Comments to the Market Advisory Council
Economic Demand Response Pilot
IMO Document ID# MAC-05-02

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October 3, 2003

Introduction

The energy industry is currently experiencing fundamental structural changes due to many issues including utility deregulation and environmental concerns. The result has been an increase in price and price volatility and a heightened awareness of energy and environmental impacts of energy use. In Ontario, the deregulating of the electricity marketplace in May of 2002, and the natural gas price spikes in 2000 has highlighted these changes to all consumers – from large users to individual residential customers. Similar experiences are true in other jurisdictions around the globe.

In Ontario, deregulation of electricity was significantly different than in most jurisdictions however in that it originally exposed all customers to spot market pricing. This was either done directly, through time based interval meters that matched energy usage to the time of day, or more commonly through weighted average system pricing. I refer to originally, since as of November 2002, residential and small commercial customers (approximately half of the provincial load) have been temporarily returned to fixed energy pricing.

In fact, electricity deregulation has really only shown the consumer what has been always true in the energy industry. The wholesale price of energy varies over time. In the case of electricity in Ontario and most deregulated markets the period of time is hourly. Electricity is bought and sold on an hour-by-hour spot market basis requiring customers, retailers, and LDC's to understand consumption on an hour-by-hour basis.

This put a new energy management focus on real-time pricing and consumer price response. During critical periods of supply shortages or high demand periods significant price spikes are common as well as risks of voltage reductions or power outages.

In the past, these critical periods were managed by a combination of demand control of large commercial/industrial customers capable of curtailing large loads and/or utilizing alternative on-site generation, and appeals to residential consumers to reduce consumption. In the case of the large customers the previous Ontario Hydro paid for this strategy, under various contractual agreements.

The ideas of Demand Response and Demand Side Management (DSM) have had a long history in Ontario dating back to the mid-eighties with the former Ontario Hydro. At the time electricity planning and policy was going through a fundamental change from a supply only issue, to be met with new supply growth provided by Ontario Hydro, to a supply and demand issue, where spending to reduce demand was seen as part of the new planning option. With respect to new supply or reduced demand, Ontario Hydro was seen as the driving force and the principal in control. They either paid to develop new supply or provided incentives to customers to reduce demand.

Since then much has changed but the traditional industry paradigm still clouds the basic issues.

Price Response, Demand Response, and Curtailment

In discussing demand management, I believe that the issue of demand control needs to be further disaggregated in to:

- Price Response
- Demand Response
- Curtailment

The recent August 14th power outage provided a clear example of curtailment. During the week after the failure consumers were asked to reduce load while the system was being brought back on. At the time there was a considerable amount of coverage in the news indicating that while business was able to drop demand significantly, residential demand did not show the same ability. This was given as an indication of the demand response potential of these end user groups.

This however was not an indication of demand response. It was a demonstration of an emergency curtailment response. Commercial and industrial operations were able to shut down considerably or even completely. Since most operations were participating, business was not so much lost but delayed. In some cases (such as in the auto industry) where inventories were high the shut down may have also been a benefit. These shut downs meant that there were more consumers at home, somewhat offsetting much of the potential residential reductions.

Demand response is the ability to reduce demand or load based on a request to do so. Typically in order to do this, the end user must be able to identify load that is not essential for short periods of time. While commercial and industrial customers do potentially have this ability it is often at the expense of production or service, which often has a higher value to the end user. That is why demand response programs in this sector are often costly to the utility or the load authority. Examples of this are natural gas curtailment contracts or the previous Ontario Hydro RTP curtailment programs.

Residential customers on the other hand are often asked to reduce demand in critical times without any compensation. As well, various utilities in have also used dedicated controllers to control residential electric water heaters, and recently air conditioner set points and pool pumps. While in the past equipment costs and logistics of controlling residential end users made these types of programs difficult, new technologies and the low cost per kW controlled has resulted in a new residential demand response initiatives, and is starting to gain favour again. This is discussed more fully in this document.

Finally there is price response - the Holy Grail of demand side management (DSM).

As mentioned above the one unique and superior feature of the market design in Ontario is the fact that all end users, residential, commercial, and industrial, with interval meters or with non-interval ‘dumb’ meters, were to be exposed to the spot market. This was as issue that was heavily debated and discussed in the Market Design Committee (MDC) meetings, leading up to the new market regulations.

In the market design, customers without interval metering are exposed to the spot market through the Weighted Average System Price (WASP) mechanism based on the Net System Load Shape

(NSLS), which was considered superior to other settlement methods such as assigned load profiles and statistical sampling that are prone to unfairness and gaming.

From a demand management perspective the major drawback of the WASP approach in comparison to interval metering is that since the WASP is shared among consumers, there is no price response in the market.

In many ways, interval data and interval metering is the cornerstone of Ontario's deregulated marketplace. In fact, at the time of the Market Design Committee recommendations, it was thought that there would be a natural migration to interval metering, as customers who were NSLS positive (benefited by their real load shape) would opt for interval metering. To accommodate this, current distribution regulations stipulate that LDC's must provide interval metering to any customer wishing to be directly on the spot market. This switch did in fact occur in multi-residential and some commercial/industrial sectors.

The problem to greater adoption has been that while the current Distribution System Code does require that LDC's be able to provide interval metering and spot market access to **all** customers, there has been no driver to find cost effective solutions for small consumers. Most LDC's as well as the Market Design Committee have **assumed** that only large customers would be interested.

As a result many LDC's continue to utilize existing expensive and antiquated commercial based systems. The typical prices quoted by LDC's for interval metering have ranged from $2,000 to $4,000 plus a dedicated phone line ($45 per month). This makes the interval meter, and therefore demand management, a very expensive alternative to all, but the largest customers. As well as indicated by comments to the recent IMO report, "Blueprint for Demand Management…" some LDC's require up to $80 per month per account of internal effort to manage the data.

However, current interval-metering technology is at an installed cost of $300 (or less) for residential accounts and approximately $1,000 (or less) for commercial accounts. As well, this meter reading technology is cost competitive with current benchmarks. In Ontario, there are currently at least four suppliers of technology and services that can meet or beat these prices. As well, these meters are essentially electronic devices and therefore the prices above are very sensitive to quantity. In the ENEL project mentioned further ahead in this section the price per residential interval meter is approximately $40 to $50, which is less than the current Ontario price for a 'dumb' electronic meter.

It should be noted that in the first few months after market opening, OZZ was getting considerable market acceptance and exposure as customers, many of whom were residential and small commercial, saw interval metering and demand management as a way to mitigate price volatility. As well, we were moving forward with 11 LDC's on both pilot projects and service agreements, and working with two retailers interested developing creative time based offers (similar to the cell phone and long distance industries).

The residential or small commercial is of particular interest due to the following:

- A customer with a typical residential load profile would have saved money over the weighted average system price without any demand management if they were interval metered and on the spot market.

- Residential customers are the most flexible when it comes to load management, which is why they are always asked to reduce during critical times.

- Many LDC's had residential demand management, especially for domestic hot water, and Time-of-Use residential programs prior to deregulation. An interval meter and access to the spot market would have allowed these customers to continue to practice price response demand management.

However, when prices were fixed on November 11, 2002, this customer pull and price response was essentially put on hold. The debate on around residential demand management and the need for interval metering however has been renewed, and somewhat confused with demand response and Time-of-Use metering and rates.

The following clarifies the confusion in a simple manner. Demand response does not necessarily require intelligent metering since there is no price transparency or end user price response. Traditional Time-of-Use metering is basically the same as multiple 'dumb' meters and in itself does not induce price response. It is time-based rates (spot market or time-of-use **rates**) that are the price signal. In fact the Time-of-Use meter issue is in many ways a barrier to eventual price transparency since it will limit flexibility of rate design and access to a true spot market. ENEL in Italy is currently undertaking a project to replace all of the country's 27 million meters with true interval meters which will allow complete flexibility in their market.

Finally, as mentioned price response, price transparency, and interval metering and settlement are the Holy Grail as they are the critical enablers for modern DSM and much of the new energy technologies that are expected in the new energy marketplace. Residentially this includes remotely managed devices often referred to as 'Smart Homes or Appliances', energy storage systems, green energy, and on-site generation.

Residential Economic Price/Demand Response and Demand Management Pilot

In this discussion our focus is on the 30 to 50% of the load, the residential customer that is often asked to reduce load voluntarily, the residential end user.

Residential customers represent the most flexible energy users when it comes to demand management. It is also interesting to note that many of the critical demand periods are as a result of changes in the residential demand pattern. For example, during the moderate temperature summer days the typical residential demand pattern runs counter to the common provincial use pattern and price curve. During the day when prices and overall demand are high, residential load patterns are typically in a valley, however on very hot days, this valley disappears due to the use of air-conditioning in the home. When this occurs demand becomes critical and prices are at their highest.

If the thermostat settings in these homes were to set-up during the day similar to night setback during the winter heating season, these coincident demands could be avoided.

Pilot projects testing this control scenario are currently underway in many areas of the United States, and recently PacifiCorp Utah announced the US's first residential, "Virtual Peaking Capacity Program™".

Similarly, pre the price freeze, OZZ had been developing our **Personal Power Manager Program™** to work in concert with interval metered residential customers to control up to 4 electrical loads, as a price response energy management offering. Under the current fixed price regime this system can be operated as a demand response system based on requests from the IMO.

It should be noted that, prior to deregulation in Ontario, many electric utilities had demand management control programs for residential electric water heating, Time-of-Use metering, and thermal storage heating. Many of these programs however were in disarray, due to lack of interest by the LDC and were cancelled due to deregulation since the traditional utility approach to central control of demand is not supported under the new regulations. The LDC's responsibility was to provide access to the spot market and price signals. This would enable end users to control demand based on information and price, much the same way they do with other commodities. Under this approach energy services companies such as OZZ and others would come forward with product and service solutions (gateways, control devices, monitoring services, etc…) to assist consumers or customers could choose to act on their own behalf.

We at OZZ firmly believe that consumers and service companies could have and would have responded as they became more familiar with the dynamics of the deregulated market. Prior to bill 210, OZZ was working on various initiatives with new homebuilders to develop and provide solutions to this new market.

The focus on "new" homes is basically as a response to the infrastructure cost barrier. Currently the developer, homebuilder, and/or homebuyer most likely pay for the cost of metering on new homes. As well, new homes are the most likely to have newer smart appliances with built in timers, such as dishwashers where this feature is now almost a standard, and air conditioners with programmable thermostats.

Description of The Personal Power Manager Program™

The working title of our residential demand management program is **"The Personal Power Manager Program™"**. As this was originally envisioned as a price response program, the term personal power has the double meaning of personal control and demand (power) management. As a demand response measure the personal control comes in the form of choosing to participate, as control would be external to the end-user.

The program outline is actually quite simple. Essentially, the IMO and OZZ, working with various stakeholder groups, would engage appropriate end-use customers using multiple communications sources to participate in this project. These customers would be retrofitted with control and communication devices (and potentially smart interval meters), which would allow load to be shed and the impact monitored and confirmed. Since there is currently no price response mechanism, customers would be paid for the amount of load offered for control.

The program would basically be conducted in a similar fashion to past utility-based DSM projects except that the latest technology including the Internet would reduce costs and all savings would be monitored and measured, with payments tied to these hard measurements.

The following outlines the various components of this program.

Appropriate End-Use Customers

Basically the program is modeled somewhat on the old electric domestic hot water control programs with the addition of other significant loads. Ideally we would like customers with two or more of the following loads.

Load	Type of Control	Notes
Electric Domestic Hot Water	Curtailment and Storage	Approximately 400,000 units in the province with electric elements ranging from 0.8 to 3.5 kW/tank.
Central Air-Conditioning	Temperature Set-Up and Curtailment	Over 1,000,000 units with capacities of 1.5 to 5 tons (representing Loads of 2 to 8 kW/unit).
Electric Heating	Temperature Set-Back	Load per house is typically 15 to 40 kW.
Electric Thermal Storage Heating	Curtailment and Storage	These systems exist but are currently not in use due to the price cap.
Pool Circulation Pumps	Curtailment	Many pool pumps operate 24 hours per day during the summer although nighttime only operation is sufficient

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Program Marketing/Communication Plan

In order to keep customer acquisition costs to a minimum. A good marketing/communication plan is critical. An example approach may include several large advertisements in both the main and local community newspapers explaining the program and the benefits to the end-use customer, to the electric system, and to the environment. The advertisements would provide potential customers with a web site, fax address, post address, email address, and phone number where they could obtain more information, view the terms and conditions of the program, and sign up.

There also exists a potential for radio and television promotion. A detailed assessment of all marketing and communications would need to be completed prior to commencement, and reviewed throughout the program.

Control and Communication

Customers who subscribe would have their homes fitted with a thermostat “gateway” device capable of controlling 4 or more loads.

A "gateway" is essentially a device that allows communication and control between a central service provider and equipment in a home. Communication can be either by private or public network, hard-wired or wireless. Currently there many manufacturers of these devices and trials are being conducted many jurisdictions.

OZZ has not specifically selected a technology provider for this project as we feel a project of this nature is best served from a technology perspective by a competitive bid and analysis process. The selection of one, or more likely multiple devices will allow for technology comparisons and development.

At OZZ we have been investigating and developing numerous technologies. With respect to developing a price point for this technology we have been working with an American/Canadian group, Broadband Energy Networks Incorporated and the Coactive Networks product technology. This group is currently undertaking a two-year development project in New York City and area with funding from New York State Energy Research and Development Agency. Costs discussed later in this document are based on our knowledge of this technology.

Interval Metering and Program Measurement

One key area in this type of project will be metering and program measurement. OZZ firmly believes that effective energy and demand management throughout the energy supply chain, from the traditional energy efficiency contractor and energy retailer to the local distribution company and energy wholesaler, relies on quality energy information.

Ideally in today's, market what is required is detailed hourly or sub-hourly energy and water usage data. This data, and Internet delivery, provides a thoroughly modern approach to energy information management.

With respect to a demand response initiative, detailed interval metering is not necessarily required in order to monitor the performance, as a record of occurrences only would suffice. However, utilizing interval metering would be a more accurate and efficient verification standard.

One advantage of interval metering is that homes equipped with interval meters could continue to practise price response demand management once the market opens again and they are directly on the spot market. They could do this either through the continued use of the gateway or other remotely managed devices and services often referred to as 'Smart Homes or Appliances', or manually through life style changes.

Costs

Based on preliminary analysis and investigations of products and similar program initiatives around the world, we at OZZ were able to work up some indicative program costs in order to compare this residential initiative with other demand initiatives including temporary power deployments. Again as with metering, costs, especially those related to equipment, are very dependent on quantity. The costs shown here were developed on the assumption of 2,000 to 4,000

participants. If we look at electric water heating alone this number could be increased 10 to 20 times.

Due to the equipment and service nature of a demand response program as described, the budget costs are broken into two categories:

- A fixed price for program development, equipment and installation, and control system implementation.
- A monthly fee and/or incentive, which will go to the customer as an incentive for each curtailed or affected load.

The basic cost to outfit a home with gateway device and control equipment is expected to average at approximately $750 (for the quantities listed); of this approximately $250 was assumed to be labour. At an average load reduction of 2.0 kW per home this represents a capital cost of $375 per kW. Interval metering, as mentioned is optional to a demand response program and would increase the cost by approximately $300 per home.

As far as a participation incentive is concerned it is difficult to assess this cost and whether or not it would have an effect on the participation rates. As a first guess a suggested amount would be in the $5 to $10 range monthly, which is similar to the typical discount that was applied in the old controlled water heater programs.