been difficult to achieve?

The Study in Brief

The move from regulation to competition in various sectors of the economy, from finance to air transport, has been one of the greatest success stories of the past three decades. The electricity sector offers another area where deregulation can potentially bring benefits. Against these potential gains, however, is a fear that a switch to a market-oriented system could lead to rising prices and systemic instability; fears exacerbated by recent experiences of market deregulation.

This *Commentary* dissects the reasons that may make electricity deregulation different from experiences in other sectors. The central place of electricity in our modern world makes sudden changes in prices a major political concern and makes it difficult for competitive suppliers to pass true prices on to consumers. The nature of electricity production and distribution raises issues of market concentration and monopoly that need to be addressed in moving to a more competitive market structure. Consumers may be reluctant to invest time making complex comparisons between different providers for small savings. Most importantly, the special characteristics of electricity may require central control to ensure reliability of supply.

Given these challenges, the author presents concrete steps that can be taken to move to a more competitive system, including:

(i) Focusing retail deregulation on commercial and industrial users who are better able and more willing to shop for better prices.
(ii) Encouraging real-time pricing so that consumers can better react to price signals.
(iii) Examining supply decisions, rather than prices, in trying to limit the exercise of market power.
(iv) Separating operational control of regulated transmission and distribution from ownership of generation, while recognizing, however, that the degree of separation that best balances protecting competition and maintaining operational efficiency remains an open question.

Above all, the author stresses that caution remains the watchword in moving forward with deregulation in this crucial, fragile and interconnected sector. Carefully and intellegently structured deregulation will be necessary if the potential benefits of decentralization and competition, particularly greater efficiency of energy use, can be brought to this important sector.

The Author of This Issue

Timothy J. Brennan is Professor of Public Policy and Economics, University of Maryland, Baltimore County and Senior Fellow, Resources for the Future, Washington, D.C.

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For nearly three decades, arguably the greatest economic policy success story around the world has been the movement from regulation to competition. The gains have come not only in relatively obvious sectors such as long-haul trucking, where regulation was doing little more than setting cartel prices and preventing competition, but also in finance, broadcasting and air transport, where concentrated market structures have been replaced by deconcentrated structures with a significant number of suppliers. Telecommunications is another major sector where deregulation has been largely successful, with technological change (primarily Internet-based telephony) paving the way for full deregulation, as recently ordered for most Canadian metropolitan areas.

Despite some adverse distributional effects, such as reduced service provision or higher prices in low-volume, high-cost areas, the overall benefits of deregulation have been significant. These include deregulation's direct competitive effects and the substitution of entrepreneurial initiative for central planning. This overall success suggests that the benefits of open markets should be extended to electricity.

Local electricity distribution and, less obviously, long-distance electricity transmission retain scale economies and other monopoly characteristics that preclude significant competition. However, the electrical generation and marketing sectors lack the same scale economies of the "wires" — distribution and transmission — and thus appear ripe for competition, particularly if independent generators have non-discriminatory access to transmission lines at reasonable prices.[1] Growth of interest in environmentally friendly "green" power and commercial and industrial energy management systems, as well as the opportunity to find ways to sell energy at lower prices, promises opportunities for competition in selling electricity at the retail level.

In Canada, the US, and around the world, with notable initial efforts in Chile and the United Kingdom, electricity markets have been opened with the expectation that these benefits from competition would be forthcoming.[2] Since then, many have questioned whether electricity deregulation has achieved this promise (Iacobucci et al., 2005). The purpose of this *Commentary* is to provide some insight into special characteristics of electricity as a commodity, how it is produced, supplied and purchased, in order to understand why such difficulties may be endemic to electricity and are not the result of idiosyncratic regulatory error or political forces, important as

This *Commentary* is based on a talk given in Toronto on November 6, 2006 at the C.D. Howe Institute Policy Conference on "Competition Policy in Regulated Industries: Principles and Exceptions." At the time, Professor Brennan was the T.D. MacDonald Chair for Industrial Economics at the Competition Bureau. The opinions expressed here do not necessarily reflect the views of the Bureau, the Commissioner or her staff. The talk benefited from comments and questions at that conference. This report has profited extensively from suggestions following careful readings by numerous reviewers. It is important to note the opinions expressed here are solely those of the author and do not reflect those of the C.D. Howe Institute or any of its staff. Any errors remain the sole responsibility of the author.

1 Although some generation technologies, particularly nuclear, lead to optimally sized units far larger than others, generators typically lack scale economies that preclude competition, especially where transmission networks have the capacity to deliver electricity over a wide area. Congested transmission grids, unable to carry electricity from a number of generators into a particular area especially during peak periods, can lead to local "load pockets" in which a generator may have market power. The topic of generator market power during peak periods is discussed below.

2 The focus of this report is on Canada and the US. Other studies address circumstances around the world; e.g., Gilbert and Kahn (2007).

those may be. After looking briefly at the state of electricity competition in Canada and the US, the *Commentary* will focus specifically on the following five inter-related topics:

- Residential consumer reluctance: Do people want to have the ability to choose their electricity supplier?
- Pricing: Will electricity markets be sufficiently competitive to keep prices tracked reasonably to costs?
- Market power: Might individual suppliers possess the incentive and ability to raise prices when demand is at its greatest, without having to collude?
- Corporate structure: Is vertical separation in the industry, considered necessary to foster competition, consistent with efficient short-run operation and long-run expansion of the electricity grid?
- Reliability: Last and probably foremost, do the special characteristics of electricity imply that central control is necessary to ensure reliability of the grid?

Negative answers to all, some, or even one of these questions need not make electricity deregulation unattainable or undesirable in its effects.[3] The conclusion offers policies to mitigate some of the potential negatives. These suggested initiatives include:

- Focus retail deregulation and efforts on commercial and industrial users, who are better able and likely to be more willing to shop for electricity and thus provide incentives to produce and use it most efficiently.
- Encourage real-time pricing, especially for commercial and industrial users.
- Examine supply decisions, rather than price, to try to limit the ability of firms to exercise market power and raise prices by withholding supplies.
- Separate operational control of regulated transmission and distribution from the ownership of generation, keeping in mind that the degree of separation that best balances protecting competition and maintaining operational efficiency remains an open question.
- Exercise caution in moving to deregulation, as the need to maintain reliability in this crucial, fragile and interconnected sector requires a careful approach.

None of these recommendations may counter all of the potential difficulties in opening electricity markets, but in recognizing their limitations, one needs to remember that the regulatory alternative is also never ideal. Regulators rarely have enough information, operate under legal and procedural constraints and can only adapt slowly to changed costs, technology and demand. Moreover, rewards under the political system may lead regulatory decision makers to promote special interests

3 We do not consider here the effects of environmental regulations; e.g., the effects of carbon emission permits or taxes that discourage some forms of generation and encourage others. For a brief survey, see Chapter 15 in Brennan et al. (2002). The electricity sector, although targeted by such regulations, is not the only sector that will have to adapt to them. More to the point, environmental regulations, while affecting costs and potentially market structures, do not imply that opening markets to competition is problematic. The focus here is on the unique combination of features in electricity that has made competition more problematic than other sectors where deregulation has worked relatively well.

Table 1: *: Installed Electricity Generation Capacity in Megawatts — Nationally and by Province*

	Can.	Nfld.	NS	NB	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Public	90.3	7.1	0.0	4.0	34.6	22.7	5.5	3.3	1.6	11.2
Private	23.3	0.3	2.4	0.4	1.4	8.8	0.0	0.5	8.2	1.3
% Private	21.0%	3.0%	100.0%	8.9%	4.0%	28.0%	0.4%	13.0%	83.4%	10.0%

Note: The provincial figures add up to less than the national figure because the latter includes capacity on Prince Edward Island and in the Territories.

Source: Statistics Canada (2005), 8-9.

rather than the public's interest. But the above issues need to be considered in making any assessment of the prospects for electricity competition, which requires a cautious balancing of the costs and benefits rather than a decision rooted in a prior ideological commitment.

Current Events

Since markets were opened on a large scale in the US in the mid-1990s, the performance of the electricity sector has been far from smooth. In the fall of 2000, about two years after putting into place the first and most extensive market opening initiative in the US, the California electricity market imploded with skyrocketing prices, rolling blackouts and utility bankruptcies (Brennan, 2001). In August 2003, a massive blackout paralyzed the northeastern US and Eastern Canada. More generally, instead of falling as competition advocates promised, electricity prices have been rising in much of the US, particularly in states that have opened markets. In Maryland, one of those states, the main default service provider, Baltimore Gas and Electric, recently raised its rates about 70 percent.[4] Less dramatic, but unprecedented and politically controversial price increases — particularly during peak periods — have taken place in Ontario, one of the Canadian provinces that have taken the largest steps toward opening electricity markets (Iacobucci et al., 2005 at 31-32).

Whether or not these events are the result of opening markets, they reversed the momentum that had built in the 1990s toward having electricity follow telecommunications and other markets into the deregulated camp. In Canada, where electricity markets are controlled by the provinces, only two, Alberta and Ontario, have opened retail markets to some degree, as indicated by Figure 1 (National Energy Board, 2005, 6).[5] Table 1 offers more detailed data on the public/private breakdown.

Of the roughly one-fifth of Canadian electricity capacity held by private utilities, most is in Ontario and Alberta. Other than Ontario and Alberta, the provinces have only opened markets, if at all, for wholesale access — primarily bulk power sales to local monopoly distributors — or, in some cases, to large industrial users. Most of the

4 As I am somewhat more familiar with the US market, many of the examples here will be drawn from there. One may regard the US experiences as instructive in terms of potential pitfalls and mistakes to avoid as much as, if not more than, practices to emulate.

5 Although the diagram is three years old, it remains largely accurate.

Figure 1: *Canadian Restructuring Status (as of 1 April 2005)*

Source: National Energy Board.

other provinces (and Ontario) continue to have most of their needs supplied by publicly owned, vertically integrated companies.

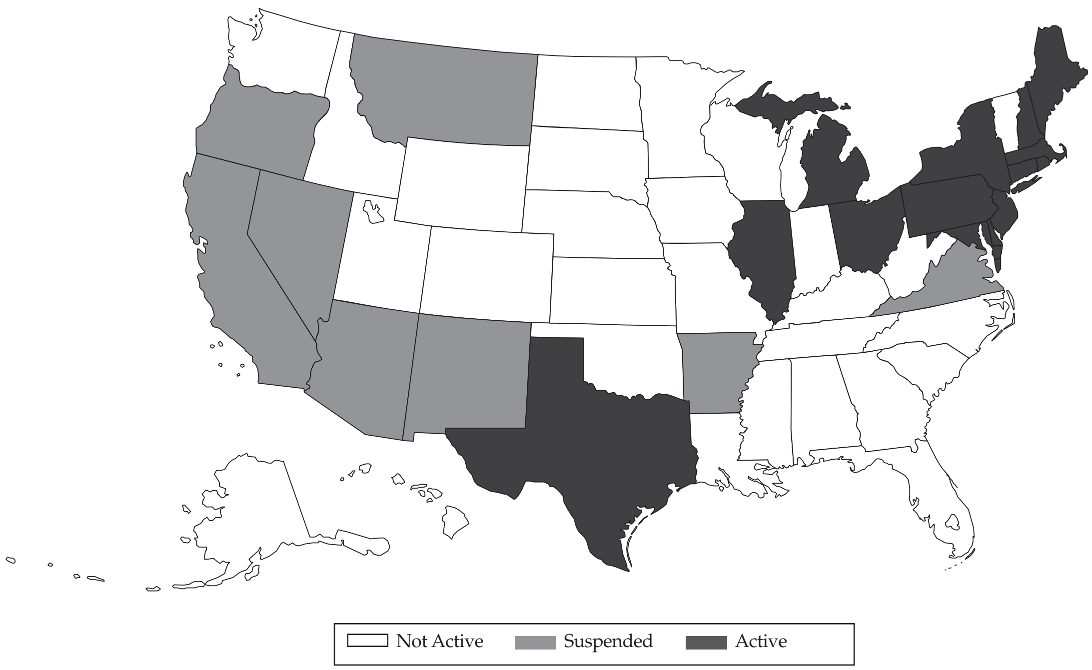
In the US, at the federal level where jurisdiction over wholesale and interstate markets lies, efforts to facilitate the opening of competitive markets have foundered on both regulatory and legislative fronts. Initiatives to open retail markets, controlled by the states, stopped after the California meltdown, and some states that had opened markets are considering reversals. Figure 2 shows the status of state restructuring efforts; notable are the many states that had started to deregulate and then reversed course following the California crisis and run-up in electricity prices.[6]

Whether these crises, outages and price increases were idiosyncratic or would have taken place without open markets is a good question. In California, high wholesale prices turned into a disaster when regulators kept retail prices from rising to match purchase costs. Keeping prices low kept demand high, throwing the distribution companies into or near bankruptcy. This exacerbated the situation, as wholesale prices rose even further to incorporate the significant chance that generators would never get paid (Brennan, 2001).

The 2003 Northeast blackout resulted from actions in the regulated sectors, distribution and transmission, and not a failure among competing generators (US-

6 As explained below, "restructuring" is synonymous with opening markets to competition because doing so required changes in the structure of the closed, end-to-end vertically integrated utilities that had dominated the sector during the regulatory era.

Figure 2: *Restructuring Status by State*



Source: US Department of Energy, Energy Information Administration. "Status of Electricity Restructuring by State." April 2007, http://www.eia.doe.gov/cneaf/electricity/page/restructuring/restructure_elect.html.

Canada Power System Outage Task Force, 2004). Finally, as everyone who has been to a gasoline station or paid a heating bill knows, prices have skyrocketed over the last few years throughout the energy sector, not just for electricity. It should not be surprising that there is a connection between energy prices in general and electricity rates, since combustion of fossil fuels, particularly natural gas, is the technology of choice for new entrants in generation, especially for plants used at peak periods.

Despite the availability of explanations having nothing to do with inherent shortcomings with bringing more competition into the electricity sector, these events have raised doubts among the public and policymakers as to the future role of competition in electricity markets. At the root of the confusion is the public's seemingly ambivalent attitude towards competition in this area.

Retail Competition: Do Consumers Really Want It?

One of the central tenets of the economist's view of the world is that more choice is better. The benefits of competition arise from having multiple providers of products that attract consumers by offering lower prices and more desirable features. Yet, the residential electrical consumer seems largely immune to these benefits. With some exceptions (Ontario; Texas and Ohio in the US), North American households have exhibited remarkable reluctance to switch from the incumbent electricity supplier (SPi

Group, 2004; Rewey and Sedano, 2005, 7).[7] Recent data from Maryland indicate that as of October 2006, new electricity suppliers provide less than 2.5 percent of peak load to residential customers.

New competitors are much more able to flourish in other segments of the retail electricity market (Public Service Commission of Maryland, 2006, 5). To illustrate the relative difficulty of attracting residential consumers, competitive suppliers in Maryland provide 69.1 percent of all commercial and industrial (C&I) peak load and 94.1 percent of peak load for large customers in the category.

Numerous factors could explain this reluctance of residential consumers to switch to new entrants. The political processes that opened retail markets often included retail price controls over a transition period. Sometimes, this resulted in lower prices, reflecting in part the expectation that electricity prices would fall with competition, rather than rise along with energy prices generally.[8] In addition, large commercial and industrial users are more attractive to new energy suppliers, with the prospect of larger sales and, as noted below, better ability to price for contingencies such as peak power use and allowing for interruptions. Simply put, the costs of searching for and evaluating proposals from new entrants are proportionally smaller and more likely to be worth undertaking for buyers that use large amounts of electricity.

The experience of deregulation in the US and Canada suggests that switching suppliers entails greater costs in evaluating suppliers and making decisions than many residential customers are interested in bearing. Alberta provides a useful illustration. Box 1 displays the chart that the Alberta Utilities Board provided to help consumers compare alternative suppliers by showing them the information they should gather and how to make use of it.

One might not be surprised to find that few residential consumers would volunteer to undertake this assessment with multiple suppliers just to shave a few dollars off their electricity bill. The Alberta Electricity Board has since dropped this form, but now supplies a multistage website from the Utilities Consumer Advocate providing extensive instruction on how to read and evaluate service contracts and make price comparisons.[9] As University of Alberta Energy Policy Professor Joseph Doucet has observed, “Residential consumers don’t understand restructuring and don’t appear interested in switching retailers” (Doucet, 2004). In Ontario, the other province with open retail markets, low-volume buyers can and largely do still obtain electricity at a regulated fixed price (Ontario Independent Electricity System Operator (IESO), 2007, 1).[10]

7 Twenty-five percent of Ontario-based customers chose a retail supplier prior to the opening of the market in 2002, but since then that percentage has declined. See SPi Group (2004).

8 The huge rise in natural gas prices, which in many markets fuels the “marginal” power plant and thus sets the price, was almost certainly not foreseen at the time markets were opened.

9 See Utilities Consumer Advocate. Ministry of Service Alberta. “Understanding the Choices.” http://www.ucahelps.gov.ab.ca/80.html (accessed September 21, 2007).

10 One reviewer of this report noted that www.energyshop.com provides consumers with information on alternative offers. While it does provide information on prices by contract term and additional features, it does not answer the consumer-specific questions of the sort given in the Alberta Electricity Worksheet. It is still not surprising that many consumers would rather let a regulator police prices and choose for them rather than undertake contract evaluations and comparisons themselves.

Box 1: *Alberta's "Electricity Worksheet," 2005*

Comparative Electricity and Natural Gas Shopping Worksheet	
Name of energy supplier	
Contact name	
Phone number	
Energy supplier type (competitive retailer/regulated service provider)	
Reference of supplier (e.g., Existing customers, Better Business Bureau, credit references, etc.)	
Is there a basic service charge, even if i don't consume any electricity or natural gas?	Yes/No
What is the fixed rate?	$
What is the variable rate?	$
What is the energy charge per kilowatt-hour (kWh) or per gigajoule GJ) (Gas Cost Recovery Rate for Natural Gas)	$ /kWh or $ /GJ
Are these price breaks for different levels of consumption?	Yes/No
Any built-in price increase? (Electricity Only) If yes, amount and when.	$ /kWh Date:
What are the retail service fees?	
Are ther additional components to the energy charge? (Electricity Only) Unaccounted for energy Pool service charge Distribution loss charge	Yes/No If Yes, explain:
Is there a premium for green power? (Electricity Only)	Yes/No
Terms of the agreement?	
What does the clause concerning supply interruption indicate?	
Does the price depend on the time of year that I consume electricity or natural gas?	Yes/No
Does the price depend on the time of day that I consume electricity? (Electricity Only)	Yes/No
What is, if any, the switching fee or other up-front charges?	$
What are the exit provisions for cancelling the contract?	
Are there meter reading fees?	Yes/No
How frequently will I be billed?	
Can you bill me at a regular date of my choice?	Yes/No
Am I buying anything other than electricity or natural gas?	Yes/No
Are services available to help me use electricity or natural gas more efficiently?	Yes/No
Who will inform my previous gas supplier about my new arrangement?	
Who do I call if I have questions or problems? Contact Retailer number	
Is the price/supply tied to a specific electricity generation plant? (Electricity Only)	Yes/No
What occurs in the event of an outage at that plant? (Electricity Only)	
Disclaimer The contents of this worksheet are only suggestions of possible considerations for consumers. The worksheet is not intended to be a comprehensive guide nor is it a substitute for your own judgement. The govenment of Albert makes no warranty or representation of any kind in respect of the contents of this worksheet and has no liability for any damages that may be caused to any person in connection with or arising out of the use of this worksheet.	

Source: Alberta Energy and Utilities Board. "Customer Choice." http://www.customerchoice.gov.ab.ca/index.html (accessed April 14, 2005).

At least partly because residential consumers have not responded to competition as theory might predict, regulated service remains available and, in many jurisdictions such as Maryland, is far and away the dominant choice. Significant residential switching to new providers has required either massive education and marketing campaigns (the United Kingdom's "door-to-door" solicitations), forcing consumers into the open retail market by instituting substantial rate increases for the purpose of making entrants viable (Texas) or rewarding entrants for providing residential service by letting them transfer delinquent accounts back to the incumbent utility (New York).

That consumers do not switch in response to small changes in price is consistent with their behaviour in other arenas (Brennan, 2007). Most consumer brand market shares are stable from year to year, with significant changes a relatively rare occurrence. In the US effort to open long-distance markets following the AT&T divestiture in 1984, consumers complained when they could no longer get default service through their local telephone company. Consumers were essentially told they had to choose and subscribe to a carrier, or be allocated to one they had not selected.

One can look at this reluctance in cost-benefit terms, where the “costs” include the time and energy spent estimating use, comparing prices and assessing contracts. On the benefits side of the ledger, the electricity product for most consumers is almost impossible to differentiate, unless they have a preference for “green” power, electricity bundled with energy management services, and perhaps other distinguishing factors. Even in provinces that have opened markets, electricity remains available to residential consumers at a rate overseen by provincial utility regulators that is close to the wholesale cost plus a payment for distribution. For many, the costs of shopping may outweigh the benefits.

It is not hard to show that, if the cost of switching suppliers is significant to a set of consumers such as residential users, then the net benefits of deregulating retail markets to that set may be negative (Brennan, 2007). Some consumers who do not mind switching, or who use enough energy to make the assessing of new suppliers worthwhile, will gain. On the losing side are two sets of consumers. One set comprises those consumers who pay a higher unregulated price to stay with the incumbent rather than switch. The second set comprises those who switch to avoid this higher unregulated price, but would rather have remained with the incumbent at the lower regulated price than have shopped for a competitive supplier. Aggregate costs to these latter two sets of customers could — although not necessarily will — exceed the gains to the first group.

The reluctance of residential consumers to switch provides some indication that retail markets may not be working well for that set of users. One response to this reluctance, discussed extensively in the US, has been to attempt to design programs to provide some semblance of indirect competition to the residential side of the business. For example, one could hold auctions to determine the “default” retail provider. Potential bidders could bid on prices or markups over the wholesale price and distribution fee.

However, “competition for the market” may not be an effective substitute for regulation. For competition to determine the default provider to benefit the buyers, the competition has to be held on the basis of selling price rather than on the basis of payments to be the provider. Otherwise, one has only a transfer of the monopoly profit from the providers to the jurisdiction holding the auction. But the appropriate price is likely to change during the term of the franchise, because costs and demand are unlikely to remain constant over the lifetime of the assets used to provide the default service. The process of getting approval to adjust prices, citing changed

Table 2: *: Alberta Electricity Customer Usage Estimates by Customer Class.*

	2006 Number of Customers (000s)	2002 Usage(TWh)	2003 Usage(TWh)	2004 Usage(TWh)	2005 Usage(TWh)	2006 Usage(TWh)
Residential	1,192	7.2	7.6	7.6	7.8	8.3
Farm	79	1.7	1.8	1.7	1.7	1.8
Commercial	142	11.2	11.1	11.7	12.1	12.7
Industrial	36	28.8	27.9	28.6	29.1	29.2
Total	1,448	48.5	48.3	49.6	50.6	52.0

Notes: TWh = terawatt hours, or trillions of watt-hours of electricity. Errors in addition due to rounding.

Source: Alberta Energy. "Electricity Statistics: Customer Usage Estimates." July 2007. http://www.energy.gov.ab.ca/Electricity/682.asp.

circumstances, is likely to resemble the regulation such franchise competition is designed to avoid (Williamson, 1976).[11]

A better strategy might be to focus on the success of deregulation to the commercial and industrial segments of the electricity market. These are the larger buyers for whom the benefits of shopping for the best price and contracts exceed the costs. In Maryland, as noted above, over two-thirds of the peak load to commercial and industrial users is supplied by competitors to the default supplier. In Ontario, 54 percent of the load goes to large users or "metered market participants" who pay the hourly wholesale prices either to their local distribution company or the Independent Electricity System Operator (IESO, 2007, 3-4).[12] Meanwhile, in the US commercial and industrial users purchased about 62 percent of electricity sold in 2005.[13] In Alberta, the commercial and industrial sector composed over 80 percent of the market in 2006 (see Table 2).

Rather than lament the 20 to 40 percent of the market that resists retail competition, we should focus on the 60 to 80 percent that is willing, able and likely to become involved in retail markets. Substantial participation by commercial and industrial users would produce much of the benefit to a provincial or national economy that complete retail competition might provide. Lower energy prices in that

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11 One reader suggests that competition to be the default provider is not about providing competitive rates, but "is all about improving the liquidity of the forwards contract market on the wholesale side." Since regulated retail providers can and do purchase wholesale bulk power under long-term contracts, the issue of whether the benefits of holding a competition to be a default retail provider exceed the costs seems a separate matter.

12 "Low volume" users, as defined by the IESO, include those whose use extends up to 250,000 kWh per year; or 20 or more times the average Ontario household electricity use of 11,000 kWh per year. These "low volume" users undoubtedly include many who would be classified as industrial and commercial. Hydro One reports that the average household in Ontario uses 900 kilowatt hours of electricity per month. See Hydro One Networks. "Power Saver: Electricity Meter and Meter Reading." http://www.hydroonenetworks.com/en/efficiency/downloads/PowerSaver_08_MeterRead.pdf. (accessed September 22, 2007).

13 Calculated from data provided in US Department of Energy, Energy Information Administration, "Direct Use and Retail Sales of Electricity to Ultimate Customers by Sector, by Provider." http://www.eia.doe.gov/cneaf/electricity/epa/epat7p2.html.

sector would likely be passed on to consumers in the form of lower prices for goods and services. These large users are more likely to find advantageous hourly-based pricing, which can have significant effects on cost and system reliability, as noted below. As residential users and consumer advocates observe the benefits of competition in this sector, they may be willing to adopt competition for themselves. Until then, it may not be worth the political effort to foist competition on a largely uninterested mass market.

Real-time Peak Load Pricing

The aversion of residential consumers to switching suppliers exacerbates a second difficulty with electricity markets — connecting prices to costs, especially during peak demand periods. The divergence between price and costs can be many orders of magnitude. Enabling markets to reflect those prices requires changes in the technology used to measure electricity use. At the same time, buyers must be able to get real-time information on prices and reduce or defer use in response. One might see public resistance to exposure to such prices, although much of the gains from tying prices to costs, as with the gains from opening markets as a whole, are likely to be generated by fostering opportunities for large users to reduce costs by adopting real-time pricing practices.

One of the most important characteristics of electricity is that once produced, it cannot be economically stored in sufficient quantities to meet peak demands at off-peak prices.[14] Consequently, the capacity to produce electricity at peak demands has to be available during those times, even if it is not used at other times. The effect can be dramatic. In Ontario in 2006, the peak demand for power was just over 27 gigawatts (GW), or 27 billion watts of electricity. However, demand exceeded 25 GW for only 32 hours out of the 8,760 in a year, not quite 0.4 percent of the time (IESO, 2007, 13).[15] To recover the cost of installing that capacity, the price of electricity in those 32 hours would have to be many multiples of the price if the costs were spread over the full year.

To recover these capacity costs in 0.4 percent of the time, the price of a kilowatt hour of energy would not be 250 (100%/0.4%) times the off-peak price. The per-kilowatt hour fuel cost for on- and off-peak demand hours is probably not that different, since fuel can be stored and is thus likely to be less variable over time.[16]

14 As the claim that capacity sets limits on consumption of electricity depends crucially on the inability to store electricity, we should perhaps discount claims from some commentators that keeping reservoirs high behind hydroelectric generators is a form of "storing" electricity. This might be better thought of as storing fuel in advance of the production of electricity. Storage in this sense is not a substitute for the capacity to produce electricity when needed at peak times. This no more "stores electricity" than does keeping a pile of coal or a tank of natural gas full at a fossil-fuel burning plant. A pumped-storage system, where electricity produced elsewhere at one time is used to pump water below a reservoir up into it so the water can be used at a later time to produce electricity, constitutes a limited form of electricity storage.

15 Demand exceeded 23GW, about 85 percent of peak load, for only 125 hours, or about 1.4 percent of a year. In effect, 15 percent of the capacity of the Ontario electricity system is used about 1.4 percent of the time, and about 7.5 percent, or 2 GW, is used less than 0.4 percent of the time. See IESO (2007, 13).

16 Fuel costs could differ not because of differences in the prices of fuels themselves, but because the fuel mix used at peak times is likely to be different than for off-peak use.

More important, plants designed to operate specifically to meet peak period demands will tend to be less capital intensive, in order to reduce the expense that has to be recovered in such a short time. As a consequence, however, they will be more fuel intensive, increasing the fuel cost per kilowatt-hour (kWh) during those times (Crew and Kleindorfer, 1986). This would mitigate any reduction in the ratio of on peak to off peak prices arising because of on-peak units being relatively less capital-intensive. In light of all of these considerations, it should not be surprising that wholesale electricity prices on the order of 50 to 100 times off-peak prices have been observed.[17]

Unfortunately, from the perspective of economic efficiency, most electricity users do not see this price variation. Electricity prices typically are constant regardless of supply and demand conditions at particular times, for reasons of both technology and policy. On the technology side, charging prices based on demand conditions at particular times requires that one be able to bill for energy at the time it is used. At present, in most markets the standard meters for measuring electricity use are only cumulative. A monthly meter reading tells how much was used over the course of a month, but not when it was used.

Therefore, electricity suppliers have no way to charge for electricity according to their cost of supply at the exact time that it is used. In some parts of Canada (and much of the US), where peak electricity use is for summer cooling, a kilowatt-hour used in July at midnight, when the only marginal cost is fuel use, is much less expensive to produce than a kilowatt hour on a late July afternoon, when extra capacity is needed to run air conditioners at the hottest and most humid times of the year. In other parts of Canada, where electricity is used for heating, the high-cost, peak-demand times may be on winter evenings rather than summer afternoons.

So-called "smart meters" that store data by hour of use, not just cumulatively, are required before consumers can be charged for electricity when it is used. With the resulting ability to charge real-time prices, the grid could operate much more efficiently. In the short run, if consumers saw peak-load prices, consumers would use electricity only at peak demand periods if the value to them of that use exceeded 50 to 100 times the normal price. The reductions in demand this would bring could eliminate significant, costly investments in generation and transmission capacity.

A small reduction in energy use can have a huge effect on capacity requirements. Taking the Ontario 2006 numbers as an example, reducing demand by just 7.5 percent or by about two gigawatts during those 32 peak hours when the rate of energy demand is above 25 GW, would eliminate the need for that 2 GW of capacity. Even though such a demand reduction would reduce capacity needs by cutting out only about 64 GWh out of 151,000 GWh of energy used during 2006 (IESO, 2007, 3), or by about 0.04 percent, it would have a significant overall effect. Expressed as percentages, lowering total energy use by this 0.04 percent would reduce the need to provide generation capacity by 7.5 percent. The effect could be even more dramatic, since some of that reduced energy use could be redirected to off-peak uses with no need to install additional capacity. For example, activities such as running clothes dryers or dishwashers could be shifted to other times when the grid has excess capacity.[18]

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17 Market power may be involved as well. That possibility is discussed below.

18 The IESO reports that,"Ontario experienced a negative hourly electricity price of -$0.40 per megawatt hour between 1:00 AM and 2:00 PM on September 18." Media Desk. ...

Realizing such savings requires more than smart meters. Electricity users have to obtain information about electricity prices at peak times, and they must be able to shift or eliminate some electricity uses based on this price information. Effective, real-time demand reductions could be implemented by automated control devices that receive price information via the Internet and, as thresholds are crossed, turn down or turn off air conditioners and other equipment. Such automation might be necessary to limit some residential use if peak demand periods are during the day when no one is home. A less expensive, but perhaps less effective, method would be to inform consumers in advance what prices are likely to be during peak hours because of expected weather conditions, and let them plan accordingly.

Recognizing these practicalities, one would expect that real-time pricing would be most attractive to commercial and industrial users.[19] In light of what we've seen about residential user reluctance to switch suppliers, one might expect them to be less interested in having to deal with the added complication of monitoring continuously varying prices. In addition, opening markets can bring with it redistribution of wealth from buyers to sellers that may create political roadblocks to efficient pricing. Under competition, when prices shoot up because demand rises, requiring the use of high-cost supplies, everyone gets to charge the higher price. In the case of electricity, during those 32 peak hours in Ontario, the price necessary to cover the cost of providing those extra 2GW of power is collected not just by the generators, but by everyone in the power supply chain at that time.

If moving to full real-time pricing is not in the cards, a step in the direction of real-time pricing is time-of-use pricing, where consumers pay higher prices during pre-set periods. Ontario has such a pricing program, which also requires smart meters. Under this plan, peak summer and winter prices are 8.7 cents/kWh; off-peak night and weekend prices are three cents/kWh, and mid-peak prices are seven cents/kWh. Few residential users have such meters now; most will get a smart meter between 2008 and 2010 (Ontario Energy Board, 2007a).

Time-of-use pricing, where rates vary by time but not by demand, may make demand reductions easier to administer, but it is only a partial solution. This method does not reflect the fact that the major divergence between price and costs takes place during very few hours of the year; depending primarily on weather conditions. There is no need to cut back power on a July afternoon that happens to be relatively cool, and a price only some three times the off-peak price will not provide sufficient incentive to conserve energy during these limited very high-demand hours.[20]

footnote 18 cont'd

... http://www.theimo.com/imoweb/media/md_index.asp, (accessed September 22, 2007). This seemingly impossible circumstance can occur when the costs of shutting down and restarting plants are such that generators would, in effect, pay customers to use power to keep them operating.

19 When the gains from conservation exceed the costs of installing and effectively using real-time meters, users should respond by installing them. Such a response would reduce the justification for policies to subsidize or require such meters. To the extent that any customer's real-time uses impose blackout risks on the entire grid, policies to subsidize such meters could be justified. See Brennan (2004a).

20 An Ontario pilot project showed that consumers will cut back more when they see very high prices (30 cents/kWh) at "critical peak periods" compared to 10.5 cents/kWh "time of use" pricing. See Ontario Energy Board (2007b, 2 and 4).

Economists recognize as efficient the principle that all suppliers should see prices that reflect consumer willingness to pay, in order to determine how hard to push their plants and workers, and whether to defer maintenance-related plant shutdowns until times when electricity is less valuable. However, the general public and its political leaders will regard this principle, when applied to electricity usage, not in efficiency terms but as a massive redistribution of wealth from consumers to generators. This is likely to be intolerable even when a blackout from excess demand is the result. For example, the California debacle was exacerbated, if not caused, by the political inability to pass high wholesale prices through to consumers.[21]

Regulation insulates consumers from higher prices by averaging the costs of expensive peak-power generators into the constant hourly rate. This hiding of the real cost can lead to inefficient overuse of power at peak and higher costs overall, but without the politically unpalatable dollar transfer. Economists can point out that, over time, any resulting higher profits will be eliminated as they attract new competitors, reducing electricity prices at all times and returning the savings from more efficient operation to the buying public. That point, along with arguments that real-time pricing encourages efficient use, reduces long-run system costs and improves reliability, may not be enough to make the public sufficiently patient to wait for these new competitive suppliers to appear.[22] Interim measures, such as paying consumers to reduce use or accept grid-controlled air conditioning or heat controls, may be the politically and technologically most effective ways of bringing some real-time response to the residential market.

Is Peak-Period Market Power Inevitable?

Metering peak-load usage does not by itself ensure that electricity markets, even at the more open wholesale level, will perform efficiently at those crucial times. There is some reason to think that generation may not be as competitive as other services with comparable market structures. Even if no firm were to have what would normally be regarded as a dominant or monopoly share, prices may tend to be substantially above competitive levels. The concern here is not with collusion, although electricity, as a physically identical product, may lend itself to price agreements. Rather, the problem is that at or near peak demand, generators with even relatively small market shares might have incentives to withhold output in order to raise prices. As we see below, although long-term contracting can mitigate this problem, it is likely to remain. If so, regulators should focus not on whether the price is too high compared to some measure of cost, but on whether output has been withheld in order to make prices artificially high.

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21 An early indicator of the problem in California, just before the collapse of the state-wide market, was that the state rescinded retail deregulation in San Diego in the spring of 2000, after rates had doubled in response to tight supply conditions. For a more detailed discussion of the multiplicity of factors contributing to the California electricity market crash, see Brennan (2001).

22 We might also note that entry may be blocked by local objections to the construction of new generators in their vicinity — the classic “not in my back yard” problem.

A. *Why peak-load market power is a concern*

Three factors in combination determine whether a single firm has appreciable market power, which is defined as the ability to raise price a significant amount, to make a larger profit as a result, and to achieve both without collusion (Landes and Posner, 1981). The three factors determining market power are the firm's market share, the willingness of buyers to keep buying if the price goes up (inelasticity of demand) and the inability of competitors to offer more product if the price does goes up (inelasticity of supply). Importantly, the greater are any two of these factors, the less important is the third. For example, if a firm has a very large share and consumers will keep buying at high prices, the ability of relatively small suppliers to respond will have a relatively low deterrent effect on the firm's exercise of its market power.

At peak periods, both electricity demand and supply are insensitive to price. On the demand side, people will keep buying because electricity has few substitutes. To the extent the peak prices are not immediately felt by the purchasers, either because of the absence of smart meters or the existence of retail regulation that prevents peak costs from being passed through, high wholesale prices will have no effect on demand. On the supply side, at peak demand periods the system is close to capacity and generators have little ability to increase their electricity output in response to price increases. Transmission grids may be congested during peak periods, further limiting the ability of competition from imported electricity to keep prices down. Also, the practical inability to store electricity implies that electricity inventories are not an alternative that would mitigate market power any generator might exploit.

As a result, a generation company with a share too small to raise market power concerns in most other contexts may find it profitable at peak periods to reduce output and raise prices. Using a standard formula expressing the equilibrium relationship among markups over marginal cost, market share and supply and demand inelasticity, a firm with a 10 percent market share would find it profitable to charge prices substantially exceeding competitive levels [Brennan, 2001]. These inelasticity effects also suggest that under some models of strategic behaviour, where generators choose how much to sell, a relatively unconcentrated market may nevertheless lead to very high markups.[23]

B. *Does contracting help?*

One proposed remedy for the exercise of market power is more long-term contracts. But with electricity prices rising, the impression that such contracts keep prices down is illusory. Long-term contracting has the virtue of providing price insurance, but that does not imply that prices will be low. A long-term contract includes obligations to keep buying if the price goes up, as well as an obligation to keep selling even if the price falls. The ability to arrange long-term contracts provides some encouragement to enter the generation business, particularly for long-lived, expensive plants, in that it can provide some reduction in the expected cost of bearing risk. Those benefits, however, do not provide any protection against market power. The price of electricity

23 Lee Friedman notes that at full peaks, firms may not have an incentive to withhold because the market price is already high. See Friedman (2007). In effect, the monopoly price is the same as the competitive price; the lost revenue from cutting back sales would not be made up by being able to raise prices on what one is still selling. Using a strategic model of the sort mentioned here, Friedman finds that the likelihood of market power being exercised is greatest when demand is near but not at its peak level.

procured under a long-term contract should reflect the expected spot price, plus a premium paid to generators for having them face risk from variation in fuel costs. If that spot price reflects the exercise of market power, so too should the contract price.

The argument that long-term contracting reduces market power is that when the spot price is set, the quantities sold and prices paid for them under contract are given (Allez and Vila, 1993). On this account, a firm, when exercising whatever market power it has, will have less incentive to raise prices than if all its sales were spot sales since the profits from increasing prices will be made only on the spot market. The firm gains nothing on sales it made previously. In effect, a firm that sells both under contract and on spot markets ends up competing with itself, in that present sales reduce the market power it can exercise later, and the reduced spot-market power in turn lowers the price of long-term contracts.[24]

The theory that long-term contracting attenuates market power rests on the assumption that generators compete through quantity commitments (contract and spot) rather than on price. The idea is that selling one more megawatt hour under contract reduces spot sales not just by oneself, but by one's competitors as well. The generality of the argument, then, remains a matter of discussion.[25] One should also point out that to the degree selling electricity under contract provides some insulation from spot prices, it may reduce the incentive to conserve electricity when real-time conditions cause cost spikes — probably the most important conservation concern, as noted above.

C. *Improving residual regulation: quantity, not price*

Accordingly, even with nominally competitive generation industry structures, peak-pricing market power for bulk electricity sales cannot be dismissed. In the midst of the California market meltdown of 2000/01, the US Federal Energy Regulatory Commission (FERC), which oversees wholesale electricity markets, adopted price regulations to constrain such power. While such regulation could be useful, the cost of doing so may well outweigh the benefits, and the FERC actions illustrate why. As noted above, the price of extreme peak electricity power will be orders of magnitude above the off-peak price. Such very occasional, but very high, scarcity rents will be necessary to pay for the capacity needed to provide electricity during those very few highest-demand hours of the year.

Such prices will be far above any short-run operating and maintenance cost of the plant. Nevertheless, it will be tempting for regulators to base prices on such costs; e.g., the highest average variable cost of the marginal plant in service. Unfortunately,

24 The intuition is akin to that of a famous argument by Nobel laureate Ronald Coase that a monopolist over a durable good will end up selling at the competitive price, since once it supplies the quantity, it has no incentive not to refrain from selling more, up to the point where price just covers marginal cost, that is, the competitive level. See Coase (1972). If the putative monopolist cannot commit to refrain from future sales, buyers know the price will fall, and thus will not pay the monopoly price up front. Electricity, of course, is not durable; the similarity is that in both contexts present sales (via contract) in effect compete with future (spot) sales.

25 To the extent that contracts embody additional dimensions such as when they are entered into and their duration, collusion may be difficult because the list of factors on which to agree and police increases, further reducing concerns over market power. On the other hand, the rewards for cheating on a cartel agreement when spot prices are high could similarly make collusion difficult in spot markets, since the rewards from defecting make it harder to trust one's competitors not to increase output.

many of the leading studies of electricity markets have used just such a measure to determine when and how much market power is exercised over wholesale electricity prices (Borenstein et al., 2005). FERC adopted such a rule when it set limits on wholesale prices during the California meltdown (FERC, 2001). Such a restriction would ensure that no one would enter with new generation in order to meet peak demands, as they would never recover their capital costs (Brennan, 2003a, 2006a).

Attempts to set a regulated price incorporating scarcity rents will be impractical. No single time snapshot can tell if a price is too high or too low simply on the basis of a comparison to cost, variable or fixed. The discounted value of scarcity rents should just cover capital costs, but one cannot regulate scarcity rents over the multi-decade lifetime of a generation unit. One also never knows if a very high rent today is anticipated to balance out relatively low rents tomorrow, or is a competitive response to unexpectedly high demand.

If there is to be public oversight of peak behaviour, it should not be based on price. Any such regulation should focus on quantities.[26] When prices are at their peaks, one would expect that plants would be operating at full capacity, reserving downtimes for when the price of electricity is much lower. Observing that a generator is not operating at full capacity could indicate withholding to drive up prices. Such withholding may be more suspicious if that firm owns other units that are able to charge higher prices because power has been withheld.

Simply observing apparent withholding need not imply the exercise of market power. It will be difficult to determine whether reduced output might be an exercise of market power or the result of efficient operating practices (Harvey and Hogan, 2001). For example, a generation company may hold back production from one of its units, even if prices are high, to protect against a need for maintenance at a later time if the price were to rise even more. Because we know that the competitive peak-load price is itself impossible to assess against costs, the best hope for any sound control of peak market power is observing the supply responses of units when the grid is under stress, not the prices they charge.

Vertical Separation

As noted earlier and elaborated below, the “wires” side of the electricity sector is unlikely to become competitive; it remains regulated in Canada and the US. Making that regulation effective by protecting buyers from the exercise of market power requires that these regulated firms not be able to exploit their monopolies. One such method has been through vertical integration across the regulated/unregulated boundary, followed by tactics such as cross-subsidization of competitive operations or discrimination against competitors in access to its regulated service. For this reason, operational or institutional separation of ownership of competitive assets from control over the regulated sector is a leading feature of restructuring electricity markets. Whether such separation goes far enough to protect competition, or goes too far by impeding efficient operation and expansion of the electricity sector, are the

26 The Ontario Market Surveillance Panel’s procedures for ascertaining market power are complex, but appear to focus on whether prices lie outside pre-determined competitive ranges and whether the market structure is sufficiently competitive, but not whether a supplier withheld energy. See IESO (2006).

tough questions that are discussed, if not ultimately answered, in this section. We begin by reviewing why complete deregulation is unlikely and probably would be ill-advised.

A. *Residual monopoly on the wires side*

Market power may be a problem beyond peak times. As noted above, complete deregulation of the electricity sector is unlikely and probably undesirable. Local distribution, for one, is a monopoly chiefly because one set of wires going through streets and neighbourhoods suffices to meet demand. Competition would require duplication of expensive facilities, including disruptive construction through public streets and rights-of-way. Accordingly, entry is unlikely. With virtually no marginal cost associated with the quantity of energy delivered through the system and the relatively small costs of connecting an additional customer, the post-entry competitive price would likely be too low to cover the cost of the wires needed for a new competitor to provide the service.

Transmission in North America remains a regulated monopoly for relatively subtle reasons. To some extent, transmission, like distribution, has high fixed costs, which will tend to reduce the likelihood of duplicative networks. Unlike distribution, the quantity of electricity sent between two points could be large enough to consider using multiple competing pathways. A transmission grid typically offers multiple pathways to best exploit the opportunities to send electricity from areas where it happens to be relatively plentiful to areas where it is in relatively short supply — for example, because weather is mild in one region, yet very hot or cold in another.

Crucially, unlike the use of valves to send water over particular pipes, or switches to route telephone calls over a particular long-distance network, the costs of restricting a particular generator's electricity to specific transmission pathways is prohibitively high. Subject to resistance induced by congestion, electricity travels along all interconnected pathways between two points, regardless of who owns the pathways. If one transmission line is expanded, it changes the capacity of all lines interconnected with it, increasing those that are relatively parallel to it and decreasing those coming off of its initial and terminal points.

These interconnection effects, known as "loop flow" or "parallel flow," imply that there is a single transmission grid spanning all interconnected points, regardless of nominally separate ownership.[27] With closed markets and vertically integrated regulated utilities, access was not an issue; lines were shared through pooling agreements among these non-competing local monopolists. With open wholesale markets, these generators now compete, as do merchant generators without ownership interests in transmission lines. Accordingly, the terms of access to these lines are regulated to prevent owners of those lines from exploiting market power over transmission.

B. *Problems when straddling the line between regulated and unregulated markets*

Because the wires portions of the electricity sector are likely to remain regulated monopolies for the foreseeable future, joint ownership and control of transmission

27 In the US, there are three such grids, two covering most of the country, separated into eastern and western grids near the Rocky Mountains, and a third in Texas, which is not connected to either of the other two.

and distribution systems by generation owners presents risks to competition (Brennan, 1987). The primary concern is discriminatory access, particularly at the transmission end. A transmission-owning generator could downgrade performance of existing lines or delay construction of new lines that competitors may need. Such tactics use the latent market power in transmission to create an artificial barrier to competition, allowing the vertically integrated generator to raise prices without fear of expansion or entry by unaffiliated rivals. Although the primary concern with discrimination has involved the transmission side, one can imagine discrimination by distribution utilities favouring affiliated retailers.[28]

Another concern with vertical integration is that firms might engage in activities to falsely present high costs in order to get rates increased. One such activity is improper transfer pricing involving self-dealing at inflated prices. Take a distribution company that continues to operate as a regulated retail monopoly that purchases electricity from affiliated generators at prices above costs.[29] If the regulator cannot detect the high wholesale markup and passes through the inflated cost, the distribution company in effect is able to charge higher retail prices, exploiting the inability of rivals to compete them away.

A second tactic, called cross-subsidization, involves assigning costs of competitive enterprises to the regulated side of the business. This could allow the firm to charge higher prices for the regulated services by justifying them with these costs. The ability to shift costs artificially reduces the costs the regulated firm bears for supplying the competitive services. One direct harm is that the cross-subsidizing firm use may its artificial cost advantage to displace supply from competitors whose costs are actually lower. A second less direct harm is that cross-subsidization may allow the regulated firm to threaten entrants with below-cost predatory prices. Such threats would not normally be credible, absent the ability to shift costs to captive ratepayers in the regulated market.

Concerns with discrimination and improper transfer pricing have led electricity policymakers to impose some degree of separation between transmission and generation. In the US, the preferred solution has been “functional unbundling,” to allow vertical integration between transmission and generation to continue, but to have transmission controlled by an independent operator. These operators have been known primarily as “independent system operators,” or ISOs. Following a FERC regulatory order in late 1999, they have come to be known as RTOs, or “regional transmission operators” (FERC, 1999). FERC approves ISO and RTO designs under rules set out in the two major proceedings dealing with access to transmission, but so far has not required utilities to form them (FERC, 1996, 1999).

Different provinces in Canada have taken both paths, some requiring full divestiture, others only functional unbundling. Ontario undertook the equivalent of divestiture, separating generation from transmission, placing the former in Ontario

28 One example might be giving preferential treatment in laying new lines for housing or building developers who commit to purchase power from the affiliate. Up to now, such an example is more hypothetical than actual.

29 The distribution company may be the default retail provider because a provincial government has continued retail regulation, regardless of whether it has opened wholesale markets to competition. A government authority may have done so in part because residential consumers do not desire choice, for reasons discussed above.

Power Generation and the latter with Hydro One, both of which are owned by the Ontario government. Ontario uses a separate Independent Electric System Operator (IESO), primarily to manage wholesale markets and provide payments to manage congestion, but it does not operate the transmission system.

In Alberta, the model is more like the ISO in the U.S., where generation companies (e.g., EPCOR) continue to own both generation and transmission. But in Alberta, transmission control is vested with the Alberta Electricity System Operator (AESO). The members of the AESO board are appointed by the Alberta Minister of Energy (Kennedy, 2003). AESO is "independent of any industry affiliations and owns no transmission or market assets."[30]

> [It] is governed by an independent board, which has a diverse background in finance, business, electricity, oil and gas, energy management, regulatory affairs and technology. The Board's governance strategy is founded on balancing the interests of a diverse set of stakeholders, while at the same time, providing benefit for the overall industry stakeholder needs. (Alberta Electricity System Operator, "Our Company.")[31]

C. *But is vertical separation a good idea?*

Since opening electricity markets entails changing the traditional end-to-end vertical integration of the sector, such policy initiatives are called "restructuring." The policy question is how much vertical separation is enough? When the US telecommunications sector faced similar issues, full corporate divestiture of competitive long distance operations from regulated local telephone monopolies in 1984 was the result. The strict separation was maintained until 1999/2000, following enactment of the *Telecommunications Act* in 1996 setting out detailed rules designed to prevent discrimination.

The US has not ordered similar divestitures in electricity. Canada did not do so in telecommunications; in electricity, as noted above, provincial governments have taken both the full separation and functional unbundling paths. Meanwhile, the EU is contemplating full divestiture of generation from transmission in response to concerns regarding market performance (Kroes, 2007).

The optimal level of separation reflects a balance of political, legal and economic considerations: Is the "I" for "Independent" in ISO sufficient, or would the benefits of greater separation exceed the costs? On the political side, stricter divestiture will be more difficult to impose for the simple reason that the degree of resistance to any proposed change will increase with the proposal's severity. On the legal side, the need for separation depends in part on the availability of remedies for any anticompetitive conduct by transmission owners that remain vertically integrated.

In Canada, remedies under the *Competition Act* may be possible as long as electricity remains provincially regulated. Under its interpretation of the "Regulated

30 See http://www.aeso.ca/ourcompany/ourCompany.html. (accessed September, 28, 2007).

31 See AESO. "Board Members." http://www.aeso.ca/ourcompany/board.html. (accessed September, 28, 2007).

Conduct Doctrine," the Competition Bureau has stated that although case law is limited, it

> will not refrain from pursuing regulated conduct under the reviewable matters provision(s) [of the *Competition Act*] simply because the provincial law may be interpreted as authorizing the conduct or is more specific than the *Act* given that the Bureau's mandate is to enforce the law as directed by Parliament, not a provincial legislature or its delegate. (Competition Bureau, 2006, 5.)[32]

In the US, deference to regulation by competition authorities has become much stronger following the Supreme Court's 2004 ruling in Verizon v. Trinko (540 US 398 (2004); Brennan, 2006b), which stated that when a regulator is charged with overseeing competition, the costs of additional antitrust enforcement outweigh the benefits.

On the economic side, increasing the separation between the regulated and unregulated sides of a firm reduces the incentive and ability to evade regulatory constraints on pricing, thereby reducing competition in the unregulated markets. Effectiveness of the separation depends on the ability of the regulated side and competitive side to act independently. Specifically, to preserve entrepreneurial initiative, the regulator has to be able to set pricing and investment policies of the regulated firm without requiring extensive prior notification of the supply and expansion plans on the competitive side of the sector. Similarly, competitors have to be able to make their marketing plans and strategic investments without having to get prior approval from the regulator.

Recent analyses of the electricity sector have raised questions regarding this effectiveness, affecting both short-run operations and long-run investment (Michaels, 2004; Taylor and Van Doren, 2004; Brennan, 2006c). On the operational side, the gains from competition depend on being able to make supply decisions based on a reliable and predictable regulated price. Efficient incentives to manage costs and respond to demand on the regulated side in turn rely on the ability of regulators to set a price that the regulated firms can take as given in making their supply decisions. Such prices also should provide appropriate incentives to expand capacity over the medium term.

In telecommunications, stable prices in the form of access charges paid by long-distance carriers to local telephone exchanges were feasible.[33] In electricity, efficient management of the grid, particularly during high-demand periods, may require that transmission prices vary on a node-by-node, minute-by-minute basis so generators can adjust output in light of congestion along particular lines (Hogan, 1992). If so, regulators cannot simply set prices that allow transmission grids to operate and expand efficiently; more active intervention is necessary.

32 The Bureau's deference to conduct made pursuant to federal regulations is stronger:
The Bureau will not pursue a matter under any provision of the *Act* where Parliament has articulated an intention to displace competition law enforcement by establishing a comprehensive regulatory regime and providing a regulator the authority to itself take, or to authorize another to take, action inconsistent with the *Act*, provided the regulator has exercised its regulatory authority in respect of the conduct in question. See Competition Bureau. (2006, 6).

33 That is not to say that such prices were always set at the right level, at least in the US. See Crandall and Waverman (1995).

The problem may be more acute over the long run. The gains from competition include, if not hinge on, the ability of entrepreneurs to make independent decisions in light of the information they have on prices and demand-information that is inherently difficult for the government to obtain (Hayek, 1945). New entry into the supply of electricity requires large, indivisible investments in generation. The economic viability of these investments requires that transmission capacity be in place to support them. Similarly, transmission investments are typically large and indivisible, requiring coordination with expansion of generation capacity.

Transmission and generation investment may need to be planned in tandem. In most sectors, such planning can be handled by long-term contract or vertical integration. When the transmission system is a regulated monopoly, this coordination to at least some degree brings the nominally competitive generation sector under the umbrella of central planning. The ability of generators and transmission companies to act independently yet come up with efficient investment plans is, at best, unknown.[34] If so, the degree to which entrepreneurship on the competitive generation side is consistent with efficient operation of the electrical system as a whole remains to be seen. This question becomes more acute when we consider management of the electricity system's reliability.

The Big Question: Reliability

The tension between the competitive benefits of separating wires from generation and the operational benefits of managing them together becomes most salient in considering how to maintain reliability of the system — limiting the probability and severity of blackouts. Reliability influences electricity policy to such a dominating degree because electricity as a commodity features a rare if not unique confluence of three factors (Brennan et al., 2002, 116-26 and 194-97). The first is that electricity is crucial — blackouts matter. Developed economies simply grind to a halt without electricity. A useful rhetorical reminder of the importance of electricity in the age of the Internet, TiVos and BlackBerrys is that we call the dominant form of communications not "digital mail," "computer mail," or "Internet mail," but "electronic mail."

Many items are crucial to society, of course. The second distinctive aspect of electricity is that the system is *fragile*, in the sense that demand and supply have to be kept in virtually continuous balance to prevent blackouts from too little supply and system burnouts from excess production. The fragility arises because it is prohibitively costly to store electricity to get past times when supply is insufficient to meet demand. As discussed above, the practical inability to store electrical energy once produced is the main reason why the cost of producing power at extreme peak times is so great. If capacity is not available to meet demand, suppliers or users cannot rely on stored power; the lights go out.

Even being crucial and fragile are not enough to make electricity a special policy concern. In principle, suppliers could compete by offering a spectrum of price and

34 Such concerns have arisen in Alberta, surfacing as political opposition to investments in transmission characterized as benefiting only generators in the north or customers in the south. See Brennan, Timothy and Joseph Doucet, "More Power Creates Puzzle," *Edmonton Journal* (November, 23, 2001).

reliability options, letting buyers choose among them. Users who could tolerate interruptions could opt for less expensive power; those who need nearly absolute guarantees of availability could pay premiums to companies who keep substantial reserve capacity available. The third property of electricity that combines with the others to attract policy attention, and that rules out independent competition to provide reliability, is that the system is interconnected at both the local distribution and regional transmission levels. If Supplier A fails to meet its customers' requirements at any time, not only will those customers be blacked out, so will be the customers of Suppliers B, C, D, etc.

In effect, system reliability takes on the characteristics of a public good, and the costs of a blackout make it too large to ignore.[35] The core issue for whether electricity markets work is the degree of central control and planning necessary to provide reliability. At the low end, reliability management could be akin to an air traffic controller who allocates real-time landing and takeoff slots while allowing airlines to compete over the other dimensions of air travel. At the other extreme, ensuring reliability could require so much central control over the dispatch of energy to render insignificant the scope of meaningful competition.

One could imagine handling outages through *ex post* remedies such as a liability law that holds generators responsible if their negligence leads to a blackout. But this is likely to prove a difficult remedy. Paying damages resulting from a blackout would likely put the supplier into bankruptcy. This makes *ex ante* tactics to reduce outage probabilities relatively attractive. A leading example is the imposition of reserve requirements: For every megawatt of power one might have to expect to provide, one has to have an extra percentage of power-generating capacity on hand. In some areas, this is supplemented by having, in addition to markets for energy, markets for the reserve capacity. Generators could either keep capacity for themselves to sell via contract or on spot markets, or hold that capacity off the market and sell it as reserves for others to have as required.

Since one supplier's inability to meet its customers' needs because of an unexpected unit failure or surge in demand imposes blackouts on the customers of other suppliers, a requirement to provide insurance against a blackout through keeping capacity in reserve may have merit. But it is notable that, for most goods and services, even where capacity may be kept on hand, separate capacity payments are rare. It is as if air travellers not only bought tickets for flights — a non-storable service, like electricity — but paid a separate fee to keep other airplanes around in case of a failure. The cost of keeping extra capacity available for emergencies is usually incorporated into the price one pays for a service as one uses it.

In electricity, capacity market payments, and the cost of the reserve requirements bringing them about, will eventually show up in the price users pay. How such requirements are designed — e.g., how capacity obligations are set and what price a provider of reserve capacity gets when that capacity is called upon — determines how those requirements are translated into prices users pay. The prices resulting from such requirements should reflect two factors. The first is the "blackout externality." How does one consumer's use of the system increase the probability of a power

35 Estimating the costs of a blackout is a far from trivial exercise. Some effects of outages are instantaneous, while some appear only over time. Some can be ameliorated via shifting the time of use while other losses cannot readily be made up later.

outage. The second is the premium one would pay for insurance against a blackout. The extent to which reserve requirements accomplish these objectives remains unclear, as the focus of discussion is on the obligations imposed on suppliers, not how the cost of these obligations are translated into the prices consumers pay (Brennan, 2003b). In considering these requirements, one needs to keep in mind that the costs of a blackout, while large, are not infinite.[36]

The unusual nature and operational complexities of capacity markets illustrates the underlying tension reliability creates. It sets up a conflict between the independent, entrepreneurial decision-making authority necessary for competition and the central control necessary to maintain the reliability to which we have become accustomed. Whether the "air traffic control" or "central planner" model, that is, whether more or less independent entrepreneurship, works best for this sector remains an open question. The recent analyses noting the costs of vertical separation discussed in the prior section intensify, but do not resolve the question. Even in California, the paradigm for electricity market collapse, competition in wholesale and retail markets worked quite well for more than two years prior to the crisis.

Conclusions and Recommendations

Reliability, along with vertical control, peak-load market power and pricing, and consumer reluctance to change suppliers, all provide warnings that choosing the most suitable electricity market structure should reflect more than a theoretical conclusion or ideological commitment. The analysis above suggests a few recommendations that may help:

- Focus retail deregulation efforts on commercial and industrial users, who are better able and likely to be more willing to shop for the best electricity deal. These users provide incentives to produce and use electricity most efficiently. Attempting to force residential consumers to adopt choice before they express a desire for it may be costly both in terms of managing the transition to competition and undercutting political support for it.
- Repeat the above recommendation for encouraging real-time pricing. Commercial and industrial users purchase enough electricity to make worthwhile the costs of metering use, monitoring price and adjusting demand. It takes only a comparatively tiny reduction in use to provide lower system costs for everyone.
- Canadian (and US) competition law will not work to prevent the unilateral exercise of market power during peak periods. Price regulation, however, is not feasible either, since peak periods are when peak power suppliers recover long-run capacity costs. Regulators, perhaps, should have some authority to examine supply decisions, rather than price, to try to limit the ability of firms to raise prices by withholding supplies. However, generators should be able to defend themselves with credible arguments that failures to operate at full

36 Using capacity markets to provide a mechanism for setting the price to meet reserve requirements may be useful, but a capacity price does not tell us whether the reserve requirement is set correctly or whether the effect on the price consumers pay for electricity reflects how they would purchase insurance against blackouts.

capacity during peak periods were the result of legitimate operational and maintenance practices.

- The extent of vertical separation required to best balance protecting competition with maintaining operational efficiency remains an open question. Canadian (and US) competition law should allow interventions to protect competition even when there is a regulator overseeing access policies. Any such interventions should allow those on the other side to argue that vertical control is necessary for efficient short-term operations or to provide adequate incentives for long-term investment.
- Most importantly, the need to maintain reliability in this crucial, fragile and interconnected sector requires a careful approach to deregulation, recognizing that it may end up being the exception to the general rule that competition should be implemented whenever reasonably feasible.

Fortunately, Canadians have the opportunity to learn from a variety of approaches across the provinces, in the US and around the world. Until that experience provides sufficient knowledge to assure us how to design markets to work effectively while addressing this multitude of concerns, caution, not pessimism, is the watchword (Brennan, 2004b). We can conclude, though, by noting that the wide variety of experiences from which to learn provides a useful lesson in the costs of premature, centralized policy standardization. Decentralized decision-making remains eminently valuable for devising, setting, implementing, evaluating and comparing policy options, even if its ultimate merit in the electricity sector is still to be discovered.

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