Electricity is the Answer

The EDA's Road Map for Delivering Ontario's Electric Future
November 1, 2011

EDA
The Voice Of Ontario's Electricity Distributors

Electricity Distributors Association

Chair's Message

The combined structure that is the generation, transmission, and distribution of electricity in Ontario is unique in the world. We are neither private nor public – we are both. While nuclear represents half of our power generation, the mix for the other half is changing at a rapid pace. And, as it relates specifically to local distribution companies, our mixture of large and small utilities, municipal, provincial, and private ownership means that there are few if any jurisdictions in the world that we can look to for advice.

That's just one of the insights you'll find in this important EDA document, **Electricity is the Answer** - *The EDA's Road Map for Delivering Ontario's Electric Future*. It was created under the leadership of the EDA's Board of Directors and leverages the expertise of renowned energy economist, Dr. Adonis Yatchew.

Electricity will power Ontario's future. Of that, there is no debate. From hand-held devices to electrically powered commuter trains and plug-in hybrid vehicles, electricity's share of Ontario's total energy mix will continue to grow. As it does, managing its generation, transmission, and distribution will become increasingly complex.

Today, we are at a crossroads. Whereas our transmission and distribution system was designed as a one-way street, this highway must now run in two directions. Once, only a few generators filled the system; now newly constructed on-ramps will enable the access of thousands. Tomorrow, millions may be added as plug-in vehicles provide mobile storage systems as well as emissions-free transportation. Infrastructure improvements take years to plan, decades to build and billions of dollars to finance. The crossroads at which we find ourselves requires no mere traffic light to manage. What's needed is a full-scale collaborative re-visioning involving all stakeholders.

For innovation to be successful, it cannot be centrally managed. Yet, for Ontario's dynamic electricity sector to be successful, innovation is required. Two groups of people are especially innovative – those on the shop floor and those with closest contact with customers. They both can be found at Ontario's local distribution companies. Our job at the EDA is to ensure their ideas and innovations are shared with all the stakeholders in the sector.

This paper represents our vision. The EDA calls on government decision-makers to seize the opportunity to make meaningful change in the sector, and invite them to use this vision as a starting point.

Jim Keech, EDA Chair

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Executive Summary

1. Introduction and Background

The purpose of this study is to identify the challenges that face the Ontario electricity distribution and transmission industry; to assess the structure of the industry and the roles of agencies and entities which regulate or otherwise interact with the wires segment; to evaluate strategies and policies which may be implemented to ensure that present and forthcoming challenges are met effectively; and to propose a vision and goals for the future.

The major trends affecting the industry have changed dramatically. A decade ago the emphasis was on unbundling, deregulation, competition and privatization. Today, major worldwide trends include decarbonisation, technologically based solutions such as smart-grids and smart meters, and evolving regulatory models. These trends have important implications for grid systems which we will examine in some detail.

2. The Ontario Electricity Industry in Context

Two primary forces drove electricity industry restructuring which took place in many parts of the world at the close of the last century: improved efficiency of smaller electricity generating units and increased emphasis on market forces.

The Ontario electricity industry underwent a period of restructuring and deregulation. The Ontario Hydro era ended when the iconic company was divided into multiple descendant entities. The Independent Market Operator (IMO)[1] was endowed with the responsibility of operating the competitive market which was launched in 2002. However, rising electricity prices led the government of the day to re-regulate the electricity market and a new body, the Ontario Power Authority (OPA) became the Provincial procurer of the majority of long-term supply.

During this period, the regulatory style of the Ontario Energy Board (OEB) changed as well, gradually moving, where it was possible to do so, from cost of service regulation to incentive regulation.

In 2009, the Provincial Government passed the Green Energy and Green Economy Act. The central purpose of the Act was to promote renewable electricity production and conservation, and demand management programs. The Act provided for more active and direct Government involvement in the management and decision-making within the electricity sector through Ministerial directives.

[1] The IMO subsequently became the Independent Electricity System Operator (IESO).

Considerable resources have been expended on restructuring, resulting in a substantially more elaborate institutional structure. Concomitantly, the regulatory and administrative burden has increased dramatically for much of the industry. The broader objectives of decentralization and deregulation have, in many ways, fallen by the wayside.

3. The Challenges Facing Transmission and Distribution

The Ontario electricity industry has an exemplary record of providing the highest standards of service and reliability. It has done so in the face of major changes within the industry. The essentiality of electricity to the economy and to society mandates that this record continue to be upheld. However, the industry is now facing major challenges which we delineate below.

A. Infrastructure investment: Aging infrastructure needs to be refurbished or replaced on an ongoing basis and new investment is required to meet system growth and expansion.

B. New and emerging technologies: Smart meters have been installed in much of the Province. Smart grid and other innovative technologies will require ongoing resource commitments in order to ensure that they are incorporated in a cost effective manner. In time, electric vehicles will create new challenges for the industry.

C. Conservation and Demand Management: Utilities are required to meet conservation and demand management targets set by the Ontario Energy Board. For many utilities, this has resulted in an expansion of administrative tasks and responsibilities.

D. Distributed generation: The integration of distributed generation facilities will acquire ever increasing importance particularly where substantial changes are required to the operation and design of distribution systems. Variable energy resources such as wind and solar generation place new demands on distribution system operation. Ownership of distributed generation by distributors presents both a challenge and an opportunity.

E. Costs: Ontario electricity prices are projected to grow by 46% in the upcoming five years and 100% in the long term. A large portion of the increase is attributable to renewable energy programs. Though these rate increases are not principally attributable to traditional wires functions, they put pressure on cost structures throughout the industry and can affect regulated price increases and the internal decision-making at utilities.

F. Regulation and Government Policy: Recent legislative and policy initiatives have increased political and regulatory uncertainty. Regulatory burden has also increased substantially over the last decade.

G. Shareholders Objectives: Utilities need to ensure that they are meeting the objectives set by their shareholders, which may include private shareholders, municipalities, or in the case of Hydro One, the Province.

4. *Guiding Principles*

A. Service and reliability levels must meet customer expectations.

B. Mergers and acquisitions should be voluntary wherever possible, and should serve the interests of customers and shareholders.

C. The internal structure of distribution companies should be determined by individual utilities to the extent possible.

D. Wires utilities should be run on a commercial basis and accorded a full opportunity to earn commercial rates of return.

E. The implementation of technologically-based changes and innovations should be achieved through a consultative process and through incentive mechanisms to the extent possible.

F. Regulation that is free of political interference should be a commonly held objective.

G. Correct and transparent price signals should be implemented wherever possible.

5. *Regulatory and Legislative Objectives*

In order to achieve improved functioning of the sector as a whole, a number of legislative and regulatory options should be considered.

A. Reduced government involvement: Recent legislation has provided Government officials with additional authority to issue specific directives. Ideally, there should be an arms-length relationship between regulatory agencies and government. To achieve this objective, appropriate legislative changes would need to be enacted. It would be preferable if redistributive social welfare programs were provided by the Government rather than by utilities.

B. Rationalization and coordination of oversight agencies: The IESO was a creature of the deregulatory phase in the industry; the OPA a creature of the re-regulatory phase. Though both serve important purposes within the industry, a merger of the two entities, or further rationalization of their respective functions, could lead to more efficient decision-making within the industry.

C. Improving the regulatory process: A number of avenues exist for improving the regulatory process. These include the incorporation of multi-year capital reviews within the regulatory cycle; stricter constraints on the intervenor process; and, expedited reviews where appropriate. Increased coordination among regulatory entities may also serve to reduce regulatory burden. Consideration could be given to establishing a group, consisting of representatives from existing regulatory agencies, which coordinates overlapping or related activities of regulatory bodies and that has as its mandate the reduction of regulatory burden to industry participants.

D. Reduction in restrictions: Prior to industry restructuring, a number of distributors operated within public utility commissions which provided more than one service such as electricity and water. Such commissions exhibited, on average, materially lower costs. Consideration should be given to the reduction in regulatory restrictions on utility structure and relationships with utility affiliates.

E. Reallocation: In earlier years, distributors were responsible for the design of conservation and demand management (CDM) programs. That function now resides with the OPA. Consideration should be given to devolving many CDM responsibilities to utilities. A centralized agency would retain responsibility for administering the CDM program fund, research and possibly audit functions. Utilities could take on responsibility for design and development in addition to delivery of programs.

6. *Utility Objectives: Efficiency, Leadership and Excellence*

Among the important factors affecting the efficiency of distributing utilities are the scale of operation and the scope of activities. Ontario distributors display significant variation in unit costs for a variety of reasons, among them the density of the customer base, the age of the assets and historic investment and depreciation patterns.

Available empirical evidence suggests that scale efficiency can be achieved even by utilities of modest size; that contiguity and density of the customer base has important cost impacts; and that multi-utilities benefit from economies of scope.

Some have suggested that there are too many distributors in Ontario and that considerable customer savings can be achieved through major consolidations within the sector. Advantageous mergers among some distributors can produce cost savings, and innovative utilities will lead the way to new and more effective business models in a changing technological and operating environment. However, the empirical evidence generally suggests that most Ontario customers are served by utilities which have achieved scale efficiency so that consolidations would need to be evaluated on a case by case basis. Moreover, voluntary and incentive driven transactions, initiated by the utilities themselves, are far more likely to yield positive results than a directed approach.

The Ontario electricity industry has a long history of innovation beginning with the development of Niagara Falls in the early part of the 20th century, early and cost-effective electrification and the development of a unique nuclear technology. Today, Ontario continues to be at the forefront in smart and renewable technologies, many of which lie within the transmission and distribution segments of the industry.

The installation of smart meters throughout the Province is only the beginning of a process. A number of utilities have conducted their own time-of-use pricing experiments. However, much remains to be learned about the responsiveness of consumers to alternative rate designs and about the effectiveness of more advanced demand response regimes which rely upon real-time information and dynamic pricing. Technical sophistication is not synonymous with added value. Thus, reliable predictions of the likely effects of new programs would be very useful.

Government policies which promote renewable and distributed generation are a major driver of smart grid technology in the Province. As the share of renewables continues to grow, the need to accommodate variable energy resources at dispersed locations creates strong incentives for transmitters and distributors to seek solutions based on ever more intelligent technologies.

Ontario distributors enjoy an exemplary record of service and reliability. Maintaining this record should continue to be a central utility objective.

In most cases, distributors are the direct interface between the electricity supply chain and the end-user. In today's changing electricity environment, informing and educating customers has become an even more essential objective.

7. *Alternative Models*

We consider three scenarios or models for the wires segment of the Ontario electricity industry.

1. The 'status quo' assumes continuation of the present industry structure and regulatory and legislative framework.

2. The 'evolutionary model' builds on the existing structure, allowing it to evolve with suitable incentives.

3. The ‘regionalization model’ contemplates separation of distribution and transmission and the reorganization of distribution so that the Province is served by a reduced number of contiguous (‘shoulder-to-shoulder’) utilities.

Evaluation of Models

One would expect comparable levels of investment in regulated facilities under all three scenarios primarily because such investments are driven by the need for refurbishment and expansion. Regulatory approval is required for infrastructure investment and all parties recognize the importance of maintaining reliability levels.

One would expect a greater degree of innovation and assimilation of new technologies under the evolutionary and regionalization models than under the status quo.

Conservation and demand management programs would likely continue at comparable rates under all three scenarios as these programs are ultimately controlled by the regulatory authority. However, each scenario may result in differing approaches to achieving the targets. Under the evolutionary scenario, one might expect a greater degree of out-sourcing of program delivery through cooperative ventures.

Turning now to distributed generation, under all scenarios, the integration of variable energy resources constitutes a major challenge for distributors and for the transmission system. Some have argued that the regionalization scenario may have advantages in this regard.

Advantageous consolidations which lead to new efficiencies may be available, but they must be evaluated on a case by case basis. They are most likely to occur under the evolutionary model. For the industry as a whole, the potential for gain through improved scale economies in wires operations, is modest.

Economies of scope, through increased flexibility in internal firm structure and operation can be realized under the evolutionary and regionalization models, as long as the regulator approves. New scope economies may arise as smart technologies and distributed generation expand. In time, this may create new potential for greater scale economies as well.

An important consideration on the cost side would appear to be the resources that would be required to implement alternative scenarios. The regionalization scenario would consume significant financial resources and there may be some losses in economies of scope by separating transmission and distribution.

There are, of course, numerous hybrids and other industry models that could be considered. In Ontario, the population is heavily concentrated in small geographic areas; there are also vast expanses of low population density, particularly in the north. This in turn may suggest a variant of the regionalization model where low density areas continue to be served by a combined transmission-distribution entity while more populated areas are served by regional distributors. To the extent that there are economies of scope in combined transmission and distribution operations in areas of low population density, these would continue to be retained. This variant would impose lesser transition costs and therefore may be an option worthy of more detailed consideration.

8. *Conclusions and Recommendations*

Ontario is at the forefront in a number of areas of electricity industry development and initiatives. This, combined with an industry structure that differs from those in most other jurisdictions, suggests that we cannot simply look elsewhere for formulaic solutions or templates.

There are multiple nuanced differences among the scenarios that were considered. Neither the evolutionary nor the regionalization model is uniformly better than the other. However, the regionalization model would likely consume significant resources and potentially face significant opposition. Given present circumstances and objectives, the evolutionary model is likely most appropriate at this time.

Key elements of the vision for transmission and distribution utilities include i) the pursuit of efficiencies through enhanced economies of scope, and possibly scale and contiguity; ii) leadership in innovation and cost-effective implementation of 'smart' technologies; and, iii) excellence in reliability and customer service.

From the political and regulatory standpoint, an arms-length relationship between the regulator and the government would improve decision making and reduce the uncertainty of the environment within which utilities operate. This in turn would likely enhance evolution of the sector and promote further advantageous consolidation. Streamlining, innovation and a more light-handed approach in regulatory processes would reduce regulatory burden and promote new efficiency gains through expanded economies of scope.

Summary of Recommendations

1. The relationship between the Provincial Government, the electricity industry and its regulatory agencies should be reviewed. This report proposes that an arms-length relationship is best suited to promoting the most effective decision-making within the industry, long-term efficiencies and a more predictable policy, regulatory and investment environment. If, this conclusion is supported by the review, appropriate modifications to legislation would need to be implemented.

2. Major restructuring of transmission and distribution is not warranted at this time. An evolutionary approach characterized by increased flexibility, well designed incentives, consensual change and low transition costs is the preferred model.

3. Regulatory restrictions which limit utilities from finding cost savings through expanded economies of scope should be relaxed to the extent possible.

4. Utilities should continue to seek improved efficiencies by taking advantage of possibilities for improved economies of scope and through mutually beneficial consolidations which may yield additional scale and contiguity economies.

5. A merger of the IESO and OPA or rationalization of their respective activities should be considered.

6. Regulation of the wires portion of the electricity industry should be reviewed. Utilities should have the option of seeking multi-year capital approvals. Consideration should also be given to streamlining the regulatory process where possible and providing utilities with broader regulatory options including expedited reviews.

7. Utilities should be given greater opportunities to design and develop their own CDM programs. Eventually, utilities may take on primary responsibility for these functions. Program fund administration and research should remain with a centralized agency such as the OPA or its successor.

8. An accurate understanding of customer response to increasingly sophisticated technology can be of great value. Further studies and analyses of advanced metering technologies and appropriate rate designs should be conducted.

9. Utilities should continue expanding their functional capabilities to accommodate new and emerging technologies such as smart-grid systems and distributed generation. Implementation of these technologies should be achieved on a cost-effective basis as determined by individual utilities and the regulator. Incentive based approaches should be implemented where possible.

10. The essentiality of electricity to the economy and to society mandates the continuation of the record of excellent service and reliability. This will require continuing investment in the wires networks.

1. Introduction and Background

A. Purpose

The purpose of this study is to identify the challenges that face the Ontario electricity distribution and transmission industry; to assess the structure of the industry and the roles of agencies and entities which regulate or otherwise interact with the wires segment; to evaluate strategies and policies which may be implemented to ensure that present and forthcoming challenges are met effectively; and to propose a vision and goals for the future.

The major trends affecting the industry have changed dramatically. A decade ago the emphasis was on unbundling, deregulation, competition and privatization. Today, electricity industries are engaging new trends including decarbonisation, technologically based solutions such as smart-grids and smart meters, and evolving regulatory regimes which, in some cases, have moved towards re-regulation.

In Ontario, the elimination of coal-based generation and the promotion of renewable technologies have been cornerstones of the decarbonisation agenda. Smart meters have been widely installed and the promotion of smart grid technologies is now enshrined in legislation. At the same time, the regulator is seeking new ways to regulate in a changing landscape.

Even a casual glance at the industry reveals a series of ongoing and upcoming challenges that need to be addressed. Prominent among these are the following.

> The industry has provided high levels of service and reliability over the course of many decades. In order to maintain these levels, aging assets at many utilities require continued refurbishment or replacement.
>
> As the Ontario population and economy grows, the electricity delivery system must continue to expand. Advanced societies worldwide are displaying a new electrification trend, driven by efforts to decarbonize their economies. Ontario is no different with the *share* of electricity in final energy consumption projected to grow. Increasing use of electricity in transport and other sectors places upward pressure on the entire electricity supply chain, not least on the delivery segment.
>
> Provincial Government legislation and policy initiatives have markedly shifted the direction of the electricity industry with increased emphasis on renewable generation, smart meter and smart grid technologies, and conservation and demand management programs (CDM).
>
> The very design of distribution networks is experiencing a paradigm shift. Previously, their main purpose was to repackage electrons to lower voltages and to deliver them to customers. Now,

with the growth in distributed generation, they are required to collect electrons as well as to deliver them.

Increased regulatory burden, combined with functional, structural, legislative and policy changes over the last decade and into the coming years put considerable pressure on administrative resources within utilities. A fresh look at the regulatory approach should assist in relieving some of this pressure.

B. Themes

Certain interrelated themes will help to inform our review. They may be summarized using three terms: ***function***, ***structure*** and ***regulation***.

The first theme encompasses considerations such as current and nascent ***functions*** that the wires segment may need to fulfill as the electricity industry evolves. These include the integration of distributed generation, the incorporation of information technologies that facilitate such integration, the development of smart grid solutions which can improve the utilization of existing and new resources and lead to savings in capital expenditures, and the implementation of systems that ensure that smart meters are used to their best advantage.

The second theme embraces ***structural*** changes that may be considered. Among the drivers of structural change are the new and evolving ***functions*** just mentioned, the changing face of technology and government legislation, policies and directives. A perennial structural question is whether the number and geographical disposition of distributing utilities could be improved upon, and if so, by what mechanism. These relate to economies of scale and contiguity. Some have argued that there continue to be too many utilities and that some are too fragmented. But there are also important issues relating to intra-utility structure. For example, one needs to ask whether there are potential efficiency gains or scope economies which could flow from reducing barriers to functional integration of traditional wires company responsibilities with other activities. The structural changes that we consider are not restricted to the wires companies themselves. For example, we consider whether agencies which are directly involved with the wires segment, such as the Ontario Power Authority (OPA) and the Independent Electricity Systems Operator (IESO), should be restructured or whether functional reallocations should be considered.

The third theme involves the ***regulatory*** environment. Transmission and distribution in Ontario is regulated by a number of agencies, most importantly the Ontario Energy Board and the Electrical Safety Authority. Given the natural monopoly nature of the wires business, regulation is necessary. But the nature of regulation merits reconsideration, particularly in view of the changing and expanding functions utilities are being asked to perform and the associated regulatory burden. More importantly, the mechanisms by which political input influences decisions require attention.

2. The Ontario Electricity Industry in Context

A. The Forces That Drove Restructuring

A vision of the future requires an understanding of the past. For much of the 20th century, the broad structure of the Ontario electricity industry remained little changed. Ontario Hydro was the main provider of generation, transmission and rural distribution. Electricity distribution to urbanized areas was provided by a growing number of municipal utilities as municipalities exercised their right to establish hydroelectric or public utility commissions. These were regulated by Ontario Hydro which also bore primary responsibility for system planning and operation.

Two primary forces drove the electricity industry restructuring which took place in many parts of the world at the close of the last century. An understanding of these forces is important because it helps us to gain perspective on the present trends.

The first major driver was technological change which affected the scale economies of generating electricity. From the beginning of the 20th century to the 1970s, unit costs of generation fell as the size of generators increased and thermal efficiencies improved. Ever larger generating units were required to minimize costs, and by 1980, in order to achieve scale efficiency, generating units exceeding 1000 MW were being constructed.[2]

However, during the 1980`s, it became possible to construct smaller generating units that met the efficiency levels of large facilities. By 1990, gas turbine units ranging from 50 MW to 150 MW were economically viable.[3] This technological driver created the possibility of competition in the generation segment of the industry (see Figure 1).

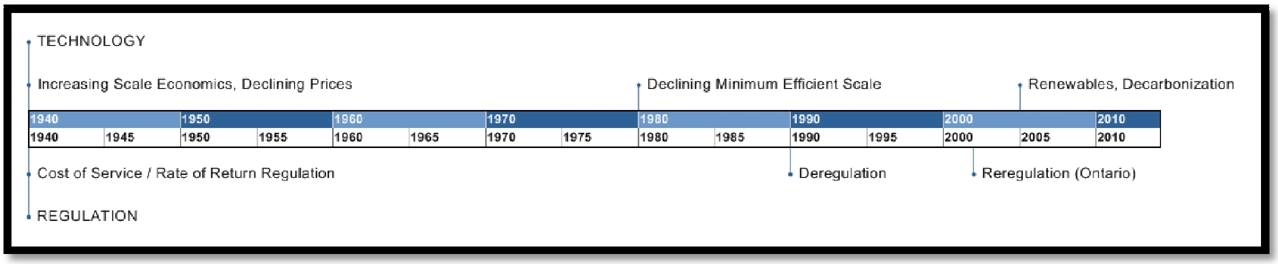
The second primary force driving electricity restructuring was a worldwide shift towards increased emphasis on market forces. Beginning with the Great Depression, which had been seen as a profound market failure, the political pendulum had swung to the left, with an increasing role of government in the economy. However, the 1970s was a period of stagflation and slow economic growth. Regulatory failure and excesses were seen to be part of the problem. The elections of Margaret Thatcher and Ronald Reagan marked the end of an era and the pendulum swung to the right through the 1980s. That

[2] See *Technology and Transformation in the American Electricity Industry*, by Richard Hirsch, Cambridge University Press, 1989, pages 1-11.

[3] See “Less is More: Why Gas Turbine Units Will Transform Electric Utilities”, by Charles E. Bayless, *Public Utilities Fortnightly*, December 1, 1994, pages 21-25.

decade ended with the spectacular dissolution of the Soviet Union which was seen by many as a vindication of the market model vis-à-vis the central planning model.[4]

Figure 1: Technology and Regulation



Since deregulation had been successful in improving a number of other industries, among them airlines and natural gas, the general consensus was that competitive market forces could also improve the performance of the *generation* segment of the electricity industry and so a variety of 'deregulatory' experiments ensued.

The electricity industry restructurings that followed were founded upon the principle of separating competitive segments (generation and supply) from natural monopoly segments (transmission and distribution). In some jurisdictions, this was implemented through functional separation whereby competitive and non-competitive segments remained within an existing utility. In other jurisdictions, the industry was vertically unbundled through divestiture and the creation of new corporate entities.

In Ontario, the iconic Ontario Hydro gave birth to new entities, among them Ontario Power Generation which inherited the major portion of generation assets, Hydro One which incorporated transmission and mainly rural distribution, the Independent Market Operator (later the Independent Electricity System Operator) and the Electrical Safety Authority. Beginning in this time period, the number of distributors, of which there were over 300 prior to restructuring, fell sharply to about 80 today.

However, deregulation and marketization did not meet with uniform success. The difficulty in the California electricity market comprises one such example. The collapse of financial markets in 2008 has also been attributed at least in part to deregulation that took place in the 1990s. Despite these setbacks it is important not to overreact and undo many of the benefits that have accrued. Increased regulation may be warranted in certain cases, but excessive regulation and government intrusion in the decision-making of business is counterproductive.

[4] The shift towards marketization was also visible in China (and elsewhere) which began its liberalization programs in 1978. Since that time China has experienced prodigious economic growth and become an economic and political powerhouse.

For the electricity sector, two major policy trends are currently serving as important drivers. The first is decarbonisation which is being pursued through programs that promote renewables and through increased conservation and demand management. The second is reregulation or at least a cautious and selective approach to deregulation.

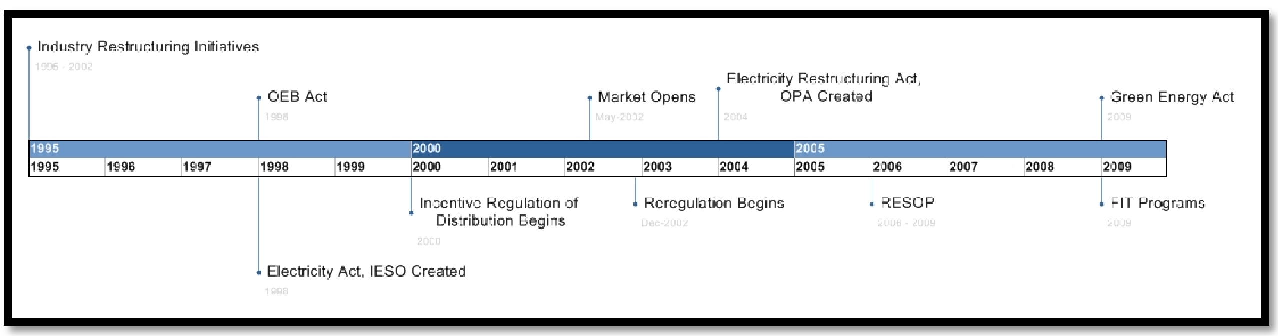
B. Formative Legislative Changes

In Ontario, a number of restructuring and deregulation models were proposed during the 1990s. By 1995, an active debate was taking place and formal mechanisms for changing the industry were being initiated.

Restructuring was enabled by a number of legislative initiatives, most importantly The Electricity Act (1998) which created the initial institutional structure, and the Ontario Energy Board Act (1998) which granted new regulatory powers to the Ontario Energy Board (OEB) over the various entities, among them distribution and transmission companies. (Previously, Ontario distributor rates were regulated by Ontario Hydro.)

In 2002, Ontario's short-lived foray into a fully competitive market structure for electricity began and ended. Shortly after the market opened, prices rose, after which the Provincial Government moved quickly to stabilize prices.

Figure 2: Ontario Electricity Industry Timeline



The Electricity Restructuring Act (2004) established a new entity, the Ontario Power Authority, which would be the Provincial procurer of the majority of long-term supply. A 'hybrid' market was now in the process of being established.

In 2009, the Provincial Government passed the Green Energy and Green Economy Act, the central purpose of which was to promote renewable electricity production and conservation and demand management programs. The Act established feed-in-tariff programs for renewable energy and required distribution and transmission entities to connect such facilities. Distributors were permitted to own small-scale renewable energy generating facilities.

The Act also introduced new objectives for the OEB, including the promotion of renewable energy, conservation and demand management, and a smart grid. It also required distributors to achieve conservation and demand management targets to be set by the OEB.

Notably, the Act provided for more active Government involvement in the management of renewable energy, conservation and smart grid initiatives through Ministerial directives. The approach marks a potentially substantial increase in government involvement in decision making and management of the electricity sector.

C. Regulatory Evolution

In the late 1990s, the regulatory style of the OEB began to change as well, gradually moving, where it was possible to do so from cost of service regulation towards incentive regulation. The latter is best understood as part of the sweeping intellectual, political and economic trends favouring market forces. The broad argument stated that just as governments should be less intrusive in the economy, the regulator should be less intrusive in its oversight duties. An important methodology underpinning incentive regulation involved mimicking market-type incentives where true markets could not be created.

Performance based or incentive regulation of Ontario distributing utilities began in the year 2000 (see Figure 2).[5] During the subsequent years, the approach was refined. In order to calibrate performance, detailed OM&A data were obtained for each distributor and the Board engaged consultants to model differences amongst utilities based on certain variables such as customer density, employee wage rates and the nature of the service territory.

This approach unfortunately failed to incorporate capital costs, which represents the dominant share of total costs. Subsequently the analysis set productivity factors in a price-cap formula based on those that had been observed in U.S. data and that incorporated detailed capital information.[6]

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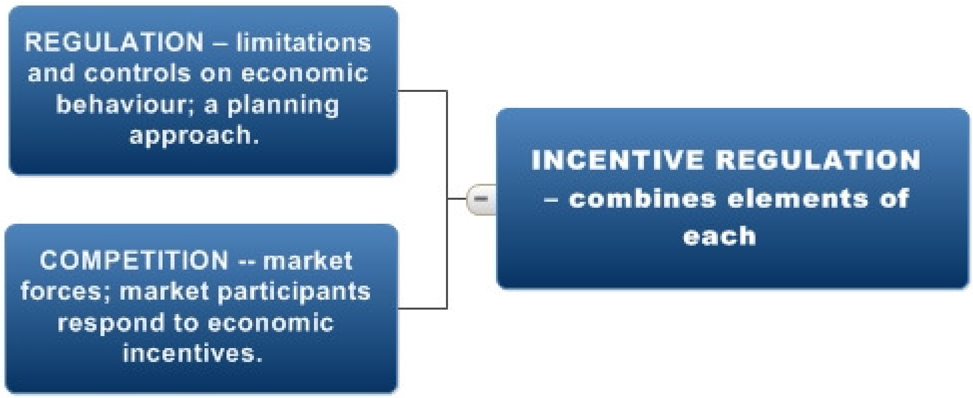
[5] Ontario Energy Board Decisions RP-1999-0034, January 18, 2000 and RP-2000-0069, September 29, 2000.
[6] EB-2007-0673, Supplemental Report of the Board on 3rd Generation Incentive Regulation for Ontario's Electricity Distributors, September 17, 2008.

Figure 3: Incentive Regulation



Regulation of rates continues to evolve and difficulties remain. The rapidly changing environment faced by utilities as well as new tasks that are being imposed complicates future evolution. On the one hand, new functions may require separate regulatory treatment and budget allocations as has been done in some instances in the past. But as the burden accumulates, one is inclined to consider other 'all-in' options where a utility may prefer to seek an uncomplicated but therefore light-handed and lenient approach rather than a multi-stage process where conventional activities are regulated by one mechanism and new functions are regulated on an individual basis.

3. The Challenges Facing Transmission and Distribution

The Ontario electricity industry has an exemplary record of providing the highest standards of service and reliability. It has done so in the face of major changes within the industry. The essentiality of electricity to our economy and society mandates that this record continue to be upheld. However, the industry is now facing major challenges.

A. Infrastructure Investment

a. **Refurbishment and replacement of existing assets.** Many of the assets within Ontario's distribution and transmission networks are aging and require refurbishment or replacement. It is essential that associated programs are conducted in a timely fashion to ensure service quality and to minimize longer term costs. Undue delay of such programs may result in greater overall costs to customers as well as rate shock if pent-up capital needs are subsequently met on an accelerated basis.

b. **System growth and expansion.** As Ontario's population and economy continues to grow, utilities must ensure that transmission and distribution facilities expand to meet this growth.

B. New and Emerging Technologies

a. **Smart meters.** The Government has mandated Province-wide installation of smart meters and many utilities have already done so. In order to fully realize the value inherent in this investment, which was mandated by the Province, utilities will need to continue to develop programs which make effective use of this technology.

b. **Smart grid.** Improved information technology is leading to innovations in grid management. In time, these developments can facilitate the incorporation of distributed generation, enhance load management and even provide for real-time customer response to system requirements. Proliferation of plug-in electric vehicles will create additional demands on electricity systems. At this time, many 'smart' technologies remain in a relatively early stage of development and their cost-effective implementation by utilities is a major challenge. [7]

C. Conservation and Demand Management

Utilities are required to meet conservation and demand management targets set by the Ontario Energy Board. The OPA has developed a series of Province-wide programs and utilities rely upon these programs to achieve their CDM objectives.[8] The OPA programs include:

- demand response programs under which end-use customers receive incentives to reduce consumption at certain peak times; these arrangements may be voluntary or contractual;
- small business programs designed to promote energy efficient lighting;
- building retrofit programs;
- support for energy audits;

[7] The impacts on grid systems of smart technologies, demand response programs, renewables and distributed generation are receiving world-wide attention. For example, a team of researchers at the MIT Center for Energy and Environmental Policy Research is presently conducting a major study on the future of the U.S. electricity grid. The report is due in the fall of 2011. Preliminary presentations are available at http://web.mit.edu/ceepr/www/about/May2011/may%20handouts/schmalensee.pdf and http://web.mit.edu/ceepr/www/about/May2011/may%20handouts/rose.pdf.

[8] See https://www.saveonenergy.ca/.

- incentives for improvements in energy use by industrial and commercial enterprises;
- incentives for energy saving upgrades in new residential construction.

In a few cases, larger utilities have proposed additional programs that they are developing. The proponents of these programs must demonstrate that they are not duplicative of OPA programs. As part of the OEB review process, the OPA is asked to provide its opinion on the utility-specific programs and whether they are duplicative.

It would seem that the balance has not been struck properly. Centralization of the provision of some CDM programs is probably beneficial, particularly to the smaller utilities. On the other hand, it discourages innovation by distributors. Many of these development initiatives could be provided by single distributors or groups of distributors. With a multiplicity of utilities engaged in development, a competitive selection process will likely result in more rapid evolution and testing of programs. Centralization of this function also reduces the incentives for cooperative efforts by groups of utilities and for consolidation.

D. Distributed Generation

a. **Distributed generation facilities.** Current incentives for renewable energy projects have led to an abundance of applications, particularly for providers of small scale solar and wind generation. Some of these are located within municipal distributor boundaries. Distribution companies can no longer be thought of as simply distributing electricity, but also of collecting it.[9] Distribution systems originally conceived and engineered to deliver electricity must be modified to incorporate distributed generation.

b. **Integration of variable energy resources.** The overwhelming proportion of new renewable supply in Ontario is solar and wind based. Unlike conventional generation, the energy produced by such facilities fluctuates widely, sometimes over relatively short time intervals. Power quality can be deprecated and in some instances reverse power flows can occur. Technical integration within a distribution system presents new challenges, some of which may be resolved using emerging technologies.[10] However, a concentration of new supply of this type presents the host distributor with new engineering and design issues and can have upstream impacts which may not be paid for by the generator.

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[9] If the latter is to occur on a large scale, the term "distribution company" becomes a misnomer.

[10] Cost effective deployment of battery-type storage or flywheel technologies may help to reduce the magnitude of the impacts on distribution systems in the future.

c. **Ownership of generation.** The Green Energy Act permits distributors to own small generation facilities. This presents both a challenge and an opportunity to some utilities.

E. Costs

a. **Cost pressures.** In past years, Ontario has enjoyed electricity prices that are relatively low by international standards and Ontario businesses have, to a greater or lesser degree, relied upon these prices in their locational and expansion decisions. Recent projections indicate that Ontario electricity prices will grow by close to 46% in the upcoming five years and 100% in the long term.[11] A large portion of the increase is attributable to renewables programs: cleaner energy implies more expensive energy, at least at the present time.[12] This in turn puts pressure on cost structures throughout the industry and can affect regulated price increases and subsequently the internal decision-making at utilities.

b. **Cost saving opportunities.** In some cases, mergers or amalgamations may lead to cost savings through improved economies of scale. In other cases, horizontal economies of scope, for example through the sharing of resources among multiple service types may also lead to reduced costs. Cooperative planning, development and marketing of programs, such as those related to conservation and demand management, can also lead to efficiency gains.

F. Regulation and Government Policy

a. **Government legislation and policy initiatives.** The Green Energy Act has created new obligations for wires companies, such as the requirement to connect renewable resources. The increased direct role of Government, through the issuance of directives,

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[11] "Over the next 20 years, prices for Ontario families and small businesses will be relatively predictable. The consumer rate will increase by about 3.5 per cent annually over the length of the long-term plan. Over the next five years, however, residential electricity prices are expected to rise by about 7.9 per cent annually (or 46 per cent over five years)."Ontario's Long-Term Energy Plan, page 59, http://www.mei.gov.on.ca/en/pdf/MEI_LTEP_en.pdf.

[12] "This increase will help pay for critical improvements to the electricity capacity in nuclear and gas, transmission and distribution (accounting for about 44 per cent of the price increase) and investment in new, clean renewable energy generation (56 per cent of the increase)." Ibid., page 59. It is unclear whether a portion of the 44 per cent share attributable in part to transmission and distribution is itself caused by renewable energy related T&D expenditures. If so, then the clean energy program is accountable for a larger than 56 per cent share of rate increases.

is also likely to increase the uncertainty of the policy environment within which utilities operate.

b. **Regulatory burden and regulatory evolution.** Utilities have experienced a marked rise in regulatory burden over the last decade. Even rate applications have become much more complex than they were a decade ago. Meeting regulatory obligations, however, is only part of the picture. Utilities can and should help shape the regulatory model under which they operate so as to streamline it administratively and improve its effectiveness.

G. Shareholder Objectives

Utilities owned by municipalities, or in the case of Hydro One, by the Province, need to ensure that they are meeting the objectives set by their shareholders, including financial performance targets. Political and regulatory bodies should ensure that they are provided with a fair opportunity to do so.

4. Guiding Principles

In past industry reviews, guiding principles have been set out to assist in the formulation of possible paths. Below we list those that are fundamental in today's environment. Some of these principles fall squarely within one of the three themes – function, structure and regulation -- which serve to organize our reasoning. Others straddle boundaries and incorporate more than one theme.

A. **Service and reliability levels should meet customer expectations:** This principle has always been central to the mandates of distribution and transmission utilities, and Ontario utilities have provided excellent service. However, the requirement to connect and integrate distributed generation is transforming distribution companies into more sophisticated entities which harvest as well as distribute electrons. The supply of electricity from distributed generation can be less predictable than traditional generation. These factors, combined with infrastructure that, in many places, is aging, can lead to increased risks to service levels and reliability.

B. **Mergers and acquisitions should be voluntary wherever possible and serve the interests of customers and shareholders.** There has been a marked consolidation within the distribution segment of Ontario's electricity industry over the last fifteen years. Consolidations should be accomplished on a voluntary basis since this is most likely to lead to arrangements that serve the best interests of customers and shareholders. Merging utilities should be provided with a sufficient period of time to harvest the benefits of consolidation.

C. **The internal structure of distribution companies should be determined by individual utilities to the extent possible.** As part of the effort to create an unbundled and competitive electricity industry in Ontario, distribution utilities were required to restructure internally, separating wires, supply, energy service and other functions.[13] This likely resulted in some efficiency losses. Since that time there has been a fundamental shift in direction for the industry and distributors have been granted new rights of ownership of generating facilities. In this changing environment, distributors may be able to find new economies of scope through restructuring or reorganizing. To the extent possible, they should be permitted sufficient latitude to do so.

D. **Wires utilities should be run on a commercial basis. The regulatory and policy environment should be as predictable as possible and utilities should be accorded a full opportunity to earn commercial rates of return.** An important reference point of regulatory theory involves considering the industry structure and company behaviour that would occur if the industry were subject to market discipline. The regulator then attempts to achieve similar outcomes in the existing environment. Incentive regulation, for example, attempts to create incentives which induce firms to behave in ways similar to those that would be observed in competitive markets. To the extent possible, utilities should be provided with incentives to optimize their commercial performance. Among these incentives are a predictable regulatory and policy environment which is central to effective planning and investment, and a realistic opportunity to earn rates of return which are consistent with capital markets.

E. **The implementation of technologically-based changes and innovations should be achieved through a consultative process and through incentive mechanisms to the extent possible.** New technologies, particularly related to the smart-grid, have the potential of improving system operations, efficiency and reliability. Their implementation requires not only evaluation of the benefits to an individual utility's customers, but also consideration of wider network benefits. Thus a consultative process is especially important if optimal patterns of technology adoption are to occur. To the extent possible, incentive mechanisms should be used to promote technology adoption where greatest benefits can accrue.[14]

F. **Regulation that is free of political interference should be a commonly held objective.** Recent legislative changes have increased the potential for politically motivated directives

[13] The Affiliate Relationships Code formed part of the new rules governing distributor behaviour.
[14] See for example the Low Carbon Networks Fund put in place by OFGEM in the U.K. electricity industry. http://www.ofgem.gov.uk/NETWORKS/ELECDIST/LCNF/Pages/lcnf.aspx.

to the industry. Energy policy is a proper prerogative of government. However, the determination of mechanisms by which policy objectives are achieved is best left to the regulator and the industry. An arms-length relationship between government on the one hand, and the regulator and the industry on the other, is the preferred model. Just as over-regulation of the industry by the regulator is undesirable, excessive intrusiveness by the Government in the implementation of its broadly stated policies is unnecessary and often counter-productive.[15] Utilities have also been engaged to deliver certain social programs. It would be preferable if redistributive functions remained with the Government rather than being delivered by utilities.

G. **Correct and transparent price signals should be implemented wherever possible. To the extent that price-distorting cross-subsidies exist, they should be re-evaluated and eliminated to the extent possible.** The move to static, time-of-use pricing has improved the price signals received by retail customers. Efforts to further refine such rates and in the future, to consider dynamic time-of-use (TOU) pricing, should continue.

5. Regulatory and Legislative Objectives

In order to achieve improved functioning of the sector as a whole, certain regulatory and legislative options should be considered. We discuss each in turn. A summary is contained in Table 1.

A. Reduced Government Involvement

The processes of setting government energy and environmental policy, and that of regulating the economic entities that provide energy, are best separated through an arms-length relationship between the relevant regulatory agencies and the government. In present circumstances, and for various reasons, segments of the electricity industry require a relatively high degree of regulation and the purpose of regulatory agencies is to provide appropriate oversight within the confines of governing legislation and governmental policies. Regulatory agencies are expected to be a repository of institutional and industry-specific knowledge and should be in a position to make balanced decisions.

Recent legislation, however, has provided Government officials with additional authority to issue specific directives to industry participants. This authority permits the Government to leapfrog over the regulatory buffer, one that should be free of short-run considerations, and intervene directly in decisions that should be made by industry participants or by the regulator.

[15] In each case the simple objective should be "Tell us what you want us to achieve, but not how to achieve it."

Some may argue that this is merely a discretionary tool upon which the Government may rely. However, the very presence of this option may result in increased pressure from interest groups on the Provincial Government to exercise its prerogative under the current law.

Industrial policy arguments have also been raised in support of the existence of government directives such as those embodied in the Green Energy and Green Economy Act. However, the absence of this tool does not preclude the Government from using fiscal tools to promote industrial development and job creation. Furthermore, governments do not have, on balance, a favourable record of picking economic winners. In many cases where governments have had a direct hand in making business decisions, industries have thrived only as long as they have been supported by the government. [16]

Important lessons can be learned from the Ontario's lengthy efforts to restructure and liberalize the electricity market. After many years of discussion, a model was implemented in 2002, but then quickly overturned in response to public outcry. The model that was eventually implemented was arrived at by a highly circuitous route, which along the way consumed massive resources. [17,18]

The recent increased role for the Government, staked out through legislation, is in our view, detrimental to the long term interests of Ontarians. It increases the risk of politically motivated decisions, it reduces transparency and it has the potential of overriding the proper separations between the levels of decision-makers. This approach can also lead to reduced accountability and the Government adopting an ever increasing role in business decisions. It is inconsistent with light-handed or incentive regulation and it even creates the potential for circumventing meaningful and effective public input.

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[16] This point is relevant to concerns about the FIT programs. A recent report states "Many governments here in Canada and around the world are putting in place energy pricing regimes that encourage the rapid deployment of renewable energy generation. A typical element of this approach is a guaranteed feed-in-tariff (FIT) – a commitment by the public energy authority to pay much higher than prevailing market rates for energy created by favoured sources. FITs are necessary because the economics of sources like solar and wind have not yet delivered energy at a competitive cost. FIT proponents argue that these temporary subsidies are necessary to bring generating capacity on line and to stimulate the process of reducing costs as experience is gained. But there are few examples of such subsidies working to get costs down and of the subsidy being eliminated." See "Canada's Innovation Imperative", Institute for Competitiveness and Prosperity, May 2011, page 46.

[17] For a detailed account and analysis of the events and circumstances surrounding the process and decision-making see "Electricity Restructuring in Ontario", Michael Trebilcock and Roy Hrab, *The Energy Journal*, 2005, vol. 26, no. 1, pp. 123-146.

[18] There are other instances of decisions made within the Ontario electricity industry which had a substantial political component. Among them, the signing of long-term uranium supply contracts by Ontario Hydro that resulted in Ontario consumers paying for uranium at prices that far exceeded those prevailing in the market. Another example involves the continuation of construction of the Darlington generating facility during the 1980s despite serious concerns at the time about the need for it.

Table 1: Regulatory and Legislative Options	
Legislation	
Reduced Government Role	Consider modifications to legislation to ensure arms-length relationship between government, the industry and its regulatory agencies.
Rationalization / Coordination	Consider merger of the IESO and the OPA or rationalization of their respective activities. Increased coordination among regulatory entities may reduce regulatory burden.
Regulation	
Capital Programs	Review of multi-year capital programs by the regulator should be given serious consideration.
Streamlining	Consider innovative incentive-based approaches and a less onerous intervenor and hearing process.
Reduction in restrictions	Consider relaxing restrictions which limit utility ability to find cost savings through economies of scope.
Reallocation	Some functions, such as aspects of CDM program design may be reallocated to utilities.

In our view, policy decisions should reside with the Government. Regulatory decisions are best made by the regulators. And business decisions should be left to the companies themselves. This in turn would imply a reconsideration of certain portions of current legislation.

B. Rationalization and Coordination of Oversight Agencies

Prior to industry restructuring, most of the functions performed by the OPA and the IESO resided within Ontario Hydro. The IESO was a creature of the deregulatory phase in the industry; the OPA a creature of the re-regulatory phase. Indeed, the OPA was not created until efforts to create a fully competitive generation market in Ontario were abandoned.

In 2007, the Province appointed an Agency Review Panel to review the activities of a number of electricity sector entities, including the IESO and the OPA. Among the recommendations of the resulting report were a reallocation of CDM functions of the OPA and a merger of the OPA and the IESO. [19]

Since that time, only a limited degree of rationalization has taken place. Presently the Ministry of Energy is involved in the design and administration of some conservation functions and it plays an

[19] "The Report Of The Agency Review Panel On Phase II Of Its Review Of Ontario's Provincially-Owned Electricity Agencies", page 22, Queen's Printer for Ontario, November 2007.

important role in setting targets for the OPA. Much of the execution and design is performed by the OPA. That these functions reside directly within the Government increases the risk that decisions could be made on the basis of short-term considerations.

Both the IESO and OPA serve important purposes within the industry. However, it may be appropriate to revisit the possibility of merging these two entities or at least to consider further rationalization of functions between them.

Consideration could also be given to establishing a group, consisting of representatives from existing regulatory agencies, which coordinates overlapping or related activities of regulatory bodies and that has as its mandate the reduction of regulatory burden to industry participants.

Either of these approaches could lead to significant efficiency improvements within the industry, a reduction in overlap, more coordinated and timely decision-making and a reduction in regulatory burden.

C. Improving the Regulatory Process

Despite the move to incentive regulation, the regulatory and administrative burden borne by Ontario utilities has grown substantially over the last decade.

Incentive regulation can be particularly effective when certain conditions are present. Among these conditions are the following: i) an environment where utility responsibilities and technologies remain relatively stable, enhancing comparability of data on a year-to-year basis; ii) a dynamic technological environment where production costs are dropping, thus reducing political pressure on regulators as rates can be lowered without endangering necessary utility expenditures or profits; iii) private ownership which can reduce political temptation to tamper with utility incentives.

None of these conditions are present in Ontario. Utility responsibilities are changing dramatically. There is upward pressure on costs arising from a variety of factors such as renewable energy and CDM programs, distributed generation and aging infrastructure. Public ownership continually exposes utilities to increased risk of politically motivated micro-management in many dimensions, including with respect to earnings.

The Ontario Energy Board, to its credit, has attempted to meet these challenges using sophisticated tools specifically adapted to the Ontario environment. In order to manage the regulation of many disparate distributors, it has relied upon a variant of incentive regulation grounded in empirically based benchmarking.

However, the growing range of utility responsibilities and capital expenditure programs will make effective regulation ever more challenging and hamper its abilities to control regulatory burden for itself and for the industry as a whole. Furthermore, some utilities require major capital expenditures to refurbish and extend infrastructure. In this connection, multi-year capital program reviews could substantially improve the regulatory process by reducing the need for repeated cost-of-service applications and by smoothing capital expenditures.

The process of streamlining regulation will create additional challenges. Faced with new responsibilities with uncertain associated costs, many utilities may prefer cost-of-service regulation to reduce their risks. Separate regulation of each new activity is burdensome and may, in turn, lead to difficult cost allocation problems.

Fundamental to efficacious regulation is the continued focus on the creation, reinforcement and sustenance of incentives. Incentives might be strengthened by providing a menu of regulatory options to utilities whereby they could choose fast-tracked approvals with lesser information requirements and consolidated applications, or more detailed approval processes.

Further refinements of regulatory processes might also be considered. These include 'objective oriented regulation';[20] stricter constraints on regulatory review by the Ontario Energy Board and on the intervenor process; and, consolidation of the representation of consumer interests. Increased coordination among regulatory entities may also serve to reduce regulatory burden.

D. Reduction in Restrictions and Reallocation of Functions

Prior to industry restructuring, when Ontario municipal distributors were regulated by Ontario Hydro, a number of electricity distributors operated within public utility commissions which provided multiple services. Such commissions exhibited, on average, materially lower costs.[21]

As part of industry restructuring, electricity distribution was separated from other activities which could reside in related but separate entities. This restructuring and separation initiative was premised upon moving towards a competitive electricity market. It too was a product of the deregulatory period in the Ontario electricity industry. However, the deregulatory model has long been abandoned and new themes dominate the industry.

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[20] 'Objective' or 'principle' based approaches have gained traction in financial regulation partly as a result of the financial collapse of 2008. Some of the ideas developed there may be relevant for regulating energy industries.

[21] Statistical estimates from data in the mid-1990s indicated that distributors that were part of public utility commissions exhibited lower average per-customer costs in the range of 6% to 10%. See "Scale Economies in Electricity Distribution: A Semiparametric Analysis", *Journal of Applied Econometrics*, volume 15, pages 187-210, Tables I(a) through II(c).

As the distribution segment of the industry evolves, incorporating increasing amounts of new technology and widening the types of services for which it is responsible, new possibilities for cross-hybridization and economies of scope are likely to emerge. It would be desirable for the regulator and the Government to take a forbearing approach in order that these new possibilities can thrive.

Recently distributors have been given the opportunity to own modest amounts of distributed generation and thus a certain degree of vertical re-integration is permitted. We note that, at present, most utilities[22] have chosen to situate this new generation within affiliates, rather than within the distribution company itself. This may be, in part, to avoid the possibility of regulatory claw-back and scrutiny. At the same time, it may be that economies of scope are being lost. It would be helpful to determine whether, in the absence of regulatory considerations, these utilities might have made their decisions differently.

In short, given that there is no longer a market-based need for separation of certain activities performed by distributors, it would be useful to consider reductions in regulatory restrictions on utility structure and relationships with utility affiliates in order to facilitate the pursuit of scope economies.

Distribution companies have a direct relationship with end-use customers and as such, are particularly well placed to assess the potential for programs that can reduce demand. In earlier years, distributors were responsible for the design of conservation programs. That function now resides with the OPA. Although some CDM activities are best performed in a centralized fashion, distributors can make important contributions not just to the delivery of such programs but also to their design and development. A significant portion of these responsibilities can be devolved to distributors. Utilities should have the option of acquiring their programs from those that are at the forefront of program development. Over time, there is likely be some degree of specialization amongst utilities and primary responsibility for these functions may be passed to the distributor segment of the industry. Administration of CDM program funds and certain research functions would remain with a centralized agency.

6. Utility Objectives: Efficiency, Leadership and Excellence

A. Efficiency: Economies of Scale, Scope and Contiguity

The efficiency of distributing utility and industry structure is affected by at least three important factors. The first is contiguity. The wires business requires a single utility to serve all customers within a contained area and for this reason service franchises have prevailed since the early years of electrification. (This does not imply that a utility must of necessity serve only one contiguous area – it

[22] We understand that PowerStream is an exception.

may serve several areas each of which is contiguous.) Highly fragmented service areas are inefficient and as a result, rarely observed.

A second factor affecting efficiency is the scale of operation. Generally, one would expect larger utilities to be more efficient, that is, until the utility has achieved sufficient size. An important empirical question is the size at which scale efficiency is achieved.

A third factor mentioned earlier, is the scope of operations. By efficiently combining activities from more than one type of service, such as billing, it may be possible to reduce overall costs.

In broad terms, the evidence on these factors is as follows.

- Contiguity economies are not estimated directly in statistical models of electricity distribution essentially because most utilities are either completely contiguous or serve a relatively small number of contiguous areas.[23] However, the importance of contiguity economies can be inferred indirectly by observing the effects of customer density. This variable is incorporated in most analyses of distributor costs and it almost invariably has a statistically significant and material impact. Ontario distributors typically serve contiguous areas, with a few exhibiting a modest degree of fragmentation.

- Scale economies are frequently incorporated in models of electricity distribution. Data are available from Ontario, Norway, New Zealand and a few other countries. These studies vary significantly in their estimates of scale efficiency. However, there is empirical support for the proposition that once a utility achieves sufficient size, unit costs remain relatively flat.

- Scope economies appear in a relatively small number of statistical analyses. However, where they are included, there is support for the proposition that broadening the range of offered services and the scope of activities can materially reduce unit costs.

There is an important caveat to this body of empirical work in that it is based on past data. Thus, judgement must be exercised when using these results in an environment where technology and utility responsibilities are changing, as these factors may influence future economies of scale, scope and contiguity.

The structure of the distribution segment continues to attract attention. The sentiment that there are too many utilities and that substantial efficiency gains could be achieved through consolidation has been expressed in certain quarters. Reflective consideration of this issue would take the following into account.

[23] Some would argue that the very fact that we rarely observe highly discontiguous or overlapping service areas constitutes evidence of the need for contiguity.

First, competitive markets accommodate substantial variation in the sizes of firms, with small firms often prospering alongside large ones. Thus, consolidation, while it may in some respects be appealing, is neither a necessary nor sufficient condition for efficiency in the distribution sector.

Second, by analogy with competitive markets, consolidation within the sector should not be an end in itself, but should be driven by the benefits that would derive therefrom.

Third, a number of factors may increase the incentives for further consolidation. Integration of distributed generation, smart-grid development, increased ownership of generation facilities, and conservation and demand management programs may create previously unavailable scale and scope economies which would give larger utilities a cost advantage. If this is the case, mergers are more likely to occur spontaneously without any additional incentives.

Fourth, contiguity is likely to continue to play an important role in determining which utilities decide to amalgamate.

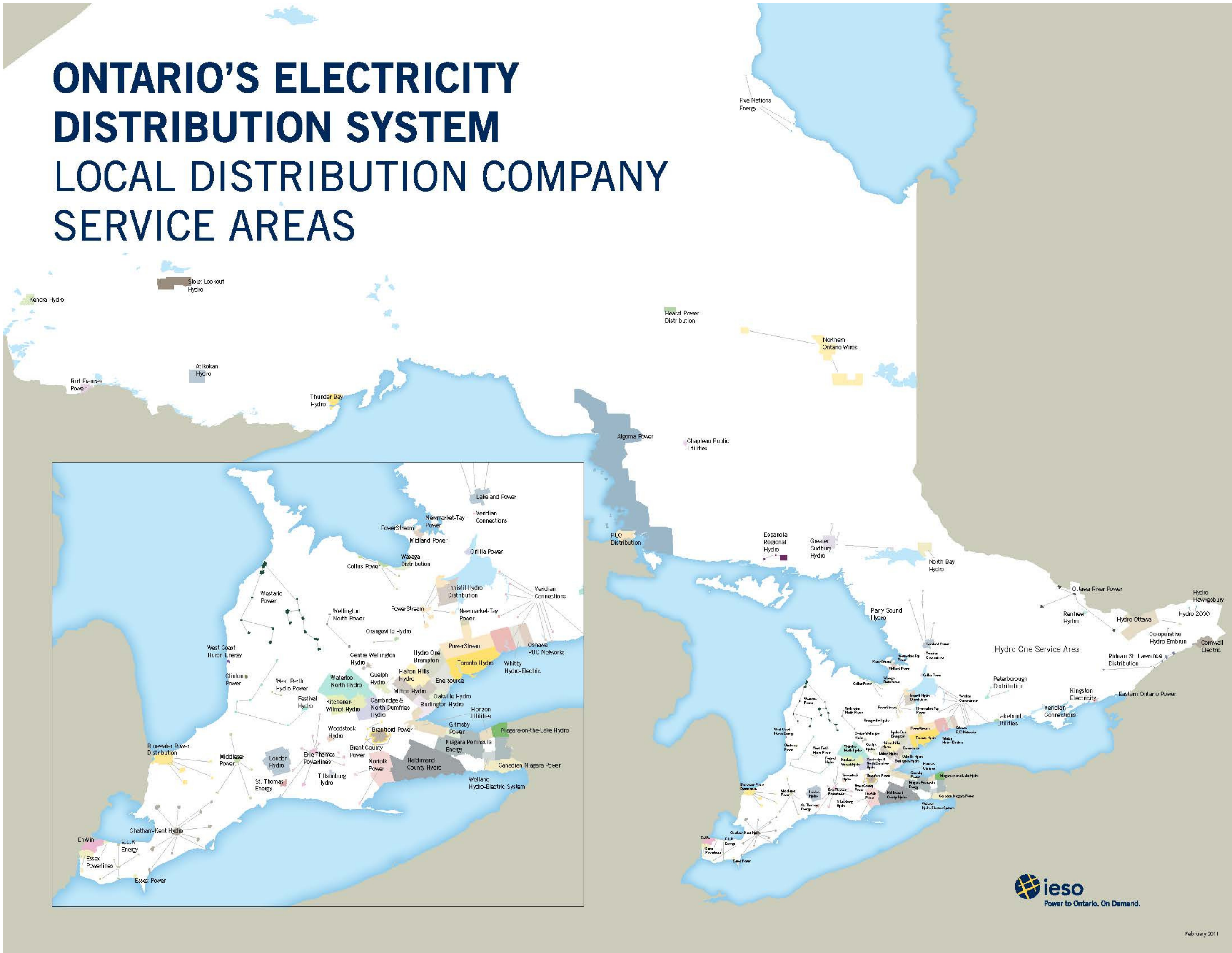
Fifth, as suggested earlier, the empirical evidence that is available does not support wholesale consolidation in the distribution sector. This does not imply that mutually advantageous consolidations are not available.

Where there are contiguity or scale gains to be made through consolidation, the natural question becomes how to achieve them. In subsequent sections we will discuss two possible approaches: an evolutionary approach whereby utility structure and consolidation continues to evolve; and, a regionalization approach under which distribution throughout the Province is restructured so that there are a relatively small number of regional distributors. In our view, additional scope economies can be realized under either approach, so long as regulatory authorities are willing to take a light-handed approach on this issue.

In some cases, mergers may, on balance, be unappealing because of rate or cost impacts. For example, labour costs at small utilities may be lower because living costs in the municipality are lower. Absorption into a larger utility may lead to a substantial increase in labour costs. In such cases, there may be alternative mechanisms by which certain economies may be captured, such as cooperative efforts amongst groups of utilities or through outsourcing.

In considering the efficiency of firms within an industry, it is also necessary to assess their dynamic efficiency; that is, their ability to respond and adapt to a changing environment. In competitive markets, firms that are unable to adapt sufficiently quickly fall by the wayside or are absorbed by other, more successful firms. Electricity transmission and distribution are natural monopolies. Nevertheless, Ontario transmission and distribution companies have been able to evolve and adapt to changing demands. Well-conceived incentive regulation can ensure that they continue to do so in the future.

Figure 1


ONTARIO'S ELECTRICITY
DISTRIBUTION SYSTEM
LOCAL DISTRIBUTION COMPANY
SERVICE AREAS
Kenora Hydro
Fort Frances Power
Atikokan Hydro
Thunder Bay Hydro
Five Nations Energy
Hearst Power Distribution
Northern Ontario Wires
Algoma Power
Chapleau Public Utilities
PUC Distribution
Espanola Regional Hydro
Greater Sudbury Hydro
North Bay Hydro
Parry Sound Hydro
Ottawa River Power
Renfrew Hydro
Hydro Ottawa
Hydro Hawkesbury
Hydro 2000
Co-operative Hydro Embrun
Cornwall Electric
Hydro One Service Area
Rideau St. Lawrence Distribution
Peterborough Distribution
Kingston Electricity
Eastern Ontario Power
Veridian Connections
Lakefront Utilities
Lakeland Power
Newmarket-Tay Power
Veridian Connections
PowerStream
Midland Power
Orillia Power
Wasaga Distribution
Collus Power
Innisfil Hydro Distribution
Westario Power
Wellington North Power
Orangeville Hydro
West Coast Huron Energy
Centre Wellington Hydro
Hydro One Brampton
PowerStream
Oshawa PUC Networks
Toronto Hydro
Whitby Hydro-Electric
Clinton Power
Guelph Hydro
Halton Hills Hydro
Enersource
West Perth Hydro Power
Waterloo North Hydro
Milton Hydro
Oakville Hydro
Festival Hydro
Kitchener-Wilmot Hydro
Cambridge & North Dumfries Hydro
Burlington Hydro
Horizon Utilities
Woodstock Hydro
Brantford Power
Grimsby Power
Niagara-on-the-Lake Hydro
Niagara Peninsula Energy
Bluewater Power Distribution
Middlesex Power
London Hydro
Erie Thames Powerlines
Brant County Power
Norfolk Power
Haldimand County Hydro
Canadian Niagara Power
St. Thomas Energy
Tillsonburg Hydro
Welland Hydro-Electric System
Chatham-Kent Hydro
EnWin
E.L.K. Energy
Essex Powerlines
Essex Power
ieso
Power to Ontario. On Demand.
February 2011

B. Leadership in Advanced Technologies

Smart-grid based innovation.

Advances in information and communication technologies have created an environment where various new technologies can now, or in the near future, be incorporated into electricity grids. These technologies have the potential of improving operations in multiple dimensions by:

- increasing the efficiency with which power is delivered,
- reducing costs through remote sensing and automated recovery,
- shortening response times in the event of malfunctions,
- facilitating the integration of distributed generation, renewable resources, storage and electric vehicle charging technologies, and
- improving overall system security.

Among the important enabling technologies are devices which permit simultaneous measurement of key characteristics at numerous points throughout the grid. Information of this type can provide system operators with earlier warnings of any system instabilities which may be emerging and require attention. [24]

Ontario is at the forefront of this technological frontier with legislators, regulators, utilities and other corporations and organizations taking a direct role. The Ontario Smart Grid Forum[25], under the auspices of the IESO, draws on representatives from various companies and organizations, including Ontario transmission and distribution utilities.

To ensure cost-effective investments in this area it is important to keep certain factors in mind. First, the overlay of these new technologies onto existing systems must not risk impairment of reliability of service. Second, there are disadvantages to the earliest adopters since this is when prices are usually the highest and the technology has not yet stabilized. Some utilities, for whom these innovations are presently less crucial, may delay their implementation until the technology reaches greater maturity.

Although one would expect that information technology will improve industry productivity, history suggests that this will not necessarily occur quickly. During the 1980s and 1990s, there was a general expectation that computers would have a dramatic impact on productivity of the overall economy. This

[24] The information from these 'phasor measurement units' or PMUs can be synchronized using GPS information. See e.g., http://www.naspi.org/.

[25] See http://www.ieso.ca/imoweb/marketsandprograms/smart_grid.asp and "Enabling Tomorrow's Electricity System, Report of the Ontario Smart Grid Forum", February 2009 http://www.ieso.ca/imoweb/pubs/smart_grid/Smart_Grid_Forum-Report-May_2011.pdf.

was not to be the case. In fact, during the same period that computer technology was becoming ubiquitous, productivity was actually slowing. Acceleration in productivity did not occur until much later during the late 1990s.[26] The electricity industry has the added feature that assets are long-lived so that the capital stock changes slowly.

Longer pay-off periods are not an argument to avoid investment in these new technologies. The expected pay-off period should, however, be considered in regulatory settings where prices incorporate the expectation of productivity growth (e.g., through the "X-factor" in price cap regulation). To summarize, while some smart-grid investments could lead to immediate and observable improvements in productivity, others are likely to have a longer gestation period.

Smart-meters and time-of-use pricing

The nature of electricity systems is such that system operators must adjust supply to meet demand at any given moment. Although operator management of demand has been part of electricity operations for many years, for example through interruptible load, this component has comprised a relatively small proportion of the overall supply-demand balance. The inability to affect demand response over short intervals has generally increased the level and volatility of system costs.

Recent technological advances have created the possibility of greater responsiveness on the demand side. Major categories of technologies which are central to demand response include:

- Meters that record electricity consumption by time-of-day enable the implementation of *static* time-of-use rates which can be calibrated to approximate *expected* system costs averaged over time.
- Information systems that transmit current system costs to consumers enable the implementation of *dynamic* time-of-use rates which reflect *actual* system costs.
- Information and control systems can facilitate end-user response to real-time prices. These include 'apps' which permit integration of price and usage information in real time and smart appliances which can automate response to such information.

Ontario has engaged in Province-wide installation of smart meters. This has been a costly undertaking but the payoffs can be significant.

[26] See, for example, Brynjolfsson, Erik (1993). "The productivity paradox of information technology". Communications of the ACM 36 (12): 66–77.

Implementation of time-of-use rates has begun. Nevertheless, there are important and ongoing issues relating to their use. Time-of-use experiments have been conducted for many years and in many jurisdictions, but the results vary significantly and the determination of optimal TOU rates remains an ongoing project. Among the central issues are the elasticity of response and the importance of real-time information.

Studies conducted elsewhere suggest that the ratio of peak to off-peak prices is a critical determinant of customer response and that real-time pricing can lead to responsive participation by end-use customers.[27]

A number of Ontario utilities have conducted time of use pricing experiments and analyses. These include Ottawa Hydro, Veridian Connections, Oakville Hydro, Newmarket Hydro and Hydro One. The results have been generally supportive of a material customer response to time-of-use pricing. Future analyses that incorporate further refinements will no doubt help to inform better use of these technologies.[28] An accurate understanding of customer response to increasingly sophisticated technology can be of great value. For example, Ontarians are already, or will soon be, on time-of-use rates. The installation of the required metering technology is effectively a sunk cost. It would be extremely valuable to determine the *incremental* system and customer benefits arising from the implementation of the next level of technology which would permit real-time transmission of price information to customers.

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[27] For a recent review see "Rethinking Prices. The Changing Architecture of Demand Response in America", A. Faruqui, R. Hledik and S. Sergici, Public Utilities Fortnightly, January 2010, pages 30-39. Additional references are provided in an appendix to this report.

[28] Most analyses conducted are based on a sample of voluntary participants, even if the initial sample is randomly selected. Thus it is unclear whether the results are an accurate reflection of the general population as there may be a "self-selection problem". It is also often difficult to determine whether variations in consumption patterns are due to electricity rate design or to other factors such as weather and demographics. Statistical techniques such as regression modeling are typically used to estimate the impacts of these various factors. However, data often limit the accuracy with which they can be estimated.

Both of these problems can sometimes be remedied given suitable naturally occurring data (hence the term 'natural experiments'). For example, contemporaneous comparisons of households that are in close proximity, some of which are on compulsory TOU rates and others that are not, are especially informative because they automatically control for factors such as weather and location.

A recent study on neighbouring California communities facing different rate designs has yielded some important conclusions. See "Do Consumers Respond to Marginal or Average Price? Evidence from Nonlinear Electricity Pricing", Koichiro Ito, University of California, Berkeley. That study suggests that consumers respond to *average* electricity prices, not to the *actual* or *marginal* prices that they face. Such conclusions have important implications for rate design; http://ecnr.berkeley.edu/vfs/PPs/Ito-Koi/web/JMP_Koichiro_Ito_UC_Berkeley_2010_1122.pdf.

In Ontario, TOU prices are being implemented on a staggered basis and, as a result, there may be opportunities for valuable data of this type to emerge.

A realistic assessment of the response is further complicated by the difficulties in predicting the effectiveness of 'apps' which can be used by end-use customers to adapt consumption patterns to real-time information and penetration rates of smart appliances and control devices.

Keeping in mind that early implementation is not necessarily optimal in all cases, knowledge of the resulting benefits could inform both the timing and the type of systems that will ultimately be installed.

In all these areas, Ontario distributors can play an important continuing role in data collection and analysis, in rate design and in post-implementation assessment.

Renewable generation and distributed technologies

Policies and legislation passed by the Ontario Government have dramatically increased the role that renewable technologies will play in forthcoming years. The basis for negotiating renewable supply has changed fundamentally. Non-utility generation programs of the 1980s and 1990s were based on avoided costs. That is, contracts that were being negotiated with prospective generators were based upon the costs that Ontario Hydro could avoid. In contrast, rates for the FIT and microFIT programs were based upon estimates of the costs that wind and solar providers would need to recover in order to enter the market.[29]

The supply mix directive, issued by the Minister of Energy in February 2011, envisions over 10,000 MW of non-hydraulic renewable energy capacity in the Province by the year 2018.[30] This will represent about 10 to 15 per cent of total Ontario generation. Most of this capacity will be comprised of wind and solar generation.

Despite the high current costs of non-hydraulic generation, particularly solar and wind energy, pressures to further increase their share are likely to intensify. First, Ontario's use of coal in the generation of electricity is to end in 2014, increasing the need for 'clean generation'. Second, whatever the objective risks associated with nuclear generation, the events in Japan in March 2011 are likely to have negative implications for nuclear generation through increased costs, greater regulatory hurdles and adverse public opinion.[31,32]

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[29] For a recent review see "Ontario Feed-In Tariff Programs", A. Yatchew, A. and A. Baziliauskas, *Energy Policy*, 39 (2011), pages 3885–3893.

[30] Letter from the Minister of Energy, Brad Duguid to the CEO of the OPA, Colin Andersen, February 17, 2011.

[31] On May 29, 2011 in the wake of the events at Fukushima and consequent impacts on public opinion, the German Environment Minister announced that nuclear generation of electricity would end no later than 2022. Wall Street Journal, May 31, 2011, "Germany to Forsake Its Nuclear Reactors".

[32] Natural gas electricity generation may also receive a boost from the events in Japan. Shale gas which is extracted using 'fracking' technologies has produced a paradigm shift in natural gas markets. Though there are

As the share of variable energy resources increases, the challenges of balancing the system also increase mainly because of the variability and difficulty in predicting supply from these sources. To accommodate them, increased transmission and reserve capacity may be required.

A significant portion of renewable supply will consist of small-scale distributed generation projects. In order to successfully integrate this supply without compromising reliability, smart distribution system technologies will be required. In due course, energy storage technologies may reduce the variability and unpredictability of wind and solar energy. However, such enabling technologies are not yet available at cost-effective prices.

C. Excellence in Reliability and Customer Service

In recent years, investment in transmission has been driven by four major factors: the Ontario Government policy to eliminate coal-fired generation; the need to improve grid reliability; the connection of renewable generation; and, the need for improved interconnection with neighbouring jurisdictions.

In the near-term, further transmission investments are required to accommodate renewable generation, and to ensure supply capacity and reliability. In future years, further investments may be required as the share of renewable capacity grows. The construction of renewable facilities in more remote locations and the integration of energy storage could also increase transmission requirements.

On the distribution side, investment is being driven by the need for replacement, expansion and upgrades. The Ontario electricity distribution industry collectively holds a portfolio of assets of widely ranging ages. Engineering as well as statistical analyses suggest a trade-off between replacement, refurbishment and maintenance costs. These processes must be undertaken on a continuous basis if long-term costs are to be minimized and reliability is to be ensured.

Distribution utilities need to be able to upgrade infrastructure to accommodate distributed generation and to take advantage of evolving technologies. In this connection, regional cooperation in transmission and distribution planning is essential.[33]

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environmental issues associated with this technology, the dramatic impact on price and supply of natural gas is likely to enhance its appeal.

[33] The Ontario Energy Board is presently "holding a consultation aimed at promoting the cost-effective development of electricity infrastructure through coordinated planning on a regional basis between licensed distributors and transmitters". http://www.ontarioenergyboard.ca/OEB/Industry/Regulatory+Proceedings/Policy+Initiatives+and+Consultations/Regional+Planning

Growth in demand for electricity, albeit at a reduced rate, is also an important investment driver. Current forecasts suggest that on average, demand will grow at less than 1% per year over the next two decades.[34] The growth will not be distributed evenly across distribution utilities; for example, utilities that serve expanding suburban areas are likely to experience faster demand growth.

Current long-term demand forecasts may be low if penetration rates of electric vehicles or other electricity intensive technologies are higher. As suggested earlier, the *share* of electricity in total energy consumed has been growing and is projected to continue to grow. On the other hand, if the price of electricity increases more quickly than currently forecast, there will be a dampening effect on demand.

Finally, distributors are the direct interface between the electricity supply chain and the end-user. In today's changing electricity environment, informing and educating customers is even more essential. Some utilities have already put in place on-line systems which allow customers to view their recent consumption patterns and the prices that they pay.

7. Alternative Models

A. Models and Scenarios

We consider three stylized scenarios or models for the wires segment of the Ontario electricity industry. The 'status quo' which assumes continuation of the present industry structure and regulatory and legislative framework; an 'evolutionary model' which builds on the existing structure, allowing it to evolve; and, a 'regionalization model' under which distribution and transmission are separated and distribution is reorganized so that the Province is served by a reduced number of contiguous ('shoulder-to-shoulder') utilities.

Each model is evaluated using criteria which are based on the challenges that the wires industry faces now and in the future and the relevant guiding principles that have been set forth earlier.

B. Evolutionary Model

Under this scenario, the present industry structure would be permitted to evolve over time, with suitable incentives.

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[34] "Demand is expected to grow moderately (about 15 percent) between 2010 and 2030." ISPS Planning and Consultation Review, May 2011, page 1-3.

It has been suggested by some that Ontario has too many distributors and that there are substantial scale economies that could be realized through consolidation within this sector. Presently, Ontario is served by approximately 80 distributors of widely varying size. This is far fewer than was the case in the 1990s when there were over 300 distributors. To determine whether there are unrealized scale economies requires an estimate of the size at which scale efficiency is achieved. If we take the threshold to be say 50,000 customers,[35] then there are 17 distributors exceeding this level and together they serve over 80% of Ontario customers. The 9 distributors with 100,000 or more customers serve 70% of Ontario customers. On this basis, wide-ranging consolidations are not likely to result in major savings in distribution costs, particularly not in major metropolitan areas.

A separate issue is whether, going forward, there will be new scale economies to be realized as distributors become progressively more involved in implementing smart technologies and ownership of distributed generation. This is an open question, the answer to which cannot be preordained from existing data. An evolutionary approach whereby utilities find efficiencies on a mutually consensual basis through voluntary consolidations or cooperative ventures would therefore seem to be preferred.

C. Regionalization Model

This scenario contemplates restructuring of the wires industry in Ontario in two steps. In the first step, transmission would be separated from distribution. In the second step, distribution would be restructured into a reduced number of contiguous, 'shoulder-to-shoulder' utilities which would cover the Province in its entirety.

One of the principles which underlies this model is the potential for gains arising out of economies of contiguity. The technology of electricity distribution is such that it is more efficient to serve customers that populate a contiguous self-contained area. A single utility may serve multiple areas, but it is preferable if each of its service areas is of sufficient size so that economies of scale are also realized.

It is worthwhile to consider the extent to which the geographic pattern of Ontario distribution meets the contiguity criterion.

- The largest concentration of population is in the Golden Horseshoe which is served by a series of contiguous utilities. Collectively these represent approximately 45% of customers in Ontario.
- Hydro One Networks serves approximately 25% of Ontario customers.
- Several utilities provide service to multiple non-contiguous areas. An expansion of their service territories to create contiguous zones to the extent possible may be worthy of consideration.

[35] Past estimates based on Ontario data find that even utilities with 20,000 – 30,000 customers appear to be scale efficient.

- There are a number of utilities which are surrounded by vast expanses of land with very low population density.

Thus, while there would seem to be potential for some contiguity benefits through restructuring, the magnitude of the gain, viewed in terms of its impact on average provincial electricity rates, is unlikely to be large.

This scenario also involves the separation of transmission and distribution. This may in turn lead to some loss in economies of scope arising from this separation.

D. Comparative Assessment of Scenarios

We now turn to a comparative assessment of the alternative scenarios, a summary of which is contained in Table 2. We remind the reader that many variations could be considered. Our intent is to provide an overall guide to three paths that could be undertaken.

One would expect comparable levels of investment in regulated facilities under all three scenarios mainly because investment is driven by the need for refurbishment, expansion and modernization. This type of investment requires regulatory approval and all parties recognize the importance of maintaining reliability levels. Under all three scenarios, the industry will be under continued cost pressures and restraints due to rising electricity prices and these will influence the timing and perhaps the levels of regulated investments that flow into rates.

Ontario's publicly owned electricity companies have a long tradition of innovation, beginning with the development of Niagara Falls in the early part of the 20th century, early and cost-effective electrification of habited areas of Ontario, and the development of a unique nuclear technology. Most recently the electricity industry in Ontario, both private and public, is involved in multiple research initiatives in renewable and smart technologies.

One can expect conservation and demand management programs to continue at comparable rates under all three scenarios as these programs are ultimately controlled by the regulatory authorities. Each scenario may result in differing approaches to achieving the targets. Under the evolutionary scenario, one might expect a greater degree of out-sourcing or program delivery through cooperative ventures. On the other hand, under the regionalization model one might expect a larger in-house component to program design and delivery.

Under all scenarios, the integration of variable energy resources constitutes a major challenge for distributors and for the transmission system. At present, it would not appear that any of the three scenarios is particularly better suited to addressing these issues.

There is some potential for gains from consolidations, though these would need to be evaluated on a case-by-case basis. Widespread enforced consolidations are unlikely to result in major scale gains, as most customers are served by utilities which have evidently achieved scale efficiency. There is potential for gain in contiguity economies as there is some fragmentation within the industry (see Figure 1). The evolutionary scenario, endowed with proper incentives, is well suited for identifying and monetizing these benefits. If optimal boundaries could be identified, the regionalization scenario, could realize contiguity gains on an accelerated basis.

Economies of scope, through increased flexibility in internal firm structure and operation can be realized under all scenarios, as long as the regulator approves.

A major consideration on the cost side would appear to be the resources that would be required to implement alternative scenarios. Continuation of the status quo incurs, by definition, no restructuring costs, but losses suffered through the failure to incorporate efficiencies in a timely fashion, could be significant. Transition costs under the evolutionary model are likely to be modest. More importantly, they would be 'self-justifying' so long as the changes were voluntary and therefore undertaken only if the net benefit were positive. The regionalization model would consume significant financial resources. Moreover, it is likely to be opposed by a number of utilities.

The consequences for regulation differ moderately for each scenario. Under the regionalization scenario, there would likely be some reduction in regulatory burden borne by the regulator as the number of utilities would decline. However, regulatory convenience should not be a major driver of industry structure.

The responsiveness of utilities to Provincial government policy and directives is likely to be comparable under all three scenarios. However, if under the restructuring scenario, small municipal utilities are merged into large utilities, responsiveness to local communities may decline.

There are of course numerous hybrids and other industry models that could be considered. In Ontario, the population is heavily concentrated in small geographic areas with vast expanses of low population density, particularly in the north. This in turn may suggest a variant of the regionalization model where low density areas continue to be served by a combined transmission-distribution entity while more populated areas are served by regional distributors. To the extent that there are economies of scope in combined transmission and distribution operations in areas of low population density, these would continue to be retained.

Table 2: Summary Evaluation of Alternative Models			
	Status Quo	**Evolutionary Model**	**Regionalization Model**
A. Infrastructure Investment	Levels of regulated investment are expected to be comparable in all three models.		
B. New and Emerging Technologies	Implementation of new technologies will continue, but probably not at a pace that would occur under the other models.	These models facilitate adaptive and innovative responses to a changing technological environment.	
C. Conservation and Demand Management	Implementation of CDM will continue to achieve targets.	Likely greater reliance on cooperative ventures and out-sourcing.	Larger in-house component to program design and delivery.
D. Distributed Generation	Integration of variable energy resources is challenging under all models.		
E. Costs			
Economies of scale	Consolidations seem to be in a holding pattern at this time.	Incentives which lead to further consolidations may yield additional scale economies.	Judiciously assembled regional utilities may improve scale economies.
Economies of contiguity	Some fragmentation likely to continue to exist.	Incentives which lead to consolidations of neighbouring utilities may yield additional contiguity economies.	Restructuring of distribution into 'shoulder-to-shoulder' utilities could optimize contiguity economies.
Economies of scope	Unexploited scope economies result in costs higher than necessary.	Potential gains in horizontal economies of scope if regulator agrees. Separation of transmission and distribution may lead to some losses in scope economies.	
Transition costs	No transition costs.	Modest transition costs incurred on an as-needed basis.	Significant restructuring costs. Potential resistance from some utilities.
F. Regulation and Government Policy			
Regulatory burden	Increasing regulatory requirements constitute a major burden for utilities.	Streamlining regulation, multi-year capital plans and improved intervenor processes may reduce overall burden.	
Regulatory efficacy	Expanded role of government	Proper division of responsibilities and decision-making as between	

	increases regulatory uncertainty and may lead to sub-optimal decisions.	Government, regulators and utilities should improve efficacy of regulation.

8. Conclusions and Recommendations

Ontario is at the forefront in a number of areas of electricity industry development. This, combined with an industry structure that differs from those in most jurisdictions, suggests that one cannot simply look for formulaic solutions or templates elsewhere.

We have evaluated three alternative scenarios for the wires segment of the industry – the status quo, an evolutionary model and a regionalization model. There are multiple nuanced differences among these models: no scenario is uniformly better than the others. However, the benefits of radical change at this time do not seem to be justified given the costs and potential loss of focus on key objectives.

The Ontario electricity industry underwent major changes during the last decade and a half, at very considerable cost. In hindsight, given where the industry is today, the necessary changes could have been achieved at much lower overall costs. The regionalization model also involves considerable transition costs. In our view, the evolutionary model represents the preferred approach.

Earlier we suggested three themes which can help to organize our thinking. We now use these to organize our additional conclusions.

Function:

Transmission and distribution functions are changing and emerging information-based technologies require the development of new functional capabilities. Foremost among these are the incorporation of distributed generation and the integration and expanded utilization of smart-meter and smart-grid systems.

Structure:

The internal structure of wires companies should be permitted to evolve in order to exploit potential economies of scope. The separation of wires functions from other activities, that is unbundling, was sensible at a time when the main objective was to open the industry to maximum competition. That model has long since been abandoned and combining some activities, to the extent that it reduces costs, may be appropriate.

The best available empirical evidence indicates that the most promising path for evolving the structure of the distribution segment of the industry is to proceed on a voluntary basis. Strategic and advantageous mergers will occur so long as there are sufficient incentives to do so. Utilities that are at the forefront of developing new and better business models will lead the way.

The structure of agencies that affect the wires segment bears further consideration. The IESO was a creature of the deregulatory phase in the industry; the OPA a creature of the re-regulatory phase. Both serve important purposes within the industry. However, a merger of the two entities, or further rationalization of functions between them to reduce overlap, could lead to more efficient decision-making within the industry.

Regulation:

Regulatory burden has grown steadily over the last decade and on its present path is likely to grow further. The intervenor process, although it is an important part of the review process, has become increasingly burdensome. Capital expenditures to replenish depleted capital stock, new conservation programs, investment in systems which can accommodate distributed generation and emerging information technologies will increase demands on regulators and wires companies.

Improving and streamlining the regulatory process will be essential, but this responsibility does not reside with the regulator alone. Utilities may need to accept more risk and responsibility in order to save regulatory resources. At the same time, they should be provided with a clear opportunity to operate their businesses with as little regulatory and political intervention as possible. One useful step that can be immediately undertaken is the development of a unified position, shared by wires companies, on the means for implementing smart-grid solutions and the appropriate regulatory treatment.

There has been considerable attention focussed on smart-grid technologies and Ontario is one of the jurisdictions at the forefront in this area. It should be recognized that these technologies alter the risk profile of distributing utilities which, when these risks achieve materiality, should be reflected in the returns that utilities are permitted to earn.

It is natural to ask whether, after a decade of structural and legislative changes, we are in a better place. Considerable resources have been expended on restructuring resulting in a substantially more elaborate institutional structure. Concomitantly, the regulatory and administrative burden has increased dramatically for much of the industry. The broader objectives of decentralization and deregulation have, in many ways, fallen by the wayside.

Perhaps the most important lesson from the past is not to jump on the next trend too vigorously without careful reflection. Ratepayers have limited capacity for costly changes that prove to be lacking in efficiency or effectiveness. This, in turn, can endanger legitimate long-term objectives. In short, political capital must be expended wisely. The previous government embarked on a costly marketization experiment. The present government has embarked on a path fundamentally driven by the decarbonisation of the electricity sector. Both are laudable objectives. However, an arms-length relationship between the political masters that set policy and the regulators who have deep institutional knowledge of the industry is the preferred approach.

Summary of Recommendations

1. The relationship between the Provincial Government, the electricity industry and its regulatory agencies should be reviewed. This report proposes that an arms-length relationship is best suited to promoting the most effective decision-making within the industry, long-term efficiencies and a more predictable policy, regulatory and investment environment. If, this conclusion is supported by the review, appropriate modifications to legislation would need to be implemented.

2. Major restructuring of transmission and distribution is not warranted at this time. An evolutionary approach characterized by increased flexibility, well designed incentives, consensual change and low transition costs is the preferred model.

3. Regulatory restrictions which limit utilities from finding cost savings through expanded economies of scope should be relaxed to the extent possible.

4. Utilities should continue to seek improved efficiencies by taking advantage of possibilities for improved economies of scope and through mutually beneficial consolidations which may yield additional scale and contiguity economies.

5. A merger of the IESO and OPA or rationalization of their respective activities should be considered.

6. Regulation of the wires portion of the electricity industry should be reviewed. Utilities should have the option of seeking multi-year capital approvals. Consideration should also be given to streamlining the regulatory process where possible and providing utilities with broader regulatory options including expedited reviews.

7. Utilities should be given greater opportunities to design and develop their own CDM programs. Eventually, utilities may take on primary responsibility for these functions. Program fund administration and research should remain with a centralized agency such as the OPA or its successor.

8. An accurate understanding of customer response to increasingly sophisticated technology can be of great value. Further studies and analyses of advanced metering technologies and appropriate rate designs should be conducted.

9. Utilities should continue expanding their functional capabilities to accommodate new and emerging technologies such as smart-grid systems and distributed generation. Implementation of these technologies should be achieved on a cost-effective basis as determined by individual utilities and the regulator. Incentive based approaches should be implemented where possible.

10. The essentiality of electricity to the economy and to society mandates the continuation of the record of excellent service and reliability. This will require continuing investment in the wires networks.

Appendices

A. References and Information Sources

A Selection of Useful Websites

1. Ontario websites:
   a. Ontario Energy Board http://www.ontarioenergyboard.ca/OEB/Industry
   b. Independent Electricity System Operator http://www.ieso.ca/
   c. Ontario Power Authority http://www.powerauthority.on.ca/

2. Sites associated with academic institutions:
   a. MIT Center for Energy and Environmental Policy Research http://web.mit.edu/ceepr/www/
   b. MIT Grid Study – forthcoming, fall 2011; preliminary presentations available at http://web.mit.edu/ceepr/www/about/May2011/may%20handouts/schmalensee.pdf and http://web.mit.edu/ceepr/www/about/May2011/may%20handouts/rose.pdf
   c. Electricity Policy Research Group, University of Cambridge http://www.eprg.group.cam.ac.uk/
   d. Harvard Electricity Policy Research Group, http://www.hks.harvard.edu/hepg/index.html
   e. Energy Institute at Haas, University of California, Berkeley, http://ei.haas.berkeley.edu/leadership.html

3. Other sites:
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B. Private Equity and Privatization Considerations

In this section we briefly consider some of the issues and consequences relating to privatization in the wires segment of the industry. Changes to legislation and regulatory policy would be required if widespread privatization were to occur. It may be also necessary or desirable to first complete certain restructuring initiatives. For example, it may be appropriate to first separate transmission and distribution and to restructure the distribution segment into a system of contiguous 'shoulder-to-shoulder' utilities.

One of the arguments favouring privatization is the access to equity markets that descendant private utilities would possess. Municipalities (or in the case of Hydro One, the Province) that decide to sell their utilities would benefit from an immediate influx of funds which can be used for other purposes. Partial privatization options, whereby the government owner sells an interest, (but not necessarily a controlling interest), could also be considered and would, if implemented, would provide new funds.

There are regulatory arguments that tend to support the privatization scenario. First, private companies are more responsive to financial incentives. This in turn provides a firmer basis for incentive creation and consequently incentive regulation. Second, private companies have a greater potential for resisting government efforts to control rates by reducing profits.[36] Even a moderate increase in the degree of private ownership of distribution companies in Ontario could have beneficial spin-off effects in providing a bulwark against political interference. This might in turn provide a measure of protection for utilities remaining in public hands as fairness would seem to require that all distributors be treated equally.

Under the privatization scenario, investment in unregulated activities by utilities or their affiliates could be higher as a result of augmented access to funding. For example, one would expect a greater degree of utility ownership of distributed generation under the privatization scenario. Whether privatization would lead to an overall increase in aggregate distributed generation within the Province is unclear as under present programs (in particular, the FIT and microFIT programs) there is an excess supply of applications for facility approval and connection.

There are, however, arguments which would tend to make it less likely that privatization would receive sufficient popular and political support.

First, privatization, and any associated restructuring is likely to be costly. The restructuring that took place in the Ontario electricity industry in preparation for competition in generation was very costly and no doubt contributed to upward pressure on rates. One must ask whether another round of radical changes would benefit the ratepayer and whether the perceived benefits would justify incurring such costs.

[36] For years, Ontario Hydro operated at debt ratios and levels of net income that would be difficult or impossible to sustain in the private sector. More recently, Ontario distributors have been operating in an environment where it has been difficult, for some utilities, to attain reasonable rates of return.

Second, while the empirical evidence is overwhelming that privatization in competitive markets leads to greater efficiencies, the evidence is far less convincing when one focuses attention on natural monopolies. Thus one cannot be assured that substantial cost savings would arise if a substantial portion of distribution were to be privatized. Indeed, electricity prices in the U.S., where most of the electricity industry is privately owned, are generally higher than in Canada.[37]

Third, once private property rights are created, they are difficult to reverse. Thus, privatization might constrain future restructuring of the industry, should it be desirable.[38]

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[37] One of the few analyses of the efficiency consequences of privatization for distribution networks is contained in "The Restructuring and Privatization of Distribution and Electricity Supply Businesses in England and Wales: A Social Cost-Benefit Analysis", Preetum Domah and Michael Pollitt, *Fiscal Studies*, 2001, 22(1), 107-146. That study concludes that there were only minor benefits to customers during the first decade following privatization.

[38] This is sometimes referred to as the "option value of state ownership". See, e.g., "Issues and Options for Restructuring Electricity Supply Industries", David Newbery, University of Cambridge, June 2004.

C. Author Qualifications

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Ph.D. Economics 1980
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Since receiving his Ph.D. from Harvard University in 1980, Adonis Yatchew has been a member of the Economics Department at the University of Toronto. He has also taught at the University of Chicago. He has held visiting research appointments at Harvard University, Cambridge University, Australian National University, University of Melbourne and the National Bureau of Economic Research, among others. He has been a recipient of the Social Science Undergraduate Teaching Award at the University of Toronto.

His principal areas of research are econometrics, energy and regulatory economics. Since 1995 he has held various editorial positions at *The Energy Journal*. He is presently Editor-in-Chief of that publication, a position he has held since 2006.

He has also served on the editorial boards of *Economics Letters* and *Foundations* and *Trends in Econometrics.* In 1997 he jointly edited a special issue of *The Energy Journal* entitled *Distributed Generation*.

Professor Yatchew has prepared numerous analyses and studies of the electricity industry. He has prepared short term market assessments and forecasts of the cellular telephone industry; coauthored studies on oil pipeline cost allocation; and has been involved in major analyses of the natural gas, gasoline and airline industries, among others. He has also prepared testimony on a range of subjects concerning the electricity industry, incentive regulation and in various contractual disputes and litigations.

His book, entitled *Semiparametric Regression for the Applied Econometrician*, 2003, 213 pages, Cambridge University Press, contains many examples from energy economics.

A selection of his publications follows.

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