EB-2017-0049

ONTARIO ENERGY BOARD

IN THE MATTER OF the *Ontario Energy Board Act*, *1998*, S.O. 1998, c.15, Schedule B;

AND IN THE MATTER OF an Application by Hydro One Networks Inc. for an order approving just and reasonable rates and other charges for electricity distribution to be effective January 1, 2018 to December 31, 2022.

COMPENDIUM OF THE SCHOOL ENERGY COALITION
(Shared Services)

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complete listing of the vehicles and helicopters as well that Hydro One owns.

Are these are owned, by the way -- let's start like this -- or are some of them leased?

MR. BERARDI: These are owned.

MR. LADANYI: These are owned. All right. And I was interested, actually surprised how many vehicles there are. Hydro One, as I understand it from evidence earlier in this case, has roughly 8,500 employees; would you accept that?

MR. BERARDI: Yes, that's correct.

MR. LADANYI: And some of those employees are in the office here in Toronto, and others are outside in field operations. So roughly, how many employees would be in field operations? Roughly only.

[Witness panel confers]

MR. BERARDI: Approximately 6,000, subject to check.

MR. LADANYI: 6,000. So there are actually more vehicles than employees, would that be right? So it's really -- so can you explain to me -- like how much use do these vehicles get, or this equipment? A lot of them must be just sitting around, I assume.

MR. BERARDI: I just wanted to address the utilization. So in 2017, we've implemented a tool called telematics. And during that time in 2017, we reduced our fleet by approximately 10 percent. So we went from 8,000 in 2017 to 7,200.

And so by implementing tools like telematics that gives us real-time information on utilization and real-time

information on idling, we were able to reduce our fleet by 10 percent.

So the numbers that you are seeing are as a result of the fleet reduction from 8,000 to approximately 7,200.

MR. LADANYI: Does each employee in the field have a vehicle?

MR. BERARDI: No, they do not.

MR. LADANYI: And these do have vehicles, are they allowed to take them home?

MR. BERARDI: It really depends. It really depends on the work that they're doing. So, for instance, if they're moving from one location to another location, it might be more efficient for them to take that vehicle home.

But for the most part, large, heavy equipment, would be at the operation centre, so they would have to drive to the operation centre to get some of the large classes.

MR. LADANYI: Some companies have a policy of returning all of the light vehicles and virtually all the vehicles back to the yard, the company yard, at the end of a shift. Do you have that similar policy?

MR. BERARDI: We do not.

MR. LADANYI: Do not. Have you considered something similar?

MR. BERARDI: Not to the best of my knowledge.

MR. LADANYI: Is there -- do employees get charged for personal use of the vehicles?

MR. BERARDI: They do.

MR. LADANYI: And it becomes a benefit, or how are

they charged?

MR. BERARDI: Well, I believe it's through the CRA rules and taxable benefits. I'm not the expert in this area.

MR. LADANYI: All right. Do you keep track of kilometres per vehicle per year?

MR. BERARDI: Yes, we do.

MR. LADANYI: And I presume that would vary. I guess heavy equipment would have lower kilometres than light vehicles, is that right?

MR. BERARDI: That's correct.

MR. LADANYI: I don't want to ask you an interrogatory -- or an undertaking for that, because I'm not sure if the numbers will be meaningful to me. But I'm assuming you are monitoring this and you are getting efficient use of vehicles, and that's your objective, is it?

MR. BERARDI: Yes, we do a regular asset condition assessment on each one of our vehicles, so we have very detailed accounts on each piece of equipment.

MR. LADANYI: One last question about the vehicles before we go to another subject. So at what point in time would you be disposing of vehicles?

MR. BERARDI: It really depends. It really depends on class. It really depends on usage, and it really depends on the amount of kilometres, wear and tear.

So for instance, light vehicles versus heavy have different criteria for when we dispose. But we do have a regular asset condition assessment that we do on an annual

OEB Staff Interrogatory # 173

Issue:

Issue 29: Are the proposed capital expenditures resulting from the Distribution System Plan appropriate, and have they been adequately planned and paced?

Reference:

Q-01-01
1.2 A reduction in the capital forecast; updated rate base and in-service additions forecasts

Interrogatory:

Hydro One has updated the capital forecast for the years 2018-2022 due to adjustments made to General Plant projects and productivity targets.

Please provide the updated ISD for each General Plant investment that has affected the updated capital forecast and highlight the changes in project scope or explain the productivity change that attributed to the updated capital forecast.

Response:

The attachment to this response includes the following updated ISDs:

- GP-01
- GP-02
- GP-03
- GP-04
- GP-05
- GP-06
- GP-07
- GP-08
- GP-09
- GP-10
- GP-11
- GP-12
- GP-13
- GP-14
- GP-15
- GP-17

- GP-18
- GP-19
- GP-20
- GP-23
- GP-35

Additionally it includes the following newly created ISDs as a result of the updated capital forecast presented in Exhibit Q, Tab 1, Schedule 1:

- GP-36
- GP-37
- GP-38
- GP-39
- GP-40

GP-18 Integrated System Operating Centre

Start Date:	Q1 2015	**Priority:**	High
In-Service Date:	Q3 2020	**Plan Period Cost ($M):**	61.3
Primary Trigger:	Asset Driven – Failure Risk & Capacity		
Secondary Trigger:	Regulatory		

Investment Need:

The Network Operating Divisions ("NOD") Backup Control Centre ("BUCC") facility was placed in-service in 1956, and is the means that regulatory, business and operational requirements are sustained for monitoring and control operations to North American Electricity Reliability Corporation ("NERC") standards, Distribution and Transmission System Code ("DSC") requirements and Hydro One standards respectively. The BUCC facility consists of the building, computer tools and systems that support Operations in the event of a partial or total loss of the primary Ontario Grid Control Centre.

A risk of future extended outages, inability to execute necessary upgrades /replacements and increase capacity to required computer systems and tools, could result in significant disruption to business continuity and Hydro One's ability to meet customer's service level expectations. The facility is currently at capacity in computing space, HVAC, power and due to the age of the structure, among other factors, remedial efforts are either not viable alternatives, cannot be mitigated or are cost prohibitive to execute. In addition, a prolonged activation would impede supporting Operations; i.e., Outage Planning, Operations studies and support due to a lack of back office support space. Current Operations support groups that are fundamental in daily Operations, are unable to occupy the BUCC during any event, and would require current staff at the Richview facility to be relocated, procurement and set up of required computer equipment and would take vital time to implement.

Alternative 1: Status Quo/ Use Offsite Leased Space

Hydro One Network Operating maintains the existing Control Room, and Security Operations maintain existing facilities. A new offsite leased Data Centre facility (to mirror capacity of OGCC data centre based on 20 year lease and initial setup costs) could be provisioned and additional office space would be required and furnished for prolonged activations. This alternative includes additional leased space for the Backup Integrated Telecommunications Management Centre's ("BUITMC") control room and compute needs.

Outcome Summary:

Customer Focus	• Improve the reliability and availability of emergency activation, response and restoration in the event any failure is experienced in the Primary Control Centres. • Reduced rate impacts from a single integrated solution as compared to multiple standalone investments. • Retiring of the current interim NOD BUCC and removal of the risk of costly remedial efforts in the event further failures are experienced.
Operational Effectiveness	• Mitigates the critical risks (infrastructure failures, capacity constraints, location and activation timelines etc.) that exist at the Network Operating Backup Control Centre and the Backup Integrated Telecommunication Management Centre. • Monitoring and control reliability will be sustained under all system contingency scenarios improving Hydro One's compliance risk, customer responsiveness and Operational agility.
Public Policy Responsiveness	• Accommodate all regulatory requirements for physical protection, cyber security and activation timelines responsiveness. (See Appendix A and Compliance section of this document for further details).
Financial Performance	• Reduce the cost impact to Hydro One customers through the realization of economies of scale, mitigating the need to provide multiple sites, buildings and shared critical support infrastructure. • Negate the need to maintain an Interim NOD BUCC and reduce the risk of costly mitigation in the event additional failures are experienced at the main BUCC.

Costs:

Key considerations affecting the final cost of the project consist of the following:

- Availability and Reliability Standards including the need for redundancy in system and building architecture to maintain the existing target of 99.95%. The largest cost element revolves around the Data Center and critical support infrastructure, and the "Tier" or "Redundancy" level can weigh heavily on the investment required. Given the criticality of the Control Centre functions, with leading industry advice, a Tier III level was recommended and designed. This category includes the investment required in the SONET control telecommunications network required to connect the BUCC to field assets for monitoring and control.

- Security Requirements impose additional cost considerations ensuring the facility can withstand both natural and human events i.e. Tornado's, blast protections. Included in this consideration are prescribed regulatory requirements for six sided secure perimeters, cyber security (IT architecture), site access and monitoring of critical assets.
- Costs have been managed through an extensive and thorough assessment with various third party industry experts, internal subject matter experts as it relates to industry best practices, cost saving initiatives (i.e., free cooling), alternative option assessment for independent project elements (site selection, industry comparators), integration of solutions for various business units, functions and needs across Hydro One at a single site. An independent cost consultant has provided costing of the current stage of detail designs.

Variance due to refinement of the IT, Telecom, and construction engineering cost estimates as the engineering design had been finalized.

($ Millions)	**2018**	**2019**	**2020**	**2021**	**2022**	**Plan Period Total**	**Total Project Costs****
Capital* and Minor Fixed Assets	22.0	36.3	3.1	-	-	61.3	69.3
Less Removals	-	-	-	-	-	0.0	0.0
Gross Investment Cost	**22.0**	**36.3**	**3.1**	-	-	**61.3**	**69.3**
Less Capital Contributions	-	-	-	-	-	0.0	0.0
Net Investment Cost	**22.0**	**36.3**	**3.1**	**0**	**0.0**	**61.3**	**69.3**

**Includes overhead at current rates.*
*** Total Project includes amounts spent prior to 2018.*

APPENDIX A – DETAILED PROJECT DESCRIPTION

This investment, formerly known as the Backup Control Centre – New Facility Development, has expanded to include other operational synergistic lines of business that require facilities to perform similar functions (operating, monitoring, control and response functions) that are critical to support Network Operating and to secure Hydro One's assets. An integrated solution was sought to ensure costs are minimized, maximizing the effective utilization of critical infrastructure, office space and the site with the intent to maximize capital investments and reducing customer rate impacts. Below is a description of the Security Operations (SOC), Security Event Monitoring (SEM) and the Integrated Telecommunications Management Centre (ITMC) identified investment need.

The Backup Integrated Telecommunications Management Centre (BUITMC), in-serviced in 1950, requires extensive setup during activation and cannot accommodate back office support staff and regulatory security requirements for access control for critical computing equipment. The current HVAC is not adequate for net new occupancy or equipment and lacks the necessary facilities should a prolonged activation be required. ITMC is a critical element in ensuring that the Network Operations telecommunications network is available and in providing first level support in the event of any communications failure. In the event the ITMC cannot meet its service objectives, and Hydro One experiences an issue with telecommunications paths, Network Operating will be unable to monitor or control the respective field assets. ITMC requires a new Backup Control Centre to alleviate the risk at the current location.

Security Event Monitoring (SEM) is accountable to provide cyber surveillance monitoring services and requires Data Centre capacity, (not a physical tenant) to support primary and backup operations. SEM monitors Network Operating's Compute Network to ensure threats are detected, assessed and remediated so that critical cyber assets are not negatively impacted. Loss of visibility, control or erroneous operations of equipment due to a cyber-vulnerability, poses a serious threat to Hydro One's Operating functions. The risk of cyber related events has increased rapidly due to the relative increase in the amount of IT critical cyber assets employed in Hydro One Networks.

A Security Operations Centre (SOC) and an Emergency Operating Centre are required to provide a primary site for operations, monitoring and coordinated response for physical security threats and are imperative for business continuity. Currently, Security Operations are dispersed across the province and is reliant on third party services. In the event the current vendor cannot meet service obligations, Hydro One will be unable to monitor its critical sites. An integrated security presence at the ISOC will ensure physical threats can be detected,

assessed and appropriate response dispatched. If a physical threat goes undetected, catastrophic impacts can result, in the event critical assets are damaged, which has potential to result in sever impacts to the Transmission and Distribution system networks. In addition, a lack of detection has potential to expose Hydro One to safety and environment risk for staff and the general public.

The current ISOC investment has evolved through a significant collaborative effort with Hydro One Network Operating, ITMC, SEM, Security Operations, industry participants and external subject matter experts. Initiation of this investment was predicated on current asset driven deficiencies / requirements (documented safety hazards, capability constraints, Reliability/Performance Impacts and risks, failures, condition, age, obsolescence, and regulatory and/or Hydro One standards (as described above).

Below is a detailed description of the ISOC investment planning process and execution strategy, which has been developed with the aim to a) fully understand requirements and needs across Hydro One; b) gather leading industry best practices, lessons learned; c) develop detailed programmed space and sizing requirement and asses against industry benchmarks; d) project costing from leading industry experts; e) ensures cost controls and oversight.

Planning Needs Assessment: Phase One

Requests for Proposals (RFP) were issued to conduct a Market scan and a Planning Needs assessment. This provided a detailed assessment of sites available in the market that met a set of specific “essential location requirements” and to provide expertise into the conceptualization and documentation of business needs and requirements of Hydro One Networks, ITMC, SEM and Security operations. The main focus was balancing needs and costs against reliability requirements, industry best practices (including Industry participant’s feedback (New York ISO, New England ISO)) and lastly with lessons learned from the current Primary Ontario Grid Control Centre (OGCC). In addition, business requirements were translated into programmed space requirements based on Hydro One’s experience and at the advice of industry experts. A basis of design was developed, capturing the stated requirements and a cost estimate was provided by an external estimator (for building and support infrastructure) and internal Hydro One engineering groups (for Telecommunications and Dual Power and Power System IT).The final basis of design and cost estimate were utilized to initiate the subsequent Detailed Design Phase.

The sizing of the ISOC is predicated on duplicating the OGCC current functions for Backup Control, including parallel use for training simulation and controller / dispatcher training.

The training facilities at the OGCC are currently at capacity. This effectively reduced the size of the ISOC facility by negating the need to program space for training simulation and instead uses technology to use real-time operating space while not active (in backup mode). In the event the OGCC is rendered inoperable or uninhabitable, the new ISOC facility will be able to continue all day to day functions indefinitely with a limited transition period, expected to be one hour or less.

Security Operations sizing was predicated on defined needs of operators, support staff, an investigation room and an Emergency Operations Centre (which will utilize a shared conference rooms when required).

ITMCs Backup Control Centre duplicated the current Primary Centre exclusively, including Control Room space, Data Centre requirements and provisions a back office support compliment to ensure adequate facilities are available for prolonged activation redundancy and assurance of Operations.

SEMs compute needs were documented, forecasted and the incremental capacity was added to the Data Centre white tile space.

Future growth has been accommodated and captured in the detail design however not all space will be built in the initial ISOC build. Data Centre growth has been included up to and including 2035 due to the sensitivity of the equipment and the risk future construction would pose; however the support infrastructure will be purchased on an as needed basis. Future facility expansion will be enabled for future consideration by way of footings and ensuring construction can be achieved without impacting operations (designing connection points etc.) Future extension of the facility, when required will be included in future OEB rate cases.

Detailed Design: Phase Two

At the completion of the Planning Needs Assessment Phase, a Detailed Design phase commenced with the objective to provide all required documentation, designs and costing to tender the end state solution for construction. During this phase, all drawings, facility programing (space definition), IT architecture etc. will be completed, including site procurement (~$3M), Proof of Concept for IT architecture and a final estimation. This information will be packaged and ready for submission for RFP for the construction phase. It is expected to be completed in 2017.

Pending completion of the Detailed Engineering Design and receipt of required approvals, Hydro one will leverage its internal Supply Chain, an Open Market Construction Tender process in two phases.

Phase One: Request for Pre-Qualification ('RFPQ")

Hydro One will seek to pre-qualify a select number of vendors in an open market process, who demonstrate "required competencies" (e.g., proven large project construction experience, defined safety/environmental programs, change control process controls, demonstrated ability to deliver large construction projects on time and to budget, etc.) related to the construction of the ISOC and acceptance of HONI required market-based Terms and Conditions.

Phase Two: Request for Proposal ("RFP")

Hydro One will release to only the pre-qualified vendors a detailed RFP with a complete set of construction documents. Pre-qualified vendors will be required to review the construction documents, offer input with respect to area's which could result in increased costs if not addressed before construction and provide a "fixed" price proposal to a defined scope of work and schedule, linked to a delivery penalty.

Construction Phase: Phase Three

The successful proponent will commence construction and is planned for Q4 2017.

Post Construction award: Hydro One's external designer will monitor on site activities throughout the construction to ensure any issues are addressed early and that required contract quality is delivered. HONI and designates will participate in interactive Bi-weekly onsite construction process meetings to gauge progress to requirements and address concerns which may impact the process.

The ISOC investment has been identified and assessed as a high priority and was subsequently prioritized and planned due to risk and considerations described below.

Site location risks that will continue to be present as there are no viable remedial alternative to the following risks:

- The current site location, and required travel time, requires maintaining an interim backup facility to perform limited functions in the event the OGCC is rendered inoperable and staff have to transition to the BUCC. The ISOC will eliminate this requirement;

- Structure is landlocked, and no expansion potential exists as the facility is surrounded by a Transformer Station;
- Current emergency preparedness risks will remain:
    - In a flight paths (Pearson International Airport);
    - Between two major highways (Hwy 427 & Hwy 401) in the event of hazardous spills;
    - Gas pipe lines located underneath property;
    - Adjacent to transformer station (electrical, fire and asset failure hazard). In 2011, T7 and T8 transformers at Richview both failed catastrophically, resulting in loss of the station and a major fire. This removed the BUCC from use for an extended period of time;
    - Congested area in the event of wide spread emergencies i.e. Civil unrest, blackout, natural disaster, and commute;
    - Adjacent to public storage facilities.
- Facility risks that could render the Hydro One Networks Control Centre or critical equipment unavailable for an extended period of time, eliminating redundancy of critical monitoring and control of the Distribution system include:
    - Flooding in basement, roof and cable entrances, where computer rooms, power rooms, telecom rooms, switchgear, and SONET communications are currently located;
    - Failures of critical support infrastructure including; the fire panel, HVAC, emergency backup power (generator);
    - Inability for expansion and a high cost for retrofit / maintenance activities;
    - Relocation of the equipment located in the basement of the facility is not viable given the space required on the main floor (Computer rooms, telecommunication gear (SONET), Uninterrupted Power Supply units, switchgear etc.;
    - Competing demands for physical space, power, cooling from multiple tenants; and
    - Electric power system is undersized (Station Service).
- ITMC's current BUITMC has documented the following risk and constraints;
    - Located in a shared space with an inability to expand;
    - Requires extensive setup during activation as the facility cannot accommodate a permanent active installation;
    - Cannot accommodate current back office support requirements;
    - Cannot meet security requirements for access control for critical computing equipment;
    - The current HVAC is not adequate for net new occupancy or equipment;

- Lacks the necessary facilities should a prolonged activation be required; and
- ITMC is a critical element in ensuring that the Network Operations telecommunications network is available and in providing first level support in the event of any communications failure.

Hydro One's Security Operations are currently reliant on an external facility that is owned and operated by a third-party creating corporate and regulatory risks given that Hydro One lacks a contingency site that is capable of monitoring the physical security of its sites and assets. Should the facility or 3rd party services no longer be available to Hydro One due to factors outside of Hydro One's control, Hydro One will not be in a position to monitor the real-time security (including door alarms, motion sensors etc.) of its critical sites, creating both a security and public and employee safety risk. Such an occurrence would also lead to a regulatory non-compliance violation with NERC Standards and possible sanctions, financial penalties and risk to corporate reputation.

Industry Comparators	Description/Name	Cost ($M)	Size (Sq. ft.)	Year Built	Adj. Cost to 2016 $ (CPI)	Cost (2016 $) / Sq. ft.
New York Independent System Operator	NYISO Control Center	$59.4M	64,000	2014	$60.82M	$950
American Electric Power	Transmission Operations center	$57.2M	83,500	2007	$65.92M	$789
ISO-New England	Windsor Backup Control Centre	$50.7M	70,000	2014	$51.91M	$742
Pacific Gas & Electric	Distribution Control Center	$52.0M	37,674	2015	$52.57M	$1,395
	Distribution Control Center	$37.05M	24,000	2014	$37.97M	$1,582
	Distribution Control Center	$46.8M	50,000	2016	$46.8M	$936
First Energy	FirstEnergy Tx Control Centre	$58.5M	70,000	2013	$61.16M	$874
BC Transmission Corporation	System Control Modernization Project	$133M	113,022	2008	$148.07M	$1,310
	System Control Centre (building ONLY)	$40M	64,584	2008	$44.53M	$689
	Backup Control Centre (building ONLY)	$30M	48,438	2008	$33.4M	$690
Average Cost :				-	$60.3M	$996
Distribution Portion of ISOC.		$69.3M	63,188	2016	$69.3M	$1,096
Proposed ISOC Cost Comparison		$138.4M	126,200	2016	$138.4M	$1096

Converted from USD to CDN at an exchange of 1 USD to 1.3CDN

Note: The ISOC is comprised of Distribution, Transmission, ITMC and SOC.

Site Assessment

As the table below shows, sites south of Barrie were higher cost and the sites North of Barrie were considerably less expensive. Orillia, given its relative location compared to the Primary Centre, was optimal given the City size, access, lodging, development and emergency services, including the OPP headquarters. Communities further away were ranked lower due to distance, access to emergency services, development and lodging, winter driving hazards and relative site suitability among other factors.

Ranking	Community	# of Sites	Ave. Cost / Acre
1	City of Orillia	4	$114,935 - $181,200
2	Town of Bradford	3	$346,636
3	Town of Collingwood	3	$135,469
4	Town of Midland	6	$90,000
4	Town of Penetanguishene	3	$87,500
5	Town of Alliston (New Tecumseth)	3	$273,900
6	Town of Newmarket	2	$850,000
7	Town of Orangeville	1	$215,000
8	East Gwilliambury	6	$400,000
9	Angus	1	$80,000
10	Innisfill	0	$ -
11	Schomberg (King Township)	1	$475,000
12	Wasaga	0	$ -

Note: An assessment of internal Hydro One TS sites was reviewed against available acreage and emergency preparedness criteria and was determine that there was no existing Hydro One site that could accommodate the proposed facility. This represented a departure for previous assumptions with impacts of land purchase and support infrastructure that must be extended to the preferred site.

GP-18 Integrated System Operating Centre

Start Date:	Q1 2015	**Priority:**	High
In-Service Date:	Q3 2020	**Plan Period Cost ($M):**	56.4
Primary Trigger:	Asset Driven – Failure Risk & Capacity		
Secondary Trigger:	Regulatory		

Investment Need:

The Network Operating Divisions ("NOD") Backup Control Centre ("BUCC") facility was placed in-service in 1956, and is the means that regulatory, business and operational requirements are sustained for monitoring and control operations to North American Electricity Reliability Corporation ("NERC") standards, Distribution and Transmission System Code ("DSC") requirements and Hydro One standards respectively. The BUCC facility consists of the building, computer tools and systems that support Operations in the event of a partial or total loss of the primary Ontario Grid Control Centre.

A risk of future extended outages, inability to execute necessary upgrades /replacements and increase capacity to required computer systems and tools, could result in significant disruption to business continuity and Hydro One's ability to meet customer's service level expectations. The facility is currently at capacity in computing space, HVAC, power and due to the age of the structure, among other factors, remedial efforts are either not viable alternatives, cannot be mitigated or are cost prohibitive to execute. In addition, a prolonged activation would impede supporting Operations; i.e., Outage Planning, Operations studies and support due to a lack of back office support space. Current Operations support groups that are fundamental in daily Operations, are unable to occupy the BUCC during any event, and would require current staff at the Richview facility to be relocated, procurement and set up of required computer equipment and would take vital time to implement.

Alternative 1: Status Quo/ Use Offsite Leased Space

Hydro One Network Operating maintains the existing Control Room, and Security Operations maintain existing facilities. A new offsite leased Data Centre facility (to mirror capacity of OGCC data centre based on 20 year lease and initial setup costs) could be provisioned and additional office space would be required and furnished for prolonged activations. This alternative includes additional leased space for the Backup Integrated Telecommunications Management Centre's ("BUITMC") control room and compute needs.

Outcome Summary:

Customer Focus	• Improve the reliability and availability of emergency activation, response and restoration in the event any failure is experienced in the Primary Control Centres. • Reduced rate impacts from a single integrated solution as compared to multiple standalone investments. • Retiring of the current interim NOD BUCC and removal of the risk of costly remedial efforts in the event further failures are experienced.
Operational Effectiveness	• Mitigates the critical risks (infrastructure failures, capacity constraints, location and activation timelines etc.) that exist at the Network Operating Backup Control Centre and the Backup Integrated Telecommunication Management Centre. • Monitoring and control reliability will be sustained under all system contingency scenarios improving Hydro One's compliance risk, customer responsiveness and Operational agility.
Public Policy Responsiveness	• Accommodate all regulatory requirements for physical protection, cyber security and activation timelines responsiveness. (See Appendix A and Compliance section of this document for further details).
Financial Performance	• Reduce the cost impact to Hydro One customers through the realization of economies of scale, mitigating the need to provide multiple sites, buildings and shared critical support infrastructure. • Negate the need to maintain an Interim NOD BUCC and reduce the risk of costly mitigation in the event additional failures are experienced at the main BUCC.

Costs:

Key considerations affecting the final cost of the project consist of the following:

- Availability and Reliability Standards including the need for redundancy in system and building architecture to maintain the existing target of 99.95%. The largest cost element revolves around the Data Center and critical support infrastructure, and the "Tier" or "Redundancy" level can weigh heavily on the investment required. Given the criticality of the Control Centre functions, with leading industry advice, a Tier III level was recommended and designed. This category includes the investment required in the SONET control telecommunications network required to connect the BUCC to field assets for monitoring and control.

- Security Requirements impose additional cost considerations ensuring the facility can withstand both natural and human events i.e. Tornado's, blast protections. Included in this consideration are prescribed regulatory requirements for six sided secure perimeters, cyber security (IT architecture), site access and monitoring of critical assets.
- Costs have been managed through an extensive and thorough assessment with various third party industry experts, internal subject matter experts as it relates to industry best practices, cost saving initiatives (i.e., free cooling), alternative option assessment for independent project elements (site selection, industry comparators), integration of solutions for various business units, functions and needs across Hydro One at a single site. An independent cost consultant has provided costing of the current stage of detail designs.

($ Millions)	**2018**	**2019**	**2020**	**2021**	**2022**	**Plan Period Total**	**Total Project Costs****
Capital* and Minor Fixed Assets	10.5	42.6	3.3	-	-	56.4	64.4
Less Removals	-	-	-	-	-	0.0	0.0
Gross Investment Cost	**10.5**	**42.6**	**3.3**	-	-	**56.4**	**64.4**
Less Capital Contributions	-	-	-	-	-	0.0	0.0
Net Investment Cost	**10.5**	**42.6**	**3.3**	**0**	**0.0**	**56.4**	**64.4**

**Includes overhead at current rates.*
*** Total Project includes amounts spent prior to 2018.*

Industry Comparators	Description/Name	Cost ($M)	Size (Sq. ft.)	Year Built	Adj. Cost to 2016 $ (CPI)	Cost (2016 $) / Sq. ft.
New York Independent System Operator	NYISO Control Center	$59.4M	64,000	2014	$60.82M	$950
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	Distribution Control Center	$37.05M	24,000	2014	$37.97M	$1,582
	Distribution Control Center	$46.8M	50,000	2016	$46.8M	$936
First Energy	FirstEnergy Tx Control Centre	$58.5M	70,000	2013	$61.16M	$874
BC Transmission Corporation	System Control Modernization Project	$133M	113,022	2008	$148.07M	$1,310
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	Backup Control Centre (building ONLY)	$30M	48,438	2008	$33.4M	$690
Average Cost :				-	$60.3M	$996
Distribution Portion of ISOC.		$64.4M	63,851.5	2016	$64.4M	$1,009
Proposed ISOC Cost Comparison		$130M	127,703	2016	$130M	$1018

Converted from USD to CDN at an exchange of 1 USD to 1.3CDN

Note: The ISOC is comprised of Distribution, Transmission, ITMC and SOC.

School Energy Coalition Interrogatory # 61

Issue:

Issue 29: Are the proposed capital expenditures resulting from the Distribution System Plan appropriate, and have they been adequately planned and paced?

Reference:

B1-01-01 Section 3.8 GP-18
With respect to the Integrated System Operations Centre:

Interrogatory:

a) [EB-2013-0416, Ex. D2-2-3-O-04] In EB-2013-0416, Hydro One sought approval for expenditures related for a Back-Up Control Centre at a cost of $18.8M. The current Integrated System Operations Centre appears to be a project of similar scope and is forecast to cost $56.4M. Please explain the evolution of the project and the significant increase in cost.

b) Please provide a copy of the full business case for the project.

c) Please provide a copy of the 'extensive Market Assessment" that selected the Orillia site.

d) Please confirm that this facility is the 'advanced technology hub' that has been referenced in local Orillia media (for example: http://www.orilliapacket.com/2016/08/15/orillia-sells-opdc-to-hydro-one-for-2635m].

Response:

a) The current project is not of a similar scope. The initial planner's estimate was exclusively for a Back-Up Control Centre, based upon two key assumptions: it was to be built on Hydro One land, and telecommunication infrastructure would be available.

b) As the project evolved, Hydro One conducted a planning needs assessment, to assess complimentary requirements across the company and identify the optimal way to fulfill business needs. Coming out of the needs assessment, it was learned that multiple lines of business required the same critical support infrastructure. As a result, a scope was created for an Integrated System Operations Centre, which added the following functionalities:

- An Integrated Telecommunication Management Centre,
- A Security Operations Centre,
- A Security Event Monitoring Centre,
- Office space for Operating support staff, and
- Incremental data centre space to relieve constraints at the existing data centre and accommodate the additional lines of business at the ISOC.

Furthermore, the ISOC necessitated new land acquisition and telecommunication infrastructure. These above noted changes to scope led to the cost increases.

c) The business case is still being finalized and will be provided once it is approved.

d) The Market Assessment was completed by ATA Real Estate Advisors and enclosed as attachment 1.

e) The ISOC is a component of the "advanced technology hub", which also includes a provincial warehouse and regional operations centre. Please note: the example link in the question returns "Page Not Found".

OEB Staff Interrogatory # 174

Issue:

Issue 30: Are the proposed capital expenditures for System Renewal, System Service, System Access and General Plant appropriately based on the Distribution System Plan?

Reference:

B1-01-01 Section 1.1 Page: 31
Distribution System Plan Overview, Section 1.1.1 (5.2.1 A) KEY ELEMENTS OF THE DSP

Interrogatory:

"General Plant investment costs are generally expected to decline modestly until the end of the forecast period in 2022 except for the spending associated with the planned new Integrated System Operations Centre (ISD GP-18). This will replace the existing backup power system control and telecommunications management centers and accommodate a new security operations centre to meet business and regulatory requirements."

a) Please explain what 'business requirements' are not being met by the current Operations Centre.

b) Could these business requirements be met without constructing a new Integrated System Operations Centre?

c) Please explain what 'regulatory requirements' are not being met by the current Operations Centre.

d) Could these regulatory requirements be met without constructing a new Integrated System Operations Centre?

e) Please provide the expected benefits of this facility for the distribution system and the cost allocation calculation.

f) Please provide scope of work for the recommended alternative complete with detailed cost estimates and project schedules.

Response:

a) Hydro One's Backup Control Centre ("BUCC") is currently meeting existing business requirements. The BUCC however, remains at high risk for critical failures which can result in significant disruptions in the event that further extended outages are experienced and cannot be adequately remediated or remediated in a timely fashion. The business justifications and risk mitigation associated with the proposed ISOC are as follows:

1. Risk avoidance, due to the current facility deficiencies:
    i. Flooding in basement where computer rooms, power rooms, telecom rooms, switchgear, SONET communications, etc. are currently located.
    ii. Facility roof and building cable entry leakage.
    iii. Generator failures – No redundancy in emergency generator power.
    iv. Fire panel failures.
    v. HVAC failures, capacity limitations and system constraints as the facility is limited due to age and design of infrastructure.
    vi. High cost for retrofit / maintenance activities.
    vii. Competing demands for physical space from multiple lines of business.
    viii. Electric power capacity will not meet future requirements.
    ix. Structure is landlocked, and no expansion potential exists as the facility is surrounded by Richview TS.
    x. The BUITMC requires extensive setup during activation and cannot accommodate back office support, growth, and regulatory security requirements for access control for critical computing equipment. The current HVAC is not adequate for net new occupancy or equipment and lacks the necessary facilities should a prolonged activation be required. ITMC is a critical element in ensuring that the Network Operations telecommunications network is available and is providing first level support in the event of any communications failure. ITMC requires a new Backup Control Centre to alleviate the heightened risk at the current location.
    xi. The current site location requires maintaining an interim backup facility to perform limited functions in the event the OGCC is rendered inoperable and staff have to transition to the Richview BUCC due to activation timelines. The ISOC will eliminate this requirement.
    xii. The Security Event Monitoring (SEM) is accountable to provide cyber surveillance monitoring services and requires Data Centre capacity (not a physical tenant) to support primary operations.

xiii. Security Operations Centre and Emergency Operating Centre required to provide a primary site for operations monitoring and coordinated response for security threats to ensure business continuity.

2. Emergency Preparedness risk considerations:
   i. In a flight path (Pearson International Airport)
   ii. Between two major highways (Hwy 427 & Hwy 401)
   iii. Gas pipe lines located underneath property
   iv. Adjacent to transformer station (electrical, fire and asset failure hazard)
   v. Congested area in the event of wide spread emergencies i.e. Civil unrest, blackout, natural disaster.
   vi. Adjacent to public storage facilities

b) Construction of a new ISOC is the most viable option. Please refer to pages 1 to 5 of ISD GP-18 for alternatives considered, and rationale for rejecting the respective alternatives.

c) Hydro One's BUCC is currently in compliance with applicable regulatory requirements. The BUCC however, remains at high risk for critical failures which can result in future non-compliance in the event further extended outages are experienced and cannot be adequately remediated or remediated in a timely fashion. In the event this investment does not proceed or is delayed, key risks are described on page 16 to 18 of ISD GP-18.

For a control centre to be compliant, the required regulatory standards are outlined on page 7 and 8 of ISD GP-18.

d) Please refer to answer (b) above.

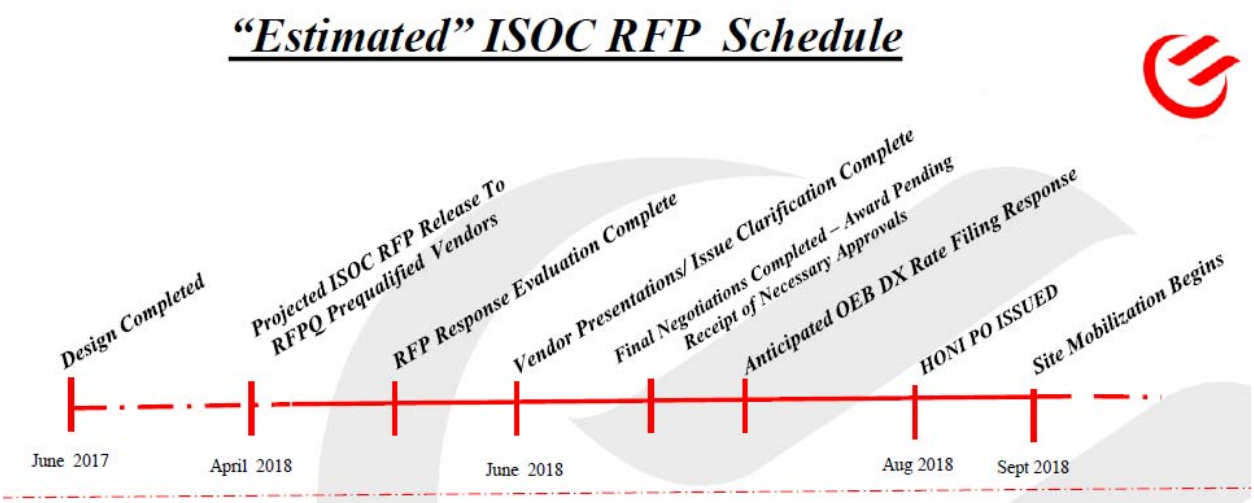
e) For expected benefits, please refer to page 9 and 10 of ISD GP-18. For cost allocation calculation, please refer to Exhibit I-24-Staff-117.

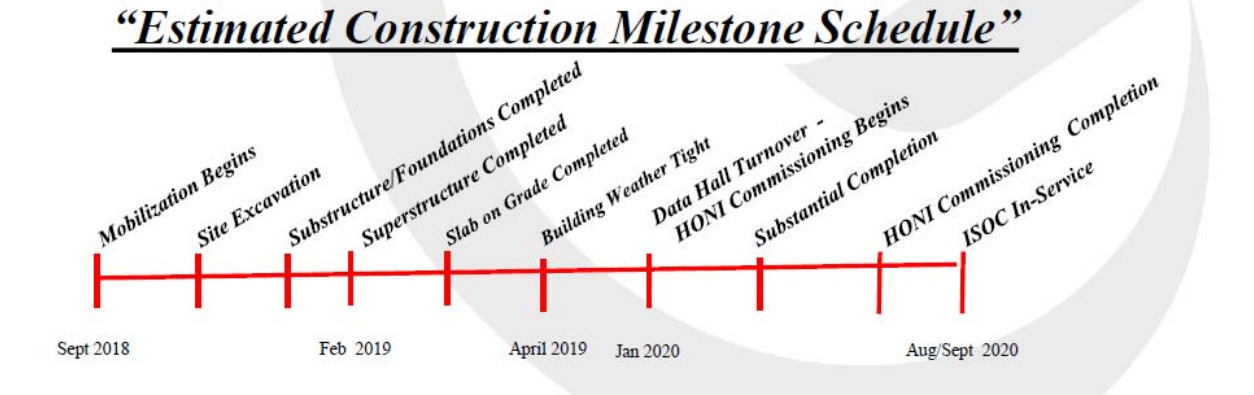
f) Pages 14 to 16 of ISD GP-18 provide a breakdown of scope of work covered in each of the phases in this investment. Cost is described in page 6 and 7 of ISD GP-18 and are summarized in the table below:

	Distribution portion only ($M)*
Land	1.5
Architecture and IT design	4.9
Construction Build (includes contingency and escalation)	51.7
Connectivity and Telecommunication	3.6
Network Infrastructure	7.6
Total:	**69.3**

*Based on Exhibit Q

Presented below is an estimated schedule for the remaining key milestones in this investment:





Hydro One

Gartner IT Budget Assessment
Final Report

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GARTNER CONSULTING

Project Number: 330034892 Version #1

Summary of Metrics

	Hydro One	Peer Average
IT Spending, Capital and Operations	$194,936,000	$200,135,986
IT Spending Capital and Operating by Cost Category		
Hardware	$18,129,048	$36,246,851
Software	$20,858,152	$47,810,263
Personnel Salaries & Benefits	$27,291,040	$77,830,661
Outsourcing (including telecom carrier costs)	$128,657,760	$38,248,211
IT Spend/% Revenue	3.0%	3.1%
IT Spend/% OPEX	3.6%	4.1%
IT Spend per Employee	$35,340	$32,911
Percentage of IT Spend - Capital	28%	40%
Percentage of IT Spend - Operating	72%	60%
Percentage of IT Spend - Run	79%	65%
IT FTEs, Excluding Outsourcing	102	513
IT FTEs Excluding Outsourcing by Technology Domain		
Enterprise Computing	3	84
End-User Computing	4	35
IT Service Desk	2	24
Voice Network	2	16
Data Network	1	52
Application Development	30	110
Application Support	15	132
Management,Project Management, Finance & Admin	46	60
IT Expense by Technology Domain		
Enterprise Computing	25%	20%
End-User Computing	14%	6%
IT Service Desk	2%	4%
Voice Network	4%	5%
Data Network	6%	10%
Application Development	13%	19%
Application Support	31%	27%
Management,Project Management, Finance & Admin	5%	10%

- Hydro One spends a similar amount on IT compared to the peer group, but there are differences in how the dollars are spent.
- Hydro One uses more outsourcing than the peer group with outsourcing representing $129M of the IT capital and operating budget.
- Hydro One spends half of the peer group level on hardware and software.
- Software includes capital and operating expenses for all software, for example business functionality software such as SAP. Hydro One is lower than the peer group in software but has a higher expense allocation to Applications Support compared to the peer group.
- Capital IT spending is lower. Hydro One does not capitalize below $2M which is higher than most organizations.
- 2015 represents a time period of Run allocation for Hydro One IT with 79% of IT spending as Run, versus 65% for the peer group.
- Hydro One expenses are focused on Enterprise Computing (servers and storage), End User Computing (laptops and desktops) and applications support. Voice and data are both lower than the peer group.
- Hydro One in-house and contractor FTEs are focused primarily in management and applications roles. It is unclear if there are overlaps with the service provider.

Observations & Recommendations

Observations	Recommendations
The benchmark results show a similar IT spend to peers but there are differences in how cost and staffing are allocated. Hydro One spending is also directed toward Run now that Cornerstone is complete, while the peer group is directing more IT dollars to Grow and Transform. This study focused on IT spending and did not measure governance mechanisms or value of IT services. It is unclear if Hydro One has a comprehensive enterprise IT strategy that articulates the vision of IT and its role in enabling the business. Currently Hydro One does not charge back or show back for IT services. Without any type of show back or understanding of where IT dollars are going, it is difficult to enable both groups (IT and the business) to be accountable for investment choices.	• Consider an assessment of the IT strategy, capabilities, governance mechanisms and organization design to better understand IT spending and staffing. The goal is to determine if the IT investments are appropriate for the direction of Hydro One. • Review governance mechanisms to understand how decisions are made for projects and services and the carried out with the service provider. • Analyze the IT spending by business service. Grouping IT spending into business services and capabilities will not only help to communicate IT spending in business terms but also determine if funds are directed in the right areas. Promote a focus on business outcomes in addition to IT efficiency to ensure that there is business value (spending on the right things at the right cost). Multiple views of IT spend can also show the impact of external forces out of the organization's control, such as regulatory and compliance and demand for services, which are within the organization's control. This will allow the business to make informed decisions about IT investments and help to manage internally driven complexity. • Review the organization design to understand roles and responsibilities of retained staff to determine if there are overlaps with the service provider, what roles should be retained and how work is managed.

Hydro One has a high capital threshold for IT investments compared to most organizations. IT cannot capitalize below $2M while other organizations are capitalizing at lower amounts (e.g. $250K-$500K range). The current policy does not book any IT spending below $2M as an asset.
While IT leaders should not be the ones to set accounting policy, there should be discussion of impact of policy on IT decisions. For many organizations, capitalization decisions of IT assets are often based on outdated capitalization policies, or "this is how we have always done it."
	• Work with business leadership to review capitalization policies. The capitalization policy has multiple impacts and will require review and analysis jointly among IT leadership, business leadership, legal and accounting professionals.
	  • Capitalization of IT assets has an impact on business balance sheet metrics (e.g. net income, cash flow, assets).
	  • Capitalization has an impact on IT budget planning and funding.
	  • Considerations include variability in the IT budget year over year, managing IT investments as company assets, and changing delivery models for services.

Observations & Recommendations

Observations	Recommendations
Benchmark findings indicate variations to the peer group by spending category and in the functional areas (end user computing, enterprise computing, and applications support are higher, network is lower). End user computing and applications support have a more direct business user impact (equipment and applications) and therefore require more business collaboration to balance cost, value and productivity. Hydro One spends differently than the peer group by category, with outsourcing receiving the highest allocation. Hydro One is outsourced with an additional 102 in-house and contractor FTEs. The in-house and contractor FTEs are allocated throughout the functional areas but with higher concentrations in applications development and support and management.	• Perform a deeper-dive analysis on specific areas to better understand cost drivers. • Ensure that outsourcing contract pricing is competitive in the market and services match both business needs and end user behavior. • As mentioned earlier, review roles and responsibilities of retained in-house and contractor staff and the service provider outsourcer. There are some indications of possible overlaps with retained staff and the service provider. For example, Hydro One reported a total of 45 FTEs in Applications Development and Support. The outsourcer also provides applications services and it is unclear if the 45 FTE and the outsourcer are duplicating effort. There are also a number of corporate IT staff including project management staff. Review role specification, processes and handoffs. • Develop a plan to rationalize enterprise computing costs and review opportunities to increase server virtualization. • Evaluate data management policies and roles at the business level to optimize storage costs. • Consider user segmentation strategies for end user computing, carefully analyzing impact on user productivity. • Review software costs in depth - including the application portfolio and other software usage such as tools against the software spending reported in the assessment. Software costs are low, but applications support spending allocation is high. Is this indicative of applications that have a low software cost but require more maintenance? Is Hydro One investing in tools or applications to improve user productivity? • Analyze data network equipment investment levels for review and possible replacement, especially in remote locations.

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IT Metrics

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IT Spending as a Percentage of Revenue

Assessment Area	Observations
IT Spending	■ IT Spending as a Percentage of Revenue is similar to the peer group. ■ The analysis period in the benchmark represents a period of minimal transformational initiatives in the IT budget at Hydro One.

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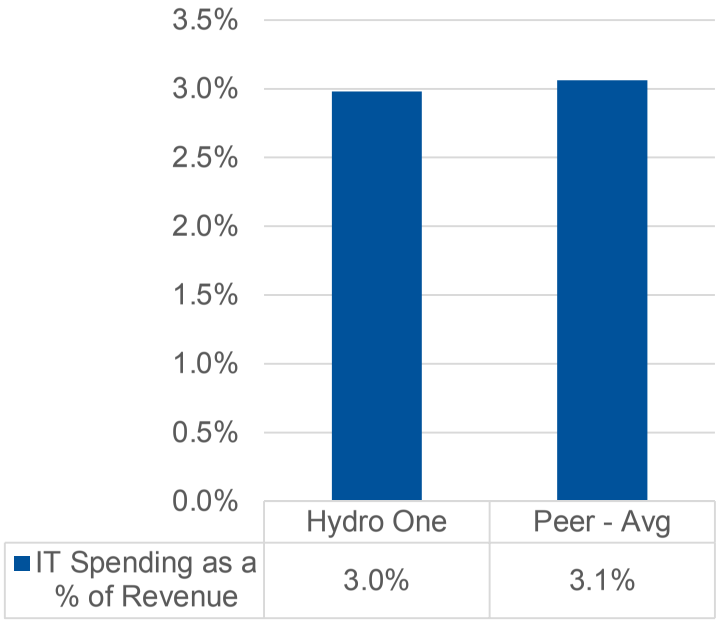
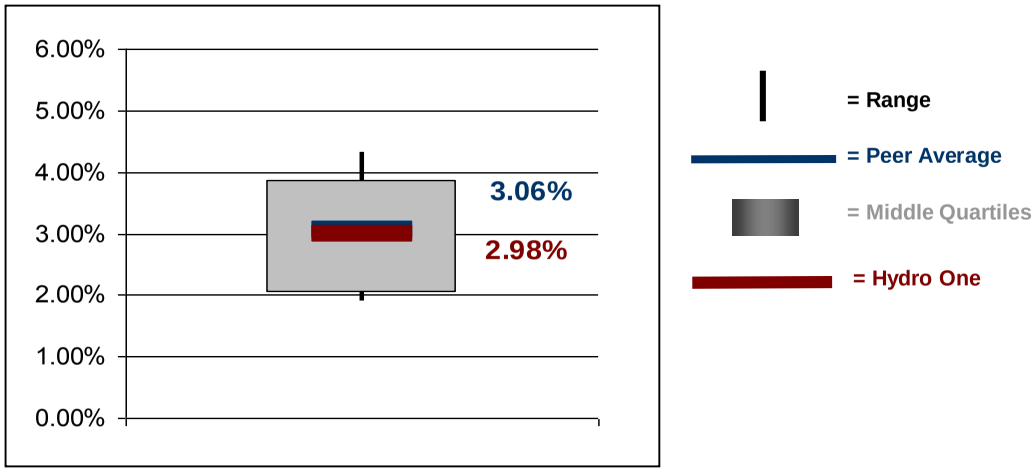
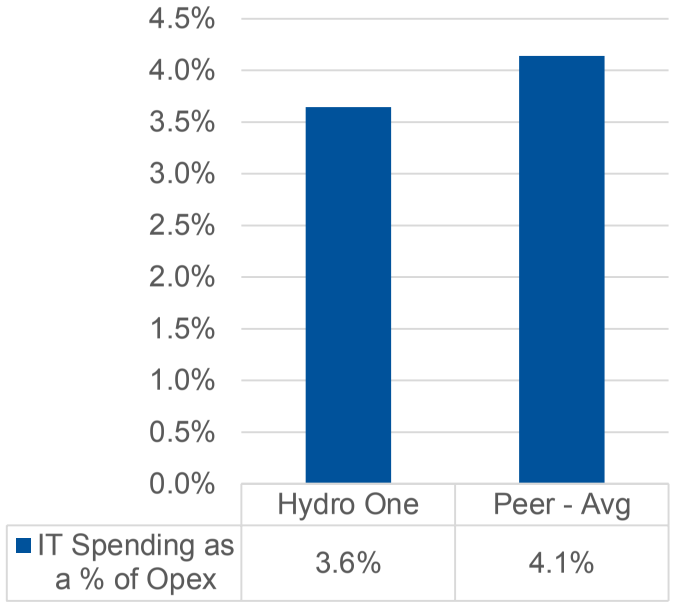


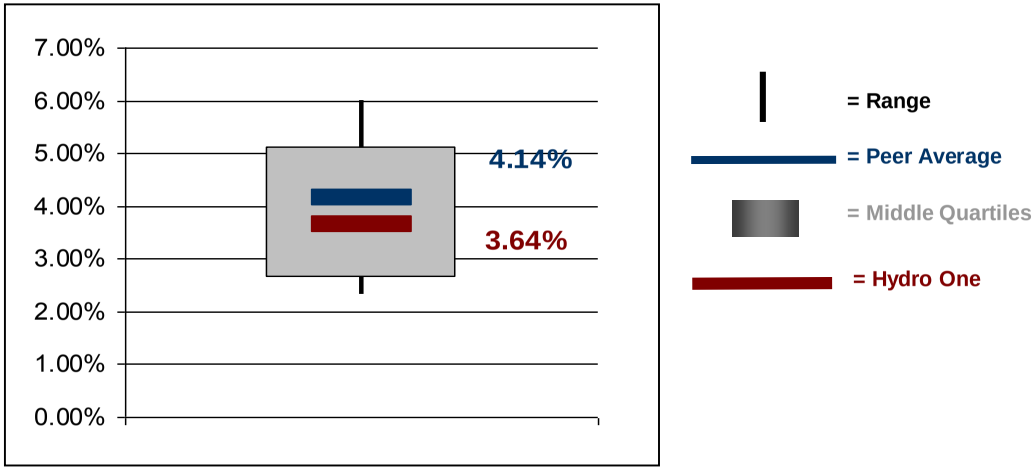


- Definitions:
  - Revenue – includes revenue for business units supported by IT. Includes fuel.
  - IT Spending – includes operations and capital spending (does not include any amortization and depreciation).

IT Spending as a Percentage of Operating Expense

Assessment Area	Observations
IT Spending	■ IT Spending as a Percentage of Operating Expense is lower than the peer group. Hydro One has a higher business operating expense compared to the peer group average.

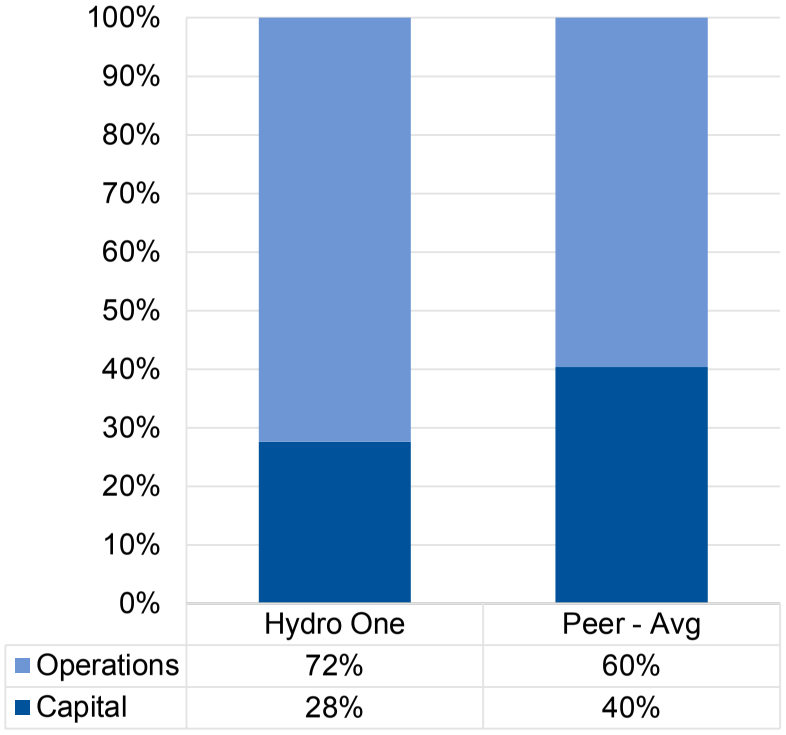




- Definitions:
  - Operating Expense – includes the total expense associated with the business units supported by the IT organization.
  - Includes items such as selling, general and administrative expenses (SGA), cost of goods sold (or cost of revenue), research and development, depreciation, depletion and amortization expenses etc.
  - IT Spending – includes operations and capital spending (does not include any amortization and depreciation).

IT Spending Distribution – Capital and Operations Spending

Assessment Area	Observations
IT Spending	■ Hydro One has a lower proportion of capital spending compared to the peer group average. ■ Hydro One does not capitalize any IT investments below $2M. This is higher than typically observed in Gartner benchmarks (for example, many organizations are in $250K-$500K range).



IT Spending Distribution – Capital and Operations

- IT capital expenses vs. operational expenses helps to portray the investment profile for an organization in a given year.
- Definitions:
  - Operational IT Spend: IT Operational expenses: Total day to day operations and maintenance expenses for this fiscal year that have not been capitalized. This does not include any amortization and depreciation.
  - Capital IT Spend: Capital Expenses: Total capitalized IT spending for this fiscal year.

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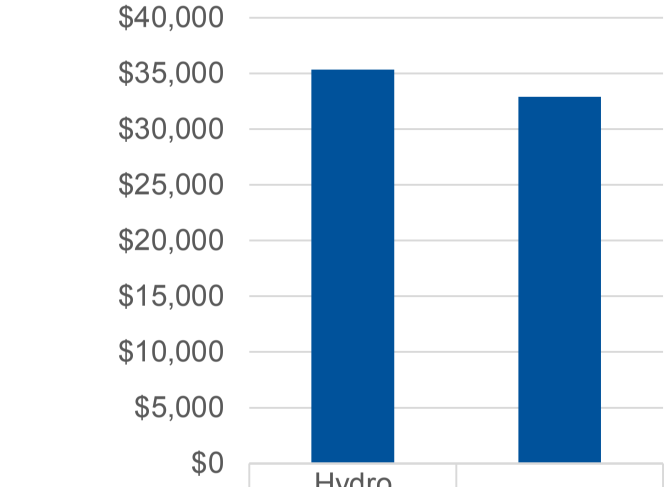
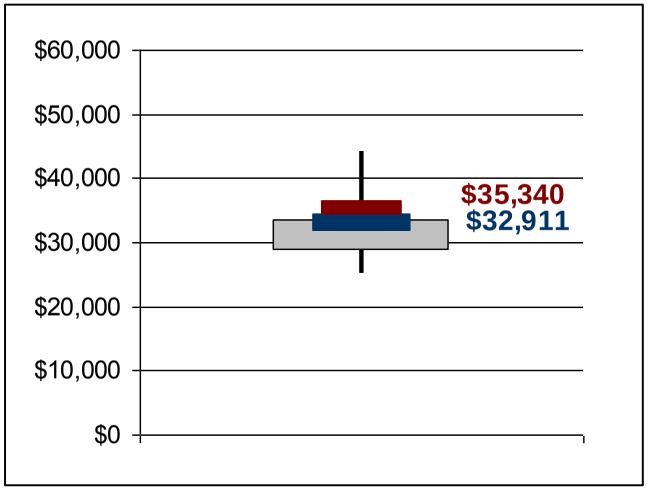
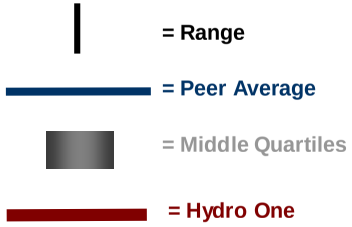
IT Spending per Company Employee

Assessment Area	Observations
IT Spending	■ IT Spending per Employee is higher than the peer group average. Hydro One has fewer employees than the peer group average (5,516 versus 6,336). In addition to the 5,516 full-time employees, there are an additional 2,237 temporary, contract and part-time employees at Hydro One, some of which are seasonal. ■ IT Spending per Employee is the IT spending for capital and operations for the number of company employees, which excludes contractors and outsourcing. ■ Hydro One estimates a 20% premium on labour cost due to their heavily outsourced model.



	Hydro One	Peer - Avg
IT Spending per Company Employee	$35,340	$32,911





- Definitions:
  - IT Spending – includes operations and capital spending (does not include any amortization and depreciation).
  - Company employees.

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Category	SDOC	SDOC Breakdown	Historical and Bridge (previous plan and actual $M)							
			2013	2014	2015		2016		2017	
			Actual	Actual	Plan	Actual	Plan	Actual	Plan	Forecast
	Common Corporate Costs and Other Costs	Facilities & Real Estate	10.1	20.3	19.0	18.5	15.3	25.1	15.4	19.9
		Information Technology	13.4	17.7	22.6	30.9	20.1	58.8	22.9	56.2
		Other	-2.9	1.5	0.0	0.1	0.0	0.8	0.0	4.3
		Transport and Work, and Service Equipment	43.5	49.1	43.8	52.1	49.1	47.6	44.8	45.0
General Plant Total			**115.3**	**99.9**	**94.8**	**110.1**	**103.3**	**145.9**	**90.1**	**146.3**
Grand Total			**637.0**	**647.5**	**648.9**	**678.3**	**654.7**	**694.2**	**661.4**	**633.5**

1

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Category	SDOC	SDOC Breakdown	Test Years (Forecast $M)				
			2018	2019	2020	2021	2022
Service	Capital	Meters	6.0	6.0	5.9	5.8	5.8
		Stations	0.0	0.0	0.0	0.0	0.0
	Development Capital	System Capability Reinforcement	63.6	80.1	72.3	64.6	55.9
	Operations Capital	Operations	0.0	0.0	0.0	0.7	0.0
		Smart Grid Pilot	5.0	0.0	0.0	0.0	0.0
System Service Total			**81.8**	**93.4**	**85.6**	**78.8**	**69.5**
General Plant	Development Capital	System Capability Reinforcement	8.2	1.3	0.0	0.0	0.0
	Operations Capital	Operations	16.8	46.4	6.1	6.4	9.1
	Capital Common Corporate Costs and Other Costs	Cornerstone	0.0	0.0	0.0	0.0	0.0
		Facilities & Real Estate	36.5	44.0	38.0	38.0	35.1
		Information Technology	43.2	46.3	42.0	37.9	39.3
		Other	6.6	6.5	6.1	5.8	5.9

Witness: Darlene Bradley

Table 1: Summary of Total IT OM&A for Hydro One ($ Millions)

Description	Historic			Bridge	Test
	2014 IRM	2015	2016	2017	2018
	Actual	Actual	Actual	Forecast	Forecast
IT Sustainment	84.1	87.2	82.5[1]	82.6[1]	78.8[1]
IT Development	44.8	18.0	22.1[2]	23.0	20.4
IT Security	-	-	-	2.6	2.4
Business Telecom	17.8	17.3	18.1[1]	18.4[1]	18.4[1]
IT Management & Project Control	18.6	20.0	21.1	19.1	17.9
Cornerstone	0.7	-	-	-	-
Total	**166.0**	**142.5**	**143.8**	**145.7**	**137.9**

[1] Hydro One's 2017-2018 transmission cost of service application (EB-2016-0160) included costs allocated to Hydro One's transmission and distribution accounting segments and excluded costs allocated to its unregulated accounting segment.
[2] The 2016 figure reflects the increase in spending required to support an increased capital portfolio.

Table 2 is a summary of IT OM&A expenditures allocated to Hydro One Distribution for the period 2014 to 2018.

Table 2: Summary of IT OM&A Allocated to Distribution ($ Millions)

Description	Historic					Bridge		Test
	2014 IRM	2015		2016		2017		2018
	Actual	Actual	Approved	Actual	Approved	Forecast	Approved	Forecast
IT Sustainment	51.4	55.4	54.4	51.2	53.8	51.2	52.6	48.8
IT Development	41.4	12.6	12.4	15.9[1]	13.8	15.5	14.9	13.4
IT Security	-	-	-	-	-	1.6	-	1.5
Business Telecom	8.0	8.6	8.1	8.3	8.3	8.3	8.3	8.3
IT Management & Project Control	8.2	9.2	10.8	9.9	10.6	9.0	10.3	8.4
Cornerstone	0.3	-	-	-	-	-	-	-
Total	**109.3**	**85.8**	**85.7**	**85.3**	**86.5**	**85.6**	**86.1**	**80.4**

[1] The 2016 figure reflects the increase in spending required to support an increased capital portfolio.

BCG

hydro one

Good to Great: Assessment of Full Potential

Steering Committee #1

Feb 9, 2016

THE BOSTON CONSULTING GROUP

Org effectiveness analysis being completed

	Spans & Layers	FTE benchmarking	Effectiveness diagnostic
	Assess and benchmark spans of control of people managers to identify areas of focus for mgmt consolidation	Conduct benchmarking of support ratios to identify focus areas for efficiency assessment	Identify pain points and specific actions to improve org. effectiveness and achieve productivity gains
Corporate Functions	✓	✓	✓
Operations	✓	✗	✓

Effectiveness diagnostic for Operation on management structure only. Field workforce covered by other work streams:

- Asset management
- Customer
- O&M efficiency
- Capital efficiency

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