ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

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Nancy Marconi
Acting Registrar
Ontario Energy Board
Sent via email to: RPP.Price.Design@oeb.ca

EB-2022-0074 Design of an Optimal Enhanced TOU Rate

Dear Ms. Marconi:

The Ontario Society of Professional Engineers (OSPE) has been researching and analyzing various alternative TOU rate plans and other rate structures for retail electricity for about 8 years with the purpose of reducing the amounts of curtailed emission-free electricity and to reduce greenhouse gas emissions. Our most recent 2019 report on the subject is titled “Retail Electricity Price Reform: Path to Lower Electricity Bills and Economy-Wide CO_2 Emission Reductions”.

A copy of the report was previously sent to the OEB and is also available online at OSPE’s website.

This letter includes a summary of OSPE’s conclusions and recommendations regarding the design of an optional enhanced TOU Rate.

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OSPE's Analysis of Retail Electricity Pricing Plans

Large electricity consumers in Ontario have access to both firm and interruptible (surplus) electricity in the wholesale market at significantly different rates commensurate with the value of that electricity. This is also true of adjoining power systems. They can purchase surplus electricity at very low wholesale market prices because that energy is not capacity backed (ie: it is interruptible when capacity is not available). Low-emission surplus electricity is available on the Ontario wholesale electricity market at typically less than 1.5 cents/kWh ($15/MWh) and surplus fossil fuelled electricity (mainly natural gas fuelled) is available at its marginal cost of production (effectively its fuelling cost).

The IESO is projecting significantly lower amounts of surplus base-load generation (SBG) in the future due to the refurbishment of the nuclear plants and the closing of the Pickering plant. However, the IESO has not yet included the following additional quantities in their SBG estimates:

- Self-curtailment by hydroelectric generators
- Exported amounts of electricity on an interruptible (low cost) basis
- Ministerial orders to put a moratorium on new natural gas-fired plants
- Public pressure to eliminate natural gas-fired generation

OSPE simulations suggest the total amounts of surplus emission-free electricity beyond domestic requirements, after the nuclear refurbishment program is complete and with natural gas plants still operating will exceed 8 TWh per year. In addition, there will be much larger amounts of surplus natural gas fuelled electricity available that can easily be used to charge Electric Vehicles (EV's) at night. If the public and government ban the use of natural gas for electricity production the amounts of surplus emission-free electricity will increase dramatically as production capacity from those plants will need to be replaced by emission-free generation capacity. All low-emission power systems can produce significant amounts of surplus emission-free electricity.

Consequently, developing an improved TOU rate plan now for voluntary use is prudent. The OEB and distribution utilities will benefit from an early roll-out of a voluntary enhanced TOU rate plan to provide more time to fine tune the pricing, time-periods and other rules before the amounts of surplus emission-free electricity rise. The amounts of surplus emission-free electricity in Ontario is shown in Table 1 below:

Residential and small commercial consumers who purchase electricity at the retail level from distribution utilities do not have access to surplus electricity at the very low wholesale market price. This is primarily, but not exclusively, due to the fact that the global adjustment charge is applied based on the consumer's energy consumption rather than the consumer's peak power demand. The ratio of off-peak rates to peak rates is not low enough (currently it is about 0.5). It is impossible to extract enough economic value from using that surplus electricity to pay for the required load management and fuel switching equipment. Consequently, retail consumers do not use surplus electricity for a number of applications that could save them money on total energy costs and reduce their greenhouse gas.

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Table 1
Amount of Surplus Emission-Free Electricity in Ontario

Year	Curtailed Surplus Amount TWh	Number of Homes Equivalent for Curtailed Surplus	Total Surplus Amount TWh	Number of Homes Equivalent for Total Surplus
2014	3.6	380,000	10.0	1,040,000
2015	4.8	500,000	13.3	1,390,000
2016	7.6	840,000	15.9	1,770,000
2017	10.2	1,130,000	23.9	2,520,000
2018	5.8	644,000	13.5	1,500,000
2019	6.5	720,000	17.3	1,920,000
2020	7.0	780,000	19.6	2,180,000

It is frustrating for Ontario domestic consumers, who pay the fixed costs to build the electricity system, to watch as surplus electricity is sold to adjoining power systems at very low prices, and even worse, to see surplus electricity that can't be exported, curtailed (wasted). Furthermore, as evidenced by Enbridge's Electricity-to-Hydrogen project, large business interests are obtaining preferential access to this surplus energy and are monetizing it for their own economic benefit. Regardless of the original intention, awarding preferred access to publicly funded grid capacity (whether transmission capacity or surplus energy) to private economic interests incurs significant risks. This became a major political issue with the preferred Samsung access to transmission capacity during the Green Energy Act and is at risk of replicating itself with preferred access to surplus electricity. Enabling public access to this grid capacity on similar terms is an important way to mitigate these risks.

Current retail price plans disadvantage small consumers who have flexible loads. Those loads can easily take advantage of surplus electricity during off-peak periods without imposing any additional installed capacity demands or costs on the power system. That surplus energy should be made available to retail consumers at the same volumetric energy price that it is sold to adjoining power systems (inclusive of all energy [kWh] related retail surcharges).

In performing our analysis, OSPE has identified a number of issues that should be considered in the design of enhanced retail electricity price plans:

1. <u>Price plan changes should be voluntary (opt-in).</u>

   Mandatory price plan changes should not be imposed on consumers. The current price plans have resulted in inequities depending on the load profile of the consumer relative to the load profile of the power system. The current TOU price plans have given a price advantage to some consumers and disadvantaged others. By making the change voluntary, consumers who are willing to purchase the required equipment to take advantage of the new price plans will voluntarily adopt the new price plans and benefit from the lower price of surplus electricity. Consumers should be able to opt out of a voluntary price plan at the end of a billing period (typically monthly) with advanced notice to their distribution utility.

2. New voluntary price plans should be available to consumers permanently, but in no case less than 10 years, to allow consumers sufficient time to recover the cost of equipment needed to take advantage of the new plans.

   The load management needed to effectively use surplus electricity and capture its economic and environmental value cannot be done manually by consumers. The equipment must operate automatically either based on time or based on power system load conditions. Automatic time-based load management is much easier and cheaper to implement for both the consumer and the distribution utilities. Consequently, creating a new time of use (TOU) period is the easiest and cheapest way to introduce voluntary plans designed to facilitate use of surplus electricity. By using a TOU based plan, residential and small commercial consumers will be able to get access to surplus electricity overnight when most of the surplus electricity is available. Large consumers can access surplus electricity at any time of day or night because they have direct access to the wholesale market.

3. Retail electricity price plans should be designed to more closely align prices with the actual costs of providing electricity to retail consumers.

   Residential and small commercial consumers are not familiar with how power (kW) demand charges reflect the cost of installed capacity for the generation and transmission needed to support that consumer. Nor are residential and small business consumers aware of the extent that distribution utilities have made substantial investments in advanced metering infrastructure and major changes to those systems would be costly. Consequently, the electricity pricing structures that are suitable for major power consumers are unlikely to be comprehensible or appropriate for retail and small business electricity consumers.

   An alternative approach that was successfully tested as part of an OEB TOU rate pilot was the creation of a new TOU rate period called the “Low Overnight Rate” period. That new period would be effective every evening throughout the year. The pilot used midnight to 6 am to define the low overnight rate period. However, total system load demand begins to drop rapidly after 10 pm and does not return to high levels until after 7 am. A wider TOU time-window for the low overnight rate period should therefore be considered. OSPE suggests that 11 pm to 7 am should define the “Low Overnight Rate” period. A more detailed analysis by the OEB may suggest that an even wider window would be appropriate.

4. Simultaneous ON or OFF operation of all flexible loads is not expected to be a major concern in the early years of the introduction of a new voluntary TOU rate plan.

   However, as word-of-mouth spreads of its economic benefits to the consumer, federal carbon taxes rise and entrepreneurial energy management companies develop new low-cost technical capabilities to take advantage of surplus electricity, eventually it will become necessary for the utilities to ration the surplus electricity on a fair basis among voluntary subscribers. There are several ways to do this ranging from simple administrative rules (such as the timing and size of load increases at night) to fully automatic instructions sent by distribution utilities to control equipment at consumers homes. OSPE believes low-cost load management technology will evolve faster than the power system will require that functionality. Therefore, consumer load switching will not

be a practical problem preventing the OEB from moving forward immediately with new voluntary TOU rate plans. There are technologies available now on the market for consumers to manage EV charging gracefully and in some jurisdictions for distribution utilities to over-ride EV charging rates when necessary. These features will become available in the marketplace for other loads if the OEB approves a new voluntary TOU rate plan capable of economically displacing fossil fuels with surplus low-emission electricity.

5. The volumetric price of surplus electric energy at the retail level should be its true marginal cost of production at the wholesale level. This is necessary to:

    a. ensure the volumetric price of surplus emission-free electricity is lower than the volumetric price of fossil fuels, and
    b. ensure the users of surplus electricity do not transfer incremental costs to other consumers who do not participate in the new voluntary price plans, and
    c. ensure the users of surplus electricity do not incur incremental costs from other consumers.

    Pricing of surplus electricity at a level different than its wholesale marginal cost of production introduces system inefficiencies and unfairness between different types of consumers.

    Because residential and small commercial consumers are too small to participate in the wholesale market, OSPE suggests the OEB create a proxy overnight TOU price. This rate setting mechanism would operate in a similar manner to OEB-administered regulated electricity and natural gas rates adjusting mechanism that has already been widely accepted by retail and small business consumers.

    That proxy TOU price would be equal to the projected average weighted wholesale market energy price during the overnight period. The proxy TOU price would be effective for the subsequent period and adjusted for any over or under recovery in the prior period. The proxy overnight TOU price should be adjusted lower to remove any energy related surcharges in the electricity bill due to transmission, distribution and regulatory charges so that the final retail volumetric energy cost for surplus electricity is equal to the average weighted wholesale market energy price. This is important because the large ratio in the value to consumers of firm electricity compared to surplus (interruptible) electricity that is reflected in the wholesale market should also be reflected in the Low Overnight Rate at the retail level. That value ratio is currently about 10 to 1. That high ratio is needed by consumers to pay for the equipment they need to take advantage of surplus electricity.

6. Any under-recovery during the overnight period can be allocated either to the monthly fixed charge (preferred approach) or to the other 3 rate periods by slightly increasing the electricity rate the same amount per kWh for those other periods (off-peak, mid-peak and on-peak).

    To ensure the new voluntary rate plans do not under-recover power system costs, the voluntary rate plans should be analyzed by the OEB to determine the amount of under-recovery for a typical residential consumer for their historical firm electricity use during the low overnight rate period.

Because most firm electricity is used outside of the low overnight period, OSPE's analysis shows the rate increase to the 3 rate periods will be very modest. It is important for regulators, utilities and consumers to appreciate that flexible loads that can use interruptible surplus electricity should not be forced to pay more than the marginal cost of production for surplus energy use. The rates applicable to periods other than the low overnight rate period, should be designed to recover most of the fixed costs of generation and transmission the consumer uses. That will provide a sufficiently low price during the low overnight rate period to financially incentivize the purchase of EVs, fuel switching equipment and load leveling storage.

7. Additional consumption of surplus electricity helps reduce system costs for all consumers

   One misunderstood fact is that the wholesale market energy price is the marginal cost of production of the final MW that balances supply and demand. That market price is paid to all generators, even those with a lower marginal cost of production. This means that as the wholesale market energy price rises in the low overnight rate period as more surplus electricity is used, the fixed costs of cheaper generation is paid for in part by the higher wholesale market energy price.

   By ensuring that surplus electricity is fully consumed at the highest value, fixed power system costs can be partially recovered directly through consumption charges rather than being recovered through other mechanisms such as the Global Adjustment Charge or Capacity or Demand Charges. What this effectively means is that consumers who use surplus electricity, even at the low overnight rate, contribute to the fixed costs of the power system thus helping to lower the cost of electricity for all electricity consumers.

8. Adoption of OSPE pricing recommendations will enable consumers to deploy technology that creates the highest value to them from the surplus electricity.

   Many technologies are available to create value from this surplus electricity. It is not the role of the regulatory authorities to prescribe how surplus energy is to be used. The highest value for one consumer may be different to that for another consumer. Some consumers may be incented by cost savings. Others may find high value in the opportunity to reduce greenhouse gas emissions. A third group may be motivated by the opportunity for energy independence and resiliency.

   The typical applications that a low overnight TOU rate will incentivize in the near term will include:

   a. EV purchases: EV's are typically 30 to 50% more expensive than equivalent internal combustion vehicles. The lower electricity rates overnight are effectively a monthly stream of EV subsidies proportional to the amount of charging done overnight. This is a no-cost alternative to direct EV HST and purchase price subsidies that have been historically used.

   b. Automatic fuel switching from fuel oil or propane to electricity for hot water and space heating. Natural gas is currently available at a very low price, therefore, it is unlikely natural gas heating consumers will have a large enough financial

incentive to invest in the required fuel switching and control equipment at this time. Also, consumers that do not own their own homes are not likely to participate in fuel switching. However, some consumers may elect to deploy technologies that both reduce carbon emissions and energy costs by using surplus energy for space and water heating.

c. Electrical and thermal storage equipment used to shift electrical loads from their current on-peak periods to off-peak periods. This reduces future peak demand and the need for additional generating capacity which lowers the future fixed cost of operating the power system.

Each of these applications have different values for the consumer. The marketplace will select the most economic applications once the new voluntary TOU rates are established. If the favoured application does not have sufficient demand to use up the available surplus electricity, then other applications will enter the market. EV charging makes better use of surplus electricity. However, the potential demand for surplus electricity for EV charging is limited by the number of EVs. It will take some years before there are enough EV's to use up all the surplus electricity. In the interim, fuel switching applications will enter the market as long as surplus prices remain low enough. Policy support for fuel switching should not be our main focus. In the longer term there may be better ways to heat water and buildings than to use surplus electricity via fuel switching strategies. District heating systems in high density urban areas and heat pumps and emission-free energy carriers in low density rural areas are likely to become more economic.

Ontario currently has substantial amounts of surplus natural gas-fired generation at night even during the winter and summer. Nothing should prevent EV owners from using natural gas-fired generation at night to charge their EV's. Natural gas-fired electricity still results in lower CO_2 emissions compared to internal combustion engines. That means EV owners will eventually use up all the surplus electricity at night because their economic breakeven point is at a much higher energy price than for fuel switching. With growing amounts of electrification of vehicles, the off-peak electrical load profile will approach the available emission-free generating capacity. Some years later the off-peak electrical load profile will also use up the available natural gas-fired generating capacity unless there is a ban on natural gas-fired generation.

Consumers who want to install fuel switching equipment, need to do so well ahead of the EV sales, so they can pay off their equipment before future EV load uses up all the surplus emission-free electricity.

The correct policy response to an absence of any remaining surplus emission-free electricity is to build more emission-free generation if emissions are above the province's goals. Ontario should not rely too heavily on surplus natural gas-fired generation if it wants to meet its emission reduction goals.

9. <u>Electric Vehicle usage reduces emissions even when the electricity used to charge EVs is generated by natural gas generators</u>

Electric vehicle motors are far more efficient than combustion engines even after considering natural gas generation, battery charging and electrical system distribution

losses. This efficiency improvement does not include additional emissions savings from the avoidance of emissions from the oil and gasoline production/refining processes and pipeline and tanker/road distribution system. While natural gas production and distribution also generates emissions (particularly if substantial methane leaks are allowed to occur), when converted to electrical energy, natural gas-to-electricity generates significantly less greenhouse gas emissions than production, refining and consumption of gasoline and diesel fuel. Consequently, it is legitimate to encourage EV owners to charge their vehicles at night even if the additional electrical load is supplied by natural gas-fired plants.

While EV usage provides significant benefit to society, EV owners should be discouraged from unnecessary daytime EV charging. Significant EV charging demand during the day will require additional electrical capacity to be installed. For emission-free power systems the fixed cost of capacity (generation and transmission) is about 10 times the marginal cost of producing the actual energy. EV owners therefore impose very little cost on the power system when they charge their EV's during periods when there is idle capacity. To encourage faster EV adoption, EV owners should not be required to pay more than the wholesale market energy price for surplus electricity. As mentioned earlier, the price of surplus electricity already includes a portion of fixed system costs, especially if natural gas-fired generation is setting the energy market clearing price.

10. <u>While energy regulators should not dictate how surplus energy is to be used, they can help consumers make informed decisions about beneficial ways to take advantage of surplus energy.</u>

    As noted previously, most residential and small commercial consumers do not have the technical or financial analysis skills to determine their best options to use surplus electricity. Rather than creating rules to mandate the energy being used for a specific purpose or technology, regulators can help consumers make informed personal decisions by providing them factual information on energy pricing and use.

    The Ministry of Energy or the OEB could undertake a number of actions that would help to accelerate the productive use of surplus electricity and reductions in greenhouse gas emissions within Ontario. These include:

    a. make available to residential and small commercial consumers the comparative volumetric cost in the same measurement unit for all fuels that consumers use for their energy needs. This could be delegated to the distribution utilities if the prices of various fuels vary significantly in different Ontario regions.

    b. arrange for an engineering consulting firm to:
        - develop specifications for various methods to take advantage of surplus emission-free electricity.
        - arrange for a testing laboratory to certify energy management systems offered by suppliers to assure consumers that the supplier's equipment meets the engineering consultant's specifications.

    c. provide consumers with an information brochure. The brochure should include various equipment options, typical installed prices and the typical annual energy cost savings (electricity plus fossil fuels) they can expect over a 5-year period.

The savings should be based on the IESO forecasted total quantities of surplus electricity (including import/export quantities that could be made available domestically), forecasted low overnight rates and the distribution utilities forecasted number of subscribers of the voluntary low overnight TOU rate plans. The brochure should include the names and contact information of private sector companies that supply equipment, installation and maintenance services that meet the specifications developed by the engineering consultant.

d. provide periodic revisions to the information brochure to coincide with the semi-annual OEB TOU rate reviews.
e. consider stronger consumer protection for major upgrade work (say any energy upgrade contracts over $5,000). Companies could be required to offer the consumer a formal guarantee of a minimum cost savings in total energy costs (electricity plus fossil fuels) for the first whole year after installation. The companies would have the right to ask the consumer for their electricity and fossil fuel bills for the previous 12 months to perform their analysis. Should the equipment fail to provide that minimum level of savings the consumer would have the right to a refund to recover their losses up to the value of the contract and the right to require the company to restore the consumer's equipment to its original state if the losses are substantial and of a continuing nature.
f. distribution utilities should be incentivized to provide alternative communication capability to consumers in areas where smart meters are not able to communicate with the utility computers. To effectively use TOU price plans the meters must be read monthly and contain at least hourly data. Distribution utilities should be incentivized to enable TOU price plans to be available to all consumers who want to use surplus electricity by employing other means of communicating with the smart meters. Other smart meter reading options should be considered including monthly meter reader visits, public internet-based communication, cellular-based communication or landline telephone dial-up communication services. The OEB may wish to select one or more distribution utilities and technology companies to develop one or more solutions that other smaller distribution utilities could then deploy in their areas. The use of international standards should be encouraged.
g. incentivize distribution utilities to introduce improved communication and load management capability into their service areas so that their consumers can take advantage of new technologies to lower their overall annual energy costs, improve electricity system operation and contribute to lower greenhouse gas emissions.
h. develop programs to optimize energy usage between the electricity system, the natural gas system and other truck-delivered fuels.

Thank you for the opportunity to provide feedback on the Design of an Optimal Enhanced TOU Rate.

Sincerely,

ONTARIO SOCIETY OF PROFESSIONAL ENGINEERS

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