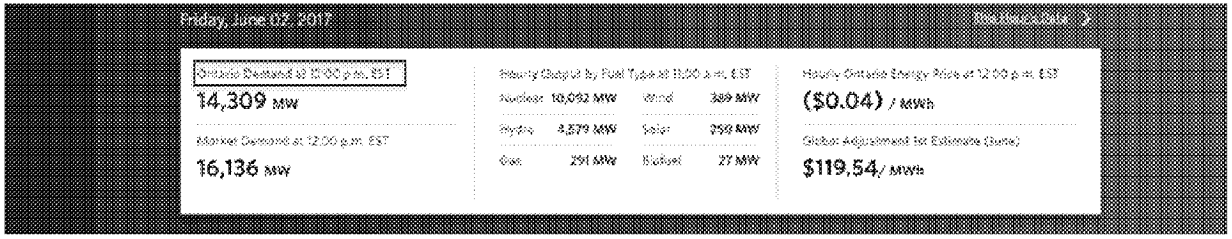
ENERGY STORAGE CANADA

Rationale and Approaches to Remove Non-Energy Charges for Energy Storage

June 14, 2017

Primary Benefits Related to Removal of Current Regulatory Barriers To Storage

1. **Eliminate Electron Waste** – Non energy charges are impeding investment in storage and the related ability to minimize, or eliminate, wasted electrons
   - Forcing storage to charge during specific time may limit benefits to Ontario marketplace.



Source; IESO Power Data for Friday, June 2, 2017, Noon Hour

2. **Optimize Energy Sector/Markets** (Power, Gas, Emissions, Storage)
   - Existing ON wholesale market may offer significant benefits to external stakeholders and detriment to domestic consumers. Domestic storage enhances benefits to ON energy ratepayers.

3. **Encourage Sustainable Revenue Growth** to Mitigate Customer Bills
   - Putting storage on a level playing field with exports supports ratepayer benefits if non-energy charges are eliminated on wholesale storage.

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Why Remove Non-Energy Charges For Energy Storage?

- Transmission and distribution systems are built for the purpose of serving retail loads, therefore loads pay for the ongoing cost of those systems through non-energy charges
- Electricity-based energy storage is different than stand-alone load and should be exempt from non-energy charges because:
  - Energy storage provides a net benefit to the electricity system, and assists with the cost-effective system integration of renewable energy (electricity, thermal, gaseous energy, etc.). Storage, like exports, does not increase costs that result in non-energy charges
  - Non-energy charges reduce market signals and efficient operation of energy storage facilities and the system benefits they provide

Why Remove Non-Energy Charges for Storage? (cont.)

- Transmission and demand charges incent inefficient bypass of distribution and connection to the high voltage transmission system. This impedes locating storage to maximize congestion relief, ensure cost-effective system integration, and avoid increasing costly distribution costs.
- Different levels of demand charge (i.e. different transmission demand charges, and LDC charges) creates an inequality between competing energy storage systems (e.g. high voltage vs. distribution connection and LDC-owned vs. third party, wholesale exports and wholesale storage)

Existing Non-Energy Charges For Energy Storage

Currently, wholesale energy storage in Ontario is subject to the following non-energy charges:

Regulatory Charges[1]

- Global Adjustment
- Uplift (Hourly, Daily, & Monthly)
- IESO Administration Fee

Transmission Demand Charges (Depending on Point of Connection)

- Network Service Charge
- Line Connection Service
- Transformation Connection Service

LDC Charges (If Distribution Connected)

- Different rate structure across LDCs, can include volumetric and demand charges, Transmission Demand charges may be a pass-through, or built into the LDC rate

Note 1: Assumes an in-service date of mid 2018 and that Debt Retirement, RRRP and OESP Charges will be removed by then

Regulatory Charges

Item	Amount $/MWh	Explanation of Non-Energy Charge	Why Energy Storage Should be Exempt from Non-Energy Charge
Global Adjustment	88.40 See Note 1.	• Payments to regulated & contracted facilities based on difference between Hourly Ontario Electrical Price (HOEP) and facility rate • Payments to LDCs for conservation programs	• Energy storage is not expected to have a material effect on Global Adjustment. Global adjustment allocates costs to end-users for long-term supply arrangements. Storage is being brought to market to help better optimize supply to all energy markets.
Hourly Uplift	1.39 all hours (7x24) 1.69 on-peak (7x16) 0.77 off-peak (7x8) See Note 2.	• Congestion Management Settlement Credits (CSMC) • Intertie Offer Guarantees (IOG) • Energy losses and Operating Reserve costs	• Operating reserve costs could be reduced through increased competition provided by energy storage • Energy storage is not expected to have a material effect on CMSC, IOG, and energy loss related costs
Daily Uplift	0.12 See Note 2.	Day-Ahead Commitment costs	• Energy storage would reduce day-ahead commitment costs by reducing the need for gas generation
Monthly Uplift	- 0.39 See Note 2.	Cost of contracted ancillary services, i.e. Black Start Capability, Voltage Support, and Regulation Service	• Ancillary Service costs could be reduced through increased competition provided by energy storage
IESO Admin Fee	1.16 Domestic 0.96 Export See Note 3.	Cost for IESO to operate the wholesale electricity market and manage high voltage system	• The cost of any new related IESO systems are expected to be offset by the increased flexibility storage will provide for the grid, thus making the system easier for the IESO to manage

Notes:
1. Jan 2015 to Dec 2016 average GA for Class B customers
2. Jan 2015 to Jul 2016 average for all hours
3. Effective rate as of Jan 1, 2017

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Transmission Demand Charges

Item	Amount $/MWh	Explanation of Non-Energy Charge	Why Energy Storage Should be Exempt from Non-Energy Charge
Network Service Charge	35.81 to 71.62 See Note 1.	• Provides time-of-use signal to encourage customers to shift their demand away from total system monthly peak • 3,660 $/MW-month based highest of a) demand during hour of peak demand from other transmission connected customers, or b) 85% of customer peak demand during 7 AM to 7 PM weekdays	• The existence of fixed time restrictions could prevent storage from operating during times when it could be beneficial for the system (e.g. absorption surplus during day-time, low-demand seasons, surplus baseload generation) • Energy storage is naturally incented by price signals to generate, rather than consume during times of a physical (not time dependent) system peak.
Line Connection Service	8.51 to 17.03 See Note 1.	• Charge for use of connection assets owned by Hydro One • 870 $/MW-month based highest demand in month during any hour	• Energy storage could provide congestion relief on connection lines by generating during peak hours and reducing the upstream load on the connection line
Transformation Connection Service	19.77 to 39.53 See Note 1.	• Charge for use of transformation connection assets owned by Hydro One • 2,020 $/MW-month based highest demand in month during any hour	• Energy storage that is connected to the low voltage side of a transformer could provide congestion relief for the transformer by generating during peak hours and reducing the upstream load on the transformer

Transmission demand charges are based on monthly peak demand factors and are charged on a $/MW basis.

In order to show how an energy storage operator would have to recover these costs through electricity sales, the demand charges are converted to $/MWh based on a load capacity factor of 7-14%.

The high end of the load capacity factor range was chosen to represent an energy storage facility providing a 4 hour energy shifting service, 5 days per week, with a round-trip efficiency of 85%, i.e. (52 weeks/year * 5 days/week *4 hours/day / 0.85 efficiency)/8760 hours per year. The low end of the load capacity factor range (7%) assumes the facility operates 2.5 days per week (throughout the entire year).

An energy storage facility providing a different service such as regulation could have different load factor, energy shifting was used as the reference case because it is most dependent on energy market signals (i.e. peak to off-peak pricing spread).

LDC Charges

- The cost and structure of distribution system-related charges varies across Ontario's 50+ LDCs
- LDC retail charges include:
  - Monthly service charges
  - Peak demand charges
  - Consumption based charges
- LDC charges are either charged alongside a pass-through of transmission demand charges, or the two are combined in the LDC rate
- Currently, there is no certainty as to how LDC charges will be applied by OEB to LDC-owned vs. third-party owned energy storage
- ESC believes LDC-owned and third-party owned energy storage should be subject to the same charges to create a level playing field

Increase System Benefits By Removing Transmission Demand and LDC Charges

- Energy storage may offer more value streams when deeply embedded into an electricity system (e.g. congestion relief, voltage regulation, phase to phase load leveling, etc)
- Embedded energy storage may provide net benefits to transmission and distribution systems and should therefore not incur transmission demand and LDC charges
- These charges were originally designed in accordance with cost causation principles and apply to retail loads that directly cause increased costs to the transmission and distribution systems, and most wholesale storage is incented to consume during low-market prices which tend to have correlation with lower-demand times
    - The exception is ancillary services, like frequency regulation, and this is high-value market service that is still providing wholesale market benefits which are passed on to retail customers

Increase System Benefits By Removing Transmission Demand and LDC Charges (cont.)

- If transmission and distribution demand charges are applied to storage, this incents bypassing as much transmission and distribution infrastructure as possible and may therefore lose out on the related transmission and distribution system benefits
- Energy Storage systems should therefore be exempt from all demand charges so they can be embedded in locations that provide the greatest system value
- LDC-owned and third-party owned energy storage should each be exempt from inefficient regulatory charges

Removal of GRC For Pumped Storage Facilities

- Hydroelectric facilities are subject to the Gross Revenue Charge (GRC) tax
- There is currently no regulatory certainty as to whether a new pumped storage facility would have to pay GRC. OPG's Beck Pump Generating Station currently pays this charge
- The GRC tax is based on a deemed gross revenue of $40/MWh, which is then multiplied by two different tax rates:

Deemed Property Tax Portion (Based on Total Annual Generation)	GRC Rate
Up to and including 50 gigawatt hours (gWh)	2.5%
Greater than 50 and up to and including 400 gWh	4.5%
Greater than 400 up to and including 700 gWh	6.0%
Greater than 700 gWh	26.5%

Water Rental Charge	GRC Rate
All generation	9.5%

- If pumped storage facilities are subject to the GRC tax, this effectively imposes a non-energy charge of between $4.8 to $14.4/MWh
- All pumped storage facilities should be exempt from the GRC tax:
  - GRC creates an uneven playing field for pumped storage vs. other types of energy storage
  - GRC will decrease the amount a pumped storage facility operates, thus reducing benefits to the system and its ability to reduce surplus baseload generation
  - The deemed revenue amount of $40/MWh is not realistic, since Ontario's energy market spread is much less than this amount

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Treatment of Facilities Providing Ancillary Services and other Bulk Market Benefits

- The energy market signal should incent an energy storage facility to operate in a way that is beneficial for associated transmission and distribution infrastructure
- There could be cases when an energy storage facility following a system wide ancillary service related signal (e.g. regulation service signal) has a detrimental effect on local distribution infrastructure
- Given that the ancillary services are provided solely for the benefit of the system, ESC believes all energy storage facilities providing ancillary services should still be exempted from all non-energy charges (including transmission demand and LDC charges) even if there is a minor local impact
    - i.e. retail loads are not created for the sole and explicit purpose of providing wholesale system benefits; therefore, it is appropriate that non-energy charges apply to retail loads but not storage
    - If a complete non-energy charge exemption for energy storage facilities providing ancillary services is deemed untenable, then the party receiving those services (IESO) should reimburse all non-energy charges as a pass-through (either through a contract, or market mechanism as appropriate)

Treatment of Facilities Providing Ancillary Services and other Bulk Market Benefits (cont.)

- Bulk energy storage that operates in a wholesale-to-wholesale market should be exempted from all non-energy charges (including transmission demand and LDC charges) because these storage facilities are providing a bulk market benefit when providing ancillary services and/or offering alternatives to exports when managing SBG or minimizing electron waste.
  - To minimize reliance on market exports as a system balancing option, non-energy related charges need to be removed from all wholesale storage operations when consuming energy regardless of the final wholesale energy market used for discharging (e.g. electricity, thermal, gaseous energy, etc.)
  - Optimizing low-carbon energy supplies requires a level playing field between exports and storage to improved environmental, economic and system flexibility gains

- These storage solutions offer a competitive means to diversify our options against higher priced imports and limited market export options.

Non-Energy Charges for Various Energy Storage Facilities vs. Exports

Item	4 Hour Peaking Operation, Charging at Any Time (Connected Downstream of a Transmission System Transformer) Amount, $/MWh	4 Hour Peaking Operation, Overnight Charging Only (Connected Downstream of a Transmission System Transformer) Amount, $/MWh	Regulation Service Provision (Connected Downstream of a Transmission System Transformer) Amount, $/MWh	4 Hour Peaking Operation, Overnight Charging Only (Connected Directly to Transmission High Voltage System) Amount, $/MWh	Exports, Quebec Buys During Off-Peak and Sells Back to Ontario During On-Peak Amount, $/MWh
Global Adjustment	88.40				
Hourly Uplift	1.39	0.77	1.39	0.77	0.77
Daily Uplift	0.12	0.12	0.12	0.12	0.12
Monthly Uplift	-0.39	-0.39	-0.39	-0.39	-0.39
IESO Administration Fee	1.16	1.16	1.16	1.16	0.96
Network Service Charge	35.81 - 71.62		35.81 - 71.62		
Line Connection Service	8.51 - 17.03	8.51 - 17.03	8.51 - 17.03		
Transformation Connection Service	19.77 - 39.53	19.77 - 39.53	19.77 - 39.53		
Transmission Export Rate					1.85
Subtotal, $/MWh	**154.77 - 218.86**	**29.94 - 58.22**	**66.37 - 130.46**	**1.66**	**3.31**
HST (On Non-Energy Charges)	20.12 - 28.45	3.89 - 7.57	8.63 - 16.96	0.22	0.43
HST (On HOEP)	0.39	0.39	0.39	0.39	0.39
Total, $/MWh	**175.28 - 247.70**	**34.22 - 66.18**	**75.39 - 147.81**	**2.27**	**4.13**

Current non-energy charges for an embedded energy storage system are much higher than current market signals and would prevent a merchant based system from realizing arbitrage value

Energy storage could provide regulation service at a lower cost if it was exempted from non-energy charges

To be competitive with Quebec, energy storage facilities are currently forced to bypass as much system infrastructure as possible, this eliminates system benefits associated with embedding energy storage. ***Storage is still disadvantaged against exports when consuming during low-price, daytime conditions***

Preferred Approach to Regulatory Changes

Need	Regulatory Change
Exempt energy storage facilities from Distribution Charges	
Exempt energy storage facilities from Transmission Demand Charges	
Exempt energy storage facilities from Global Adjustment	
Exempt energy storage facilities from Hourly Uplift	
Exempt energy storage facilities from Daily Uplift	
Exempt energy storage facilities from Monthly Uplift	
Exempt energy storage facilities from IESO Admin Fee	
Exempt energy storage facilities from Capacity Based Demand Response Charge	
Exempt energy storage facilities from RRRP	
Exempt energy storage facilities from OESP	
Exempt pumped hydro storage facilities from Gross Revenue Charge	
Allow energy storage facilities to be eligible for the Industrial Accelerator Program	
Allow energy storage facilities to be eligible for the Net Metering	

Omnibus Approach: Ensure storage is not disadvantaged against exports through creation of new wholesale rate / tariff for storage. OEB license could provide suitable means of establishing eligibility for this new tariff

- Added benefit - storage is removed from future retail rate proceedings where future regulatory changes could create unintended consequences for storage and create investor uncertainty

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Alternative Approach to Regulatory Changes

Need	Regulatory Change
Exempt energy storage facilities from Distribution Charges	• Amendment to 2006 Electricity Distribution rate Handbook and Retail Settlement Code
Exempt energy storage facilities from Transmission Demand Charges	• Amendments to transmitter rate orders
Exempt energy storage facilities from Global Adjustment	• Amendment to O. Reg 429/04 (Adjustments under Section 25.33 of the Act)
Exempt energy storage facilities from Hourly Uplift	• Amendment to Chapter 9 and 11 of the Market Rules
Exempt energy storage facilities from Daily Uplift	• Amendment to Chapter 9 of the Market Rules
Exempt energy storage facilities from Monthly Uplift	• Amendment to Chapter 9 of the Market Rules
Exempt energy storage facilities from IESO Admin Fee	• Amendment to Chapter 9 of the Market Rules
Exempt energy storage facilities from Capacity Based Demand Response Charge	• Amendment to Chapter 9 of the Market Rules
Exempt energy storage facilities from RRRP	• Amendment to O. Reg 442-01 (Rural or Remote Electricity Rate Protection) – if not already removed via Fair Hydro Plan
Exempt energy storage facilities from OESP	• Amendment to O. Reg 314/15 (Ontario Electricity Support Program) – if not already removed via Fair Hydro Plan
Exempt pumped hydro storage facilities from Gross Revenue Charge	• Amendment to O. Reg 124/02 (Taxes and Charges on Hydro-Electric Generating Stations)
Allow energy storage facilities to be eligible for the Industrial Accelerator Program	• Amendment to Industrial Accelerator Program Process & System Initiative Program Rules
Allow energy storage facilities to be eligible for the Net Metering	• Amendment to O. Reg 541/05 (Net Metering)

Refer to Attachment A for specific details on proposed Regulatory Changes

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