

Toronto Hydro's High-Voltage Metering Project

Presentation to IESO Revenue Metering Standing Committee

October 4, 2007



Toronto Wholesale Metering

- There are 35 Terminal Stations serving the Toronto Hydro distribution territory
- At market opening, Toronto Hydro became the MMP for 106 registered wholesale meter points, with Hydro One serving as the MSP
- As seal periods expire, these metering points need to be brought up to current market compliance standards
- At the stations that are located in densely populated downtown locations, it will be extremely challenging, expensive and resource-intensive to install compliant metering equipment

Strachan South TS

Photos of Strachan South TS metalclad switchgear arrangement



Main Floor
A1-2T



Second Floor
A9-10T

Strachan South TS



Revenue metering current transformers located behind the relaying current transformers in the foreground

Photos of Cecil TS metalclad switchgear



A5-6CE - Front



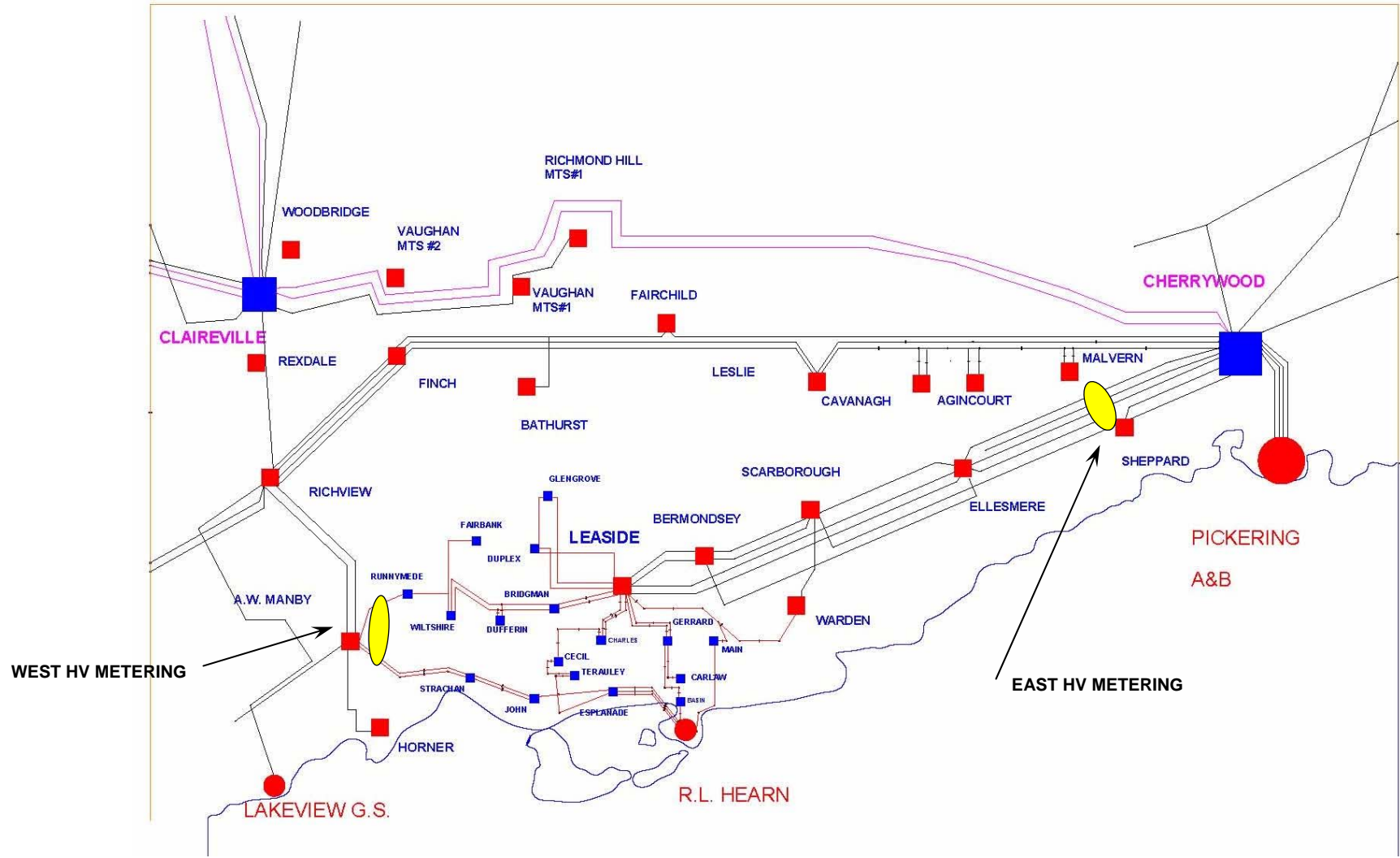
A5-6CE - Rear

Leaside TS



Leaside TS outdoor switchgear showing CTs

Proposed HV Metering Locations



Progress To Date

Toronto Hydro Metering Points	Included in HV Metering Plan	Outside of HV Metering Plan	Total
Market Rule Compliant	27	28	55
Outstanding or Not Yet Due	44	7	51
Total	71	35	106

After splitting existing summed current circuits, there would be at total of 223 meter points to maintain, if the HV Metering Plan is not implemented

HV Metering Project - Benefits

- Enables achieving full compliance in the shortest time
- Lower capital cost to install HV metering at 2 stations than upgrading LV metering at 23 stations (\$15M vs. \$40-\$45M)
- Lower operating costs to maintain fewer meters; will reduce the number of Meter Trouble Reports
- Does not require switchgear replacement at downtown TSs
- Eliminates the politically unappealing customer disruptions caused by lengthy station outages
- Simplifies settlement, has fewer delivery points, reduces the likelihood of Totalization Table and billing errors
- EITRP and stand-by equipment will be common for all points

LV Metering Equivalence

- To be accepted, Toronto Hydro must demonstrate that no market participants will be adversely affected by this change in metering
- Two adjustment factors will be required to make the HV metering equivalent to LV metering:
 - Transmission line losses
 - Load diversity between existing metering points
- A key element of the HV metering plan is to confirm that these adjustment factors can be accurately calculated and applied

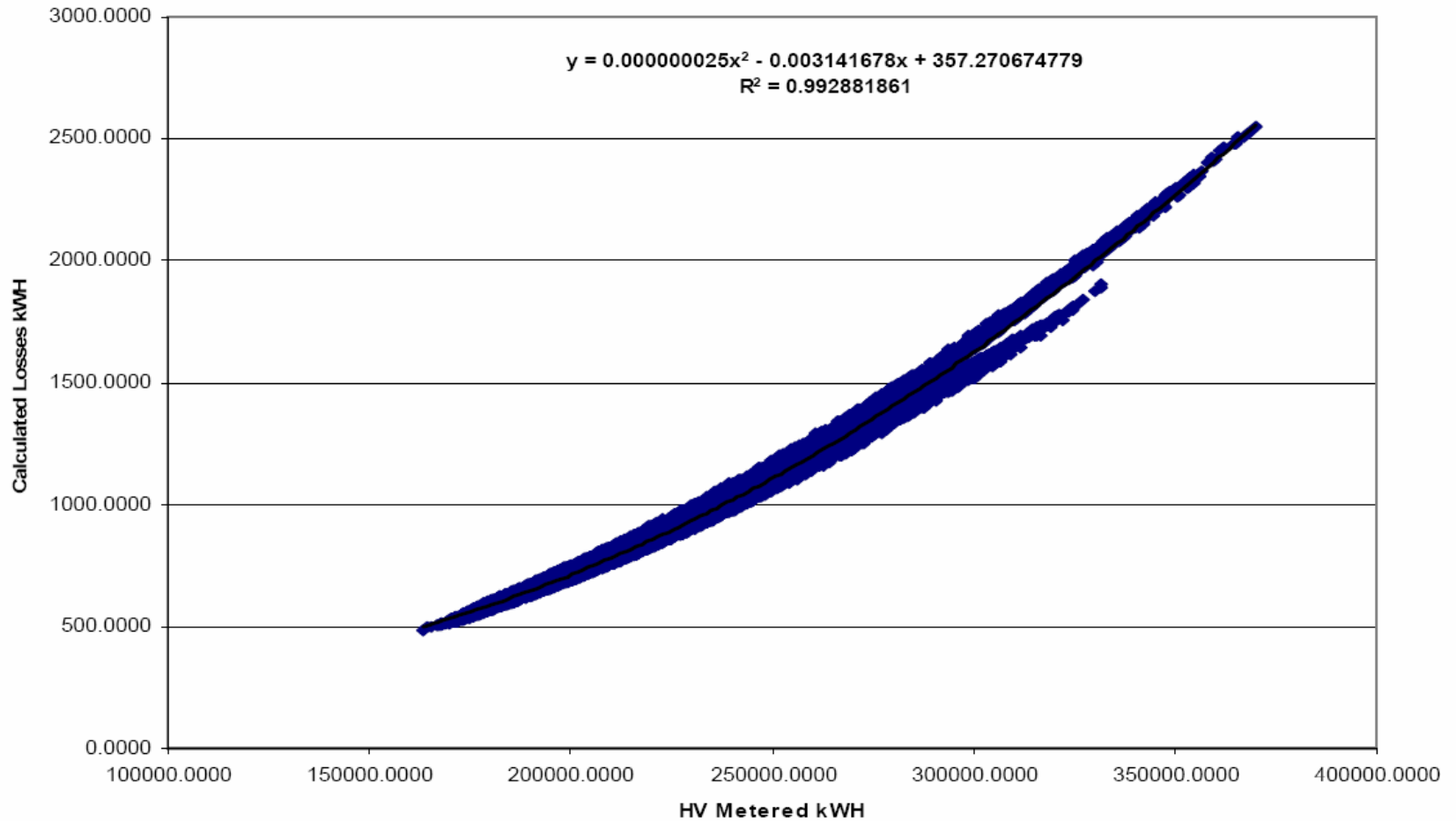
Adjustment Factor Methodology

- Line Loss Adjustment equations obtained by utilizing IESO Market Manual Site Specific Loss Adjustment Method 2
 - Loss Adjustments are determined by calculating losses at various load levels, and utilizing Curve-Fitting software to develop the K1, K2, K3 coefficients and R² factor for a 2nd order polynomial.
- Diversity Adjustment equations also are obtained using the same methodology
- IESO Interval Meter Data for the 23 actual delivery points covered under the HV Metering plan, with over 52,000 data intervals per delivery point, was used in the calculations

- Losses were calculated by determining the actual I^2R losses on each transmission line segment for each 15 minute time interval. Transmission line segment impedances are provided by Hydro One, and are the same line impedances used in Impact Studies and other reports to the IESO and the OEB
- Losses are calculated for the normal (lowest loss) operating configuration
- Transmission Diversity (Network, Line Connection, Transformation) is determined by comparing actual IESO Monthly Transmission Charges with the calculated peaks that would occur with HV Metering

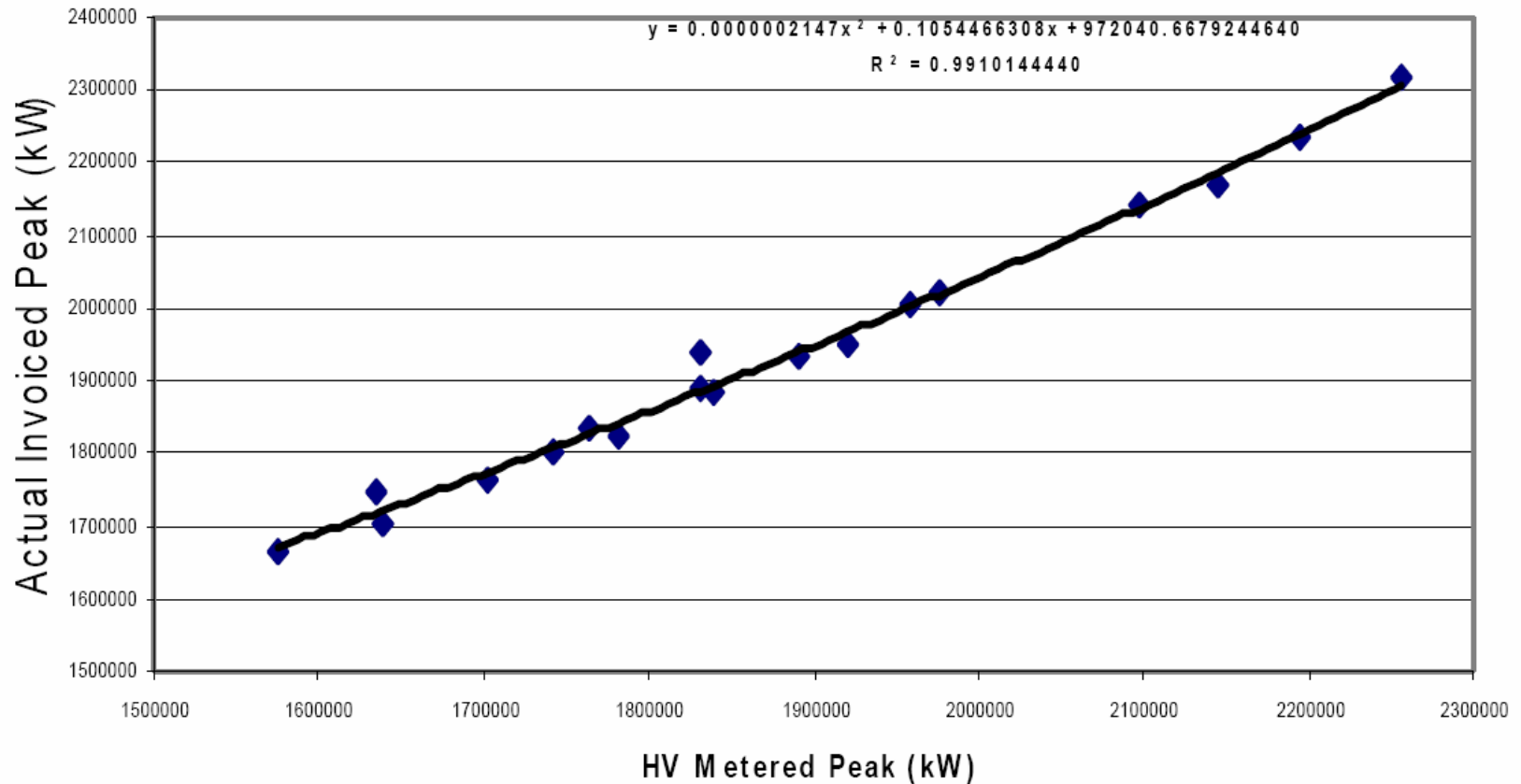
Sample Results – Loss Adjustment

Manby South Losses



Sample Results – Loss Adjustment

Sheppard - Line & Transformation Adjustment



Adjustment Results Summary

	Energy Losses Adjustment	Transformation & Connection Diversity Adjustment
Sheppard-Leaside Line	Netted Losses = $0.0000000030\text{kWH}^2 - 0.001291\text{kWH} + 1017$	$\text{Peak kW} = 0.0000002147\text{kW}^2 + 0.1054466\text{kW} + 972040$
Manby North Line	Netted Losses = $0.000000019\text{kWH}^2 - 0.000252135\text{kWH} + 63$	$\text{Peak kW} = -0.000000292\text{kW}^2 + 1.184996\text{kW} - 24102$
Manby South Line	Netted Losses = $0.000000025\text{kWH}^2 - 0.003141678\text{kWH} + 357$	$\text{Peak kW} = -0.0000000046\text{kW}^2 + 0.93576\text{kW} + 25247$

- Note: Derived R2 values in the range of 0.98 – 0.99 indicate a high statistical significance in the data

Impact of Adjustment Factors

	Line Losses Error Range	Transformation & Connection Diversity Error Range
Sheppard- Leaside Line	Unadjusted: +0.378% Adjusted: +0.0051%	Unadjusted: -3.49% Adjusted: -0.31%
Manby North Line	Unadjusted: +0.426% Adjusted: -0.0041%	Unadjusted: -1.79% Adjusted: -0.22%
Manby South Line	Unadjusted: +0.446% Adjusted: -0.0072%	Unadjusted: -1.37% Adjusted: +0.0003%

- Cumulative impacts of the adjustments over a calendar year as a percentage of metered energy (kWH) and metered demand (kW)

Conclusions

- The High Voltage Metering plan is technically sound, and the adjustment factors can reliably replicate the existing metering
- The complications introduced into the settlement process are manageable, and are offset by the significant reduction in wholesale meter points
- Toronto Hydro's customers will benefit from the reduced capital and operating costs for metering, and reduced disruption
- Toronto Hydro, Hydro One and the Wholesale Market will benefit from installing compliant metering with the least resources at the earliest possible time

Implementation Approach

- Install fully redundant, high accuracy (0.15%) high voltage instrument transformers each supplying redundant meters at Sheppard and Manby TSs
- Continue settlements based on existing metering equipment for an approved time period to prove the adjusted HV metering is equivalent within acceptable limits
- Begin settlements using adjusted HV metering, but maintain LV metering for comparison
- Add adjustment factors for any new transmission supply points, including Portlands Energy Centre, and the proposed third supply to Toronto
- Eventually Hydro One may apply for new rates incorporating the adjustment factors

Next Steps

- Address any technical questions or objections
- Confirm previous endorsement of the plan by Transmitters, especially Hydro One
- Present HV metering plan to the IESO Technical Panel
- When the Technical Panel is satisfied, apply for a Market Rule Amendment

Questions

