ROUNDTABLE SERIES 2012:
Session # 1

ELECTRICITY PRICES - HOW WILL CONSUMERS MANAGE?

June 4, 2012, Heaslip House
Centre for Urban Energy

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1.0 Overview and Introduction

1.1 Centre for Urban Energy

The Centre for Urban Energy (CUE) is an academic-industry partnership that is exploring and developing solutions to urban energy issues, such as the advancement of clean energy technologies, energy conservation and demand management, energy storage and smart grids. CUE was founded by Ryerson University with sponsorships from Hydro One, Toronto Hydro and the Ontario Power Authority (OPA). Some of the projects currently being conducted are on flywheel energy storage, utility scale battery storage and understanding the impact of photovoltaics on Hydro One assets. From its inception, CUE has attracted $18 million in funds.

Housed at the Centre for Urban Energy, the Innovation CUE Zone (I-CUE Zone) is a business incubator and accelerator devoted to urban energy. Launched in summer 2012, the I-CUE Zone is focused on the portion of the innovation process between ideation and technology development. Its goal is to help new companies turn their ideas into commercial products, services and/or technologies. The I-CUE Zone is focused on research innovation (applied research in collaboration with industry); business innovation (entrepreneurship); and student innovation (experiential learning).

Companies currently in the I-CUE Zone are Energy Savers, a student-led initiative that allows homeowners to save up to 50 per cent on their energy bills while also significantly reducing their carbon emissions; and Plug'nDrive, a not-for profit organization dedicated to creating public awareness and promoting the environmental and economic benefits of electric vehicles in Ontario.

1.2 Overview of CUE's Role in Hosting Roundtable Series

CUE's role in hosting the Roundtable Series 2012 is to support industry and identify research, technology and/or policy gaps. The CUE has the capability to assist industry stakeholders in bridging some of these identified gaps in the sector through an informed, innovation-focused dialogue, and in a proactive and rationale manner.

1.3 Introduction

Ontario has aging energy infrastructure and has made a commitment to phase out coal-fired generation over the coming years. Nuclear units are nearing the end of their forecasted useful lives; some coal plants have already been retired, and transmission and distribution networks need overdue upgrades or replacement. Further, the new cleaner supply resource mix has characteristics that need to be integrated into the grid – all presenting planning and operational challenges. These changes in the electricity sector are coming at a time when natural gas resources are plentiful and prices are low, and the convergence between energy supplies creates new opportunity.

The investment required to maintain a reliable, affordable and sustainable energy system is going to cost money, which in these economic times is in scarce supply. Ontario consumers are facing significant upward pressure on their electricity bills. This immediate-term increase in electricity prices will create opportunities for end users and policy makers to anticipate and make decisions that will shape investment decisions made by consumers and across the sector.

2.0 The Cost of Electricity and its Constituent Parts

There are a multitude of constituent parts that make up the final bill presented to consumers. This applies to both natural gas bills as well as electricity bills. So, when we say that consumer prices are increasing, what prices are we talking about?

2.1 Electricity Generation and Conservation Costs

There are wholesale market prices that determine the scheduling of generating units in the real-time electricity market. These market price signals allow the Independent Electricity System Operator (IESO) to manage supply in order to meet demand in a minute-by-minute fashion that ensures adequacy and reliability of supply.

In addition to wholesale market prices, there are payments made to parties to ensure availability of generation resources or demand-side resources. These additional costs are required to stimulate investment and availability of new supply resources to meet provincial adequacy requirements, and to meet government policy objectives in building clean and sustainable electricity generation. The total payment to most OPA-contracted generators in the province consists of the sum of the hourly market price plus an additional contract payment. These costs and the costs of electricity conservation programs are recovered through the Global Adjustment Mechanism (GAM).

The GAM also includes payments to Ontario Power Generation (OPG) prescribed nuclear and baseload hydro-electric assets to ensure production costs are met and adequate to maintain a financially viable Crown corporation.

These many cost inputs are shown on the next page (Figure 1.0).

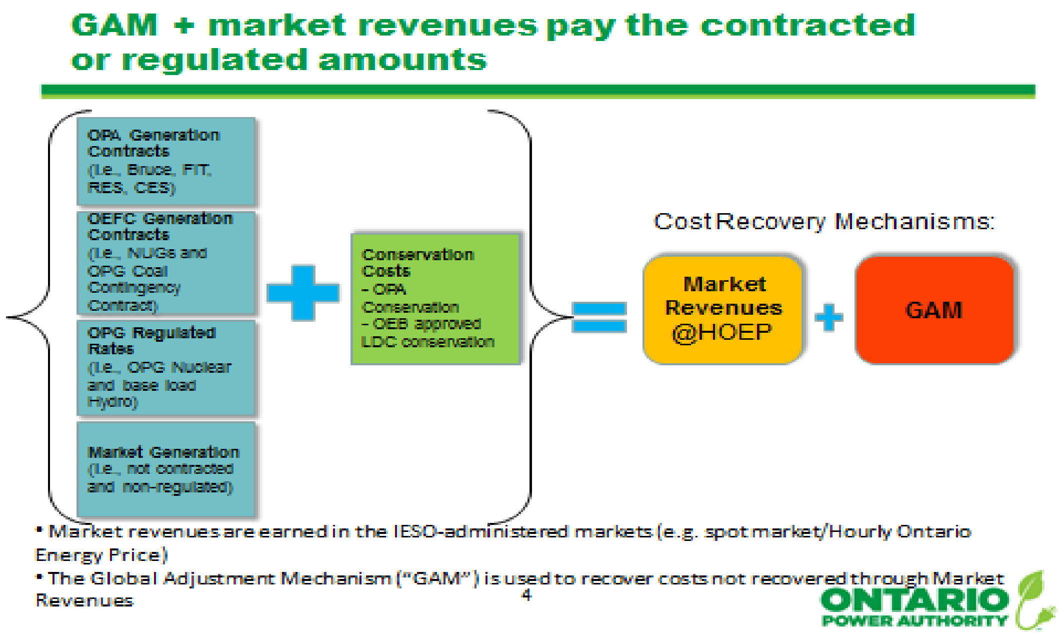

Figure 1.0 - GAM + market revenues pay the contracted or regulated amounts
OPA (2012, June 4). Current and Future Components of Global Adjustment. Centre for Urban Energy, Ryerson University- Discussion Panel Series 2012

These GAM payments are often misunderstood and have been inaccurately attributed to renewable energy procurement only, when in fact there are multiple contributors to the global adjustment costs.[1]

2.2 Recovering GAM

When low-volume consumers pay their costs for electricity, they are charged through the Ontario Energy Board (OEB) administered Regulated Price Plan (RPP), which recovers the charges for the electricity supply and demand cost inputs described above.

Currently, large industrial consumers with peak demands over 5 MW pay the hourly market price plus their share of the Global Adjustment (GA) on the basis of their relative contribution to the five annual peak demand hours over the course of the year. This results in a significant incentive for these large customers to manage and reduce their electricity demand during peak hours. If these customers can realize significant demand reductions during those critical few hours, they stand to pay proportionately less than smaller commercial or residential consumers that cannot realize such demand reductions.

Thus, all consumers make payments to recover the costs of generation and conservation through payments for market costs plus GA costs. Generally, when market prices

[1] Arnold, S. (2012, June 6). *Little-known hydro charge erodes energy efficiency work.* The Hamilton Spectator

decline, the GA costs increase resulting in a constant level of payment to the generator. Therefore, market price trends to not translate into electricity consumer billing trends.

This disconnect in the correlation between market prices and electricity bills can lead to a poor understanding among consumers. For example, in recent years wholesale market prices of 3 to 4 ¢/kWh have been inaccurately compared to the cost of new supply resources that may range from 8 to 10 ¢/kWh or even 44 ¢/kWh.

Referring to market price trends is sending the wrong message to consumers when pressures from new supply resources are putting upward pressure on electricity prices. Ontario's Long Term Energy Plan anticipates that electricity prices will increase by approximately 8 per cent per year or 46 per cent over the five years from 2011 to 2015.

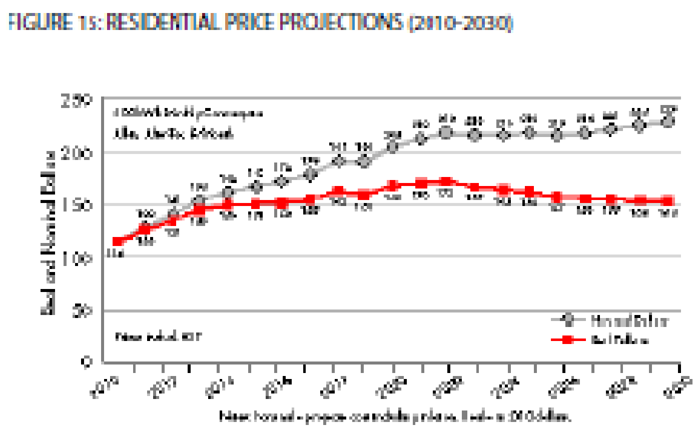

Figure 2.0 - Residential Price Projections (2010-2030)
Ministry of Energy (2010). Ontario's long-term energy plan. Ontario

The myriad of generation and conservation payment arrangements may make sense to some in the industry, but it is complex and not easily explained to the average consumer. The focus on market price trends can be confusing.

Recommendation #1:

A consumer education strategy is needed to increase awareness of the contributors to maintaining a clean and reliable supply of electricity. *The strategy would deliver a consistent message including clear and factual information. Electricity consumers are facing increasing prices for electricity and higher bills. A better understanding of the contributors to the coming costs increases will help manage consumer reaction.*

3.0 Smart Meters

Consumers are now empowered with smart meters to shift their consumption to lower-cost periods of the day. Already approximately 4.8 million smart meters have been installed, representing 99 per cent of the Ontario electricity consumers. 3.9 million consumers are on the OEB RPP Time of Use (TOU) billing. By the end of 2012, it is expected that more than 90 per cent of consumers will be on TOU billing. TOU billing results in consumers being charged different rates for their usage depending on time of day and day of week, and thus should shift their consumption patterns to save money.

3.1 RPP TOU Comparison of Peak and Off-Peak Pricing

The following table is a representation of Toronto Hydro's current TOU rates for residential customers.

Table 1.0- Current Time of Use (TOU) rates for residential customers

Fixed Customer Charge ($/per 30 days)	*$18.93 fixed monthly charge*		
Time of Use Charges (TOU)	**On-peak (¢/kWh)**	**Mid-peak (¢/kWh)**	**Off-peak (¢/kWh)**
Electricity Price	*11.70*	*10.00*	*6.50*
Percent Saving (%) (in reference to On–peak)	***0%***	***14.5%***	***44%***
Transmission Charge	*1.216*	*1.216*	*1.216*
Distribution Charge	*1.520*	*1.520*	*1.520*
Wholesale Operations Charge	*0.63*	*0.63*	*0.63*
Debt Retirement Charge	*0.70*	*0.70*	*0.70*
Total –all in charges	*15.77*	*14.07*	*10.57*
Percent Saving (%) (in reference to On-peak)	**0.0%**	**10.7%**	**33.0%**
Percent Typical Bill Saving (%) (in reference to 800 kWh consumption during On-peak)	**0.0%**	**9.3%**	**28.7%**

The table demonstrates that there is a significant difference between on-peak and off-peak electricity prices (44 per cent). The bundled rate a consumer pays results in a lower total relative savings of 33 per cent in off-peak periods and about 11 per cent in mid-peak periods. When all monthly charges are taken into account for a typical residential consumer using 800 kWh per month, the relative savings potential from shifting time of consumption is further reduced. The table shows that if all 800 kWh of monthly consumption were shifted from on-peak to mid-peak, there would be a 9.3 per cent bill reduction (or a savings of $13.60). And if all 800 kWh of monthly consumption were shifted from on-peak to off-peak, there would be a 28.7 per cent bill reduction (or $41.60 in savings).

The effect of the fixed charges and non-time differentiated charges on the consumer bill serves to reduce the financial benefit of shifting consumption. This reduced incentive to shift consumption may reduce the consumer response to load shift. Further, this RPP TOU rate structure serves as a seasonal average of electricity supply costs, and mutes the real time hourly market price signal experienced by consumers.

3.2 Alternatives to RPP TOU

Well-informed consumers could choose to take advantage of the benefit from load shifting by opting out of the RPP TOU pricing and moving directly onto hourly spot market pricing, with the GA added of course. This would expose them to stronger hourly market price signals, particularly, for example during extreme pricing periods in summer heat waves, consumers could see prices of $1.00 or more per kWh during certain hours. In more typical hours and during periods of low demand, or with surplus baseload generation and negative pricing, consumers could benefit from low prices or even be paid for using electricity.

The prerequisite for a consumer to opt into hourly spot market pricing is that they must have metering suitable for hourly settlement, as determined by the OEB. The OEB could determine that the currently installed smart meters are suitable for hourly settlement, and then local distribution companies (LDCs) would be obliged to offer wholesale spot market pricing to those consumers. This would, of course, carry with it the risk of bill increases if such consumers did not shift their consumption during high price hours.

This opportunity for well-informed consumers to participate in the market could provide real benefits to those consumers, depending on their load profiles, and could provide system benefits to the Ontario demand supply balance. Of course the remaining customer base that does not opt in and take advantage of this opportunity would have to make up any costs for those who reduced their consumption and realized savings through increased RPP costs.

There may be a market opportunity for third parties to offer assistance to low-volume consumers to participate in the hourly spot market, through the use of controls or building automation systems that would control appliances and equipment based on real-time price signals. The load control systems would need to anticipate high priced hours, and assist consumers in controlling their electricity demands during such periods.

Taking advantage of and avoiding the price risks of consumption in very high price periods would be aided by more in-home electricity controls over electric heating and cooling systems, for example.

Recommendation #2:

An assessment is needed to research the potential market opportunity for allowing low-volume consumers to participate in the hourly spot market using their current smart meters*. The hourly spot market price opportunity for low-volume consumers could stimulate innovation and demand for products and services to this segment. There may be a business case for a service provider and end-use customer on the basis of the hourly price signal alone.*

3.3 Additional Considerations and Consumer Impacts

Residential and some larger industrial consumers have some ability to manage their consumption by changing the time of use of their electricity consumption. However, other consumers do not have the same kind of flexibility. For example, how does a small business manage its electricity use? Similarly, how do consumers that have their core business hours from Monday to Friday from 9:00 p.m. to 5:00 p.m. manage? Municipalities, universities, schools and hospitals (the MUSH sector) or small retailers are examples of consumers that to not have a lot of flexibility in their load patterns.

Some progressive companies with larger demands have greater incentive to proactively manage their consumption patterns and are using heating, ventilation and air conditioning (HVAC) controls, lighting controls, and other direct energy usage control technologies that respond to price signals.

Many smaller consumers have not taken such proactive steps and may end up using less electricity, but still face an increasing bill. It will be important for the industry to reach out to these consumers to help them minimize the electricity price impacts on their operations. One of the key messages will be that it is not just about using less electricity, but also about finding ways to use less during the higher priced peak periods.

Consumer transparency will be helpful, but is not in and of itself the answer, as the inputs to consumer costs are complex. Rather, communication to these consumer segments will require clarity and simplicity in messaging.

One strategy that could be deployed would coordinate the timing of the cessation of the Debt Retirement Charge (DRC) and the Clean Energy Benefit. As the DRC is paid down over the next three to six years,[2] there is an opportunity to couple the elimination of the Clean Energy Benefit with the elimination of the DRC from the consumer bill. Clearly, communicating changes to these complex billing components reinforces the opportunity and potential benefit to further develop a consumer education strategy consistent with Recommendation # 1.

[2] Ontario Electricity Financial Corporation (2012,July). *Debt and liabilities.* Retrieved from http://www.oefc.on.ca/debtmanage.html

4.0 Global Adjustment – Now and in the Future

Since the deregulation of the electricity sector in Ontario in 2002, electricity generators in Ontario earn revenues from the wholesale market, and in some cases, directly from end-use customers through bilateral contracts.

4.1 Ontario's Global Adjustment

Most jurisdictions have an electricity market mechanism that triggers payments to generators in addition to hourly market revenues, which are comparable to Ontario's GAM. These payments can be made in the form of capacity payments, payments for the purchase of renewable energy certificates to meet renewable energy policy targets, contingent support payments to generators, or other payment structures that ensure adequacy of supply.

One feature that all of these electricity markets share is that policy makers and market operators recognize that the real-time dispatch price signals are for exactly that – signalling real-time generator dispatch. The market price alone is not sufficient to support and stimulate investment in new generation capacity, and the market revenues must be supplemented to ensure new generation investment to meet adequacy requirements, reliability standards, or sustainability and government policy goals.

Ontario has rapidly entered into a significant number of electricity supply and conservation contracts to ensure ongoing operation of existing generation as well as ensure investment in new policy-driven generation. Most electricity contracts are managed by the OPA, which now administers more than 21,000 MW[3] of supply contracts as well as demand-side contracts. These contracts typically stipulate that costs above market price payments for these generators will be recovered from all consumers through the GAM.

In 2011, the province spent just over $2.8 billion on GA payments. GA is expected to increase and result in payments to generators and fund conservation initiatives in an amount of approximately $13.7 billion per year by 2015.[4]

[3] Ontario Power Authority. (2011). *A progress report on electricity supply*. Toronto, ON

[4] OPA (2012, July). *Current and Future Components of Global Adjustment.*

4.2 Contributors to Global Adjustment

The following slides highlight the relative contributions to the cost of GA in 2011 by generation technology to the total cost of the GA, as well as a forecast of contributions out to 2015, when most of the currently contracted generation will be in service. The 2015 analysis requires a forecast of average market prices, which are assumed to be 1.5 /kWh.[5]

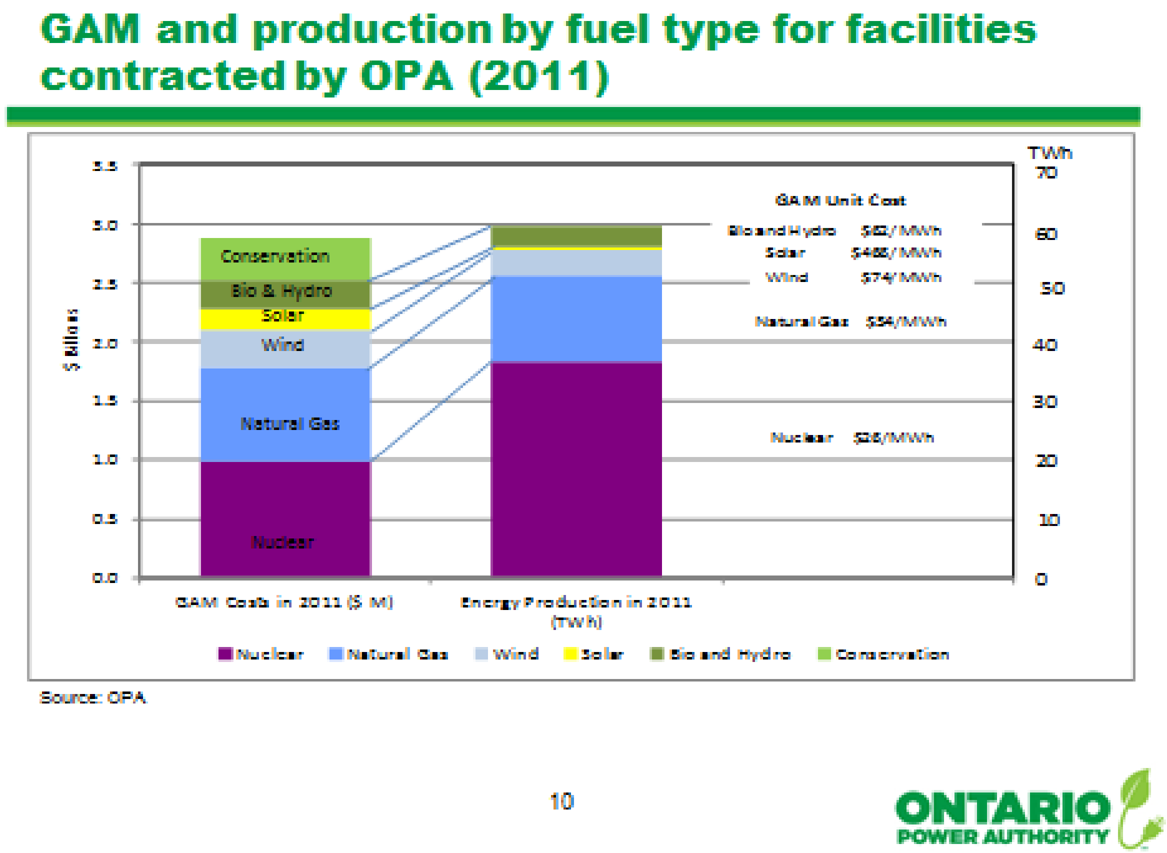

Figure 3.0- GAM and productions by fuel type of facilities contracted by OPA (2011)
OPA (2012, June 4). Current and Future Components of Global Adjustment. Centre for Urban Energy, Ryerson University- Discussion Panel Series 2012

[5] OPA (2012, June 4). *Current and Future Components of Global Adjustment.*

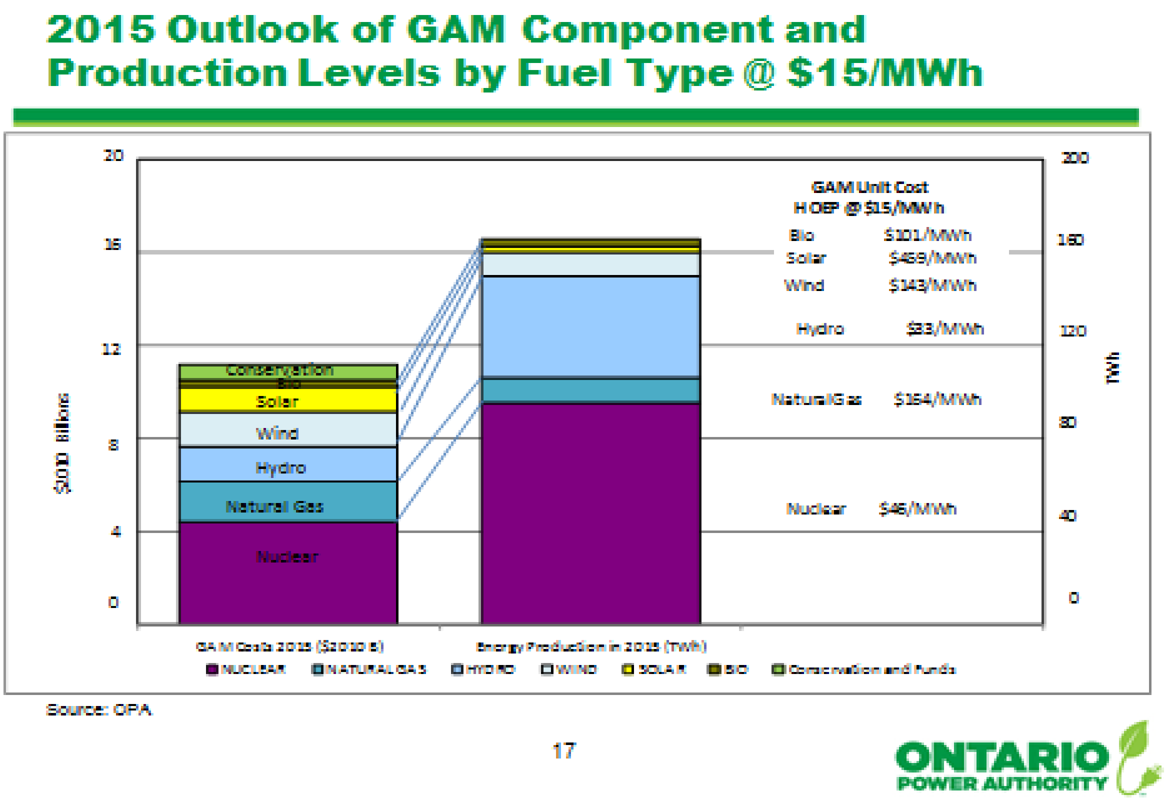

Figure 4.0- 2015 Outlook of GAM Component and Productions Levels by Fuel Type @15/MWh
OPA (2012, June 4). Current and Future Components of Global Adjustment. Centre for Urban Energy, Ryerson University- Discussion Panel Series 2012

In the event that market prices are higher than forecasted in 2015, a lesser proportion of the costs will be recovered through the GAM and proportionately more will be recovered through the market price itself. In any event, the consumer still has to pay it so the sum total of the GA and market price, therefore their bill remains unchanged.

4.3 Global Adjustment Allocation and Recovery

The OPA has contracted more than 21,000 MW of supply resources under a form of government agency power purchase agreement. In addition, much of OPG's baseload generation facilities are subject to prescribed pricing. There appears to be little to no benefit for low-volume consumers in the continued participation in the retail market from electricity retailers offering fixed-price contracts. Retailers' contracts typically offer a fixed price as an alternative to the wholesale market price, but do not include the GA costs. There is little opportunity for smaller volume consumers to have retailers manage their electricity price risk, if the vast majority of supply is under an OPA contract, thus little, if any, price benefit to the consumer.

However, there may be a retail service opportunity created that would combine moving the customer to the wholesale spot market price, as described earlier, with some form of on-site load control to manage electric heating and cooling, or to offer in real-time control of other high-volume electricity end uses.

Currently, most electricity consumers are charged the costs of the wholesale market price plus the GA in every hour of the day. The RPP prices are based on the OEB forecast of the market price plus the GA over a forward-looking 12-month period. The RPP uses a cost recovery mechanism that is built into the TOU rates, which creates incentive to use electricity in lower-price periods in order to encourage that behaviour.

For other non-RPP consumers, and large non-industrial consumers, GA is recovered on the basis of total GA costs divided by the volume of electricity consumed by those non-RPP consumers.

The GA cost recovery mechanism and its allocation to customers is established by Ontario Regulation 398/10, which amended Ontario Regulation 429/04.[6] Costs are by regulation required to be distributed among consumers on a fixed charge per kWh basis regardless of the TOU of the electricity consumption. As previously noted, as the market price signal becomes a smaller portion of the total electricity bill, this limits the ability to send strong price signals to consumers to shift their consumption patterns.

The total share of the consumer bill attributable to GA is growing and the current regulation provides no flexibility regarding its allocation and cost recovery to certain consumers. There needs to be greater flexibility in the methodology for billing and recovering the GA, and taking advantage of the capability that the province has created through the broad deployment of smart meters to Ontario's consumers.

Recommendation #3:

Analysis should be undertaken to assess alternatives to the current fixed charge in c/kWh GA cost recovery mechanism that is prescribed in the GA regulation. *The analysis should assess options and quantify benefits of allowing greater flexibility in GA cost recovery and rate design to achieve efficiency opportunities.*

[6] *E-laws* Service Ontario. Ontario Regulation 429/04, *Electricity Act, 1998*

5.0 Electricity Demand – Past and Future Outlook

Ontario has been hit particularly hard over the past number of years on its traditional manufacturing base. Many industrial and manufacturing activities formerly undertaken in Ontario have now moved offshore to lower-cost labour markets. As a result of this load destruction, Ontario's electricity demand has not returned to previous levels. The total Ontario electricity demand in 2005 was 157,000 GWh and by 2011, this had decreased to 141,500 GWh.

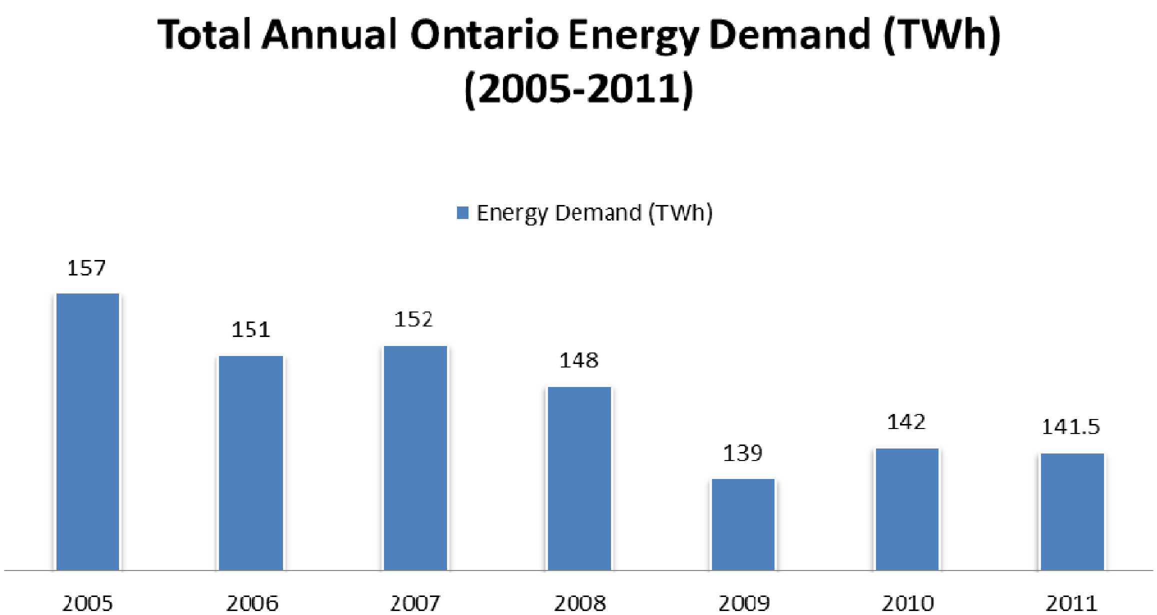

Figure 5.0- Total Annual Ontario Energy Demand (TWh)
The Independent Electricity System Operator (2012, June). Demand overview. Retrieved from http://www.ieso.ca/imoweb/media/md_demand.asp

Looking forward, the Ministry of Energy's Long Term Energy Plan identifies relatively flat load growth, with total electricity demand staying below 150,000 GWh out to 2020 under the low and medium growth scenarios.

Flat demand has the effect of reducing the total volume of electricity over which to spread new costs for needed generation, transmission, distribution and other load management resources.

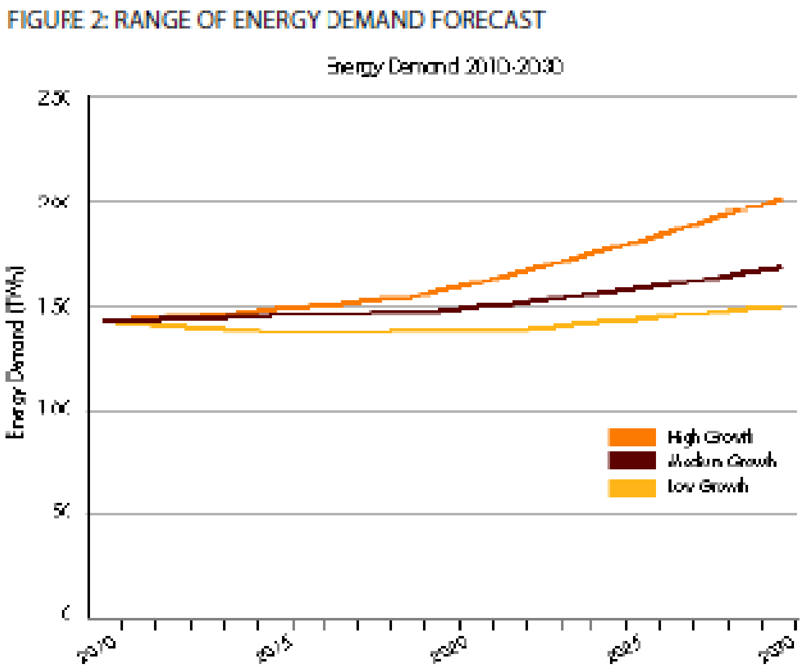

Figure 6.0- Range of Energy Demand Forecast (2010-2030)
Ministry of Energy (2010). Ontario's Long-term Energy Plan. Ontario

6.0 Regulated Utilities, Aging Infrastructure and Consumer Costs

The hourly spot market price plus the GA costs account for approximately half of the consumer bill, the other half represents charges for monopoly services that are regulated by the OEB.

LDCs and transmitters such as Hydro One are being asked to do more with less. Infrastructure that has been in operation for decades – in some cases 40 or more years old – needs replacement. There are expectations that newly acquired infrastructure assets will have greater capabilities than the older equipment to allow for the provision of new consumer services and functionality.

In some areas of the province, there is significant pressure for asset replacement and reinvestment in the immediate term, as consumers expect continued – or even improved – service and reliability. In an environment where there is little or no increase in electricity demand to spread and recover these new infrastructure costs, investment in infrastructure renewal translates into unwelcome rate increases for consumers.

The changing supply mix is also putting pressures on distributors and transmitters to integrate these new resources, maintain the reliable supply of electricity, and at the same time, hold the line on cost increases. These objectives are not compatible.

The pressure for enabling the changing supply mix is also putting pressure on regulated utilities to encourage and connect new distributed generators to the grid. There are, of course, limits to the amount of generation that can be connected to the system and to certain geographic areas on the system. But this move to more distributed generation is all new – and standards and technical criteria are being created and communicated to the industry in real time.

The bottom line is that the role and expectations on regulated distributors and transmitters are expanding, putting pressures on these businesses, while the consumer and government tolerance for increasing costs in these monopoly services may be limited.

7.0 Natural Gas and the Potential for Fuel Substitution

In recent years, natural gas costs have declined and the recent significant additions of shale gas has created downward pressure on natural gas prices and forecasts out to 2020.

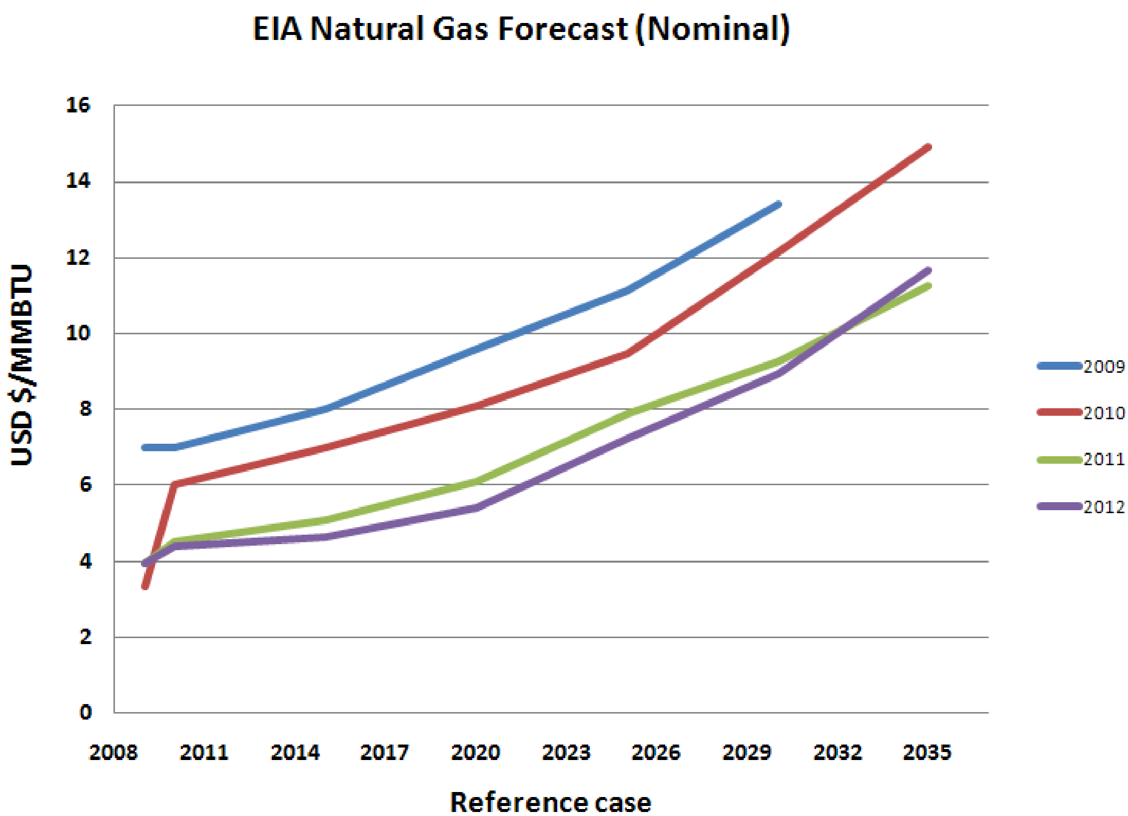

Figure 7.0- EIA Natural Gas Forecast (Nominal)
U.S. Energy Information Administration (EIA). Annual Energy Outlook. 2009-2012: 240

7.1 Self-Generation

These more recently updated natural gas price forecasts are making larger consumers assess their options to displace their electricity consumption with natural gas, or consider natural gas as a form of self-generation to avoid paying for power on the provincial grid.

In general, large industrial customers that run two or three shift operations have consumption profiles that contribute less to system peak over the course of the year and are better able to make demand reductions at system peak hours. Such large customers may seek additional means to reduce their demand during the system peak hours and further reduce their contribution to the province's GA cost recovery. Options for these consumers could include both system peak demand response measures as well as on-site electricity self-generation.

The recent industry discussions regarding the high rates charged to Ontario industrial customers (as compared to some of our neighbours) is putting pressure on the government to ensure that Ontario does not further erode its competitiveness in attracting new industrial demand. The *Ring of Fire* mining potential in northern Ontario and the recent announcement of an Industrial Electricity Incentive Program to attract and site new large industrial processing plants highlights the challenge of attracting new investment in new industry while keeping industrial rates competitive and attracting large industrial loads. The existing industrial electricity consumers in Ontario may see this new program as an opportunity to request relief on their pricing to continue their operations in Ontario in the face of these rising prices.

Actions by existing industrial consumers to further mitigate their GA costs would result in shifting costs from this industrial customer base to commercial and residential customers that are less able to reduce their peak demands.

The pressure of any additional shift in the overall fixed GA costs from industrial consumers to non-industrials will drive up non-industrial consumer costs and could result in consumer backlash, increasing the likelihood of a provincial policy solution being imposed.

The potential business case for self-generation will not be limited to large industrial customers alone, as commercial or institutional customers are also exploring self-generation with gas. Economics and the complexity of actually deploying self-generation driven by electricity cost avoidance will depend on many factors, including:

- the thermal demand of the host building,
- the payback for the project (which is closely tied to future gas prices), and
- the potential for increased reliability from on-site generation.

Some utilities have reported that customers that are not only actively exploring self-generation but also entirely disconnecting from the grid.[7] The current regulatory construct in Ontario is not established to deal with significant moves toward self-generation nor electricity customers in Ontario disconnecting from the grid entirely. This policy gap should be addressed.

[7] *Source: Conversation with Toronto Hydro executive*

Recommendation #4:

The province should develop policy options that address appropriate treatment to self-generation and grid disconnection. *The potential for customer self-generation or disconnecting from the grid raises policy issues for the province regarding the current regulatory approach to self-generation, including the level of stand-by charges for self-generators as well as any potential for system exit fees.*

7.2 Fuel Substitution and Storage

Within this changing backdrop on pricing, fuel trends and pressures to shift or reduce consumption, consumers are demanding more information and more control in their homes and places of business.

Electricity and gas consumers are using less energy per capita over the past decade and this trend is not expected to change. Appliances are more efficient and homes are more insulated. Energy efficiency and conservation are becoming second nature.

The focus of this discourse is on electricity, but electricity and gas are closely related and easily substituted in some end-use applications.

Natural gas, where available, can be used for cooking, clothes drying and water and space heating. In larger commercial applications, it can be used for air conditioning. Gas is being used for micro- and small-scale heat and power solutions. Ontario has significant gas storage potential, which provides further flexibility and opportunity for continued deployment and economic conversion from electricity to natural gas for many end-use applications.

Companies in Ontario are exploring natural gas storage to manage surplus electricity as an option, and the economics is being assessed at this time, but there are many other storage options.[8]

Ontario's current approach to large-scale electricity storage is using our transmission infrastructure of our electrical interties to our neighbours, including Quebec, New York and Michigan as our real-time storage markets. This approach has the advantage of having no incremental infrastructure costs, and is efficient assuming our intertie capability is adequate to manage and balance our hourly supply and demand.

[8] Hydrogenics. (2012,April). *Hydrogenics Announces Agreement with Enbridge to Develop Utility Scale Energy Storage in North America* . Press Release.

Alternatives to this conventional electricity storage approach exist and include:

- Lithium battery systems
- Flywheels
- Pumped hydro-electric storage
- Ice storage
- Compressed air storage

Many of these storage technologies may make sense for particular applications and to provide improved performance and may offer end use cost reductions. This is an area where a more thorough assessment of the technology, performance and costs and benefits is warranted.

Recommendation #5

There is a need to evaluate the economics of storage options and alternatives. *This would benchmark the current approach of using Ontario's transmission interties with alternatives such as:*

- *Lithium battery systems*
- *Flywheels*
- *Pumped hydro-electric storage*
- *Ice storage*
- *Compressed air storage*
- *Other storage technologies*

Analysis would look at each technology, performance characteristics, current costs and benefits, and assess the trends and the potential technical advances for future deployment.

Summary of Recommendations

The first discussion at the Centre for Urban Energy Roundtable Series 2012 identified the following as recommendations for further exploration. The CUE is ready and willing to work with industry partners to advance research and analysis in any of these areas.

Recommendation #1:

A consumer education strategy is needed to increase awareness of the contributors to maintaining a clean and reliable supply of electricity. *The strategy would deliver a consistent message including clear and factual information. Electricity consumers are facing increasing prices for electricity and higher bills. A better understanding of the contributors to the coming costs increases will help manage consumer reaction.*

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Recommendation # 5:

There is a need to evaluate the economics of storage options and alternatives*. This would benchmark the current approach of using of Ontario's transmission interties with alternatives such as:*

- *Lithium battery systems*
- *Flywheels*
- *Pumped hydro-electric storage*
- *Ice storage*
- *Compressed air storage*
- *Other storage technologies*

Analysis would look at each technology, performance characteristics, current costs and benefits, and assess the trends and the potential technical advances for future deployment.

For more information on this report or the Roundtable Series, contact Jim MacDougall at jim.macdougall@ryerson.ca or at (416) 979-5000 ext. 2987.