Transmission Rights Market Review Interim Report

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List of Abbreviations

Abbreviation	Description
ACP	Auction Clearing Price
DAM	Day-Ahead Market
DSO	Dispatch Scheduling and Optimization
EDAC	Enhanced Day-Ahead Commitment Process
ERUC	Enhanced Real-Time Unit Commitment
HOEP	Hourly Average Energy Price
ICP	Intertie Congestion Price
IESO	Independent Electricity System Operator
IT	Information Technology
LMP	Locational Marginal Price
MCP	Market Clearing Price
MRP	Market Renewal Program
NPV	Net Present Value

Acknowledgements

The IESO would like to acknowledge and thank the many stakeholders that have provided useful, timely, and meaningful comments throughout the TR Market Review. As users of Transmission Rights, your participation and perspectives have greatly enhanced the IESO's understanding of this market and helped us come to the right conclusions on the value that Tranmsision Rights and intertie trade generally bring to Ontario, as presented in this report.

1. Executive Summary

The Independent Electricity System Operator (IESO) is the interface between many different components of Ontario's power system. It delivers key services across the electricity sector including: managing the power system, planning for the province's future energy needs, enabling conservation, and designing a more efficient electricity marketplace to support the evolution of the sector. One of the less well known yet still critically important responsibilities of the IESO is to administer a financial Transmission Rights (TR) market.

In Ontario, TRs are used to support intertie trade with neighboring jurisdictions by providing a mechanism for market participants to hedge against congestion cost risks at the interties. The IESO facilitates the auction to sell these rights, which are purchased by market participants to support numerous trading and speculative strategies. The Transmission Rights Market Review was initiated to engage stakeholders to evaluate the historical performance of the TR market, develop potential changes that will improve its reliability and efficiency benefits, and ensure it is compatible with the changes that are currently being developed through the IESO's Market Renewal Program (MRP).

Today's Transmission Rights Market

The Transmission Rights market was introduced in 2002 to ensure that market participants had the opportunity to purchase TRs to hedge against congestion cost risks at the interties. The current TR market has met many of its design objectives in this regard, and this functionality has enabled the IESO to rely on its interties as a critical set of resources for supporting reliability. As an added benefit, the TR market has also provided significant economic benefits to Ontario consumers.

However, over the years, the IESO has received recommendations and feedback regarding potential inefficiencies of the TR market as observed by the Ontario Energy Board's Market Surveillance Panel (MSP)[1], IESO internal business units, and external market participants. In response, the IESO has made incremental changes to the TR market to address some issues and committed to a full review of the market to determine whether it is achieving its intended purpose.

The Transmission Rights Review Stakeholder Engagement

In 2020, the IESO launched a Transmission Rights Review stakeholder engagement with the objective of working with stakeholders to determine what changes may be required to maximize the efficiency of the TR market and to ensure that it is aligned and compatible with the Market Renewal Program. The scope of the TR Market Review includes:

[1] The existing TR market has come under scrutiny from the MSP on several fronts for potential inefficiencies.
In its August 2010 Monitoring Report, the MSP issued a recommendation: *The IESO should limit the number of transmission rights auctioned to a level where the congestion rent collected is approximately sufficient to cover the payouts to transmission right holders.*
In its January 2013 Monitoring Report, the MSP issued a recommendation: *The IESO should reassess the design of the Ontario transmission rights market to determine whether it is achieving its intended purpose.*

1. Stage 1: Value Assessment
2. Stage 2: Near-Term Improvements
3. Stage 3: Long-Term Improvements

The IESO has worked closely with stakeholders through Stage 1 to conduct the value assessment of the TR Market and understand the opportunities and implications that could result from potential enhancements to the market. The culmination of this work to date is documented in this interim report, which describes the findings of Stage 1 of the TR Market Review. The key findings are summarized below:

1. ***TRs are necessary for efficient trade.*** Analysis and stakeholder consultations confirm that intertie congestion is volatile and unpredictable, and TRs play a critical role in facilitating intertie trades by providing a valuable price hedge to traders. Without the TR Market, losses to Ontario consumers, primarily from reduced export volumes, would be in the range of $50-135 million per year[2].
2. ***The value of the TR market is not maximized today.*** Although TRs are useful as a price hedge, the value of TRs to market participants, IESO, and Ontario consumers is limited by the current auction design and the types of TRs offered.
3. ***There are material opportunities to increase the value of the TR market.*** Based on market participant consultations and proposals, there are real and substantial opportunities to explore that could increase the value of TRs to the IESO, market participants and Ontario consumers during Stage 2 of the TR Review.

In summary, the TR market is achieving its intended purpose to provide traders with an opportunity to hedge against congestion cost risks. It is creating value for Ontario consumers, market participants and the IESO, but further work is needed to capture and maximize all the value that the TR market could provide.

[2] See section 4.5.2 for further details on this analysis.

2. Background and Overview

2.1 Drivers and Scope

Intertie trading provides the IESO with operational and planning flexibility in its day-to-day operations, and significantly enhances the reliability and cost-effectiveness of Ontario's electricity system. TRs were introduced as a risk management tool to enable traders to hedge the financial risks associated with uncertain congestion at the interties.

These financial instruments were expected to contribute to the efficient and reliable operation of Ontario's electricity system, by facilitating efficient electricity trade and integration with neighboring markets. A key driver for this review was to assess and understand how TRs promote efficient intertie trading in today's market.

The Ontario TR market was established at market opening in 2002 and has since been operating largely based on the original design. Over the years, the IESO has received recommendations and feedback regarding potential inefficiencies of the TR market observed by the MSP, IESO internal business units and external market participants. In response, the IESO has made incremental changes to the TR market where it could to address specific issues. However, until the launch of the TR Market Review, the IESO has not been in a position to undertake a thorough review of the market to determine whether it is achieving its intended purpose, and to determine whether there are more fundamental issues that should be addressed.

More recently, the MRP is developing changes to the energy market which will have a significant impact on TRs. These changes include replacing the uniform Market Clearing Price (MCP) with Locational Marginal Pricing (LMP), shifting TR market settlements from real-time to day-ahead, and changes to the calculation of congestion pricing. It is important that the TR market effectively integrates these changes into its design to ensure alignment and compatibility with the future renewed market.

On May 21, 2020, the IESO launched the TR Market Review stakeholder engagement. As part of the TR market review, the IESO is working with stakeholders to determine what changes may be required to maximize the efficiency of the TR market and to ensure that the TR market is aligned and compatible with the renewed energy market in the future. The scope of the TR Review includes:

- Stage 1: Value Assessment
    - Assess the historical performance of the TR market, determine whether the TR market is achieving its intended purpose
- Stage 2: Near-Term Improvements
    - Identify and propose near-term changes that will improve the overall efficiency, value and function of the TR Market (Pre-MRP)
- Stage 3: Long-Term Improvements

- Identify and propose long-term changes to ensure alignment and compatibility of the TR market with the MRP (Post-MRP)

Any potential changes proposed through the TR Market Review must go through the IESO project prioritization process to be reviewed against competing projects before approval and implementation.

The purpose of this document is to report on findings of Stage 1 of the TR market review, to address whether the TR market is achieving its intended purpose and what value it generates for Ontario consumers, IESO and market participants.

2.2 The Need for Transmission Rights and TR Markets

Transmission rights were first introduced in the U.S. to help loads and load-serving entities (LSEs)[3] manage the congestion cost of flowing power across different price zones. Transmission congestion can arise on any transmission path where the locational marginal prices (LMPs) on either side of the path (i.e., between nodes or zones within a market or at external interties between markets) fluctuate independently of each other. When the cost to produce or procure power is cheaper on one side of the path than the other, economics dictates that power should flow from the low-cost side to the high-cost side, with the LMP equilibrating at both locations if the transmission path is unconstrained (assuming no differential due to losses)[4].

However, if the thermal limits of the transmission path prevent sufficient power flowing from the low-cost side to meet the demand at the high-cost side, higher cost generation must be dispatched to meet that demand, thus raising the LMP at that location. When this happens, loads at the higher-cost side of the transmission path must pay the difference between the higher and lower LMPs. Assuming no portion of this LMP differential is attributable to losses, the difference generated between the higher and lower LMPs is known as the "congestion rent" and is collected by Regional Transmission Operators (RTO), Independent System Operators [ISO] or Transmission System Operators [TSO][5].

Because of the inherent and often substantial differences in the cost to produce power at different locations, congestion can represent a significant cost for loads and LSEs. Furthermore, due to the stochastic nature of electricity supply and demand, it is impossible to perfectly forecast when congestion will occur and how large the congestion cost will be. For this reason, loads and LSEs are often exposed to a high degree of financial risk without a natural hedge available. This creates difficulty for LSEs to fulfill their obligations to serve loads and support the cost of operating the transmission network through regulated rates.

TRs are a financial contract that entitle their holder to congestion rents on the path specified in the contract. Financial transmission rights do not involve any use of the physical transmission system, and do not entitle the purchasers of the rights to utilize the transmission assets in any way. Allocating

[3] NERC Glossary of Terms defines "load-serving entity" as an entity that secures energy and Transmission Service (and related Interconnected Operations Services) to serve the electrical demand and energy requirements of its end-use customers. https://www.nerc.com/files/glossary_of_terms.pdf

[4] Brattle Report - Analysis of the TRCA Surplus Allocation Methodology, Page 5 http://ieso.ca/-/media/Files/IESO/Document-Library/engage/mdag/Analysis-of-TRCA-Surplus-Allocation-Method.pdf?la=en

[5] Brattle Report - Analysis of the TRCA Surplus Allocation Methodology, Page 5 http://ieso.ca/-/media/Files/IESO/Document-Library/engage/mdag/Analysis-of-TRCA-Surplus-Allocation-Method.pdf?la=en

TRs to loads and LSEs provides insurance against congestion cost, significantly reducing the congestion price risk. In the U.S., TRs are generally acquired through auction processes administrated by the RTOs, or through bilateral transactions between a TR holder and a buyer. Creating a market for TRs allows loads and LSEs the opportunity to sell TRs they do not need and allows financial traders the opportunity to purchase TRs, thereby maximizing the value of those TRs.

2.3 The Ontario TR Market

With the uniform market clearing price (MCP) in Ontario, the costs of internal congestion are combined with system reliability costs and charged to loads and exporters on an hourly basis as Congestion Management Settlement Credits (CMSCs). Therefore, TRs are not needed to hedge internal congestion costs. In contrast, congestion on Ontario's interties is priced separately as the difference between the intertie zonal price (IZP) and the uniform market clearing price (MCP), and is called the intertie congestion price (ICP). The MCP and the IZP diverge when there is congestion on the interties.

The IESO-controlled grid is connected through intertie transmission lines to its five neighbours: Québec, Manitoba, Minnesota, Michigan, and New York. The interties allow traders to import and export between Ontario and other jurisdictions. Traders look for "price spread" opportunities across the different interconnected markets and make profit when they can buy energy at a lower price in one jurisdiction and export it to another jurisdiction for a higher price. Profit-seeking traders may be interested in pursuing similar transactions on the same intertie at the same time. Like any transmission line, there is a maximum quantity of energy that can be transacted over a specific intertie at one time due to the physical limitations of the respective intertie. When the quantity of economic import offers or export bids exceeds the intertie scheduling limit, the intertie becomes congested. Net intertie transactions will only be scheduled up to the intertie scheduling limits. Therefore, traders will have to compete by paying a premium or taking a discount (ICP) above or below the uniform MCP to use the scarce intertie capacity. The ones willing to pay the highest premium or taking the greatest discount are the ones allocated intertie capacity and scheduled to flow[6].

The intertie congestion can be very volatile and difficult to predict both in frequency and magnitude, which is a financial risk that traders must manage when transacting across the Ontario interties. To help traders to hedge against such risk, the IESO introduced a financial Transmission Rights market at market opening in May 2002, offering TRs solely on the interties. The Ontario TR market generates on average $150 million in auction revenue each year from up to 30 TR market participants, including both physical and financial traders. TRs are offered on long-term (annual) and short-term (monthly) durations through quarterly and monthly TR auctions. Like other jurisdictions, TRs in Ontario are purely financial instruments and do not guarantee the physical transmission of energy, nor do they affect scheduling.

[6] Backgrounder – Transmission Rights Market Review – Phase 1 Page 2-4 http://www.ieso.ca/-/media/Files/IESO/Document-Library/engage/mdag/Backgrounder-TRCA-Review.pdf?la=en

2.4 History of Ontario TR Market

Since its inception in 2002, the Ontario TR market has undergone several changes to address identified issues and to incrementally enhance the TR market efficiency.

- In 2004, the IESO Board established a reserve threshold of $10 million for the Transmission Rights Clearing Account (TRCA). If the TRCA balance was above $10 million, the IESO increased the number of short-term TRs sold by 4% every 3 months on all ties in both directions, taking consideration of outage impact.
- In 2013, in response to the MSP's recommendations, the IESO launched a stakeholder engagement initiative (SE-110). Based on the IESO analysis and stakeholder input, the IESO board revised the TR confidence level such that congestion rents collected should be sufficient to cover the IESO's TR payment obligations on a per-path basis.
- In 2014, the SE-110 change was first implemented through an interim process to balance congestion rent with TR payouts on an aggregated level.
- In 2015, the IESO Board authorized a reserve threshold of $20 million for the TRCA, and formalized a schedule to disburse TRCA surplus funds on a semi-annual basis when the surplus funds exceed the reserve threshold by at least $5 million.
- In 2017, the SE-110 change was fully implemented to balance congestion rent and TR payout on a per path basis.

The aforementioned changes addressed some of the issues that had been identified, but not all. The key question, "whether the TR market is achieving its intended purpose?" remained unanswered. This question was the key focus for Stage 1 of the TR market review. During Stage 2 and Stage 3 of the TR market review, the IESO will work with stakeholders to explore, identify and propose changes to maximize the efficiency of the TR market and to ensure that the TR market is aligned and compatible with the renewed energy market in the future.

3. TR Market Objective Statement

3.1 Introduction

In its January 2013 Monitoring Report[7], the MSP issued a recommendation that the IESO should reassess the design of the Ontario transmission rights market to determine whether it is achieving its intended purpose. To address the MSP's recommendation, the IESO worked with stakeholders during Stage 1 of the TR Market Review to assess the historical performance of the TR market at a holistic level as well as on a parh-by-path basis.

The IESO reviewed the archives of the original market design documentations to collect any captions related to the purpose of the TR market at its outset. Few references were found, but those that were identified proved helpful in understanding the original design intent of the Ontario TR market.

3.2 Original Objectives

In the Final Report of the Market Design Committee[8], the intent to establish a financial transmission rights market in Ontario is described as follows:

"Because the IMO settlements will use zonal prices that may differ during congested period from the Ontario uniform price, there will be hours when the IMO collects more revenue from loads than it pays out to generators in settling accounts. These "congestion rentals" from the settlement surplus must be allocated back to market participants in some way. In other jurisdictions, congestion rentals are used to support a system of financial hedges, sometimes called "financial" transmission rights, that reimburse market participants for intertie congestion charges, and we recommend that such a system be developed for the Ontario market."

The document further explained the objective and function of the financial TR market as follows:

"These rights are "financial," because they do not guarantee physical access to the intertie (which is allocated to the most competitive bidders in the IMO's scheduling and dispatch process) nor preclude those without rights from gaining access to the grid (hence, the rights cannot be hoarded as a means to exclude competitors from the grid). Instead, holders of these rights are entitled to be compensated by the IMO for the congestion-related difference in prices that arise across constrained interties, thus providing a financial hedge against such price differences. Our proposed rules therefore contemplate that the IMO will administer periodic auctions to allow market participants to acquire such rights. Any participant who acquires a right would then be free either to receive this compensation or to sell its right in a secondary market process. In open, well-functioning markets, the rights between two locations would be expected to sell for the expected value of the congestion-related difference in prices at each location."

[7] Market Surveillance Panel Monitoring Report on the IESO-Administered Electricity Markets for the period from November 2011 – April 2012, Page 151 https://www.oeb.ca/oeb/_Documents/MSP/MSP_Report_Nov2011-Apr2012_20130114.pdf

[8] Final Report of the Market Design Committee, January 29, 1999

To summarize, the original intent to establish a financial TR market in Ontario was to allocate congestion rent collected to market participants in a way to support a financial hedging system. The function of the TR market was intended to compensate TR holders for the congestion-related price differences over the interties, thus providing a financial hedge against such price differences.

3.3 Evolved Objectives

The original objective statement addressed the primary function of the TR market. However, there are some important components missing. First, the wording is not specific as to why a financial hedge is needed. Although there was a general recognition in 1999 that intertie trading plays an important role in maintaining system reliability and enhancing competitiveness of the wholesale electricity market, it was not explicitly stated that the purpose of providing TRs as a hedge is to enhance the efficiency of intertie trades. In recent years, with the changing supply mix and load dynamics, Ontario has become more reliant on efficient intertie trading than ever before and TRs can help maximize this potential. Therefore, the need to enhance the efficiency of intertie trades by providing a financial hedge should be incorporated into the objective statement as a critical component.

Second, the costs associated with administering a TR market in Ontario were not contemplated thoroughly back in 1999. In order to justify a TR market, the benefits to Ontario need to be greater than the costs to maintain it in the long-term. By maximizing the economic and system gains from electricity trades, increased aggregate welfare can be achieved for the IESO, traders, consumers, generators, transmitters, etc. Benefits to other market participants are important, but secondary to the value derived by Ontario consumers, who are responsible for paying for the transmission system via regulated rates under the present and future market design.

During Stage 1 of the TR market review, the IESO has incorporated these missing components and considered stakeholder feedback to establish a revised objective statement for the Ontario TR market:

1. Enhance the efficiency of intertie trades by providing a congestion hedge to physical intertie traders
2. Maximize the gains from electricity trade and provide net benefits for Ontario consumers in the long run

The revised objective statement intends to clearly identify the purpose of the Ontario TR market and explain how the purpose can be achieved. These objectives were considered when assessing the historical performance of the TR market in Stage 1, and will be the guiding principle for Stage 2 and 3 of the TR Market Review, as well as for future evolution of the Ontario TR market.

4. Historical Performance of the Ontario Transmission Rights Market

4.1 Introduction

Measuring the ideals of the evolved objective statement against the real-world TR market forces us to answer critical questions such as “how has the TR Market performed since market opening?” and “has it provided net benefits to Ontario?” Unfortunately, these questions are deceptively simple. Not only can layers upon layers of relevant analysis be developed to answer each question, but any single snapshot of the TR Market may lead the reader to a conclusion that a different snapshot might not.

In order to answer such challenging questions and to ensure alignment with the evolved TR market objectives, the IESO approach was to produce a wide-ranging and comprehensive assessment of historical TR Market data in order to better understand congestion trends, auction participation, hedged transactions, and financial performance at the interties. The intent of this work was both to provide education on the mechanics of the market and its historical operations, and to develop a foundation for informed discussions and future decisions while still reflecting critically on the assumptions and methods used.

Given the many dimensions and variables that can be investigated in a market of this size, and the difficulty in developing a complete picture for the reader, this chapter approaches the assessment through several lenses. The IESO approach begins by presenting aggregated TR Market data across all of Ontario’s interties over a relatively long time-frame, with only a limited breakdown by intertie and imports and exports. While providing limited granularity, this had the benefit of describing the TR market from a high-level perspective that provides context and reference material for more detailed analysis and discussion.

The chapter then describes data on an individual intertie in more detail, presenting a complete analysis on the Ontario-Michigan intertie in the export direction[9]. Keeping in mind that Ontario’s interties are each a unique mix of location, interconnected jurisdiction, capacity, flows, utilization, prices, outages, congestion patterns, and the participants that use them, each intertie also has a distinct interaction with the TR Market. By presenting both detailed analysis on an individual intertie as well as analysis across the entire TR market, the reader should have sufficient context to understand general market operations, without unnecessarily expanding the length of the chapter.

Finally, the IESO describes in detail the TR auctions themselves. The focus of this work was to investigate the competitiveness of auctions, the involvement by financial participants, and if TRs awarded were being used for their intended purpose. This was a bottom up analysis of the TR

[9] Ontario to Michigan intertie was chosen for the analysis, because it had the largest transaction volume in 2019 and the highest percentage of congested hours in 2016-2019. Due to these factors, we anticipated high participation in the TR market and also use of TRs on this intertie.

market, and shows the interactions between the auction design and auction participation in its most detailed form.

Throughout this Chapter, the aim has been to identify broad trends and to highlight key observations that can be used for effective and efficient decision making for evolving the future TR market. As will be shown, system conditions and market dynamics have changed significantly over the years, which has impacted the TR market in a variety of ways and at times has resulted in outlying or extreme data points. Since large amounts of the data are presented for completeness, the IESO suggests that the reader view this chapter from a holistic perspective, reading the overall story instead of focusing on any individual data points or single results.

4.2 The Overall TR Market

This first section looks across the TR market at all intertie paths that IESO sells TRs on[10] and specifically focuses on four components: 1) historical intertie congestion, 2) TR auction outcomes, 3) energy flow hedged by physical traders, and 4) TR ownership by financial traders. These components touch on almost all of the critical TR market data at the highest level. The analysis as a whole also provides an overview of the TR market that the reader can return to for reference in later sections of the chapter. In conjunction with the history of the TR market presented in Chapter 2, the data here shows the story of many factors and changes. The intention of the data analysis presented in this section is to identify broader trends and observations with enough data that conclusions are reachable.

4.2.1 Historical Intertie Congestion Across Ontario's Interties

As mentioned in Chapter 2, Ontario trades energy across interties with 5 neighbours: Quebec (PQ), Manitoba (MBSI), New York (NYSI), Minnesota (MNSI), and Michigan (MISI). When there is more demand from traders than available intertie capacity, the prices of imports and exports diverge compared to prices in Ontario. This is due to the intertie congestion price (ICP), which can be thought of as a premium that exporters are charged, or a discount that importers are paid, when an intertie is congested. This sections identifies key intertie congestion trends including frequency (no. of hours each month), cost (the sum of ICP charged to each MW over all hours in a month by direction, or $/MW-Month)[11], and location of congestion over all the interties in the last 16 years[12] by month. Since TRs were intended to hedge intertie congestion, this assessment starts by providing details on the critical aspects of congestion faced by intertie traders.

[10] Ontario has 28 intertie paths in total, but only sells TRs on 17 of these. The intertie paths that Ontario does not sell TRs on are through Quebec and Manitoba, and have the following characteristics: 1) due to technical reasons, physical transactions are not allowed and hence market transactions are not plausible on these paths (ON-QD4Z, ON-QH9A, ON-QP33C, ON-QQ4C, ON-QX2Y, QH4Z-ON, QH9A-ON, QQ4C-ON). 2) Historically, transactions on this path are not material enough to justify offering TRs (ON-QBEAU). 3) The interconnection is operated normally open. This means there are no market transactions (and therefore no congestion) on these paths and hence no TR is offered (MANSK-ON, ON-MANSK).

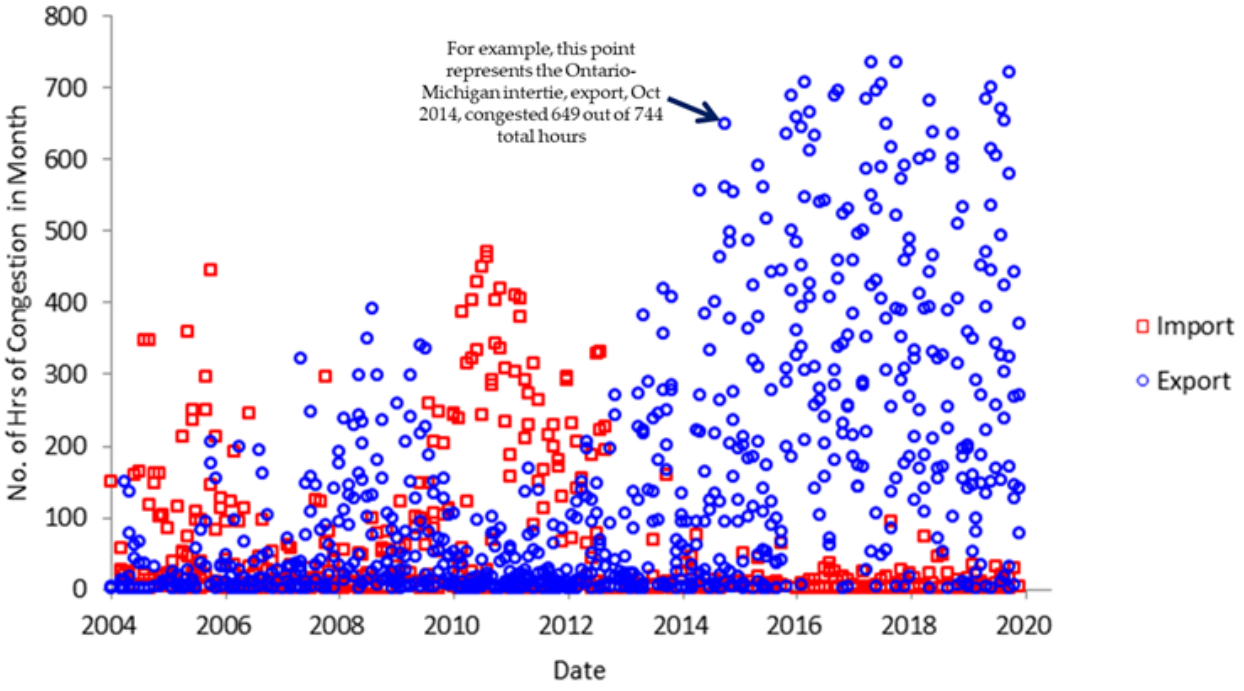
[11] In each graph in this section, the absolute value of the ICP is shown where applicable.

[12] The assessment time span covers majority of the period for which TR auctions were conducted.

Congestion Frequency

Figure 1 shows the monthly number of hours of congestion versus date across all of Ontario's interties for 16 years, from 2004-2019. This the number of hours in the month that individual interties are congested. In Figure 1, all the interties are lumped into the import direction as represented by red squares, and into the export direction as represented by blue circles. For illustration, data for a specific point is shown representing the Ontario to Michigan intertie export path for the month of October 2014. This path was congested 649 out of 744 hours through this month, or 87% of hours. While the frequency of congestion in general was more moderate in the earlier years of the TR market, it has increased substantially in more recent years. The levelling off in the upper right corner of Figure 1 shows significant congestion in recent years in the export direction for some interties.

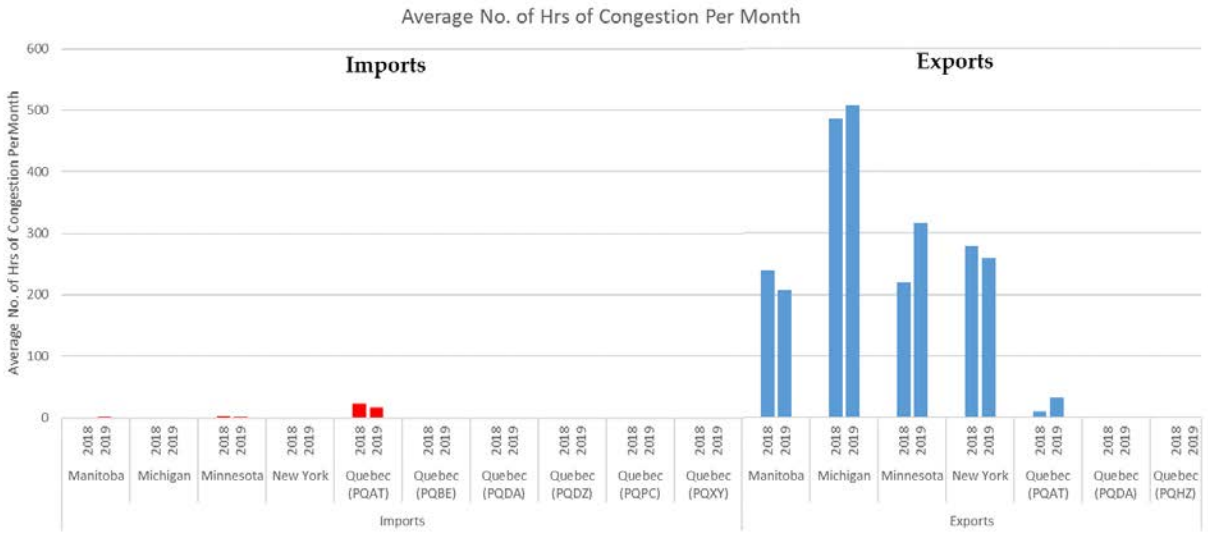
Figure 1 | Scatterplot of No. of Hours of Congestion vs. Date by Import / Export[13]



The same data represented as yearly averages and broken down by intertie for 2018 and 2019 is shown below in Figure 2.

[13] The surge of imports in 2010 shown in Figure 1 occurred when the IESO introduced a new transmission service procedure in September 2009, and includes some of the congestion behavior that was part of a compliance investigation.

Figure 2 | Average No. of Hours of Congestion Per Month by Intertie, 2018 and 2019[14]



Congestion Costs

The next set of data relates to congestion costs, as shown below in Figure 3. The sum of ICP of all hours of the month represents the congestion costs a trader would pay per MW if they flowed across an intertie path for all hours in a month. For illustration, an arrow shows a month where flowing each hour would have led to congestion costs of $15,525 per MW[15][16]. The frequency and cost of congestion in the export direction has significantly increased in recent years, but has decreased in the import direction. The frequency and cost of congestion can also be quite variable and hard to predict, both month-to-month on each intertie and over long timescales.

[14] 2019 and 2018 was chosen as it is indicative of the most recent full year trends on the interties.

[15] The standard deviation of congestion costs on the Ontario to Michigan intertie for 2016 to 2019 was $5600/MW-Month, with a high of almost $27,000, a low of $1,000, and an average of $10,000.

[16] This is the pre-dispatch 1 hour ahead unconstrained sequence. The ICP is the same in pre-dispatch and real time, the congestion costs do not change.

Figure 3 | Scatterplot of the Sum of ICP of All Hours in the Month vs. Date by Import / Export

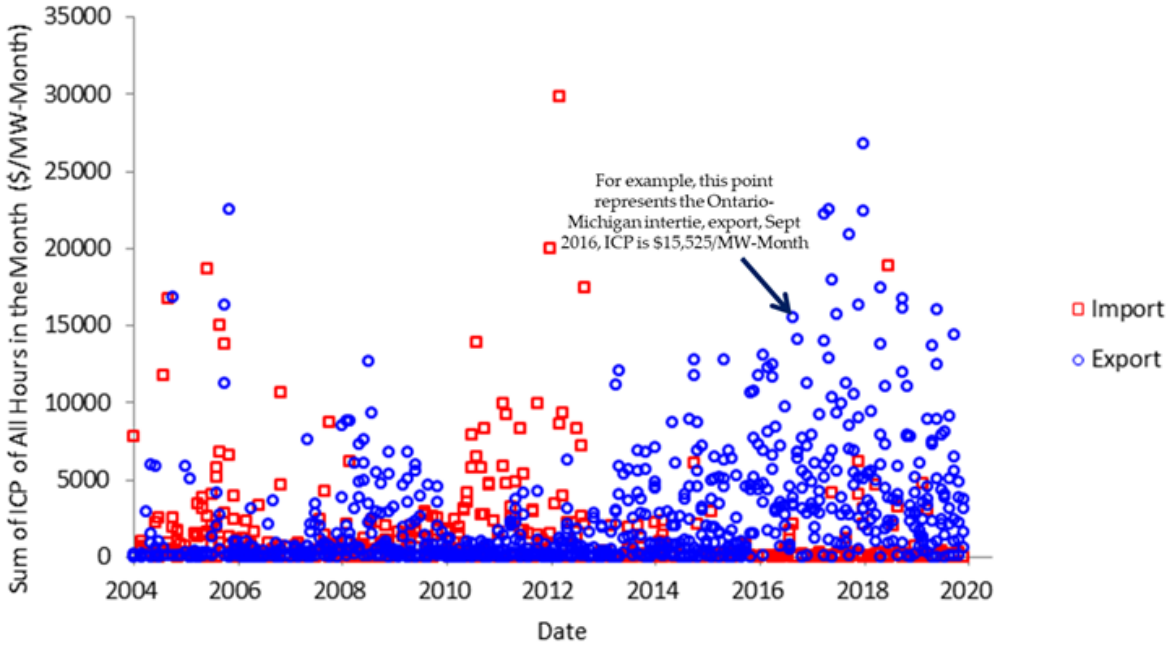
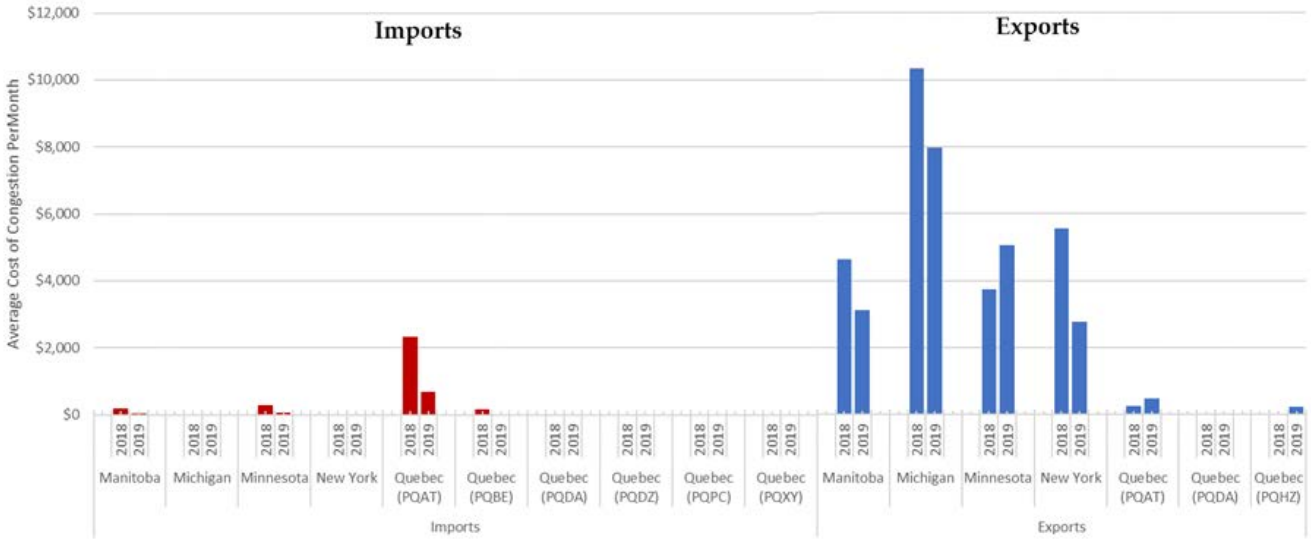


Figure 4 is a slightly different look at this same data broken down by intertie in 2018 and 2019. Consistent with Figure 3, there is much higher congestion in the export direction in recent years on the Manitoba, Michigan, Minnesota, and New York interties.

Figure 4 | Average Monthly Congestion Costs by Year by Intertie, 2018 and 2019



4.2.2 Historical TR Auction Outcomes Across Ontario's Interties

The second major component of the overall TR market that was reviewed are the historical TR auction outcomes. As part of this component, the IESO investigated 1) the number of bidders, 2) the number of TRs sold and 3) clearing prices of TR auctions over 16 years, to better understand trends in participation and clearing prices in the TR auctions. The first set of results presented in this section focuses on outcomes for short-term (ST) auctions, while the second set of results focuses on outcomes for the long-term (LT) auctions.

ST Auctions

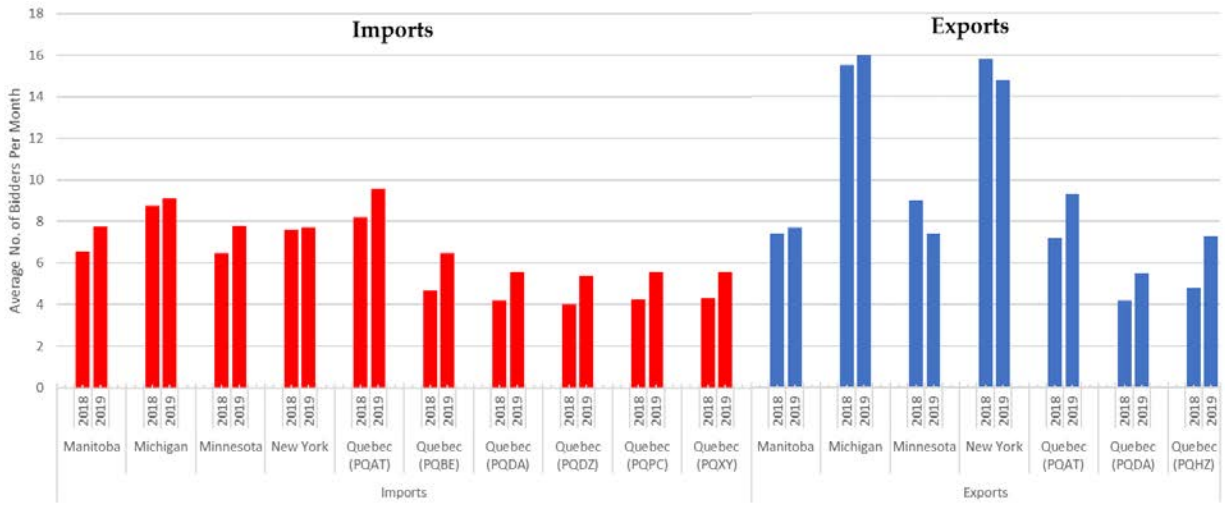
The complete dataset for the number of bidders for ST auctions is shown in Figure 5 below. As shown in the figure, there is a wide range of bidders that participate in the short-term auctions and the data also shows a wider range of bidders in auctions in the export direction than in the import direction. While the average number of bidders across all ST auctions was 8, it was 7 in the import direction, and 9 in the export direction. For the ST auctions overall, there has been a fairly strong and consistent level of participation in the ST auctions over the last 16 years.

Figure 5 | Scatterplot of ST Auction No. of Bidders vs. Date by Import / Export

On a tie-by-tie basis, the number of bidders can vary widely. Figure 6 below is another view of the same data for 2018 and 2019, showing averages of ST auction participation broken down by intertie. The figure highlights that the highest auction participation has been on the Michigan and New York ties in the export direction. Despite the month-to-month variation, these graphs describe relatively healthy average participation in the TR market for all the interties. Of particular importance, the most heavily traded and congested lines also tend to attract the most interest in the TR auctions. The IESO views this as an indicator that congestion signals and the risks associated with congestion are

drawing in participants who will likely use TRs for their intended purpose, as well as financial participants who add liquidity to the TR market for efficient auction price discovery when congestion costs are high. Conversely, the lowest participation often occurs on interties that are only very rarely congested as shown in Figure 2 and Figure 4, indicating less interest in TRs on these interties. ‘’’’

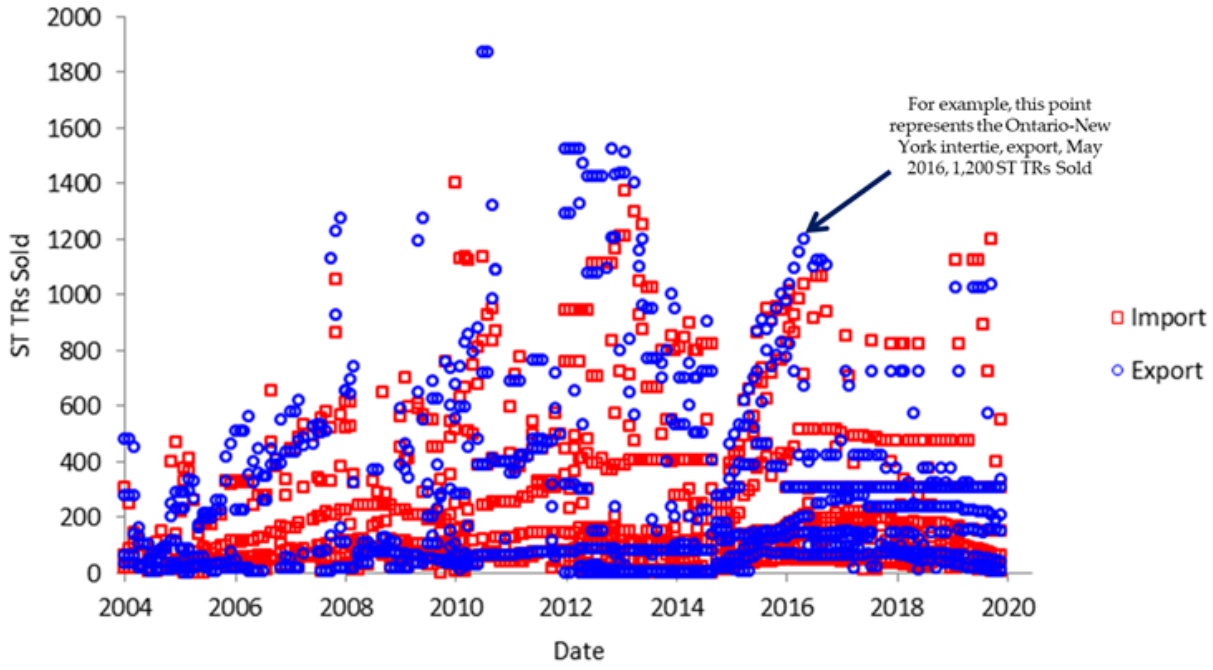
Figure 6 | Average No. of Participants in the ST Auctions by Year



A key component of the auction mechanics is the number of TRs sold by date. Figure 7 shows that there has been large variations in the TRs that have been sold in the ST auctions. The variation is caused by many factors, the size of the intertie, outages on the interties, operational constraints that limit the maximum number of TRs being offered on certain interties, the number of TRs sold in the LT auctions, and the method the IESO uses to determine the number of ST TRs to sell.

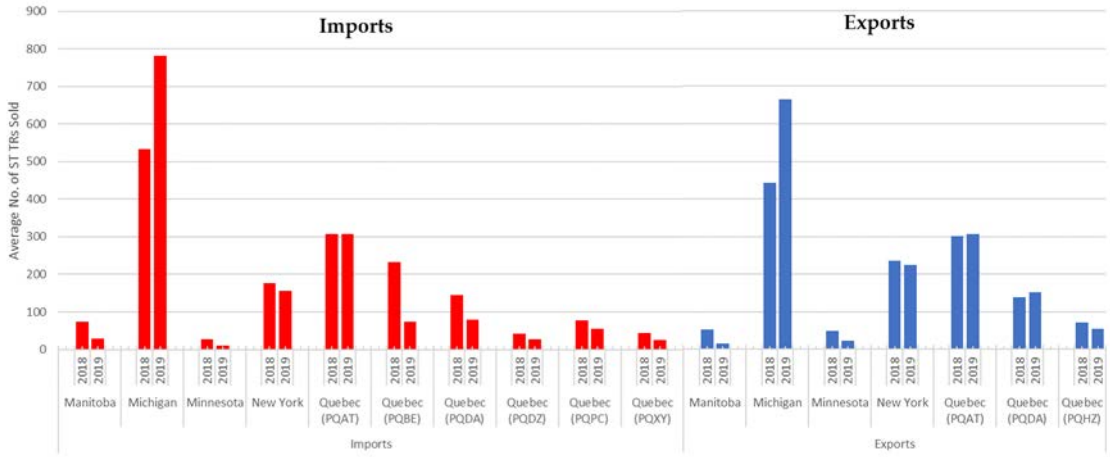
There is a slope upwards in the number of ST TRs sold for many ties for the October 2014 to 2017 period because during this timeframe the IESO balanced total congestion rent collected to overall TR payouts. If the IESO collected more congestion rent than TR payouts, it would increase the number of TRs offered on all interties by 4%. Since this criterion was met throughout most of this period, steadily increasing numbers of TRs are sold on essentially all of these interties together during this time. Post 2017, the IESO balanced on a tie by tie basis so the number of TRs sold on all the interties all go up and down independently. Prior to 2014 the financial upper limit did not impact long-term TRs, only short-term TRs, and the IESO also balanced congestion rents, TR payouts, and auction revenues on a consolidated basis on all ties. During this time the IESO was also only changing the short-term auctions by 4% in 3-month intervals, this was a slower increase but TRs sold on all the interties still moved up and down together.

Figure 7 | Scatterplot of ST TRs Sold vs. Date by Import / Export



On a tie-by-tie view, the number of TRs sold in each auction can also quite vary widely, in part as a reflection of the various controls in place that are used to determine the number of TRs sold, and in part because of the variation in the inherent size of the intertie. Figure 8 below shows the average ST TRs sold by intertie for 2018 and 2019.

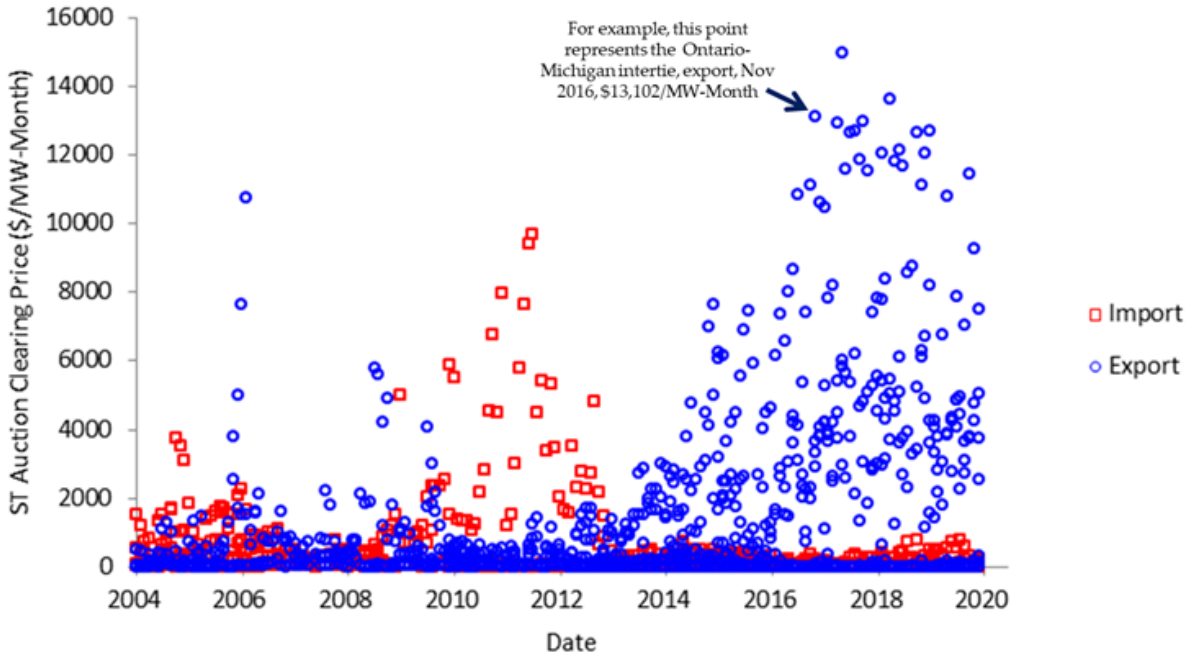
Figure 8 | ST TRs Sold by Intertie, 2018-2019



The final major component of the ST TR auction outcomes are the ST auction clearing price for all these auctions. Figure 9 below shows the historical auction clearing prices across all the interties for

the last 16 years. In Figure 9, one observation is that overall, the auction clearing prices reflect underlying conditions (such as the congestion costs presented in Figure 3) very well[17].

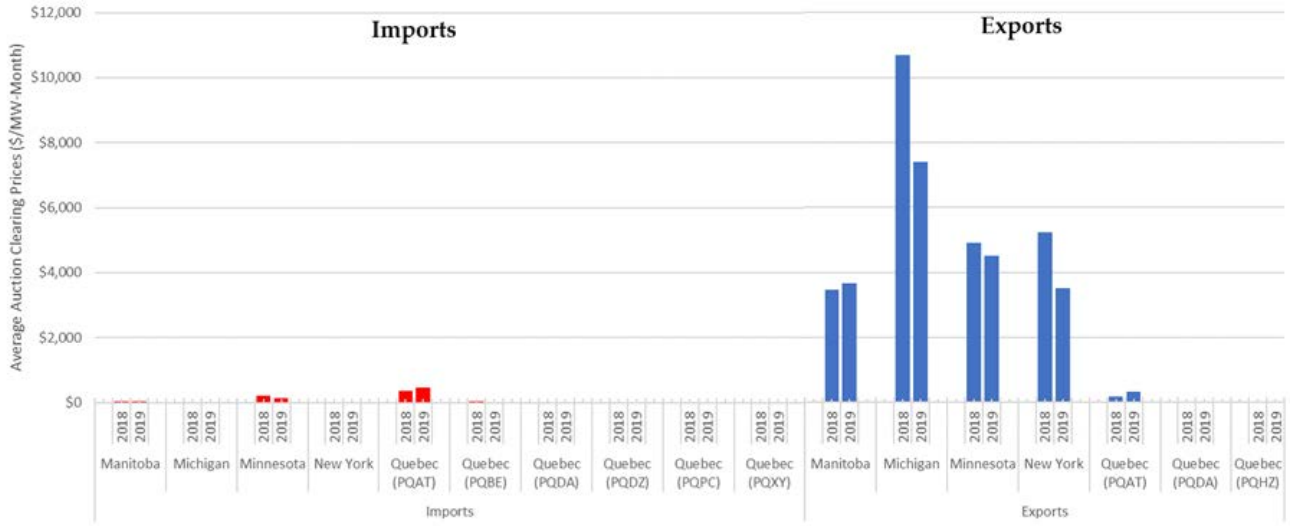
Figure 9 | Scatterplot of ST Auction Clearing Price vs. Data by Import / Export



For consistency, a breakdown of average ST auction clearing prices by intertie from 2018-2019 is shown in Figure 10. As can be seen by this picture, in 2019, 4 export intertie paths (Manitoba, Michigan, Minnesota, and New York) each have average auction clearing prices that are approximately an order of magnitude higher than the highest average auction clearing prices in the import direction, reflecting underlying market conditions and the value traders find in exporting power from Ontario.

[17] The reader may notice that in 2010-2012 there was a bump in imports. The IESO changed its operating procedure for MISO interface in Sep 2009 which prompted a surge in intertie transaction at the Manitoba intertie.

Figure 10 | Average ST Auction Clearing Prices ($/MW-Month), 2018-2019



LT Auctions

The next set of figures describes similar data for the LT auctions, including 1) the number of Round 1 bidders, 2) the total number of LT TRs sold across Round 1 and Round 2, and 3) the clearing price of Round 1 TR auctions by quarter broken down by import and export over 16 years. The Round 1 auction results are generally representative of the Round 2 results for the LT auctions, so only the Round 1 results are presented in this section.

The complete dataset for the number of bidders for Round 1 of the LT auctions is shown in Figure 11 below. As shown in the figure and similar to the ST auctions, there is a wide range of bidders that participate. The average number of bidders across all Round 1 LT auctions was 6 (with a range of 2-12), somewhat lower than for the ST auctions (which was 8). The average number of bidders in the import direction was 6 (compared to 7. for ST auctions), and in the export direction was 7 (compared to 9 for ST auctions). For the LT auctions overall, there has been a fairly strong and consistent level of participation over the last 16 years, though less than for the ST auctions.

The reason for the lower levels of participation in LT auctions compared to ST auctions is likely due to the higher cost (and higher corresponding risk) of LT auctions, as well as the more limited trading strategy options that market participants can pursue with such a long-term hedging instrument.

Figure 11 | Scatterplot of LT Round 1 Auction No. of Bidders vs. Date by Import / Export

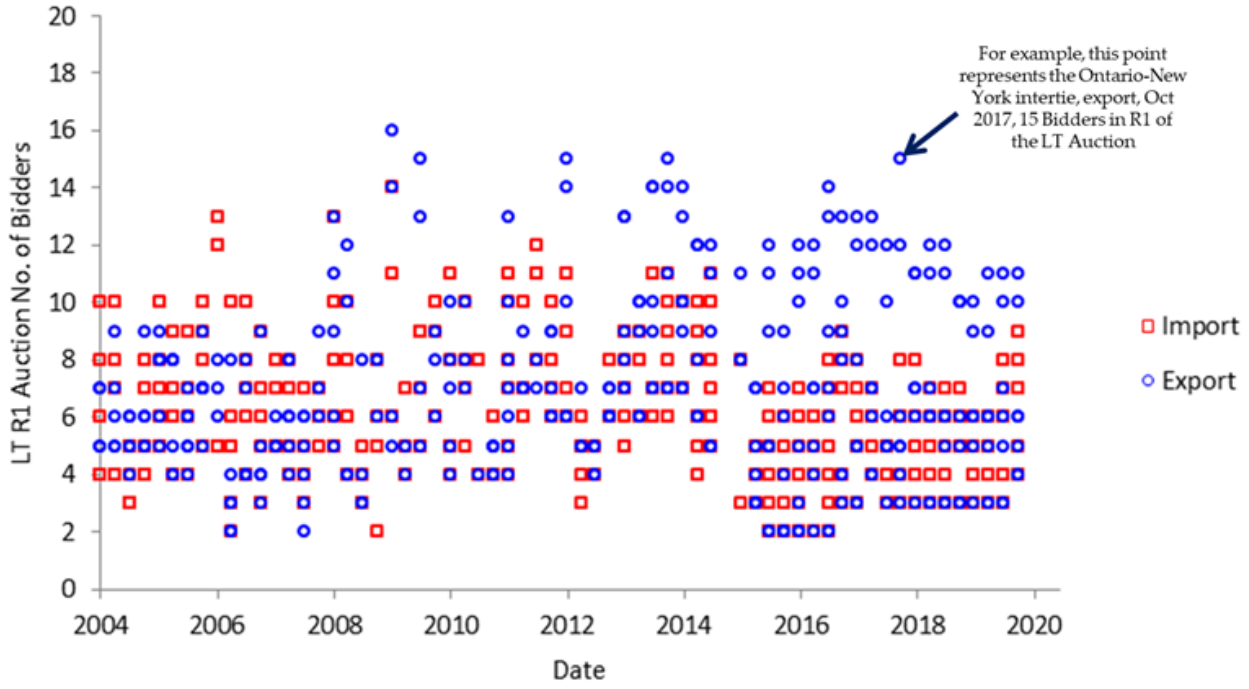


Figure 12 below is another view of the same data, broken down by intertie for 2018 and 2019. Competition is heaviest on the most congested lines, which is notable as TRs on these interties can often exceed $50,000-$100,000/MW-year. Conversely, competition is relatively weak on a number of intertie paths including some import and export paths to Quebec.

Figure 12 | Average No. of Participants in the LT Round 1 Auctions by Year

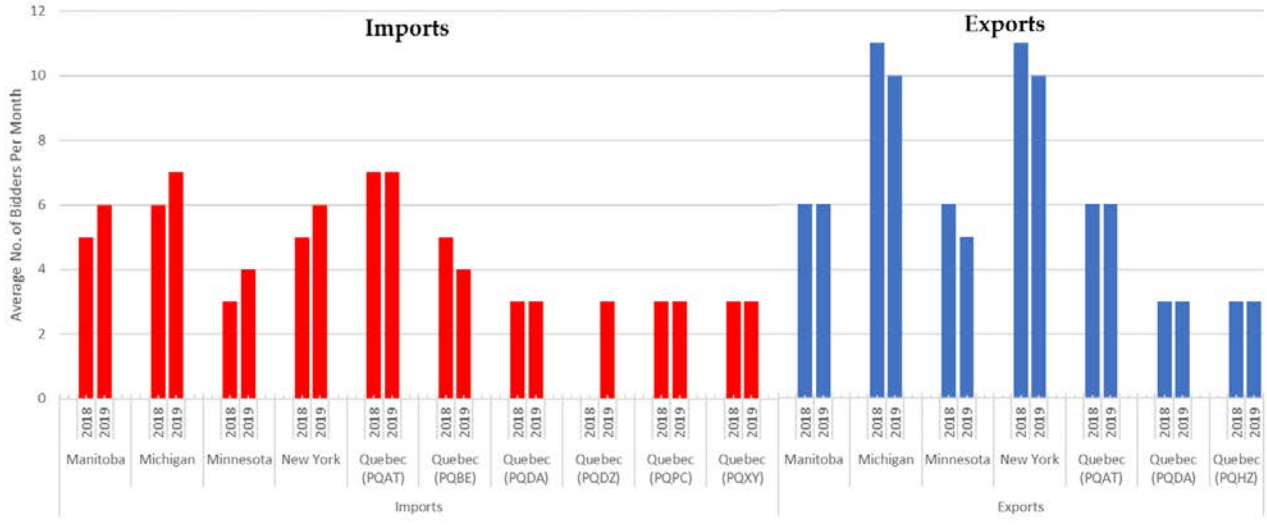
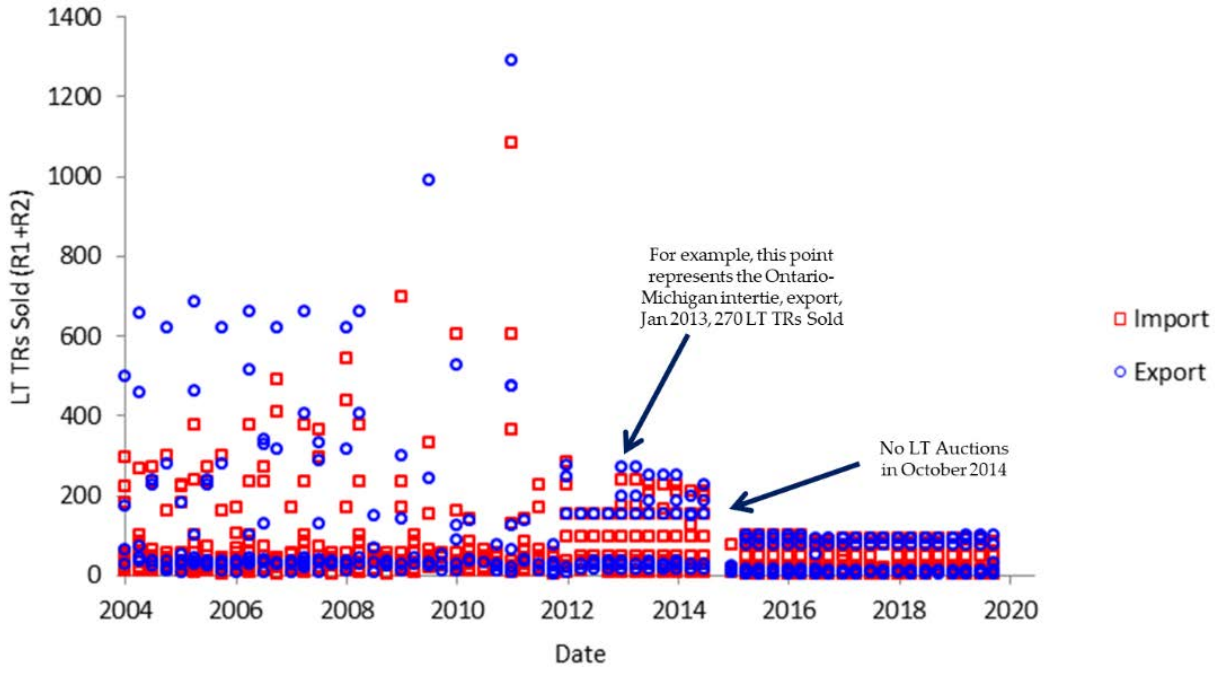


Figure 13 below shows the number of LT TRs sold historically, combining TRs sold in both Round 1 and Round 2 of the LT auctions. In earlier years, 2004-2012, the IESO sold up to the full capacity of

the line as LT TRs (on single circuits), using ST TRs essentially for balancing. The years from 2012-2014 in contrast were a transition period. In September, 2014 the IESO made adjustments to the calculation of how many LT TRs to sell, creating a newly established (redefined) TR base quantity, and afterwards only about 25% of total TRs were sold as LT TRs. Complicating the picture, TRs had been oversold for several years, and some new intertie capacity came online at the same time resulting in significantly depressed LT TR sales on some intertie paths, and somewhat increased TR sales on other intertie paths during this period. In October 2014, there were no LT TRs sold because during this month a major change to the TR market came into effect. This was the implementation of an interim maintenance process that balanced congestion rents and TR payments on a consolidated basis, the outcome of which was that LT TRs offered were temporarily set to zero for a quarter. In March 2017, the IESO further started selling LT TRs on a tie-by-tie basis. The overall result has been relatively few LT TRs sold in recent years.

Figure 13 | Scatterplot of LT TRs Sold (R1+R2) vs. Date by Import / Export



On a tie-by-tie view of the same data, the number of TRs sold in each auction can also vary widely, again in part as a reflection of the various controls in place that are used to determine the number of LT TRs sold, and in part because of the variation in the inherent size of the intertie. Figure 14 below shows the average ST TRs sold by intertie for 2018 and 2019.

Figure 14 | LT TRs Sold by Intertie, 2018-2019

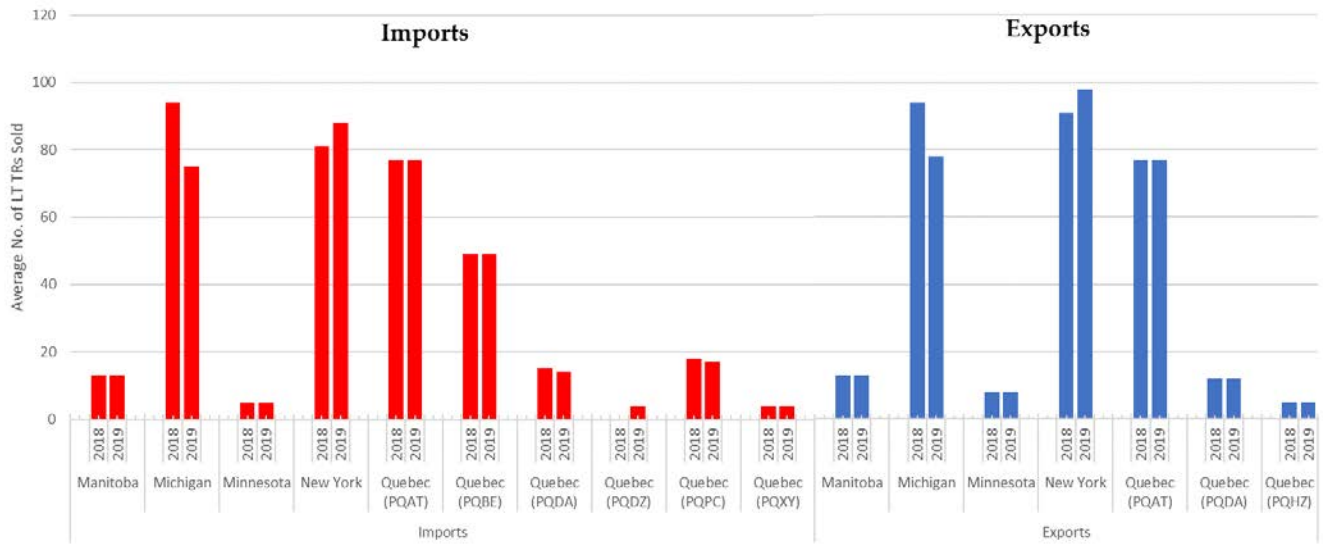


Figure 15 and Figure 16 below shows the corresponding LT TR Round 1 historical auction clearing prices across all the interties for the last 16 years and by intertie for 2018 and 2019 respectively. The units are in $/MW-year, and therefore these TRs tend to clear at much higher prices than the ST TRs. Overall, the auction clearing prices presented in these figures reflect underlying conditions (such as the congestion costs presented in Figure 3 and Figure 4) relatively well.

Figure 15 | Scatterplot of LT TR R1 Auction Clearing Price vs. Date by Import / Export

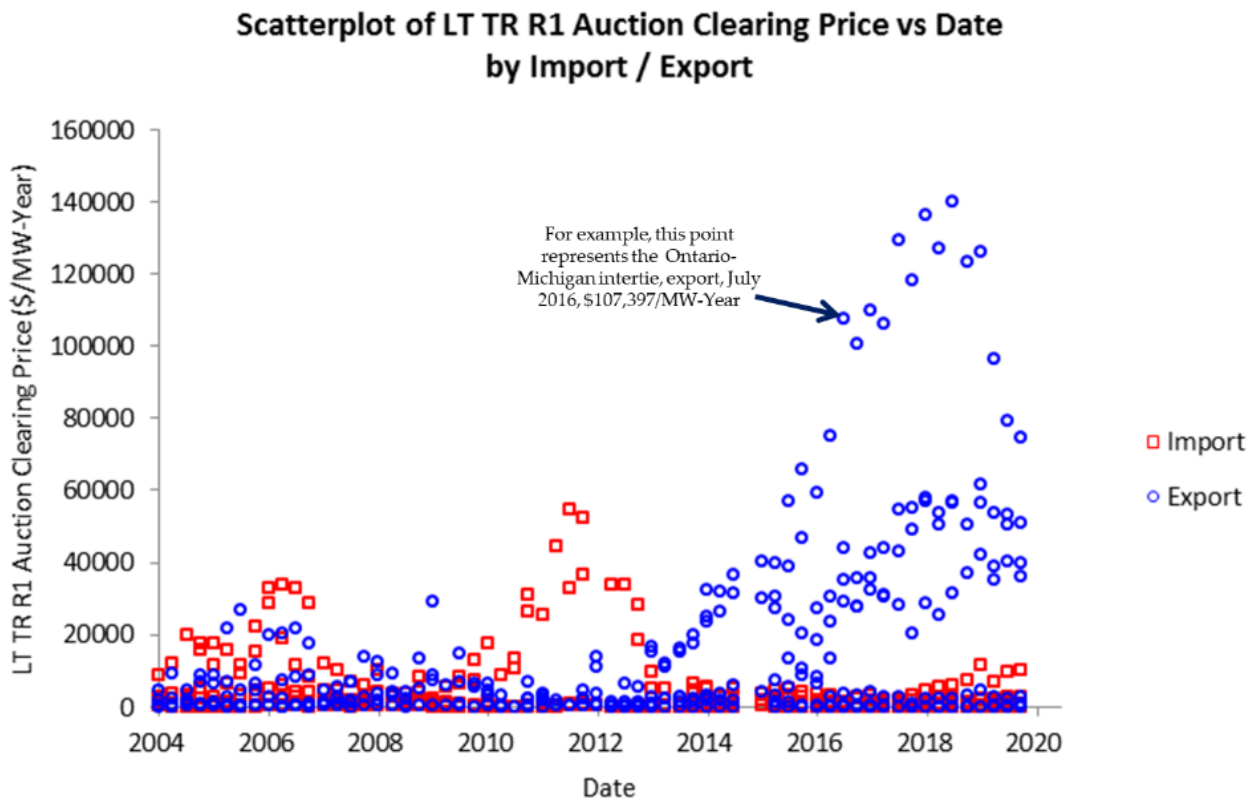
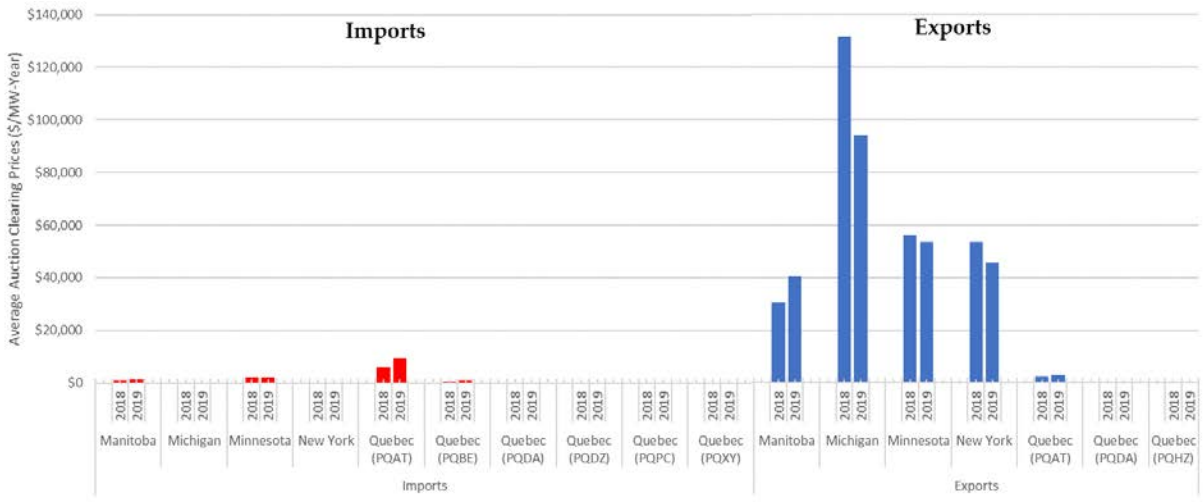


Figure 16 | Average LT Auction Clearing Prices ($/MW-year), 2018-2019



4.2.3 Energy Flow Hedged by TRs

This section up until now has provided an overview of the TR market, where congestion is, how many TRs are being sold to hedge against that congestion costs, and what prices market participants are willing to pay for the ability to hedge congestion costs. Below the discussion turns to how those TRs are actually being used by physical and financial traders.

Physical Traders

As a step towards understanding the utility of the TR Market to Ontario consumers, the IESO evaluated the extent to which TRs being sold on the interties were being used for hedging purposes. TRs can be purchased by market participants but this does not necessarily mean that they are being used, or have the opportunity to be used, to hedge intertie flow along the paths that they were purchased for. Factors such as the availability of economic arbitrage opportunities along specific paths, the purchase of TRs by purely financial participants the presence of intertie outages, and the risk tolerances for traders on specific trading strategies can all influence whether or not specific TRs are being used primarily for their intended purpose.

This section describes the results of an analysis that looked at whether physical traders who flowed energy hedged those trades by simultaneously also owning TRs along the same intertie path. To complete this analysis, the IESO matched intertie transactions with TRs owned by all market participants, from 2016-2019[18]. If a trader flowed in an hour on a specific intertie path and simultaneously owned TRs on that same path, then the analysis assumed that the transaction was hedged by TRs[19]. If a trader flowed on an intertie path where they did not own TRs, then the analysis assumed that the transaction was left unhedged. The analysis was completed on both an hourly basis and a per MW basis across this time period, and includes the ownership of both ST and LT TRs.

The high level results across all interties are described in Table 1. As shown by the Table, the percentage of intertie flows hedged by TRs from 2016-2019 ranges from 36% to 42% (and therefore 64% to 58% of total intertie flow was not hedged by TRs). The narrow range across 4 years of data and across all interties is remarkable primarily in its consistency. Viewed from this high level, it appears that TRs are being used to hedge a large portion of intertie flows in Ontario.

[18] The time frame was limited in this case to 2016-2019 due to the complexity of this analysis.

[19] The IESO cannot definitively determine whether a particular intertie transaction would or would not have occurred in the absence of being hedged by a TR. For example, it is possible that two different traders at the same company pursued two different trading strategies that happened to coincide on the same intertie path at the same time (i.e. owning a TR for purely financial purposes while simultaneously placing a high bid or offer to flow power to pursue a large price spread). However, the IESO views it as unlikely that in these cases the ownership of a TR would not at least partially influence the behavior for determining bids and offers for physical flow.

Table 1 | Energy Flow Hedged by TR Ownership by Physical Traders (2016-2019)[20]

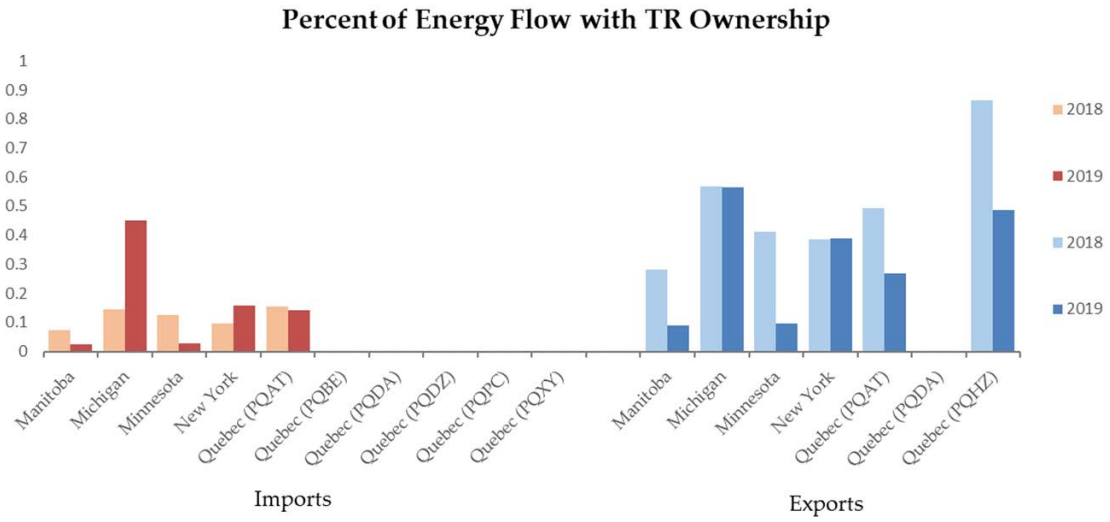
Year	Total Energy Flowed Across the Interties (TWh)	Total Energy Flow Hedged by TRs (TWh)	Total Energy Flow Unhedged by TRs (TWh)	Percentage Hedged by TRs (%)
2016	29.9	12.5	17.3	42%
2017	25.7	9.2	16.5	36%
2018	27.0	9.9	17.1	37%
2019	26.4	9.4	16.9	36%

Similar data broken down by intertie is shown below in Figure 17, which tells a somewhat different story at this more granular level. As shown in this figure, the utilization of TRs as a hedge for physical flow varies significantly by intertie, and to an extent by year. Comparing the results to Figure 2 and Figure 4, hedged flow is consistently higher on the export interties in general, which are often also significantly more congested. Further, hedged flow is highest on the Ontario to Michigan intertie in the export direction, which is also the most congested intertie. This indicates more frequent purchasing of TRs by entities that flow energy on the interties as a hedge against congestion costs.

Similarly, hedged flow is consistently lower on the import interties which are often much less congested. This indicates that despite TRs being offered on these interties, they are used less often for hedging energy flow.

[20] Table 1 includes total power flow over the interties in both directions. The number cannot be greater than 100%. If a trader owns 100 TRs and they flow 200MW in an hour, then only 50% of their flow would be hedged by TRs. If traders only flow 50MW then 100% of their flow would be hedged by TRs for that hour. These calculations use the RT constrained schedule, which takes out failed transactions from the PD schedule and is close to the actual flow. The IESO wanted to see times when traders actually flowed and had TR ownership. If the calculation was repeated on a different timeframe it would be less close to actual flow. The market schedule would likely have contained a somewhat similar mix of hedged vs unhedged flow, so that calculation would produce similar numbers. Pre-dispatch run of the unconstrained algorithm determines the market schedules (quantities) of imports/exports, and calculates prices, including ICP. The actual interchange schedule is produced by the PD constrained algorithm. Interties that we do not sell TRs on were not included.

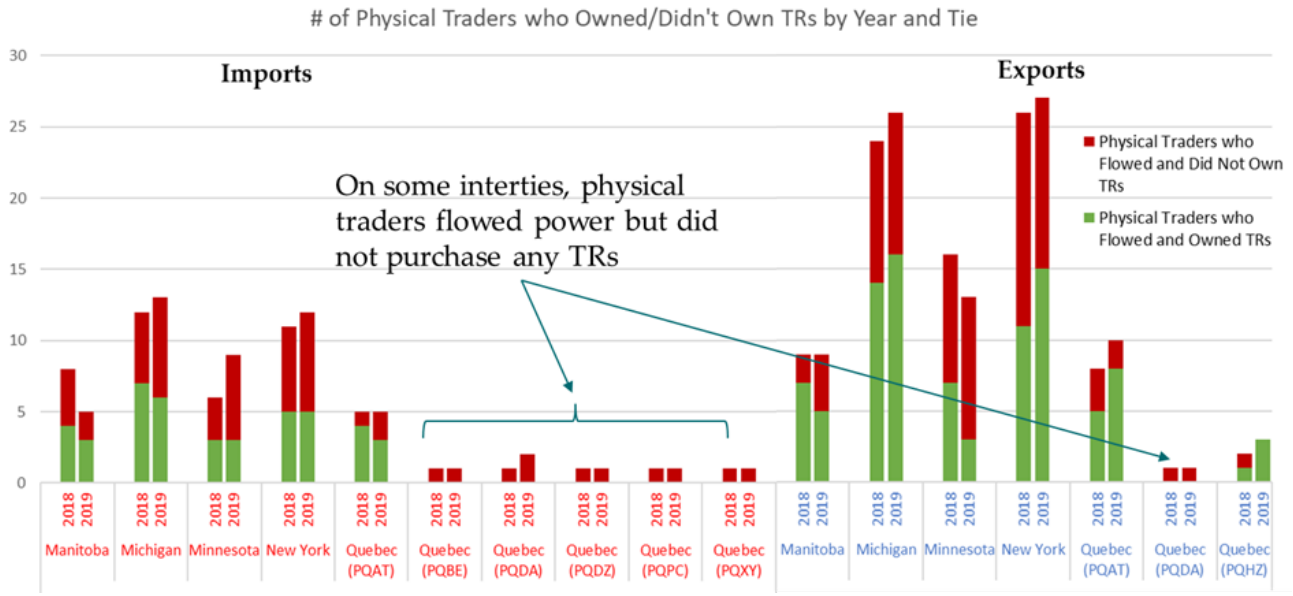
Figure 17 | Percent of Energy Flow with TR Ownership



As an extension to this analysis, the IESO reviewed the number of physical traders on each intertie, and whether or not they purchased TRs on the intertie path in which they flowed. The results are shown in Figure 18 below. As shown in the Figure, on some ties, physical traders actively purchase TRs to hedge physical flow, particularly on the most congested interties. However, on other ties, especially intertie paths that are rarely congested, physical traders flow power without purchasing any TRs.

On the import paths in which no physical trader purchased TRs in 2018 or 2019 (import paths PQBE, PQDA, PQDZ, PQPC, PQXY), the average ST auction clearing price was $8.69/MW-month, and on the export path in which no physical trader purchased TRs (PQDA), the average ST auction clearing price was only $0.12/MW-month. These low prices indicate that cost is likely not a barrier to the purchase of TRs for these physical traders but rather, that the TRs offered did not need to be purchased for intertie flows because no congestion was expected to occur. The fact that no physical traders purchased TRs on these lines despite the low TR prices further supports the argument that TRs are being used for their intended purpose, to hedge against congestion on intertie trades. If congestion does not occur, physical traders see no reason to purchase TRs. Another contributing factor to the low auction clearing price could be the fact that the IESO sells TRs based on the available capacity of the interties irrespective of the demand for TRs on these paths.

Figure 18 | TR Utilization By Physical Traders



The analysis in this section indicates to the IESO that TRs are often being used for their intended purpose, to hedge intertie congestion. Broadly there are increases in physical trader hedging for interties that are highly congested, and conversely, physical traders do not see the need to purchase TRs when no congestion occurs.

In trying to understand whether the percentage of intertie flows hedged by TRs (36% to 42%) was appropriate, the IESO heard from traders that the current TR product, which covers all the hours in a month in the case of ST TRs or all the hours in a year for the case of LT TRs, is not a good match for many of the different trading strategies that traders may want to pursue. For example, if a trader only wanted to flow energy during peak hours, they would have to buy at a minimum a block of TRs that is valid over all hours of the month. This may be one of the key reasons that the percentage of energy flow hedged by TRs presented in Table 1 is not higher.

Financial Traders

The IESO acknowledges that financial participants can play an important role in providing liquidity and competition to generate efficient TR clearing prices and help maximize auction revenues for the benefit of Ontario ratepayers. However, another reason that the percentage of intertie flow hedged by TRs is not higher may be that the TRs available are being purchased by “Financial Traders” who have no intention of flowing energy across the interties. To explore this further, the IESO also looked at the proportion of TR ownership by financial traders to better understand financial trader participation in the TR market. A “Financial Trader” in this analysis refers to an organization that buys TRs but does not complete any physical trades on Ontario's interties within a given year.

Table 2 | TR Product Ownership by "Financial Traders" (2016-2019)

Year	Total TR Product Owned By All Market Participants (TWh Equivalent)	Total TRs Product Owned by "Financial Traders" (TWh Equivalent)	Percent Ownership by "Financial Traders" (%)	Year
2016	63.9	19.6	31%	2016
2017	49.5	16.5	33%	2017
2018	46.7	15.5	33%	2018
2019	47.7	17.9	38%	2019

The results of "Financial Trader" participation are shown in Table 2[21]. In the last 4 years, between 31% and 38% of available TR product was purchased and held by purely financial traders. This means that between only 62% to 69% of total available TR product sold was available to physical traders to hedge intertie flow.

4.3 The Ontario-Michigan Intertie Path

This interim report has so far presented data across the entire TR market. This section will provide a more focused analysis specifically on the Ontario to Michigan export path, to highlight in more detail broad historical trends as well as the high levels of variability the IESO sees in the raw data. The IESO views this high level of variability it sees in congestion costs as a key reason intertie trader's may be interested in purchasing TRs. Similar to the previous section, IESO looked at three main components in a more granular level of detail including 1) intertie congestion patterns to identify trends and variability, 2) the number of TRs sold on LT and ST auctions to understand congestion price volatility and how the quantity of TRs impact prices, and 3) auction outcomes for LT and ST auctions to review clearing prices and the role of financial participants in these auctions. As part of this last component, IESO also looked at how closely market participants were able to predict the cost of congestion, whether traders who cleared ST auctions flowed, and flow hedged by TRs for a single market participant.

The percentage of hours of intertie congestion for all intertie paths that Ontario sells TRs on from 2016-2019 is shown in Table 3 below[22]. Based on this table and from the overall market analysis presented above, the IESO chose the Ontario to Michigan export path for more detailed analysis. It is the most congested intertie with the largest transaction volumes, and it also has high auction participation and auction clearing prices. From this data, the IESO anticipated that there would be a high level of interaction between this intertie path and TR market activity, and that physical traders

[21] TR Product is defined here as the total TR capacity (LT and ST) multiplied by the number of hours that each TR is valid, and has the units "TWh equivalent". Different companies were considered by calculating at the aggregated parent company level, so if multiple market participants operate under one parent company, and one of them has flow, the parent company is not considered a "financial trader" in this calculation. The number therefore represents a lower bound on speculative activity. This percentage could increase if the calculation was repeated on a tie-by-tie or month-by-month basis, or if the calculation is broken out by market participant. If the calculation was repeated at the market participant level, the numbers go up by between 1 and 4 percentage points (likely remove).

[22] The % of hours congested were calculated in the scheduling timeframe (pre-dispatch), the transaction volumes were calculated in the real-time timeframe.

would likely be using TRs to hedge against congestion on this intertie path. The IESO concluded therefore that this path would likely also be the most useful for a larger assessment.

Table 3 | Percentage of Hours with Transmission Congestion

		2016	2017	2018	2019	Transaction Volumes (MWh) - 2019
Export	Manitoba	36%	20%	33%	28%	739,373
	Michigan	82%	85%	67%	70%	9,566,455
	Minnesota	45%	52%	30%	43%	520,472
	New York	40%	48%	38%	36%	6,319,055
	PQAT	0%	0%	2%	4%	2,522,512
	PQDA					678
	PQHZ	0%			0%	112,127
Import	Manitoba	0%	0%	0%	0%	514,242
	Michigan					83,921
	Minnesota	1%	0%	0%	0%	63,894
	New York					21,006
	PQAT	2%	3%	3%	2%	4,871,220
	PQBE	0%	0%	0%	0%	758,591
	PQDA			0%		275
	PQDZ		0%	0%	0%	80,807
	PQPC		0%	0%		220,884
	PQXY		0%	0%		840

To explore the data further, the IESO generated heat maps of congestion prices, TRs sold, and auction clearing prices on the Ontario to Michigan intertie path by year and month over 16 years, from 2004 to 2019. IESO wanted to observe broad trends in congestion and TR auctions outcomes, as well as variability on this intertie path. The purpose of the heatmaps is to demonstrate trends and variability, not to analyze specific data points. The IESO therefore primarily reserves its comments for these features of the analysis.

4.3.1 Ontario to Michigan Intertie Path Congestion

Figure 19 below shows the long-term historical congestion costs and number of hours of congestion, as well as the month to month variability in these values, on two heat maps. The upper heat map shows congestion costs by year and month, the lower graph indicates the number of hours of congestion. Green indicates low values, red indicates the highest values. As shown from the figure, over a longer historical time period the frequency and magnitude of congestion over the Ontario to Michigan intertie in the export direction has significantly increased, though there remains significant month-to-month variation. To get an intuitive sense of the month to month variability, the reader is

encouraged to pick a cell in the top heat map and then move up or down by a cell. In the last few years, it is not possible to move far without the value halving or doubling from the original value picked.

Figure 19 | Historical ON-MISI Congestion Data

Congestion Cost ($Monthly ICP/MW) – ON – MISI Export

Month \ Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	$0	$0	$0	$0	$3,825	$35	$670	$931	$254	$80	$7,057	$2,025	$11,772	$7,895	$26,794	$5,140
2	$0	$2	$7	$480	$354	$2	$418	$436	$610	$91	$911	$3,711	$13,060	$6,025	$5,313	$1,390
3	$58	$145	$15	$0	$1,457	$4,652	$275	$130	$866	$1,600	$355	$6,491	$12,249	$9,244	$9,447	$2,418
4	$0	$1	$739	$425	$3,137	$6,778	$0	$0	$971	$2,924	$2,899	$5,158	$12,468	$22,225	$5,001	$8,876
5	$933	$0	$9	$680	$4,841	$403	$151	$3,755	$3,123	$5,852	$8,674	$12,796	$8,437	$22,539	$17,480	$13,661
6	$0	$0	$0	$369	$4,942	$2,353	$950	$1,415	$1,076	$5,391	$6,035	$6,854	$7,197	$17,928	$11,084	$15,992
7	$4	$178	$0	$73	$3,399	$2,638	$849	$4,104	$1,854	$3,671	$2,630	$6,399	$9,716	$15,704	$3,796	$7,946
8	$0	$0	$59	$415	$2,498	$674	$387	$489	$663	$2,548	$4,010	$5,225	$4,517	$9,898	$3,708	$8,131
9	$0	$0	$0	$56	$435	$335	$187	$67	$434	$5,537	$8,942	$1,003	$15,525	$11,220	$5,897	$9,102
10	$0	$0	$0	$54	$53	$132	$15	$64	$1,583	$2,806	$12,772	$4,528	$14,085	$20,879	$16,778	$14,346
11	$0	$0	$0	$0	$758	$3,481	$0	$113	$2,778	$5,687	$8,660	$10,598	$7,711	$10,544	$11,084	$4,897
12	$0	$0	$0	$7	$2,879	$341	$0	$786	$118	$425	$7,217	$10,718	$11,258	$16,332	$7,802	$3,744

No. of Hours of Congestion – ON – MISI Export

Month \ Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	0	0	0	0	175	6	53	60	28	17	105	197	659	459	490	358
2	0	1	2	12	23	1	44	19	105	14	55	202	644	495	322	159
3	1	7	1	0	90	205	36	13	99	137	34	486	707	500	600	291
4	0	2	28	20	127	298	0	0	150	227	223	423	665	684	392	451
5	18	0	2	40	244	47	15	77	206	383	557	591	633	736	682	685
6	0	0	0	11	153	217	98	55	94	290	384	560	539	696	637	700
7	1	5	0	5	129	226	41	138	147	239	333	518	543	706	321	604
8	0	0	5	14	131	81	19	26	63	246	402	442	408	649	326	670
9	0	0	0	3	31	52	17	9	48	419	463	99	689	616	390	653
10	0	0	0	1	13	26	1	6	196	249	649	445	695	735	636	722
11	0	0	0	0	40	156	0	12	270	408	485	636	525	572	509	443
12	0	0	0	1	54	48	0	86	19	68	555	688	530	591	534	370

Highest Values

Lowest Values

Figure 20 below shows similar heat maps of the number of TRs sold, with the ST TRs shown at the top and LT TRs shown at the bottom. As shown in the figure, historically there have been large changes in the number of TRs sold. This is due to many factors such as outages, operational constraints that limit the maximum number of TRs being offered on certain interties, the number of TRs sold in the LT auctions and the method the IESO uses to determine the number of ST TRs to sell.[23] It should be noted that the IESO sells all the TRs offered in the vast majority of its auctions.

[23] In the 2010 to 2012 timeframe there was a significant switch-over to selling more ST TRs and fewer LT TRs around this timeframe, that Is part of the story here. This change was adopted after there was an issue on the Minnesota intertie, where a lot of LT TRs were sold and locked in, and then outages on the tie significantly dropped the real-time average intertie transfer capability. The result was a significant congestion revenue shortfall which prompted the change to sell a larger proportion of TRs in the ST auctions. Another part of the story is that this period was just before the Phase Angle Regulators were made operational at the Michigan interface, so there were some outages on the tie as well. (April 2012, allowed for complete flow control at that intertie). Before this, there was also a coupling of transmission rights between Michigan and NY, which affected TR sales on this tie to an extent.

Figure 20 | Heat Maps of TRs Sold – ON-MISI[24]

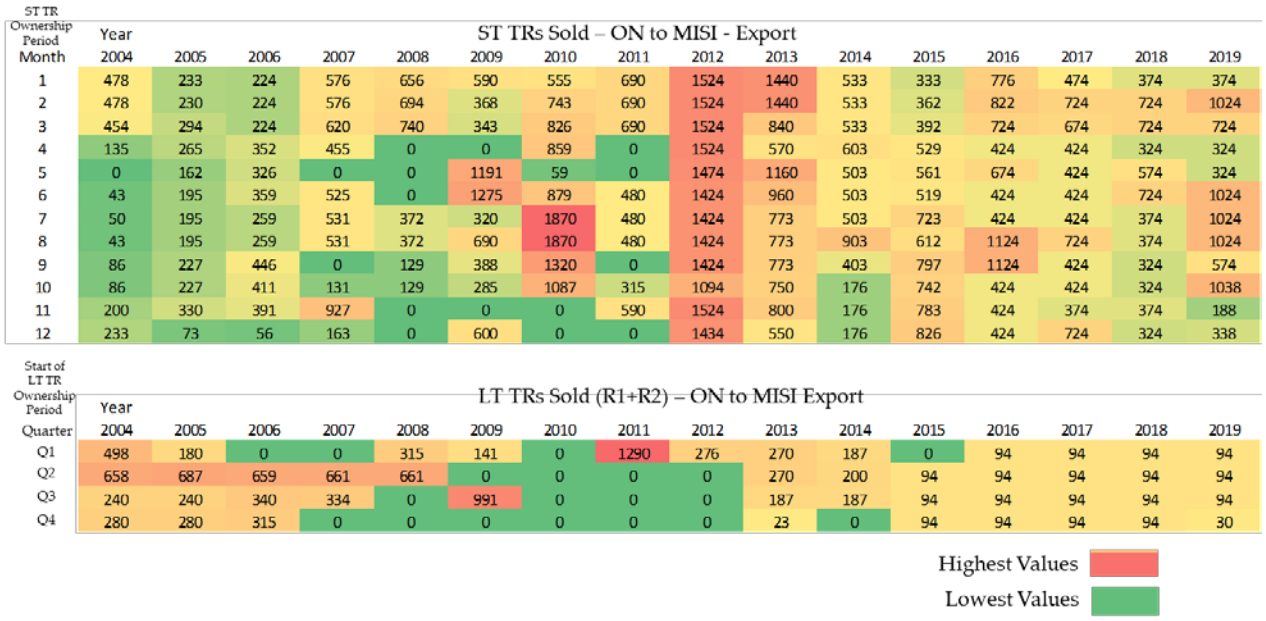
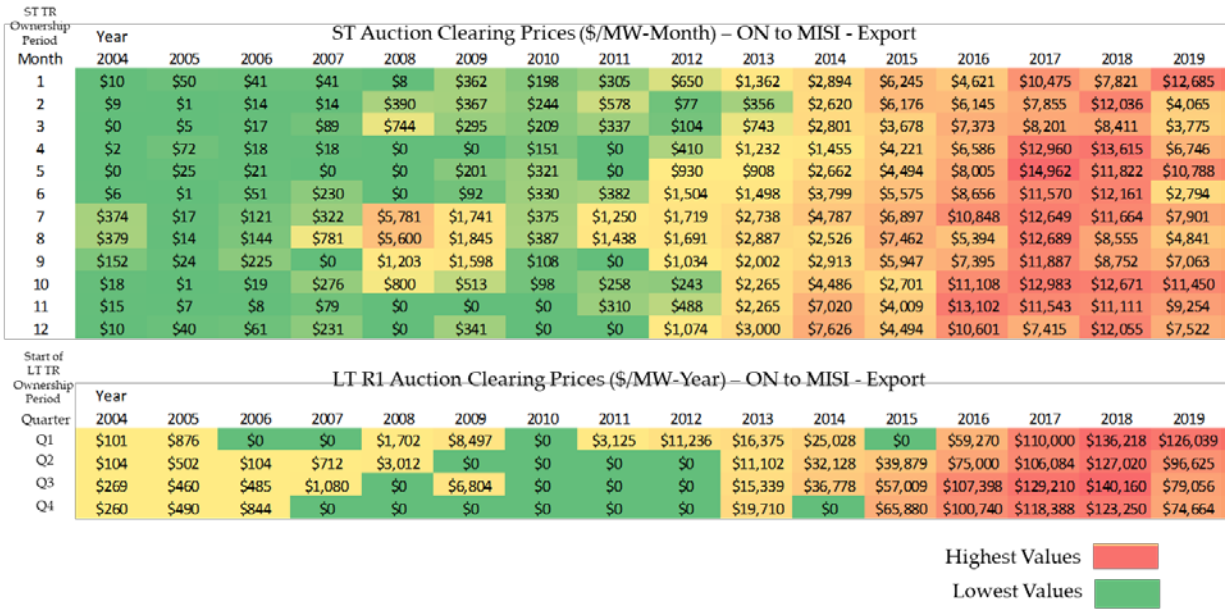


Figure 21 shows the corresponding auction clearing prices for the TRs sold in Figure 20. The clearing prices can also be quite variable in the ST auctions, though quite a bit more stable in the LT auctions. The clearing prices reflect expected congestion in the applicable ownership period, 1 month for ST auctions, 12 months for LT auctions.

[24] Data shows the quantity of TRs sold in each auction and the start date of the TR ownership period. LT TRs are valid for 12 months, so the valid number of LT TRs is greater than shown, e.g. the valid number of LT TRs for Q1 2019 is 376, the sum of LT TRs sold for Q2-Q4 2018 and Q1 2019

Figure 21 | Heat Maps of Auction Clearing Prices – ON-MISI



ST TR Ownership Period

ST Auction Clearing Prices ($/MW-Month) – ON to MISI - Export

Year / Month	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1	$10	$50	$41	$41	$8	$362	$198	$305	$650	$1,362	$2,894	$6,245	$4,621	$10,475	$7,821	$12,685
2	$9	$1	$14	$14	$390	$367	$244	$578	$77	$356	$2,620	$6,176	$6,145	$7,855	$12,036	$4,065
3	$0	$5	$17	$89	$744	$295	$209	$337	$104	$743	$2,801	$3,678	$7,373	$8,201	$8,411	$3,775
4	$2	$72	$18	$18	$0	$0	$151	$0	$410	$1,232	$1,455	$4,221	$6,586	$12,960	$13,615	$6,746
5	$0	$25	$21	$0	$0	$201	$321	$0	$930	$908	$2,662	$4,494	$8,005	$14,962	$11,822	$10,788
6	$6	$1	$51	$230	$0	$92	$330	$382	$1,504	$1,498	$3,799	$5,575	$8,656	$11,570	$12,161	$2,794
7	$374	$17	$121	$322	$5,781	$1,741	$375	$1,250	$1,719	$2,738	$4,787	$6,897	$10,848	$12,649	$11,664	$7,901
8	$379	$14	$144	$781	$5,600	$1,845	$387	$1,438	$1,691	$2,887	$2,526	$7,462	$5,394	$12,689	$8,555	$4,841
9	$152	$24	$225	$0	$1,203	$1,598	$108	$0	$1,034	$2,002	$2,913	$5,947	$7,395	$11,887	$8,752	$7,063
10	$18	$1	$19	$276	$800	$513	$98	$258	$243	$2,265	$4,486	$2,701	$11,108	$12,983	$12,671	$11,450
11	$15	$7	$8	$79	$0	$0	$0	$310	$488	$2,265	$7,020	$4,009	$13,102	$11,543	$11,111	$9,254
12	$10	$40	$61	$231	$0	$341	$0	$0	$1,074	$3,000	$7,626	$4,494	$10,601	$7,415	$12,055	$7,522

Start of LT TR Ownership Period

LT R1 Auction Clearing Prices ($/MW-Year) – ON to MISI - Export

Year / Quarter	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Q1	$101	$876	$0	$0	$1,702	$8,497	$0	$3,125	$11,236	$16,375	$25,028	$0	$59,270	$110,000	$136,218	$126,039
Q2	$104	$502	$104	$712	$3,012	$0	$0	$0	$0	$11,102	$32,128	$39,879	$75,000	$106,084	$127,020	$96,625
Q3	$269	$460	$485	$1,080	$0	$6,804	$0	$0	$0	$15,339	$36,778	$57,009	$107,398	$129,210	$140,160	$79,056
Q4	$260	$490	$844	$0	$0	$0	$0	$0	$0	$19,710	$0	$65,880	$100,740	$118,388	$123,250	$74,664

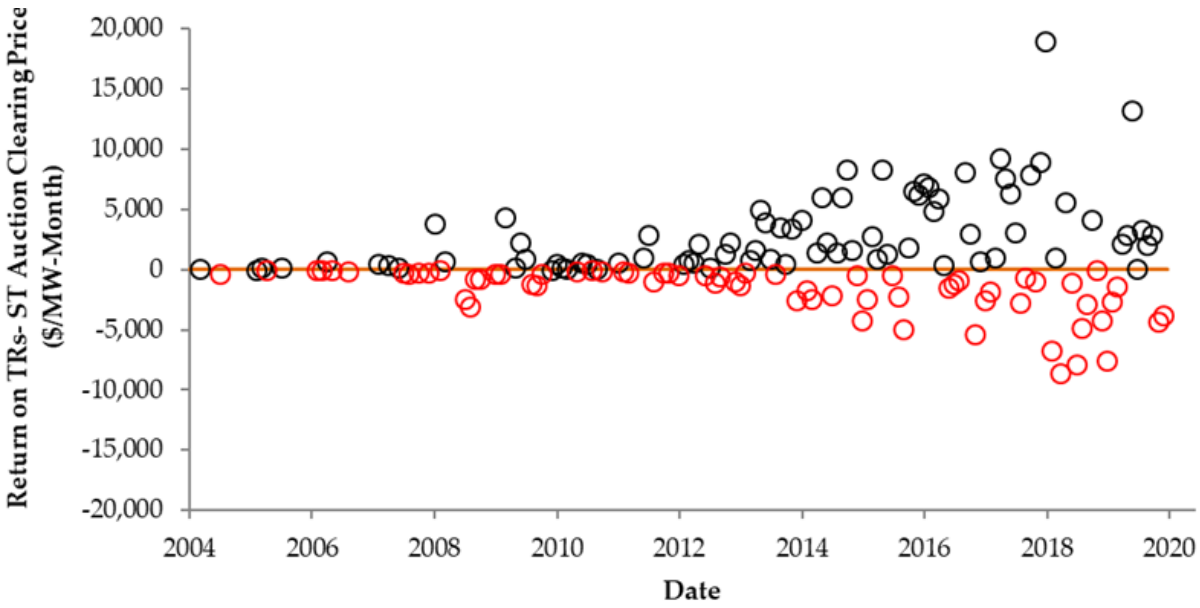
Highest Values

Lowest Values

To understand how closely market participants were able to predict the cost of intertie congestion, the IESO evaluated the return from purchasing TRs (sum of ICP in a month) minus the cost of purchasing TRs (the ST auction clearing price) for 16 years, by month, on the Ontario to Michigan intertie path. The results are shown in Figure 22 below. The black dots indicate months where TR payouts are greater than the corresponding auction clearing prices, the red dots indicate months where market participants paid more for TRs than they collected in intertie congestion costs.

A disproportionately large number of black dots would have indicated that market participants are able to predict congestion costs and profit from purchasing TRs, while a disproportionately large number of red dots would have indicated that market participants are able to predict congestion costs but that they are willing to pay a premium to hedge against congestion (or in the case of financial traders, that a loss was incurred). What the IESO interprets from this graph, however, is that there is a high prevalence of both black dots and red dots, and that this is strong evidence that predicting month-to-month changes in the cost of congestion is very challenging for market participants. Further, as congestion costs increase, differences between TR payouts and the cost of purchasing TRs can become amplified.

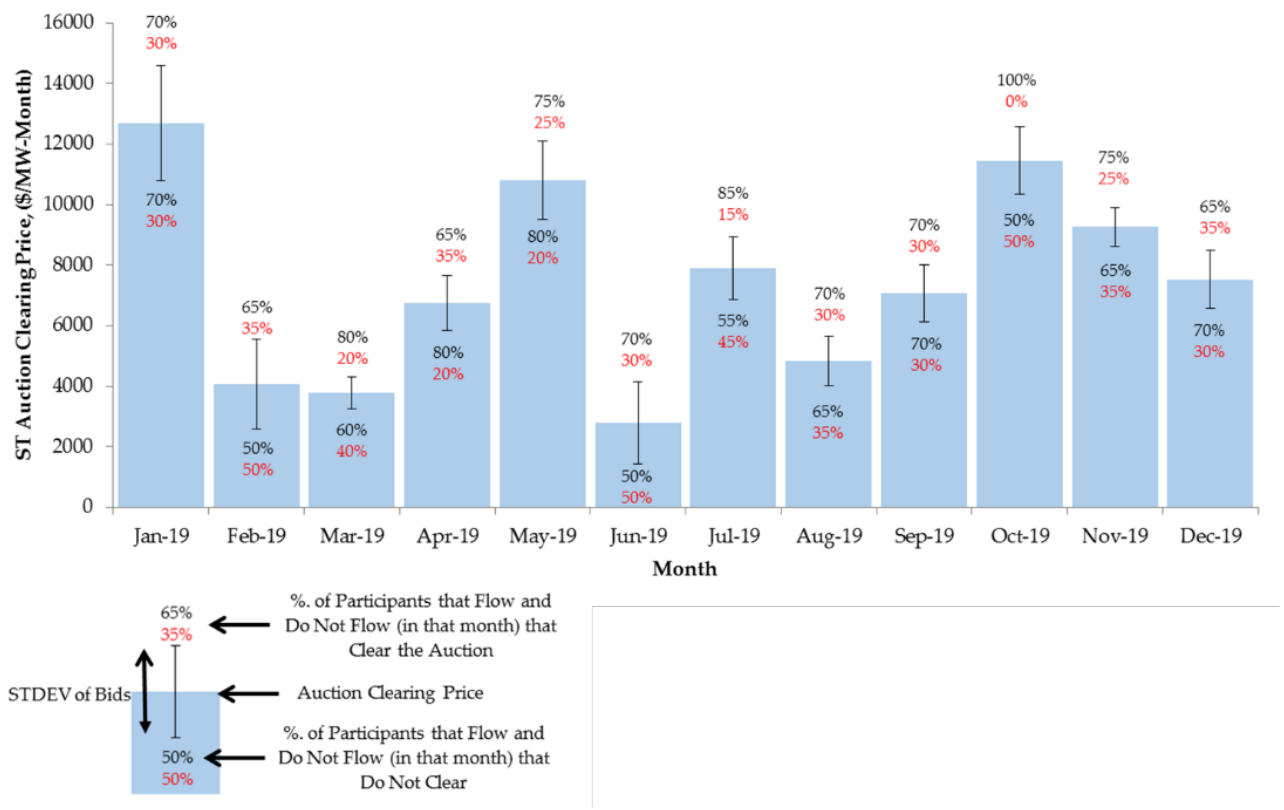
Figure 22 | Return on TRs - Cost of TRs, by Date



To tie all of these results together, the IESO combined, on one graph, ST auction clearing prices, the standard deviation of bids, and the percentage of flowing and non-flowing participants that clear and did not clear each auction, for the Ontario to Michigan intertie path for 2019 by month, as shown in Figure 23. The IESO wanted to observe in this chart (1) the month to month variation of auction clearing prices and bids, (2) if bidders who did not clear the auction still flow, and (3) the percentage of non-flowing participants that clear. The data highlights that many participants that clear the auctions flow, but some do not. It also shows that some participants do not clear, but still flow. It also shows that the STDEV of bids changes quite a bit month to month.[25] This further supports that there is high month-to-month volatility in clearing prices and bids, that some physical traders are trying to purchase TRs but not clearing the auctions, and that financial traders are active in establishing an efficient clearing price for congestion.

[25] IESO would have liked to have provided more granular data but were advised that we could not on specific auctions for confidentiality reasons.

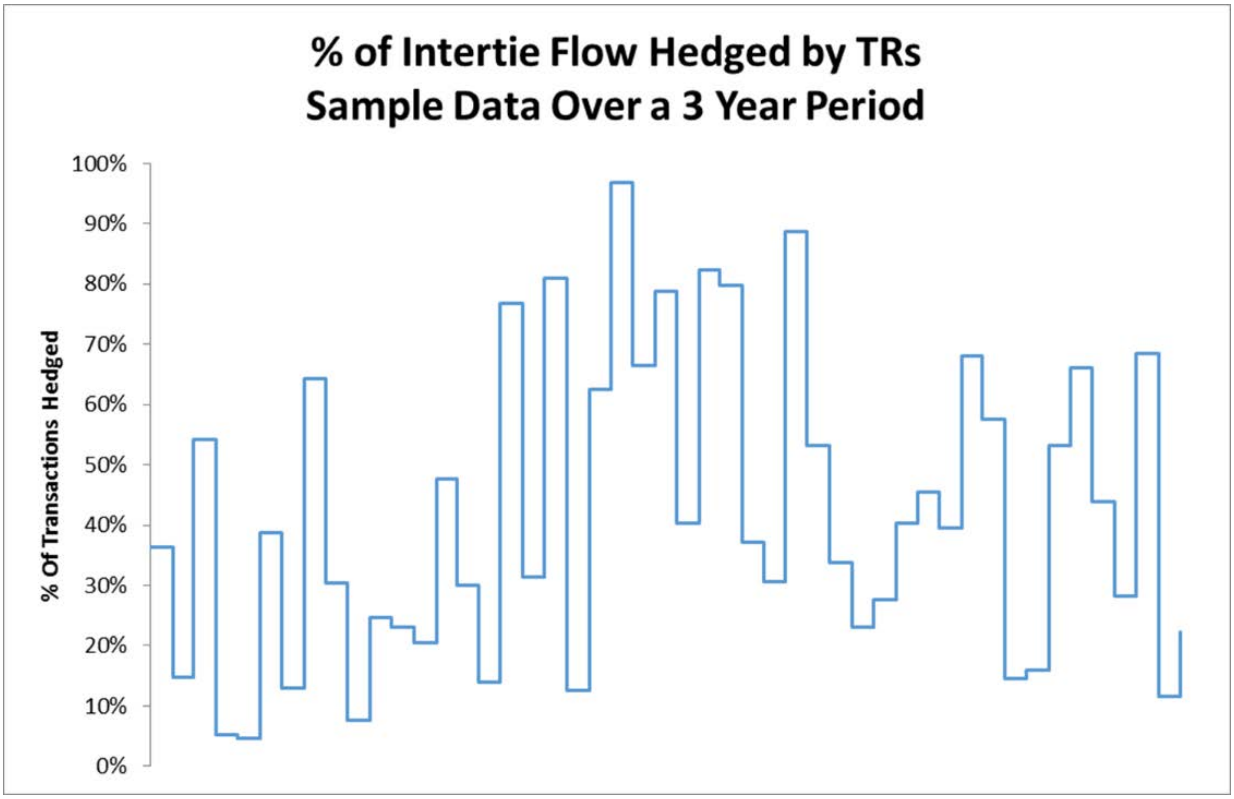
Figure 23 | ST Auction Clearing Prices, STDEV of Bids, and Percentage of Flowing and Non-Flowing Participants (ON-MISI Intertie)



As the final step in the analysis for the Ontario-Michigan path, the IESO assessed the % of intertie flow hedged by TRs for a single intertie trader, selected at random from the set of physical traders that flow over the intertie path, to see if there was relatively low or high variability in month-to-month % hedged transactions during a period in which the intertie was typically congested. The results over a sample 3 year period are shown below in Figure 24. As shown in the figure, there was high month-to-month volatility in the % of hedged transactions. Some transactions were always hedged due to the consistent ownership of LT TRs.[26] The extent that this is representative depends significantly on both the trader and the tie, some traders are hedged to a very large extent in general but others are not.

[26] This is calculated as the hedged flow divided by total flow expressed as a % for one trader.

Figure 24 | % of Intertie Flow Hedged by TRs Sample Data Over a 3 Year Period



4.4 Classification and Financial Performance of Individual Auctions

A key component of the TR market is the inner workings of the individual TR auctions themselves. This next section takes a closer look at these individual auctions. The first part of this section classifies different auction types in terms of competitiveness, and the second part of this section looks at the financial outcomes of various auctions.

4.4.1 Auction Competition

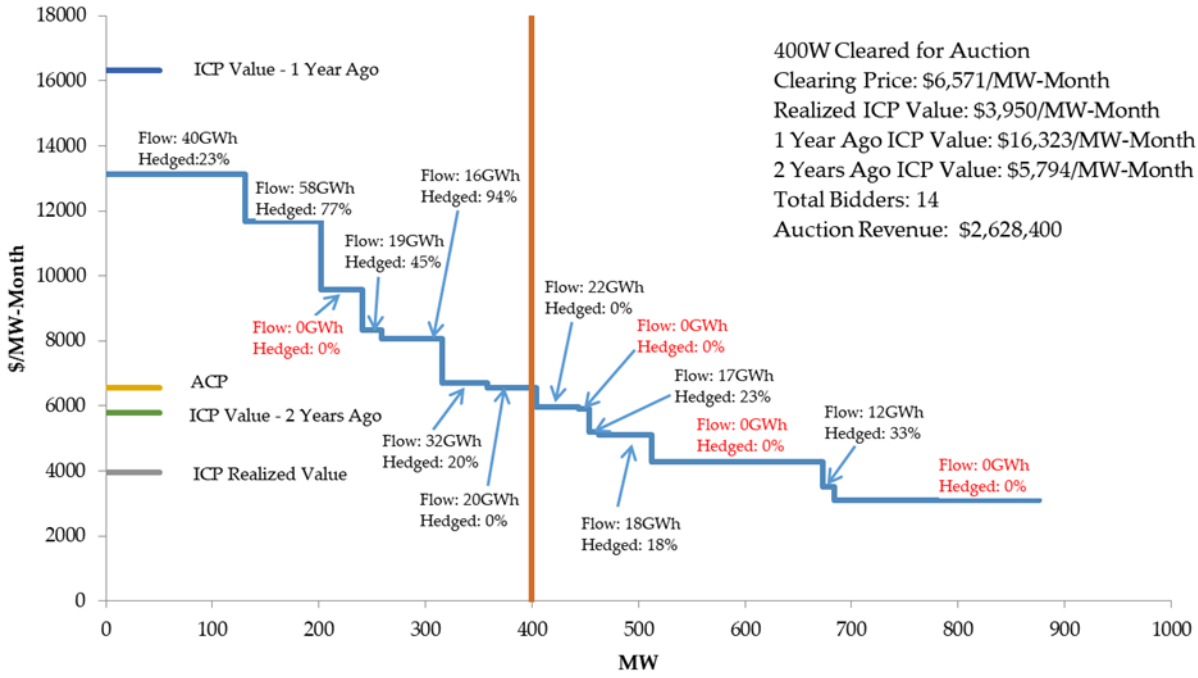
Given the previous analysis on auction participation as presented for ST auctions and LT auctions, the IESO was aware, at a high level, that some auctions were much more competitive compared to others given participation patterns, the wide variety of clearing prices, and number of physical versus financial traders. To better understand the competitiveness of auctions, the IESO first looked at a variety of short-term auctions on different interties and developed several illustrative bid curves representing a high level indicator of competitiveness of the TR auctions: 1) highly competitive auctions with 8 or more bidders, 2) competitive auctions with 6 to 7 bidders, and 3) less competitive auctions with 5 or less bidders. These illustrative bid curves are shown below in Figure 25, Figure 26, and Figure 27 respectively.

As shown in Figure 25, there is a wide variety of bidders expectations on the value of TRs for highly competitive auctions. There is also a large number of traders competing to purchase TRs, many TRs

purchased hedge physical flow, and there is a healthy mix of traders looking to purchase TRs for different physical trading strategies as well as financial traders (shown in red) that bring liquidity to the market and facilitate efficient price formation.[27]

In this auction the realized ICP value is less than the auction clearing price, so market participants that cleared the auction lost money on their TRs. However, the ICP from 1 year ago was much higher than even the highest bid in this auction. In contrast, the auction from 2 years ago was close to the auction clearing price. The bids therefore in some respect reflect the variability in ICP. There are some very high bids, close to the ICP value from 1 year ago, and there are some very low bids, even lower than the realized value. This illustrative auction brought in about $2.6 million.

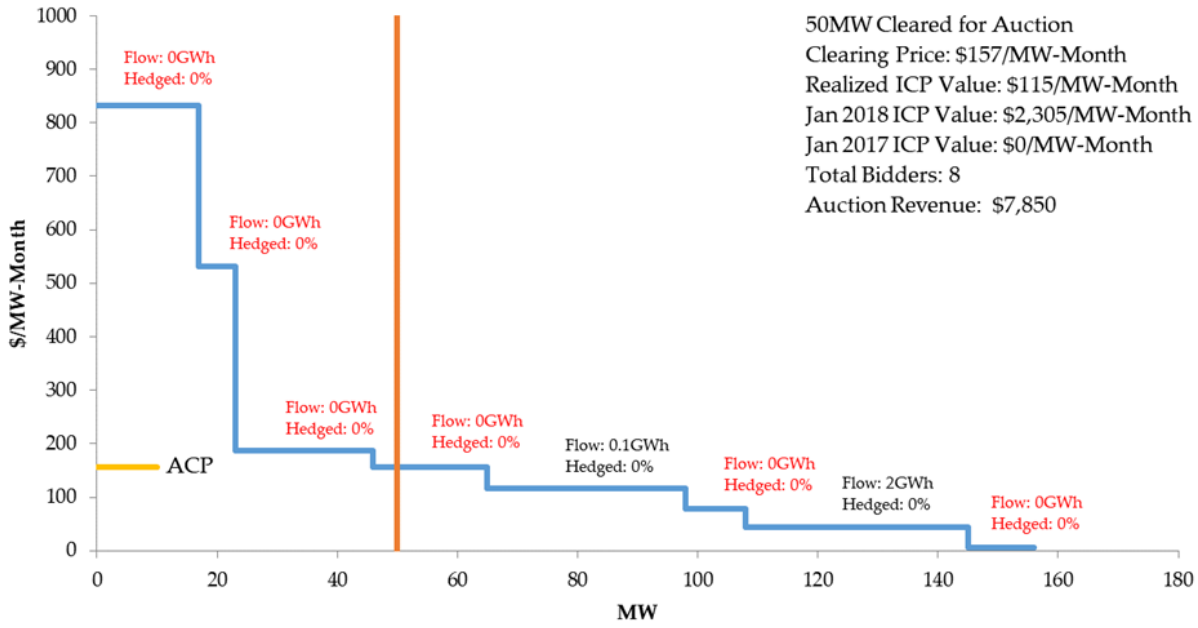
Figure 25 | Highly Competitive Auction Illustrative Bid Curve



As shown in Figure 26 in the illustrative example for competitive auctions, there are fewer bidders looking to purchase TRs, and the ratio of physical traders to financial traders is lower, but typically multiple physical traders are still bidding in these auctions.

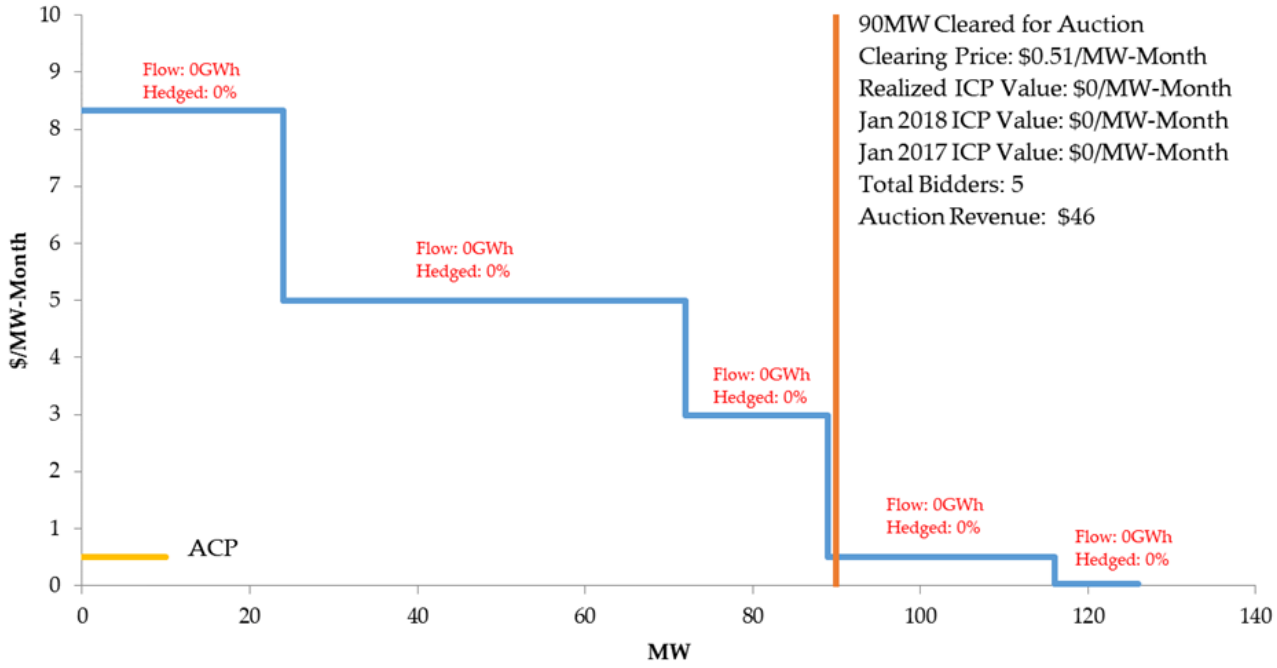
[27] Flow is calculated for this intertie and month only, does not indicate status as physical or financial trader. Hedged % was calculated based on both LT and ST TRs. This is an example of an illustrative auction that we built up out of real auction data. The bid curve (or demand curve) is created from the price quantity pairs of auction participants. Each PQ pair is labeled with the amount of flow of the participant (recall that this is illustrative), as well as the percent of that flow that is hedged by TRs (here both ST and LT TRs are considered in the % hedged calculation).

Figure 26 | Competitive Auction Illustrative Bid Curve



As shown in Figure 27 in the illustrative example for less competitive auctions, there are still fewer bidders looking to purchase TRs, and often only financial traders participate. Often TRs sold in less competitive auctions are not used to hedge intertie transactions. Congestion is infrequent, and auction clearing prices were typically quite low.

Figure 27 | Less Competitive Auction Illustrative Bid Curve



The relative frequency of each of these types of auctions for 2019 is shown below in Table 4. As shown in the table, overall in 2019, most ST auctions were either highly competitive or competitive, and only about 12% of auctions were of the less competitive type, indicating that most of the ST TR auction outcomes in 2019 were the result of relatively healthy competition.

Table 4 | The Competitiveness of ST Auctions in 2019

Level of Competitiveness	# of ST Auction Participants	Average Auction Clearing Price	Out of 179 ST Auctions in 2019
Highly Competitive	≥8	$1763/MW	53% were highly competitive (95 of 179)
Competitive	6-7	$621/MW	35% were competitive (63 of 179)
Less competitive	4-5	$3/MW	12% were less competitive (21 of 179)

Table 5 | The Competitiveness of LT Auctions in 2019

Level of Competitiveness	# of LT Auction Participants	Average Auction Clearing Price	Out of 62 LT Auctions in 2019
Highly Competitive	≥8	$31068/MW	18% were highly competitive (11 of 62)
Competitive	6-7	$6935/MW	26% were competitive (16 of 62)
Less competitive	3-5	$6648/MW	56% were less competitive (35 of 62)

A similar analysis was completed for LT auctions in 2019, as shown below in Table 5. As shown in the table, the LT auctions evaluated by the same metrics are, in general, less competitive, and also tend to have much higher clearing prices. This is likely a reflection of the longer length of the TR ownership period and as a result market participants value it more. The high prices and therefore higher risks prevent more participants from competition in these auctions.

4.4.2 Auction Revenue and Net Revenue

To investigate the financial performance of individual auctions in more detail, the IESO assessed the bid curves of individual auctions to understand the relationship between the sale of TRs, auction revenues, and TR payouts. The purpose of this analysis was to provide insight into the efficiency of TR auctions to maximize net revenues for consumers on the sale of TRs. This section presents two key graphs from this analysis. The first shows the ST Auction Potential Revenue and TR Payouts for an illustrative auction as a function of the number of TRs sold for the auction. The second shows the ST Auction Potential Net Revenue brought in as a function of the numbers of TRs sold. It is important to note that the IESO only shows illustrative data and not actual data in this section.[28] However with this understanding, IESO is trying to show an accurate representation of what was seen based on the underlying bid curves.

Figure 28, showing the ST Auction Potential Revenue and TR Payouts as a function of the number of TRs sold for this auction, is a derivative of Figure 25, the highly competitive illustrative bid curve. In Figure 28, the IESO took the auction bids and quantities and multiplied these by the number of TRs sold. This provided a measure of the auction revenue vs the number of TRs sold. The graph indicates that the auction revenue is relatively steady at between $2-3 million between 200 and 850 TRs sold. In some auctions, the IESO sees that the graph curves down sharply, indicating a loss of revenue as more TRs are sold, in line with a reduced auction clearing price. The TR payouts for various illustrative years, based on different congestion costs, are also shown with dashed lines. Whenever the revenue is greater than a dashed line in a given year, the net auction revenue is positive. Whenever the revenue is lower than the dashed line, the net auction revenue is negative. As more TRs are sold, it becomes more and more likely that the net auction revenue will be negative.[29]

[28] Illustrative data was constructed by taking actual data and adding randomization elements to its individual components. Bid prices and quantities, flow and % hedged quantities, ICP values, and MW sold are all representative only and are not real data.

[29] (Auction Revenue = TRs Sold * Auction Clearing Price, but Auction Clearing Price tends to decrease as the number of TRs sold increases, you step down the bid curve, so total auction revenue stays relatively steady when you sell more TRs).

Figure 28 | TR ST Auction Revenue and TR Payout (All Numbers Illustrative)

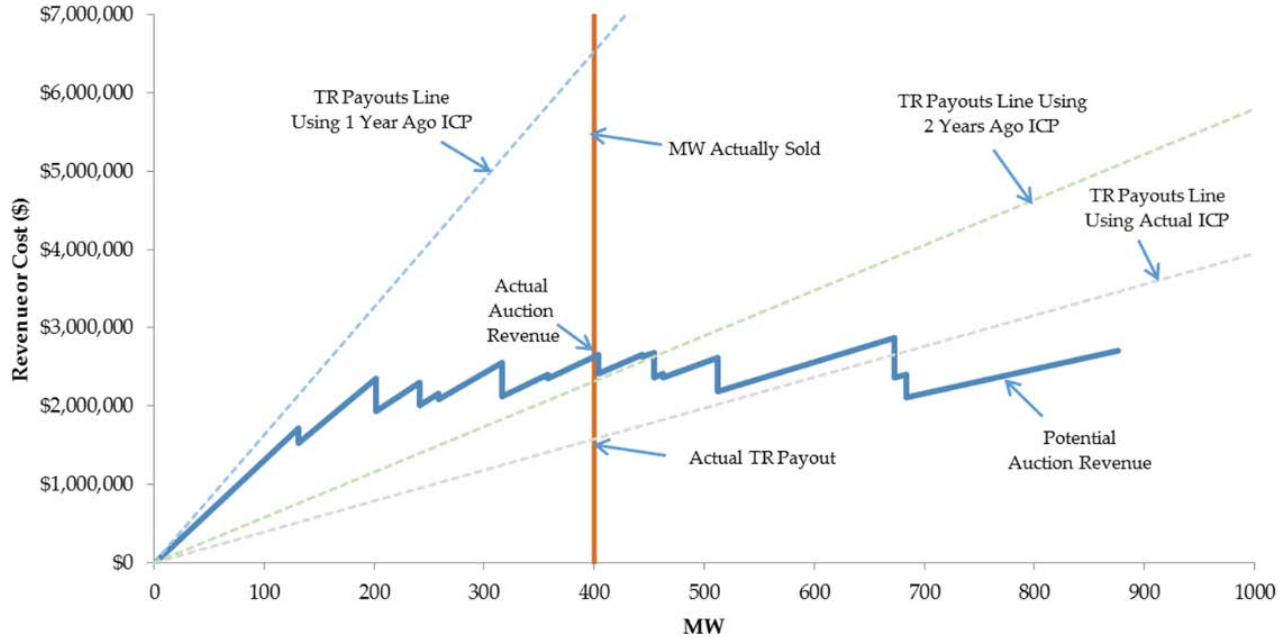
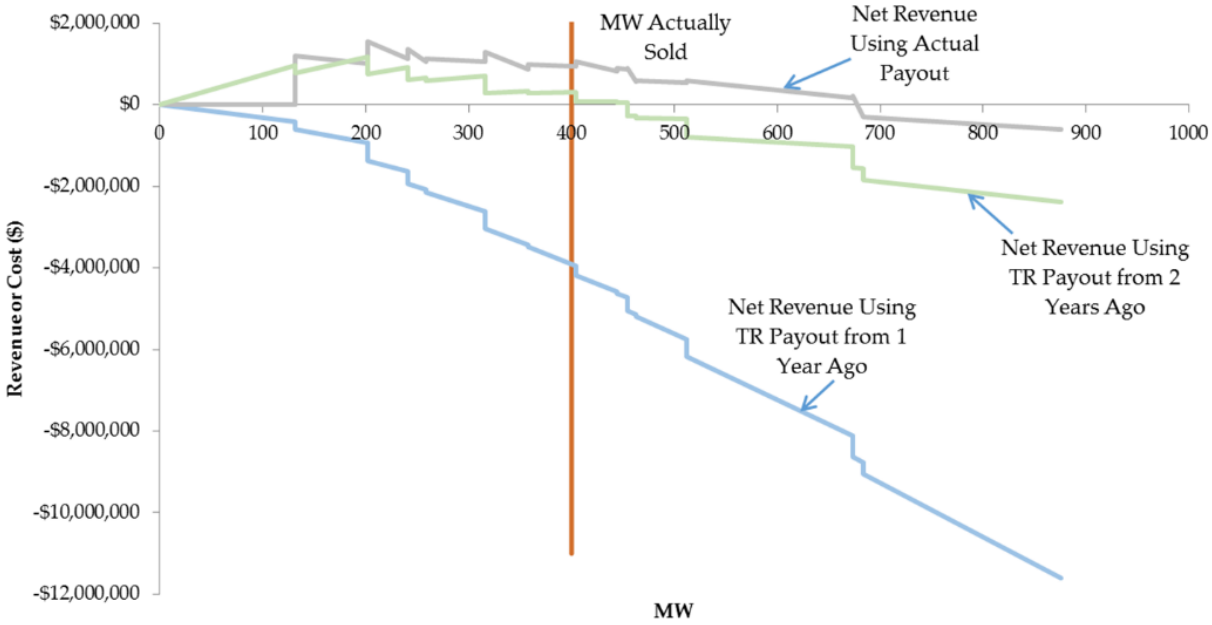


Figure 29 is another transformation of Figure 25, where the illustrative TR payouts are subtracted from the auction revenue. This gives the net revenue of the auction as a function of TRs sold. This graph illustrates that under different ICP conditions, the more TRs that are sold the more likely the auction revenues will not be able to cover TR payouts, everything being equal.

Figure 29 | TR ST Auction Potential Net Revenue (All Numbers Illustrative)



The IESO recognizes that the underlying bid curves would likely change for different numbers of TRs that were actually sold. The auction might see higher bids if fewer TRs are sold, and lower bids if more TRs are sold. However, in general auction revenue is likely to stay relatively flat (moving down the bid curve), while TR payouts are likely to increase with the number of TRs sold.[30] So it is likely that the more TRs sold, the more likely the auction revenues will not be able to cover TR payouts. This is an important result that would lead the IESO to be cautious about proposals that potentially increase the number of TRs sold.

4.5 Reliability, Efficiency and Consumer Benefits

Prior to May 21st webinar, the IESO had not yet completed a high level assessment of the potential reliability, efficiency, and broader market benefits of the TR market. However, quantifying these benefits is an important part of understanding the baseline value of the TR market and supporting a business case for potentially significant changes. To better understand these benefits, the IESO ran several simulations to: (1) understand the extent that intertie transactions with TRs fail compared to transactions without TRs. (2) understand the impact on export volumes and price if 25%, 50%, or 100% of TR-backed intertie bids/offers were removed from the bid/offer stack (holding all else constant). These results are presented in this section.

4.5.1 Reliability Benefits

To understand the potential reliability impacts of TRs on intertie transactions, the IESO tabulated export failure rates by volumes for intertie transactions that were hedged by TRs and compared it to export transactions that were not hedged by TRs. The results, for 2016-2019, are shown below in Table 6. As shown in the table below, export failure rates for export transactions that are backed by TRs are consistently lower than for export transactions that are not backed by TRs. Directionally, this lowers the number of out-of-market actions that the IESO has to undertake to make-up for failed transactions, and helps maintain price integrity and reduce uplift costs.

Table 6 | Reliability Benefits – Export Failure Rates by Volumes

	2016	2017	2018	2019
With TRs	2.7%	1.8%	1.5%	0.9%
Without TRs	4.4%	3.8%	3.7%	4.1%

4.5.2 Market Efficiency and Consumer Benefits

The IESO also developed estimates of the market efficiency and consumer benefits of the TR Market. It conducted a simulation to determine the impact of TRs on intertie trade and the corresponding

[30] Auction revenue equals the number of TRs sold multiplied by the clearing price, but the auction clearing price decreases as the number of TRs sold increases. Payouts in contrast equal the no. of TRs sold multiplied by the ICP, so always increases with the number of TRs sold.

cost to Ontario consumers. Using 2019 data, the IESO simulated the removal of sequentially larger fractions of intertie bids/offers that were hedged by TRs within models of the energy market to get new simulated pre-dispatch intertie schedules and real-time prices. This removal is meant to reflect a reduction in trader participation at the interties if TRs were not offered by the IESO. The fractions removed, 25%, 50%, and 100%, of intertie offers/bids backed by TRs, represent a wide range, but based on our conversations with traders and the feedback we received, the IESO expects that the impact to Ontario's markets would fall within these extremes. By comparing the simulated results, the IESO was able to estimate potential impact on market efficiency and consumer costs caused by changes in congestion rent, exporter fees, and other system costs.

Table 7 below presents the results of those simulations in terms of the impacts to Ontario consumers. Depending on the % of TR backed bids/offers removed, there are bigger reductions in congestion rent collected, contributions to Global Adjustment (GA), and various fees collected that all would have to be paid for by Ontario consumers. The conclusion that the IESO draws from this work is that without the TR Market, losses to Ontario consumers, primarily from reduced export volumes, would be in the range of $50-135 million per year[31] (excluding market efficiency losses by Ontario and adjacent markets).

Table 7 | Market Efficiency and Consumer Benefits[32]

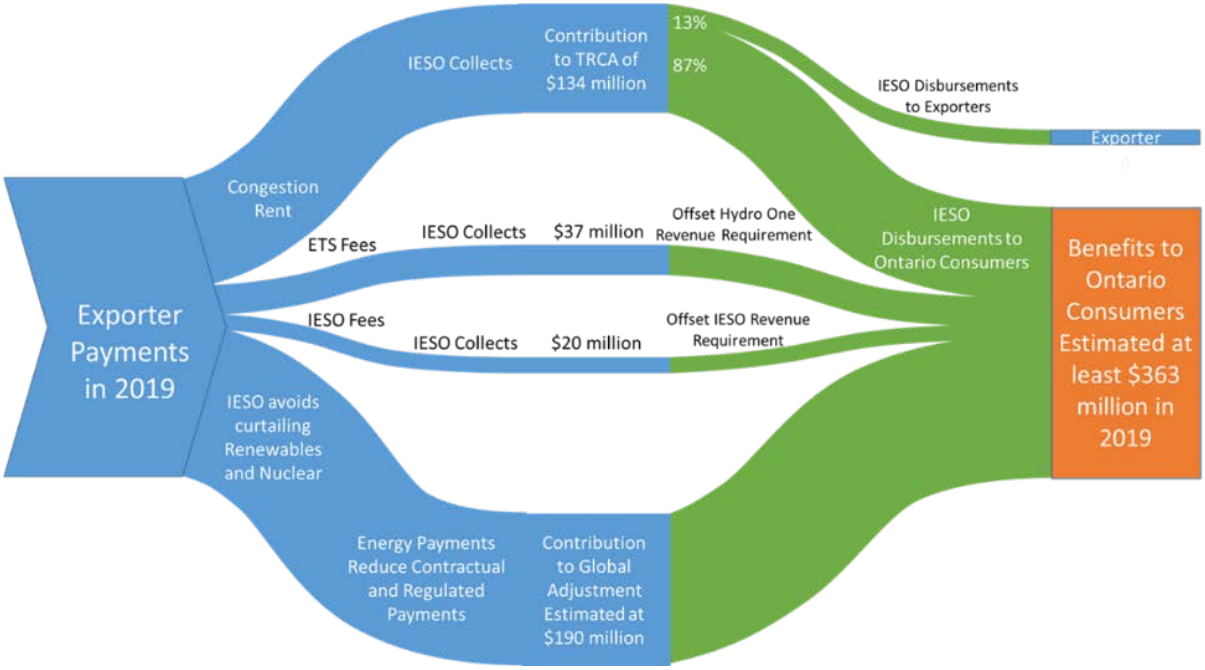
	25% of TR Backed Bids/Offers Removed	50% of TR Backed Bids/Offers Removed	100% of TR Backed Bids/Offers Removed
Reduced congestion rent	$37 million	$70 million	$86 million
Reduced contributions to GA	$16 million	$31 million	$42 million
Reduced export transmission service (ETS) rates and IESO fees	$1 million	$3 million	$7 million
Market efficiency losses[31]	$5 million	$13 million	$38 million
Total Ontario Consumer Benefits (except efficiency losses)	$54 million	$104 million	$135 million

For context, the IESO had previously done some work that estimated that the total economic benefits of exports in 2019 was approximately $363 million. These benefits were calculated by running a simulation where all exports were removed, not just the TR backed exports. Figure 30 below shows the results of this work, providing a breakdown of the total economic benefits of exports in 2019. It highlights how exporter payments can flow and become benefits to Ontario consumers. This happens through a mixture of congestion rent and fees collected, and payments by exporters for energy that, in effect, offset some of the GA costs that would otherwise have been paid for by load.

[31] As more TR backed bids/offers are removed, the impact on losses is non-linear, as is the impact on intertie flows. If a quarter of TR backed bids/offers are removed, a large fraction of the congestion rent is lost, but there are only small changes to the intertie flow as there are other bids/offers that are economic that can be scheduled.

[32] Market efficiency losses is calculated as ((external LMP-HOEP) * net export reduction in $), and results from reductions in efficient exports from a low priced region to a high priced region. This has to do with reducing the overall generation costs to meet the same demand in the two markets. It is difficult to allocate how much goes to Ontario so we left this out of the total.

Figure 30 | Economic Benefits of Competitive Exports – 2019[33]



4.6 Summary of Data Analysis

This lengthy chapter has provided an overview of the historical performance of the Ontario TR market. It has included an assessment of the overall TR market including intertie congestion, TR auction outcomes, energy flow hedged by TRs, a detailed analysis of the Ontario to Michigan intertie path, classification and financial performance of individual auctions, auction competition, auction revenue and net revenue, and reliability, efficiency and consumer benefits. Before discussing the overall value of the TR market to answer the key questions posed at the beginning of this chapter, the next chapter will present stakeholder feedback, which provides a set of complementary insights into the value of the TR market that further supports some of the analysis presented in this chapter.

[33] Notes: All values in this figure to scale. TRCA is the Transmission Rights Clearing Account. Estimates do not include exporter contributions to all uplift costs which would further increase benefits to consumers, likely similar in size to the ETS fee

5. Stakeholder Feedback

5.1 Introduction

Recognizing that the IESO is only the seller and not the primary user of TRs, the IESO has only limited information on how TRs are utilized in practice. To fill this information gap, the IESO solicited stakeholder input as a critical part of the TR Market Review engagement. During the May 21, 2020 TR Review webinar, the IESO requested stakeholder feedback on the following questions: 1) How are TRs used in practice by stakeholders and do TRs provide an appropriate or optimal hedge against congestion? 2) How do stakeholders manage the risk associated with TRs? After the webinar, the IESO also organized conference calls with 6 traders representing a broad spectrum of the trading community. The one-on-one conference calls resulted in open and meaningful discussions with a large cross section of the trading community. The IESO also received written feedback submissions from 5 stakeholders following the webinar.

5.2 Summary of Feedback

On the question about how TRs are used in practice and if they provide an optimal hedge against congestion, the following key points were made by stakeholders:

- Traders confirmed that TRs are a key enabler for intertie trading by providing a congestion price hedge
- Traders use many different strategies but TRs are universally used in some capacity as a backstop to physically flowing power into and out of Ontario
- With TRs, traders are more confident to pursue higher trade volumes and bid more aggressively in the energy market
- Individual traders aim to hedge different percentages of their flow depending on their specific trading strategy and willingness to take on market risk
- The value of TRs to traders is limited by the current auction design as well as the types of TRs offered. TRs incent and provide greatest value to longer term trades but there is limited value to shorter term trades that provide important operational benefits to the IESO / system

On the second question on how stakeholders manage the risk associated with TRs, the following key points were made:

- TRs are currently offered on a “one size fits all” basis that can make them expensive to purchase and present barriers to smaller traders.
- These types of issues and the challenge of forecasting congestion accurately make TRs risky and expensive and traders discount these costs and risks in their TR bids

The IESO has taken this feedback and, along with the historical data analysis presented in the previous chapter, developed a perspective on the value of the TR market as part of Stage 1 of the TR Market Review. This perspective is presented in the next chapter.

6. The Value of the TR Market to Ontario

6.1 Introduction

This chapter aims to tie all the other chapters in this report together to answer the two key questions posed at the beginning of Chapter 4, specifically, "how has the TR Market performed since market opening?" and "has it provided net benefits to Ontario?" These two questions are central to Stage 1 of the TR Review process, and the extent to which the TR Market meets the evolved Objectives. Answers to these questions provide direction and justification for future operation and development of the TR market as well, and together describe the IESO's position on the value of the TR Market to Ontario. The following sections provide discussion that answers these questions.

6.2 TRs Play a Critical Role in Facilitating Efficient Trade

Though there are wide variations in the design specifics, TRs (or their equivalent) are sold regularly in other markets such as in PJM, CAISO, ISO-NE, NYISO, MISO, and ERCOT to allow market participants to hedge against congestion costs. Based on economic theory[34], the historical TR market data presented in Chapter 4, and feedback received from stakeholders from across the sector as summarized in Chapter 5, TRs are similarly a critical component of intertie trade as a hedge against intertie congestion costs in Ontario.

The implication of this conclusion is that TRs facilitate efficient trade at the interties. Without them, intertie trade, along with the extensive reliability and economic benefits that Ontario receives from intertie trade, would likely decline, perhaps substantially. This concern is supported by both IESO analysis which looked at the impact of removing TR-backed bids and offers, and stakeholder comments which emphasized the need for a congestion hedge to pursue specific types of trading strategies. The IESO therefore concludes that TRs are instrumental to the operation of Ontario's markets and system, and play a critical role in facilitating efficient trade with neighboring jurisdictions.

6.3 TRs Bring Significant Reliability and Economic Benefits to Ontario

As described in Chapter 5, the IESO's assessment of the TR Market found that TRs bring both significant reliability benefits in the form of reduced failed transactions, and economic benefits to Ontario ratepayers in the form of increased congestion rent, transaction fees, and avoided GA costs.

The IESO therefore concludes that without the TR market, there could be a material impact on the ability of the IESO to efficiently and reliability manage the grid. The reduced incentives for intertie traders to participate in Ontario's markets would make it more difficult for the IESO to manage

[34] See for example J. Rosellón and T. Kristiansen "Financial Transmission Rights – Analysis, Experience and Prospects", London: Springer, 2013, 418 pages.

challenges such as surplus baseload generation, uncertainties in the output of the variable generation fleet, and extreme events.

Recent IESO simulations have further indicated that without the TR Market, reduced export volumes would have resulted in losses to Ontario consumers estimated at between $50-135 million per year due to reductions in congestion rent collected, contributions to GA, and various fees collected, all of which, would have to be paid for by Ontario consumers.[35] This indicates the subtle influence of the TR market and the corresponding impact it may have on the underlying benefits of intertie trade.

6.4 Most TR Auctions Are Competitive

The data presented in Chapter 4 indicates that most TR auctions attract many participants, and when interties are congested more frequently, TR auctions tend to attract a variety of physical traders who use the TRs to hedge against congestion costs. In conjunction with financial traders, many of these auctions result in a relatively high auction clearing price that may be higher or lower than the congestion costs on that intertie (see for example Figure 22). Given the high uncertainty and volatility in congestion costs, traders are likely making rational bids in an effort to attain TRs in most competitive auctions. At the same time, intertie congestion is hard to predict, even when it occurs frequently, which makes it challenging for participants to price their bids accurately without taking on the excessive risk of over-paying for TRs. When financial participants are present, data from Chapter 4 suggests that they can play an important role in providing liquidity, and added competition in the TR auctions which helps to generate efficient TR clearing prices and maximize auction revenues for the benefit of Ontario ratepayers.

6.5 On Some Intertie Paths TRs are Rarely Used

The historical data analysis noted that while TRs are used extensively on some intertie paths, they are used very rarely, if at all, on some intertie paths that are not typically congested. When congestion is rare on an intertie path, it tends to draw financial traders only who may bid very low prices for TRs that can (very rarely) have a large payout. This is a concern for the IESO and it is considering how to address this issue through changes to the TR market design.

6.6 Inefficiencies in the TR Design May Prevent Traders from Purchasing TRs That Would Enhance Trade

The TR auction establishes the price of intertie congestion risk and provides participants an opportunity to hedge this risk. Further to this, the data from Chapter 4 indicates that there is increased demand and willingness to pay for TRs as imports and exports increase. However, many stakeholders have commented that the current design has inefficiencies that prevent traders from utilizing the interties with a broader array of trading strategies. Through discussions with stakeholders, suggestions to resolve these issues were identified including allowing for multiple bid laminations, more varied TR product offerings, allowing TR holders to resell TRs, and making more detailed information to traders prior to auctions.

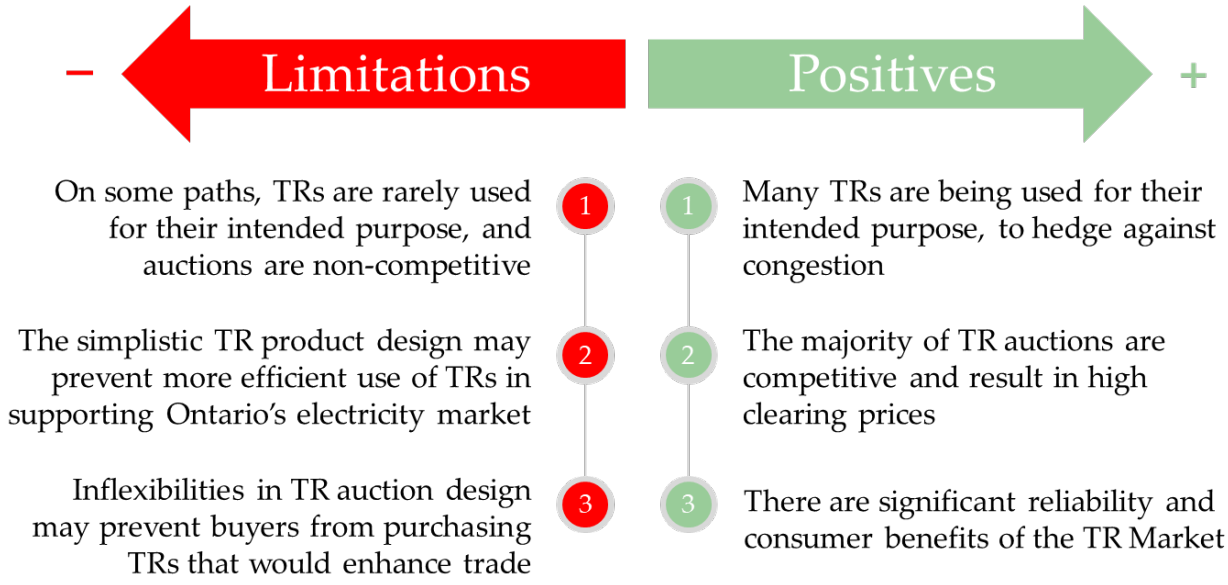
[35] See Table 7 and associated text for details.

Potential inefficiencies in the current design may limit the value of TRs to market participants directly and Ontario consumers indirectly through less efficient intertie trade. In this way, the value of TRs to market participants and Ontario consumers may not yet be maximized. As described throughout this interim report, participation in the TR market might itself be limited because the product is not as useful as it could be. Market Participants have expressed the need for changes including the need for multiple bid laminations, an expanded suite of TR products, potential changes in processes, and better information. These issues will be explored further during Stage 2 and Stage 3 of the TR Review.

6.7 Summary

The Stage 1 conclusions from the TR Market Review can be summarized in Figure 31 below. As shown in the figure and described in this Chapter, the TR market has both significant positives in terms of usefulness, participation, and reliability and economic benefits, as well as some limitations in design and flexibility.

Figure 31 | Summary of Data Analysis and Feedback



7. Conclusion

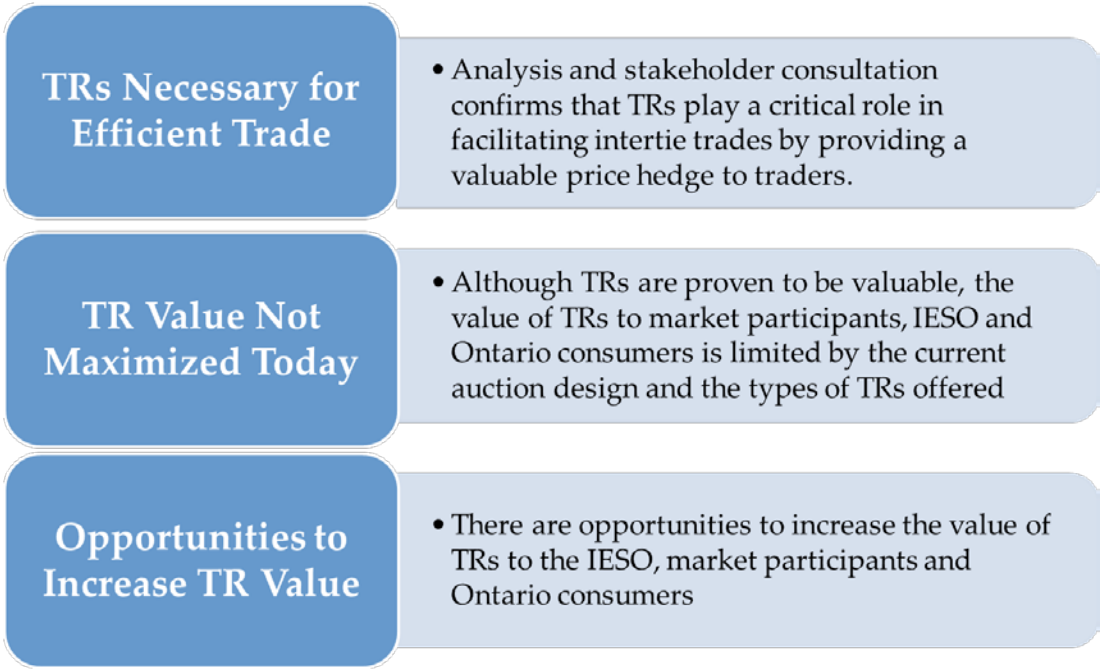
Intertie trading brings tremendous value to Ontario by providing the IESO with operational and planning flexibility, enhancing the reliability and cost-effectiveness of the electricity system. As outlined in this interim report, the IESO has determined that TRs allow intertie traders to hedge the financial risks associated with congestion at the interties, and are therefore critical for encouraging trade and integration with Ontario's neighboring electricity systems. Further, TRs provide value to Ontario consumers, market participants and the IESO. However, there is still potential to improve the TR market to better achieve its intended purpose and to increase its benefits. Based on stakeholder feedback and the data analysis presented, the value can be enhanced by exploring improvements to the TR market to better facilitate intertie trade and generate more net benefits to consumers.

The IESO has also established an objective statement for the TR market based on stakeholder feedback that can be used to guide the operation and evolution of the TR market going forward.

The IESO is currently engaging with stakeholders on Stage 2 of the TR Market Review to explore the potential improvements identified. Stage 3 will explore longer term improvements that will align the TR market with the changes being developed under the MRP. Once all three stages of the TR Market Review are completed, the IESO will summarize the findings and recommendations of this stakeholder engagement in a Final Report.

The purpose of this engagement is to explore and propose potential improvements to the TR market. It is important to note that any proposed changes resulting from the TR Market Review must still go through the IESO project prioritization process and be reviewed against other competing projects before they can be considered for implementation.

Figure 32 | Overall Key Findings



In summary, the TR market is achieving its intended purpose as a hedge, it is creating value, but this value is not yet maximized.

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