Competitive Power Markets and Grid Reliability: Keeping the Promise

Technical Workshop on Competition and Reliability
in North American Energy Markets
September 15, 2005

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Introduction

The electricity industry in North America has come through a decade of fundamental and far-reaching change. In fact, we are coming up soon to the tenth anniversary of Federal Energy Regulatory Commission (FERC) Order 888, which, along with the 1992 Energy Policy Act, is widely regarded as the defining step in the launch of competitive electricity markets in the United States (U.S.).[1]

In Ontario, we were not far behind. In 1996, the Macdonald Committee advised the provincial government to unbundle Ontario Hydro and introduce competitive markets, and in late 1997, a government White Paper announced a plan for moving to full wholesale and retail competition in 2000.[2] The Ontario market opened in the spring of 2002 but has undergone some major changes, which are described below.

The scope and speed of the industry's transformation has been amazing. Huge companies have been unbundled and reassembled. Ways of doing business have been dramatically changed. Regulatory regimes have been re-engineered. No other industry restructuring compares: not telecommunications, not gas, not airlines.

Another significant transformation is currently underway as the industry moves into a second, distinct phase of market evolution. In "Phase I" governments and stakeholders rushed ahead with enthusiasm, and perhaps some naïveté, to build the first generation of electricity markets. The focus was primarily on technical aspects of market design and the rules, protocols, and software required to implement a market. In "Phase II" we are assessing what we have learned, in a broad sense, and developing strategies to help the markets transition to a more robustly competitive form. In this second phase, we

[1] See FERC 1996.

[2] See Macdonald Committee 1996 and Ontario Ministry of Finance 1997.

will see *relatively* more attention to issues such as raising reliability standards, making standards enforceable, reducing inter-market seams, improving planning and coordination, securing resource adequacy, and, generally, managing the broader environment in which the market is embedded so that the market is sustained and nurtured.

This paper is part of the U.S.-Canada Power System Outage Task Force's study of industry restructuring, competitive markets, and grid reliability, and in particular, of how the relationships among these elements should be managed to best serve the public interest. The specific question is: how do we ensure reliability as industry restructuring rolls forward? [3]

We need to start with a common understanding about what "reliability" means. There are two dimensions to the concept. They are:

- *Adequacy* – there must be sufficient generation to meet peak load and enough transmission and distribution capacity to get it there; and

- *Security* – the system must be operated within studied limits, and according to industry standards, so as to remain stable, protect lives and equipment, and ensure continued electrical service through storms, forced outages, and other contingencies.

The first dimension of reliability is often measured by the criterion that load will not be curtailed more than once in 10 years because of insufficient supply. The second dimension can be measured by assessing the number and severity of power outages caused by equipment failure and/or operator error, the amount of time taken to restore service following transmission and distribution interruptions, and so forth.

This paper takes a historical approach. Part I reviews how reliability was managed in the pre-market period. Part II discusses the current reliability model and some of the general issues it raises. Part III presents 10 lessons that we have learned about restructuring and the introduction of markets; these lessons are fairly broad in scope but directly linked to the reliability question. Finally, Part IV suggests a program for improving reliability in the future and, more importantly, ensuring that reliability remains at the forefront of our thinking as the market evolves.

[3] The U.S.-Canada Report, 2003.

Part I: The Old Reliability Model

As a point of reference, Part I begins with a description of the reliability model with which the industry grew up.

Adequacy was ensured by planning, building, and maintaining substantial generation reserves. Capacity could be built ahead of need. Rarely used peaking plants could be financed because the integrated utilities enjoyed assured cost recovery through regulated rates paid by captive customers. This was the essence of the model. Typically, utilities maintained installed capacity that was 12 to 25% above their peak requirements.

Security was ensured through generally "conservative" operation of all equipment, and the eventual emergence of industry-wide standards.[4] In retrospect, we can say that operational success during these years was cushioned by the fact that most systems had been generously built and contained significant redundancies.

Utilities were subject to local regulatory oversight (including, in some cases, direct political control) and operated under a general commitment to "good utility practice."

Utilities were vertically integrated, for the most part, and had an "obligation" to serve their local load.[5] They were originally self-sufficient, or nearly so. Gradually, interconnections were built to facilitate inter-control area trades and support reliability. Long-distance commercial trading increased during the late 1990s with the adoption of open-access transmission, using transmission capacity that was judged to be surplus to the requirements of the native load.

There were no wide-area reliability standards until after the 1965 Blackout when the utilities took the initiative to establish the current network of Regional Reliability Councils and the North American Electric Reliability Council (NERC). The standards that were developed in ensuing years were taken very seriously by the industry, but they remained voluntary.

Part II: The Current Reliability Model

Restructuring and the introduction of markets brought about significant changes in the old reliability model.

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[4] See NPCC.

[5] The obligation to serve consists of both an obligation to connect and an obligation to supply. The latter component is of primary interest in this paper.

The demise of the franchise monopoly system meant, among other things, an end to the historic obligation to serve.[6] Responsibility for ensuring adequacy was, in effect, transferred from the utilities to the market. This has been a critical aspect of the move to competitive markets.

At first, it was generally thought that the energy market could ensure adequacy on its own. Energy prices would accurately reflect scarcity and rise to draw in the required amount of investment in generation and transmission. Locational pricing would ensure that investment also went to the places where it was needed most.

This view quickly ran into difficulty, for three reasons:

1. Electricity-sector investment generally dried up in 2001-2003 following the California market implosion, the Enron scandal, and the general collapse of credit markets and the merchant power industry. This experience showed that investment flows are heavily affected by factors beyond just the prevailing balance between demand and supply in a given market.

2. Governments and regulators decided that they could not accept the occasionally high energy prices that the market model clearly implied, even if the price spikes were short-lived and everyone had opportunities to hedge themselves through contracts or changes in consumption patterns.

3. There was growing awareness that the investment and pricing rules of the textbook competition model are for a generic widget industry and may need to be significantly refined in order to work in an industry like electricity where there are distinct peaking and base-load production modes and where the product must be consumed the moment it is produced.

As a result of these three realizations, a great deal of work is being done on how to supplement the energy market and ensure resource adequacy over the medium and longer term. Various capacity markets have been designed, and in some jurisdictions such as Ontario, it has been found necessary to arrange for centralized procurement on a transitional basis. This is discussed in more detail in Part III below.

The new reliability model also involves significant changes related to system security. New organizations – the independent system operators (ISOs) – have been established and given authority for system security. Reliability authorities that are functionally separate from commercial entities have greater influence than they would otherwise, which supports the reliability objective.

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[6] The obligation to connect devolved to the unbundled transmitters and distributors. The obligation to supply generally became an "obligation to deliver" to default (or system) customers assuming that supply was physically available.

The existence of competition is, of course, a new factor in the reliability equation. There are a number of ways that competition can impact reliability. For example, it is sometimes alleged that short-term profit maximization in competitive electricity markets will lead firms to run their equipment too long and hard or to cut costs in potentially irresponsible ways, thereby impairing reliability. It is also alleged that new trading patterns have greatly increased congestion and that the increase in small-scale renewable and gas generation has negatively affected system "inertia" and stability. On the other side is the pro-competition argument: that competition leads to trade and greater interconnectedness of control areas, thereby boosting reliability, and that more frequent congestion is actually a sign that existing facilities are being used optimally.

These claims must be evaluated empirically, but the task is daunting. We also need to address the issue of benchmarks. It is not easy to compare the reliability performance of market-based systems with that of non-market based systems because there are important differences in the underlying physical assets being operated. It is also not easy to compare the reliability performance of the current period with that of the pre-competition period because many of the specific phenomena affecting reliability (both positively and negatively) would likely have arisen anyway, only more slowly (e.g. the move to gas, renewables, and distributed generation).

More important than all of the above changes, however, is the fact that reliability became in principle a *joint* responsibility of the ISOs and market participants, through licenses, market rules, and industry standards. Large numbers of independent power producers and some independent transmission providers that did not previously exist now had to be brought into the reliability framework. In addition, agreements had to be negotiated allowing the newly independent ISOs to direct the operation of equipment owned by the transmitters. In the new model, the ISOs still have ultimate accountability for system security, but they do not have as much direct “command and control” capability as their predecessors had. Today's controllers have to work with and through their new reliability partners. This raises a number of issues about education, communications, and the enforcement of rules and standards that are addressed in Part III.

The emergence of the new reliability model seems to have been somewhat accidental. There was a great deal of thinking in the 1990s about market design, but reliability was treated almost as a given. Even though "enhancing reliability" was usually mentioned as one of the objectives of industry restructuring, it was never treated as one of the *primary* objectives, and there was little discussion about the details. The pure energy market model of investment showed that adequacy would be taken care of, more or less automatically, and it was assumed that market discipline and transparency would be a real help to the operators as far as the effects on system security. Moving forward, we

need to bring reliability back to a central position in our thinking about the electricity market. That is the theme of Part IV of this paper.

Part III: Some Lessons from the Industry Restructuring

But before moving to the "future" part of the story, it is important to spend time on some of the key lessons we have learned from the restructuring of our industry over the past decade. This section identifies 10 lessons that are especially germane to the topic of reliability.

These lessons fall into three main categories that can be called the "three pillars of market evolution":

1. The first pillar, or group of lessons, concerns the need to design markets carefully, build stakeholder consensus, and move forward in a methodical, step-by-step fashion.

2. The second pillar is the need to minimize restructuring risks by building in safeguards. Attention should be paid not only to the market *per se* but to parallel, supporting reforms. For example, strengthening reliability standards and making them enforceable is a critical complement to the introduction of competition and markets.

3. The third pillar is the need for realistic transition measures – a system of off- and on-ramps – so that the industry can move from the old way of doing things and embrace the new. A key example here, which is discussed more fully later, is the need for a backstop mechanism to ensure adequacy in the event that the competitive market alone proves unready or unable to provide enough supply.

In other words, we not only have to get the market right – its rules, procedures, algorithms, and settlement engines – we also have to build the conditions for market acceptance and success. In building and improving markets, we have to ensure that the pace of change does not outrun the capacity to absorb change.

The first three lessons relate to the first pillar of market evolution, the need to design markets carefully:

Lesson 1: The Need for a Balanced Approach

Markets work well most of the time, but they require constant care and may sometimes need to be "paired" with non-market mechanisms. We need to be pragmatic in determining what parts of the electricity sector are amenable to ongoing competitive markets, what parts are amenable to competition but not ongoing markets, and what

parts, if any, are not amenable to competition at all. These issues are discussed in general in this lesson and in more detail with specific examples in subsequent lessons.

Ten years ago, the movement to establish competitive electricity markets was building momentum, and the introduction of markets was often portrayed as the panacea that would solve all the problems of the old vertically integrated utility model. Not only would there be an energy market, there would (eventually) be markets in reserves and many ancillary services as well as market-based approaches for managing congestion. Transmission would be provided on a merchant basis. If there were problems in ensuring adequacy through the energy-market-only approach, a *capacity market* could be designed to handle them.

The revolutionary fervor that was evident in the 1990s was probably necessary to ensure that the old utility model was defeated and that a leap to competitive markets occurred in many jurisdictions. But we have now become much more realistic about the role that competition and markets can play in an industry such as ours. Realism has intruded in several ways.

First, we have grudgingly come to accept that in certain cases markets might not work particularly well or even at all. For example, a merchant investment process, based solely on market prices, cannot be relied on for the timely delivery of nuclear power plants and trunk transmission lines. These are massive projects with very long lead times and super-normal risks. There is general agreement in the industry that such projects will usually require some form of financial guarantees as well as a great deal of co-ordinated forward "planning."[7]

Second, we are coming to terms with the fact that in many cases our markets fall far short of the textbook requirements for robust competition. There are serious market power problems in some markets, with dominant generators holding far more market share than is compatible with even loose definitions of "workable competition." We need to work on structural reforms to mitigate market power and to work constantly at eradicating anti-competitive market behaviour. If we do not succeed in these efforts, the market will not deliver the social benefits that it was intended to deliver. If structural flaws in the market are not adequately addressed, the market will ultimately become dysfunctional. There is a much greater appreciation now than there was 10 years ago of how serious this issue is.

Third, we have become more realistic about the broader political environment in which we live. Electricity markets deliver what is widely perceived to be an "essential service." The service, therefore, has to be provided extremely reliably, and its price has

[7] Planning in the "pure" market approach entails little more than publication of a long-term demand forecast. The challenge of "coordinating" investments is left up to the market and the transmission connection process.

to be politically acceptable.[8] Moreover, the electricity industry is highly "visible" and takes criticism from many directions. The public has strongly held concerns about matters like nuclear safety, facility siting, and environmental emissions, and high expectations that these concerns will be addressed. In the early years, many of the more ardent market reformers chose to overlook these political realities or to see them as somehow unconnected with the success of market evolution. Political constraints, and the multitude of public views and objectives impacting the electricity industry, will have to be taken more seriously as we plot the next 10 years of market evolution.

In Ontario, politics most recently intervened in the form of the *Electricity Restructuring Act, 2004* (Bill 100), which establishes what we call a "hybrid" model in the province.[9] The bill filled a number of perceived gaps in the first generation-market model. Among other things, it created the Ontario Power Authority (OPA) as the guarantor of generation adequacy, giving the authority a mandate to procure power under long-term contracts with the costs to be passed through to consumers. The OPA was also given responsibility for long-term integrated system planning. In addition, merchant transmission no longer figures prominently in the accepted long-term vision for Ontario's electricity sector.

Many of the initiatives in Bill 100 have their counterparts in neighbouring electricity jurisdictions. Resource adequacy mechanisms are being actively explored, and the foundations for wide-area planning are being laid across the entire northeast. Resource adequacy is addressed in more detail later in this paper.

All of us who have been involved with the first generation of competitive electricity markets have become more deeply aware of the difficulties in achieving robust competition, and most of us now recognize the need to move ahead carefully, using supportive and complementary *non-market* mechanisms when necessary, often in a transitional manner. Reliability must be fully integrated into our plans for the future evolution of the market.

Lesson 2: The Need for Local Solutions

Every market has to be built with careful attention to local history and politics, the physical and business structure of the inherited supply system, the nature of electricity demand in the area, and the degree of interconnectivity with the system's neighbors. There are always things to learn from elsewhere, but this knowledge has to be filtered carefully. There are no cookie-cutter market designs that can be expected to work in every place, every time. Effective and successful market design depends on serious attention to the details of the system in question.

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[8] If this seems obvious, we should remember that not long ago serious people were proposing markets with no price caps or protections at all. As noted later, public anger over spiking prices caused the Ontario Government to freeze retail prices a mere six months after market opening.
[9] See Bill 100, 2004.

In Ontario's case, for example, several unique circumstances have definitively shaped the market. They include:

- Comparatively heavy dependence on nuclear power that is provided from comparatively large stations
- Public ownership, at market opening, of more than 80% of all generation capacity, through Ontario Power Generation
- A highly fragmented distribution sector
- A strong government commitment to maintaining a uniform energy price at all locations in Ontario
- Important interconnections with both market and non-market based neighbours
- One hundred years of power at cost as a public good
- Ten years of frozen, subsidized rates prior to market opening

It is also important to note that the Canadian constitutional framework has been different from that in the U.S., which has allowed Ontario to have mandatory and enforceable reliability standards right from market opening.[10]

The need for the type of regional diversity that this paper refers to is now broadly accepted. In the U.S a few years ago, FERC was calling for rapid movement toward a relatively rigid Standard Market Design (SMD) and was promoting the amalgamation of control areas into four super Regional Transmission Organizations (RTOs) for the entire U.S.[11] FERC has now modified its agenda and timetable, recognizing the need to permit more diversity in how market principles are implemented.[12] A more measured and careful pace for market development clearly makes sense, provided we are all following the same basic principles and are committed to eliminating unreasonable barriers to trade.

In terms of the present inquiry about restructuring and reliability, my opinion is that tailoring the first-generation markets to local circumstances supported reliability. Had restructuring involved a single, top down, one-size-fits-all approach, there would almost certainly have been more operating challenges and higher risks of system failure. The markets are evolving toward more compatibility, but we have to move ahead on this issue one step at a time.

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[10] Ontario already has in place a statute based scheme for setting and enforcing standards. Under Ontario law, IESO establishes reliability standards and enforces these standards.

[11] See FERC, 2002 and FERC 2003a.

[12] See FERC 2003b.

Lesson 3: The Need for a Reliability Champion

The introduction of electricity markets has been a paradigm shift in the organization of our industry. Most of us who were involved experienced it as a "revolution." Building markets was unquestionably a very large challenge, and in Ontario, the Independent Electricity System Operator (IESO) was involved right from the start – in the beginning as the Central Market Operator (CMO) running a fledgling procurement market from within the old Ontario Hydro; then as the Independent Electricity Market Operator (IMO), designing, building, and running the first-generation Ontario wholesale market; and now as the IESO running the wholesale market and working with other agencies to ensure the success of the new "hybrid" system.

Throughout the restructuring, IMO/IESO spoke out strongly in defense of reliability. For us, reliability is the number one priority. During the period from 2000 to 2002, we were adamant that we would not give the "go live" signal for market opening unless we were absolutely certain that the transition would be technically successful, and it was.[13] More recently, we cautioned the government about the reliability implications of trying to close all coal-fired generation plants by the end of 2007, especially the adequacy and security implications of closing Nanticoke, which is a critically-located approximately 3,900-megawatt (MW) facility. The closing of Nanticoke was recently deferred, largely on the basis of the IESO's intervention.

In reflecting on these and similar experiences, we can see that it is important that we – the reliability organization – were a separate and independent entity with direct access to government and regulatory authorities. We had credibility, and, in the end, we were listened to.

I suggest that the voice of reliability is likely to be stronger coming from ISOs, like the IESO, than it would be coming from entities where the (short-term) reliability function is organizationally part of a profit-oriented company, such as an Independent Transmission Operator.

Lessons #4-7 fit within the second pillar of "safeguards":

[13] The Ontario market, which had been promised for 2000, opened on May 1, 2002. The delay had multiple causes, including uncertainty regarding the recovery of laid-up nuclear capacity, the unreadiness of the retail sector, and a variety of challenges in settling rules and tools. The market rules and software worked admirably, but heat-related price spikes in August, September, and early October 2002 caused the government to freeze retail rates at an unrealistic level. A new government was elected in the autumn of 2003 and passed Bill 100, establishing the current hybrid model in December 2004.

Lesson 4: The Need for Mandatory Standards

As mentioned earlier, there is continuing uncertainty and, hence, experimentation, regarding how to ensure adequacy in competitive electricity markets. In contrast, there is complete agreement on the importance of standards in supporting and enhancing secure operations. The reliability standards originally developed through NERC are being upgraded and complemented by parallel business practice standards developed by the North American Energy Standards Board (NAESB).[14] More importantly, there is strong industry consensus that the voluntary standards of yesteryear have to become mandatory and enforceable and that sanctions have to be meaningful. In Ontario, reliability standards are incorporated into market rules, along with market features, and are legally enforceable.

Recently passed reliability legislation in the U.S. will make standards fully enforceable in that country. Work is also underway on establishing a new electric reliability organization (ERO) that would replace NERC and (presumably) provide more pro-active support to the standards process.

Auditing for standards compliance is an important aspect of the reliability framework. Standards have to be monitored and enforced with appropriate levels of deterrence. This is a challenge because a lot of oversight machinery must be built, and numerous jurisdictional issues will have to be overcome along the way.

Lesson 5: The Need for Inclusive Processes

Another important safeguard is having fair, accessible, and transparent processes with rights of appeal. Most jurisdictions consult widely and have either voting or advisory bodies on all aspects of the market rules and market administration. Across North America, a great deal of process re-engineering is going on with a view to improving the effectiveness of the consultation process.

Maintaining an inclusive, cooperative market evolution process is an important support to reliability because it fosters recognition of the mutual benefits of compliance with the rules and standards.

Lesson 6: The Need for Effective Communication

Effective communication is another critical safeguard. Because the main focus of this paper is reliability, let me first address communication at the control-room level.

The August 2003 Blackout was largely about communication. There was a computer failure that hid from operators what was happening on their lines. More important, there was what the investigators called a lack of "situational awareness," which resulted from insufficient training, insufficient drills, and insufficient understanding of the importance of communicating with neighbouring control areas. *Enforceable* standards on

[14] See Joint Interface Committee, 2002

training and communications are among the remedies proposed by the Blackout Task Force.

Although there were communication failures in the 2003 blackout, there has generally been an improvement in the amount of day-to-day communication among control rooms, both to facilitate trade and to improve reliability. For example, ISOs in the northeast now have a much better understanding of what is happening on each other's systems through the implementation of electronic sharing of day-ahead and real-time information.

Information sharing is also a critical safeguard at the market-participant level. Participants need timely, accurate, and relevant information on which to base their decisions. It is important to emphasize that, when information is late, incomplete, or otherwise deficient, there may be opportunities for some players to try to game the market. Gaming would bring the credibility of the market into question and could also involve behaviour that challenges the ongoing reliable operation of the grid. Therefore, providing quality information is important, not just to those using it, but to everyone who is connected to the grid and counts on reliable service.

Lesson 7: The Need for Consumer Education

The final safeguard we will discuss is consumer education. This obviously fits closely with the earlier points about effective communications and inclusive processes. A base level of consumer education is needed to support conservation and reliability, both in the medium term and when emergency appeals are necessary. More fundamentally, consumer education is needed to drive price responsiveness. Consumers need to be given clear information about short-term electricity prices as part of a package that supports price responsiveness on an hourly and daily basis, so system reliability can be supported through peak shifting or peak shaving. In addition, consumers need to be learning about long-term price trends to drive investment in conservation and demand response.

Probably every jurisdiction has learned that consumer education requires many times more money than is actually being spent. This is particularly true in the retail market, but it is also true in the wholesale market, where changing market rules and changing market-participant personnel make market-participant training a large, ongoing commitment.

In Ontario, we have learned a few painful lessons about communications/education. Our efforts in the retail sector between 2000 and 2001 suffered from an "on-again-off-again" problem as market opening was delayed several times. Our efforts also lacked focus, as various agencies were involved in sending out material, including the government, local distributors, and independent retailers. Finally, and as might have been expected, there were inconsistent messages about what "deregulation" meant for the retail consumer.

The key thing about consumer education is that it must be *meaningful*. It must have resonance for those actually making financial and consumption decisions. Education dollars are not being well spent when the recipients of the education lack the hardware and other tools to participate in the market. We will return to this point shortly.

Lessons #8-10 relate to the third "pillar" of market evolution: the need for transitional mechanisms, or off and on ramps. We begin to examine this subject by delving deeper into the question of resource adequacy.

Lesson 8: The Need for a Resource Adequacy "Mechanism"

As explained earlier, concern about adequacy arises once the historic obligation to supply is terminated, and the industry tended to take adequacy for granted in the 1990s, steaming ahead with restructuring in the belief that the energy market would solve the problem unassisted. There was "faith" that the market would deliver new generation and transmission without prices having to go sky high before investors took the plunge and put iron in the ground.

For the reasons given earlier, faith soon evaporated, leading to a long period of debate and experimentation about different ways to address the adequacy question, given the political constraint of energy price caps.

One of the main things we have learned (or re-learned) is that reserves are a "public good," to use economists' terminology, and that, accordingly, there has to be a *societal* process for determining what the level of reserves should be. There is simply no way for a decentralized *market* process to arrive at a sensible reserve ratio and then deliver the agreed-upon margin. A pure market-based process that tries to define the "efficient" level of reserve by constantly testing for the minimum (i.e., by letting the lights go out) is simply not sensible or acceptable.[15]

We have also significantly clarified our thinking about how the reserve target can be met, once it has been established.

- One option is to give the dominant supplier a *de facto* obligation to supply by ordering it to build generation. We see elements of this approach in Ontario whenever OPG is instructed by the government to undertake specific generation investments.

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[15] In determining future reserve requirements for electricity generation, some recognition is given to the fact that, on a very infrequent basis, there could be shortages in supply. In practice, day-to-day operation involves taking extraordinary efforts to avoid any supply shortages.

- A second generic option is centralized but competitive procurement, either via auctions such as Capacity Markets, or in which an independent agency enters long-term supply contracts on behalf of the market as a whole. The latter is the primary instrument we are currently using in Ontario, under the new OPA.

- A third generic option is a decentralized procurement process in which entities – Load Serving Entities (LSEs) – are assigned a portion of the reserve requirement and obligated to secure it through contracts with generators. There has been considerable experimentation with this approach.

- Another generic option is targeted assistance to generators who invest in locations and products deemed important by the newly emerging "regional plans." This category covers miscellaneous actions that governments and regulators might occasionally take to support adequacy, for example, by expediting approvals, assisting with siting issues, providing tax relief, and so on.

The OPA is a new entity in our system, and is independent from the IESO and the commercialized successors of the former Ontario Hydro. It is responsible for contracting for long-term power and is currently doing this based using a request for proposal format (the OPA will also administer the contracts under which the government recently acquired new clean and renewable generation). The OPA is expected to negotiate risk-sharing arrangements in these contracts creating more balanced contracts than the old non-utility generator (NUG) contracts negotiated by Ontario Hydro.

It is widely understood in the Ontario electricity industry that the procurement role of OPA is to be transitional in nature, defined largely by the fact that, within a single decade, Ontario has to replace all its coal-fired generation plants and address the even larger question of nuclear refurbishment / replacement. OPA procurement is done on a competitive basis, and winners participate in our market, so the process is better than having everything built by a single monopoly as in the old days. But investors are still getting some level of "guarantee" from the market, which is something we need to get away from eventually. That said, investors do need assurances that rational market behaviour will bring reasonable rewards, if not through guarantees, then by market mechanisms that are robust against political or regulatory interference.

In short, the OPA was invented as a transitional device to assure the market and the government that there will be enough power to go around. The story is a little more complex, however, because it was also given a mandate as supplier of last resort and a mandate for long term, integrated planning. These do not seem to be transitional mandates; it appears they are intended as permanent features of the hybrid model although the manner in which they are exercised will have to evolve over time. Their

purpose is to address perceived gaps in the "pure" market model. One such gap concerns generation mix, which was mentioned earlier.

The electricity industry is unique in that a single product, a megawatt-hour (MWh) of energy, can be produced using several highly distinct technologies, including nuclear, hydraulic, coal, gas, and wind. These technologies differ greatly in terms of their costs, their operating characteristics, and their environmental impacts. We have learned that a pure market-based approach to generation adequacy will not optimize among these alternatives to give the best social result, or, in more technical terms, will only do so under the unrealistic assumption that all "externalities" are fully and properly priced. A decentralized, free-market approach could lead to a generation mix that does not satisfy our operating reliability requirements. For example, it could result in the system becoming unbalanced in terms of its base versus peaking capacity, or becoming overly dependent on intermittent sources, such as wind. So we are led back to the need for long-term system planning. In the "transitional" period that characterizes many of the North American markets, the plans will provide guidance to those administering competitive procurement processes, whatever form the latter may take.

Lesson 9: The Need for Appropriate Tools

We need to ensure that market participants have not only the education, but also the tools they need to participate in the market. There must be a well-planned transition by which they get the physical tools and the training to function in the new market place.

A good example is metering. A decentralized, market-based system requires accurate metering data and efficient settlement processes. In pre-market Ontario, relatively few large and almost no small customers had good-quality interval meters. The Government has now launched a program under which all customers will have "smart" meters by the end of 2010.[16]

Putting appropriate metering in place can be thought of as a transitional step that brings customers into the real world of hourly priced electricity where they have to take responsibility to either hedge themselves financially against price swings or take steps to be able to curtail use when prices are high.

Metering is very important because, in order for the market to work properly, there must be a large number of price-responsive buyers. Smart metering will likely induce large-volume customers to become more price responsive even if they do not become dispatchable by the system operator. Smart metering at the retail level will encourage conservation and peak shifting if it is accompanied by smart rates, appropriately targeted education, and perhaps a few other incentives. The consequent reduction in

[16] See Smart Metering Initiative, 2005.

peak demands and transmission loading will translate into significant reliability benefits.

Lesson 10: Protecting Consumers

The final restructuring lesson is the transitioning of consumers to the new world of retail choice. Aspects of this issue were addressed earlier under the topics of consumer education, communications, and the need for open and inclusive processes.

The point I want to make here is the need for clear political and regulatory direction regarding how default supply will be dealt with in the medium and longer term. Will there be a default supply, and if so, what will it look like? Will all consumers eventually have to exercise a positive choice even if the result is staying with the same distributor? There has been a huge amount of debate all across North America on whether or not the retail market will ever take off and what it would take to make this happen.

In Ontario, independent retailers have signed up only a very small portion of the total market. Most residential customers are currently paying for their electricity under the Regulated Rate Plan for default consumers; the plan was developed by the Ontario Energy Board and features rates that vary according to consumption and time of year.[17] Rates under the plan are intended to eventually recover the full costs of the electricity consumed but will be averaged to protect default customers from daily and weekly price fluctuations. Alberta has recently made the decision not to expose default customers to market rates starting in 2006 but instead will extend its regulated rate for five years, with a blended-price approach that eventually phases customers to the market rate.[18]

The success of the retail market is important to the success of the entire market and to the realization of the efficiency gains we set out to achieve back in the 1990s. For markets to work optimally – and to be sustainable – we need depth and liquidity, and bringing the retail load "to market" will be a major help. Depth and liquidity, in turn, foster confidence. Confidence leads to investment, and investment leads to more resources and better equipment, which are the technical underpinnings of reliability.

So, even if our restructured electricity jurisdictions end up for the foreseeable future with only a wholesale market, or a wholesale market with a weak retail companion, we need to keep retail competition alive as a goal. In Ontario, we may need to rethink the whole subject, from default rates all the way through to the creation of LSEs, which do not currently exist in our province. We need to get busy on a step-by-step plan for addressing the issue of retail competition.

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[17] See Regulated Rate Plan, 2005.

[18] See Alberta Energy and Utilities Board, 2005.

Part IV: From Present to Future: Investing in Reliability

The previous section describes a number of "lessons" related to the electricity restructuring experience of the past decade, a decade in which jurisdictions were going through a trial-and-error process of introducing the first generation of market models. Major efforts were made to get the market designs in place, to get the infrastructure up and running, and to work out the kinks, all the while keeping stakeholders engaged in this monumental undertaking.

We were concerned about maintaining the reliability of our systems as we made the changes of the past decade. You can't take an electricity system down in order to make a change; it has to run smoothly, and the lights have to stay on, while one whole way of doing business is replaced by another.

By the same token, as noted earlier, there was a sense in which the industry took future reliability for granted. Adequacy would be taken care of by the market, and security would probably be helped by the market as well. We were not consciously *investing* in reliability to the degree we should have been. This final section of the paper focuses on how we need to turn this mistake around: how can we start *investing* in reliability?

The subsections below describe three priorities: standards, infrastructure, and reducing seams and aligning markets for investing in reliability.

Priority 1: Standards

Mandatory reliability standards are essential. Reliability legislation has now passed in the U.S.[19] This is a historic breakthrough and the culmination of many years of hard work. The symbolic and practical importance of mandatory and enforceable standards cannot be over-emphasized. NERC should be commended for recent improvements in its audit process, specifically the introduction of readiness audits, and for strengthening its Compliance Enforcement Program. These are important steps in making the transition to the mandatory, legally enforceable standards that Congress is expected to recommend to the President later this year.

We also must move ahead with the proposed ERO.[20] There are several important governance and funding issues to resolve, but this organization is pivotal to the future of electric reliability in North America.

We must recognize the importance of local conditions and practices when it comes to setting standards. Although, as noted at the beginning of this paper, local and regional

[19] The U.S. President signed The Energy Policy Act of 2005 on August 8, 2005.
[20] It is expected, but not certain, that NERC will evolve into the ERO.

tailoring are very important in the design of first-generation markets, we should keep in mind the ultimate objective of standards that are as encompassing as possible. We need standards that evolve and constantly challenge us, not lowest-common-denominator standards that merely ratify existing practices.

To date, most standards have been produced through industry committees and organizations, usually following an accredited American National Standards Institute (ANSI)-based process.[21] The market system requires that we further examine the process by which standards are produced. For example, although it is essential to have a broadly based, participatory process, we may need to assess how well priorities are being set and whether or not there is sufficient coordination in the development of electricity reliability standards and business practice standards, respectively. And we may need to involve regulators directly in the drafting (as well as the enforcement) of the standards.

Priority 2: Infrastructure

In most areas with which I am familiar, there is a need to address historic shortfalls in transmission investment. While markets were being introduced, transmission investment somehow fell behind. This was due to a variety of different circumstances: the unsettling effects of all the corporate restructurings, uncertainties regarding where transmission would best be located given a rapidly changing picture of generation location, regulatory risk, the often-interminable approvals process, nagging questions of how to recover the costs of investments and, of course, the ever-present "not in my backyard" (NIMBY) attitude.

This in fact may be the strongest charge against restructuring: not that it changed incentives adversely but that it simply distracted attention from needed investments and shifted "too much" attention to market building. In any event, recognition is growing of the critical role of transmission in supporting wholesale electricity markets. In recent testimony before the U.S. Congress, FERC Chairman Pat Wood III stressed the need for a more modernized and efficient grid, noting that, "Underdevelopment of the transmission grid impedes the achievement of the benefits of competitive markets" (Wood 2005).[22]

In Ontario and a number of other jurisdictions, the need for a "broader perspective" on investment is recognized in the new planning organizations and committees that have been formed to look at integrated planning over the long term. This is a somewhat belated recognition: that adequate generation is actually inadequate if you can't deliver it to loads effectively, and that the transmission business is not particularly amenable to competition, per se.

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[21] ANSI certifies the processes used to establish industry-wide standards. Both NERC and NAESB follow ANSI-certified procedures.

[22] See Wood 2005.

Ontario has moved away from a merchant transmitter model in favour of a model in which most (but not all) transmission investments will be recovered through rolled-in rates paid by all customers. Transmitters are required to submit regular plans regarding network investments.

As part of the renewed emphasis on upgrading the transmission network, we will need to consider new technologies that address the specific issues raised by markets and long-distance trade. For example, more investment is needed in wide-area visibility, such as can be provided by phasor measurement systems developed by the Consortium for Electric Reliability Technology Solutions (CERTS). There also needs to be more installation at key locations of "fast-acting" devices to provide better management of energy flows, including unintended loop flows.

Priority 3 Reducing Seams and Aligning Markets

In addition to investing in standards development and infrastructure, we will need to expand our efforts to address trading seams between and among markets. Considerable strides have been made in this area in recent years. Export charges have been eliminated between the New York and New England markets. New reserve-sharing protocols have been introduced.[23] Nevertheless, in many markets, there continues to be an unacceptably large number of intertie trading failures. Trading failures in real time can adversely affect reliability. The sudden loss of a large, planned import is an obvious example. Some of these transaction failures appear to be associated with the introduction of new hardware and software or new market procedures. Such failures can be seen as transitional – metaphorical teething problems – and it should be possible to reduce the problem as we gain more experience and communicate more effectively.

Other trading failures are attributable to fundamental differences in design from one market to the next. Of particular importance to Ontario is the fact that we do not currently have a day-ahead market, as do New York and the Midwest ISO (MISO). This makes it difficult for Ontario to secure energy in tight situations using the real-time market. Our market was quite successful in securing needed imports in the critical summer of 2002, but it is not clear that it would be as successful today. Recognizing the reliability risk, the IESO has armed itself with additional out-of-market capabilities in the event that such control actions prove necessary. And we are actively consulting stakeholders on whether to proceed with a day-ahead market or to develop alternative day-ahead commitment processes.

Another key difference in market design is that Ontario does not have locational marginal pricing as its U.S. neighbours do. There is a single, uniform energy price for all loads in the province. The result is that Ontario needs a fairly complex set of rules for

[23] See Reserve Sharing, 2004.

settling congestion redispatches (which may have to be carried over into any comprehensive day-ahead market design). The government has stated clearly that it does not want locational prices, so our near-term market design enhancements will continue to respect the uniform price policy for consumers.

Seams issues must be continuously addressed because energy and reserve trading are critical for ensuring reliability in the market paradigm. It is primarily by sharing reserves through trade that jurisdictions can economize on local generation and achieve their reliability target without "over" building. But the approach depends on having ample intertie capacity and good rules that are as compatible as possible with those of the neighbours. We cannot expect to eliminate all market seams, as that would entail eliminating important local variations, but we can and must invest the time and effort to minimize barriers to cross-border trade and thereby achieve at least part of the reliability gains that restructuring and competition were intended to bring.

It is particularly important that, as each jurisdiction develops its market, full consultation and cooperation with neighbours is maintained to ensure that no detrimental market or reliability risks are inadvertently created.

Conclusion

This paper suggests various links among restructuring, competitive markets, and reliability and observes that we are now in a second phase of market evolution, in which we are consolidating electricity markets and broadening our perspective beyond traditional design issues. We are taking a harder look at questions like resource adequacy, standards, and the potential role for planning. We need to integrate reliability into our evolutionary planning and collectively ensure that reliability is maintained and improved as the industry evolves.

Markets and inter-regional trading are conducive to improved reliability, but there is a lot to do to provide support to the market. Going forward, the agenda should include strengthening standards, improving infrastructure, and reducing trade barriers. We need to think of these efforts as complementary elements in an overall strategy for enhancing reliability, not as singular initiatives. I conclude by proposing an overarching, industry-wide commitment to "invest in reliability" as one approach for managing the restructuring / reliability relationship in the years ahead.

Our understanding of competition and electricity markets is becoming more sophisticated and nuanced; our markets are gradually taking root and achieving liquidity, despite the many bumps in the road getting to where we are today. As we continue to fine-tune and improve, we need to ensure that the promise of reliability is kept.

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