Project Charter for: Market Analysis and Simulation Toolset (MAST)

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1 Executive Summary

This project will replace the existing market assessment and simulation tools used by the IESO, given these legacy tools will become obsolete once the Market Renewal Program (MRP) goes live. This project will allow the IESO to fulfill its responsibility to operate and monitor an efficient wholesale electricity market ("market"). Existing energy market analysis and simulation tools have been developed over the past two decades using end user developed solutions replicating a simplified version of the current wholesale energy market. These tools will be incapable of analyzing the new market which consists of much more advanced optimization and hundreds of locational prices for the day-ahead market and real-time market, instead of a single Hourly Ontario Energy Price (HOEP) solely for the real-time market based on very few optimization constraints. While the tools delivered by MRP will provide some assessment capabilities, they have been deemed insufficient to meet the need for advanced analysis and simulation of the new market to ensure it is working as intended and deliver the expected benefits that justify the project.

This project is critical to realize the anticipated benefits of the renewed market as unintended outcomes resulting from inefficient market schedules or perverse financial incentives via counter-intuitive market prices or design gaps that are not currently identified will greatly diminish the benefits of MRP and have a negative impact on the stakeholder perception of market operations. In the 20 years of administering the existing market, the monitoring and analysis of the market using simulation tools have resulted savings to the ratepayer of well over several hundred million dollars. Such tools have allowed the IESO to analyze market outcomes found to be irrational, stifle competition, provide unwarranted windfall gains, or economically inefficient. Going forward the IESO must have the tools to assess the effectiveness of MRP to identify potential solutions to address unintended outcomes and inefficiencies. The MAST project is designed to provide the IESO with this critical functionality. This initiative directly supports IESO core corporate strategies of:

- **Drive Business Transformation**: This project will give the IESO the required tools to effectively monitor the newly-implemented electricity market design, analyze its

outcomes, and support the evolution of that market through the assessment of new market development initiatives.

- **Ensure Cost Effective System Reliability:** A well-functioning energy market is economically efficient and aids to achieving reliable outcomes. This project will ensure that the IESO has the ability to more efficiently anticipate and resolve market outcomes that could threaten system reliability such as insufficient resource commitment, infeasible dispatch, or other unintended outcomes of the MRP market design.
- **Enable Competition:** This project will enable competition by providing the means to identify inefficiencies and barriers to competition and participation for both existing and new resources.

The MAST Project was included in the 2021 approved project portfolio and is included in the IESO's 2022-2024 Business Plan. A total expenditure of $6.8M is required to complete the project of which $6.4M is capital. The project budget includes a contingency of $1.5M which reflects an estimation accuracy of +/- 40%. On-going support and maintenance cost post project go live is estimated at $650K.

The project is expected to take 36 months to complete with an additional 12 months of contingency to account for scheduling uncertainties given the dependency on MRPs schedule[1].

The table below shows the anticipated expenditure over the period of the project.

Year	2021	2022	2023	2024	Contingency	Total
Capital	$20,000	$400,000	$2,500,000	$1,980,000	$1,500,000	$6,400,000
Operating	$40,000	$80,000	$80,000	$80,000	$120,000	$400,000
Total	$60,000	$480,000	$2,580,000	$2,060,000	$1,620,000	$6,800,000

Project Charter Approval Process

To improve cost controls and allow for progressive elaboration, the project's budget and schedule will be released through a staged approval process. The first version of the project charter will request approval of the funds and schedule required to complete the Planning phase only. During Planning phase, the project will refine the business objectives and measures, develop detailed requirements, solution design documents, engage in initial procurement activities and improve cost and schedule estimate accuracy. The first version of the MAST

[1] The project is dependent on the completion of vendor Factory Acceptance Testing for MRP before this main vendor effort to support MAST can proceed. It is anticipated that the vendor cannot work in parallel with MAST and delivery the core MRP market solutions.

project charter will be approved by the Project Sponsor who is also the OAR authority for the Planning Phase budget.

At the end of Planning phase, a second version of the project charter will be produced requesting approval for of the overall project budget and schedule required to successfully deliver the solution and complete the project. The second version of the MAST project charter will be approved by the CEO in accordance-with the OAR.

At this time, we are seeking approval of version #1 of the project charter which is requesting $450K of capital (including $50K of contingency) and 12 months (including 2 months of contingency) in order to refine the cost and time estimates which will be reflected in subsequent versions of the Project Charter. As MAST will build upon the base assessment capability to be delivered with MRP (of which is proprietary in nature), this upfront effort will allow the project team to define the solution design that will achieve the business requirements and determine the solution changes (application and infrastructure) needed.

2 Business Objectives and Measures

1. Maintain our regulatory obligation to support the monitoring and investigative mandate of the Ontario Energy Board's Market Surveillance Panel by simulating market results with assumptions on market design and participant behaviour.

2. Sustain the ability and have more advanced capability that matches sophistication of the new market to monitor the performance of the IESO-administered markets and identify anomalous/unintended outcomes and the exercise or abuse of market power.

3. Provide the capability to simulate scenarios to measure benefits realization and to identify potential unintended market outcomes from implemented market initiatives.

4. Provide the capability to represent and simulate efficiency and reliability benefits of possible new market design features, and impacts from sector policy changes after Market Renewal Program goes in-service

5. Improve the quality and consistency of analysis results between Markets and Reliability and Market Assessment & Compliance Division (MACD) by moving to a common IT supported toolset while maintaining separation of function between the two groups.

Ref #	Business Objective	Procedure for Measures (identify how the performance will be measured)	Measured when and by whom?

1	1	Tool-set provides capability to perform 3 market assessments to allow the Market Assessment Unit (MAU) to meet the analytical and reporting requirements to produce Market Surveillance Panel Monitoring Report.	When: Initiate within 6-months post implementation. Whom: Senior Manager, Market Surveillance
2	2	Tool-set provides the same capability to perform 3 market assessments of historical market outcomes as those provided by status quo tools for the purposes of monitoring market performance ([redacted]).	When: Initiate within 6-months post implementation. Whom: Conducted by Senior Manager, Wholesale Market Development
3	3	Tool-set is able to perform 3 simulations from day-ahead market to pre-dispatch, and from pre-dispatch to real-time that represent a hypothetical change in market participant behaviour and/or implementation of a market initiative.	When: Initiate within 6-months post implementation. Whom: Conducted by Senior Manager, Wholesale Market Development and Senior Manager, Market Surveillance

4	4	Simulation toolset is capable of calculating 1-set of measurements related to capturing efficiency and reliability benefits: • production costs, • dispatch results, • objective function values, and producer and consumer surplus	When: At project completion. Whom: Conducted by Senior Manager, Wholesale Market Development and Senior Manager, Market Surveillance
5	5	Verify that Markets and Reliability, Market Analysis, and Market Assessment Unit to have access to MAST and are able to produce the same outcome with the same inputs and under market design assumptions without impacting each other's work. Verify that Market Analysis staff are not able to view or modify simulations being performed or constructed by MAU staff, and vice versa. Market Analysis and MAU staff are able to concurrently access and perform independent simulations within the simulation environment.	When: At project completion. Whom: Conducted by Senior Manager, Wholesale Market Development and Senior Manager, Market Surveillance

2.1 Benefits Expected

The development of MAST will yield the following benefits:

- Savings to the ratepayer of well over several hundred million dollars (see Appendix D: Benefits from the Use of Existing Simulation Tools for historical examples of savings generated)
- Improved quality (accuracy) and detail (resolution) of results used for wholesale market monitoring, analysis and reporting;
- Increased efficiency in conducting wholesale market monitoring and analysis;
- Provide functionality that Operations and potentially other business units can use for analysis that is currently unavailable but sought after (e.g. Real-Time Assessments will use MAST to improve parameters used for power system modeling that will result in savings for the ratepayer);
- Reduced/elimination of effort to develop and maintain End User Computing (EUC) tools allowing Markets & Reliability, and MACD staff to focus on and achieve business unit objectives;
- Removal of barriers between business units using different tools and use of time assessing and comparing results; and
- Improved controls compared to the limited access controls used by the existing suite of EUC tools

3 Project Overview

3.1 Project Scope

- Development of vendor SOW to participate in detailed requirement & design
- Procurement & integration of Market Analysis & Simulation Toolset (MAST) solution
- Procurement & installation of storage infrastructure
- Procurement & installation of database infrastructure
- Procurement & installation of application infrastructure
- Determination of data retention requirements to ensure only relevant period of data is maintained

3.2 High Level Assessment of Impacted Business Processes, Systems and Governing Documents

3.2.1 Processes

- [redacted]

3.2.2 Systems

- [redacted]

- [redacted]

3.2.3 Governing Documents

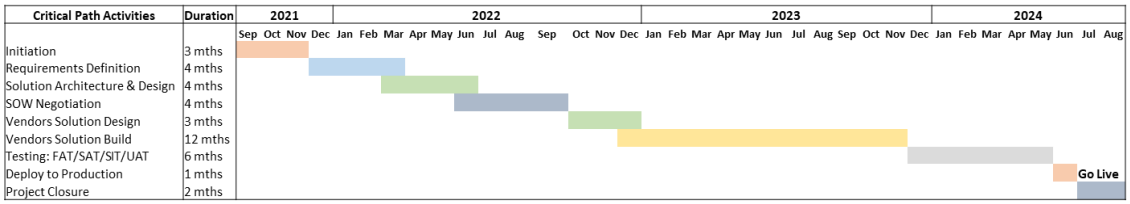
- Internal Manual 2: Operations, Part 2.31: Operational Assessment Procedures

3.3 Out of Scope

- Market Power Mitigation assessment and Economic Operating Point (EOP) Optimization Tool functionality (to be delivered by MRP)
- Other Market Information System (MIS) enhancements
- Ex Post functionality

3.4 Overall Project Timeline

The project is expected to take 36 months to complete without the use of contingency. An additional 12 months of contingency will be required to account for project risk and uncertainties.



3.5 Cost

The project is expected to cost $6.6M of which $6.4M is capital (including $1.5M of contingency). The chart below provides a breakdown of expected expenditure by year.

Year	2021	2022	2023	2024	Contingency	Total
Capital	$20,000	$400,000	$2,500,000	$1,980,000	$1,500,000	$6,400,000
Operating	$40,000	$80,000	$80,000	$80,000	$120,000	$400,000
Total	$60,000	$480,000	$2,580,000	$2,060,000	$1,620,000	$6,800,000

On-going support and maintenance cost post project go live is estimated at $450K solution support and $200K for infrastructure licenses.

3.6 Key Resource Needs

Resource Type	2021	2022	2023	2024
PMO - Project Manager	0.4	0.4	0.3	0.2
EC - Business Analyst	0.4	0.4	0.2	0.2
IT SME - PAO (Contract Manager)	0.1	0.1	0.1	0.1
MACD - SME	0.1	0.1	0.1	0.1
MACD - SME	0.4	0.4	0.4	0.4
Market Analysis - SME	0.1	0.1	0.1	0.1
Market Analysis - SME	0.4	0.4	0.25	0.25
Market Analysis - SME	0.4	0.4	0.25	0.25
Procure to Pay - SME	0.1	0.2	0.1	
Procure to Pay - SME	0.1	0.2		
Operations Assessment - SME	0.2	0.2	0.15	0.15
Solution Architecture	0.15	0.15	0.15	0.15
Test Lead	0.1	0.3	0.3	0.3
INF - Network & Telecom SME		0.15	0.15	
CTS - SME		0.15	0.15	

3.7 Planning Phase

Project Phase	Time Estimate			Cost Estimate				
	Duration	Contingency	Total Duration	Capital	Contingency	Operating Expense	Contingency	Total Cost (incl. Contingency)
Planning	10	2	12	$400K	$50K	$70K	$10K	$530K

3.7.1 Resources

Resource Type	2021	2022
PMO - Project Manager	0.4	0.4
EC - Business Analyst	0.4	0.4
IT SME - PAO (Contract Manager)	0.1	0.1
MACD – SME	0.1	0.1
MACD – SME	0.4	0.4
Market Analysis - SME	0.1	0.1
Market Analysis - SME	0.4	0.4
Market Analysis - SME	0.4	0.4
Procure to Pay - SME	0.1	0.2
Procure to Pay - SME	0.1	0.2
Operations Assessment - SME	0.2	0.2
Solution Architecture	0.15	0.15
Test Lead	0.1	0.3
INF - Network & Telecom SME		0.15
CTS – SME		0.15

4 Key Stakeholders

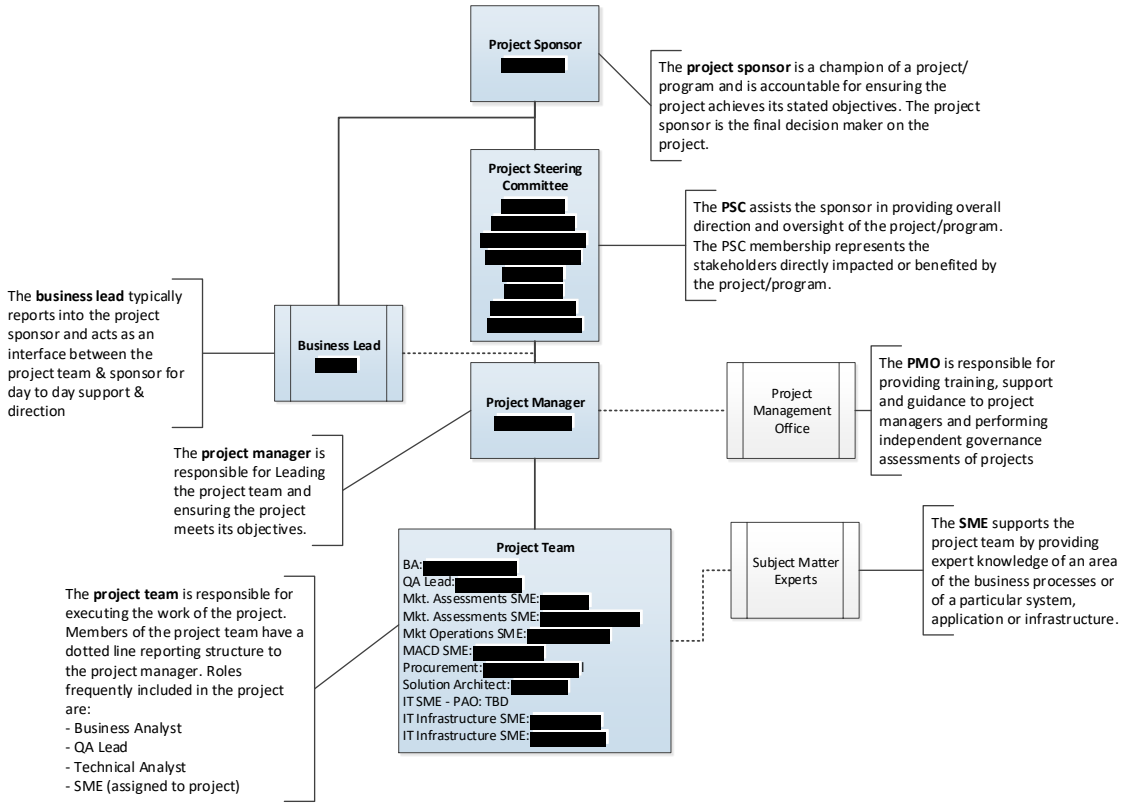
Table 1. Key Stakeholder list

Stakeholder	Stakeholder Role	How They Are Affected or How They Are Participating
Market Development Department	Customer	Potential changes or enhancements to business processes, tools and documentations as a result of this project.
Market Assessment & Compliance Division	Customer	Potential changes or enhancements to business processes, tools and documentations as a result of this project.
Performance Application and Integrations	Customer	Potential changes or enhancements to business processes, tools and documentations as a result of this project.
Director, Corporate Finance	Manager	Owner of business processes related corporate finance. A member of the steering committee.

Stakeholder	Stakeholder Role	How They Are Affected or How They Are Participating
Sr. Manager, Market Development	Manager	Owner of business processes related to market development & design. A member of the steering committee.
Director, Market Assessment & Compliance Division	Manager	Owner of business processes related to ensuring compliance. A member of the steering committee.
Director, Business Services & Solution Delivery	Manager	Owner of business processes and solutions related to IT applications. A member of the steering committee.
Director, IT Operations	Manager	Owner of business processes and solutions related to IT Infrastructure. A member of the steering committee.
MRP Program Delivery Executive	Manager	Responsible for the delivery of Market Renewal Program. A member of the steering committee
Operational Effectiveness	Builder	Market Operations Subject Matter Experts - a core member of the project team; provides requirements and is required for testing.
Market Assessment	Builder	Market Assessments Subject Matter Experts - a core member of the project team; provides requirements and is required for testing.
MACD - Market Assessment Unit	Builder	MACD Subject Matter Experts - a core member of the project team; provides requirements and is required for testing.
IT Operations	Builder	Responsible for the monitoring and support of the IT Infrastructure.
ITS – Business Service & Solution Delivery – PAO	Builder	Provide solution architecture and integration expertise, support vendor evaluation, etc.
ITS – Business Service & Solution Delivery – Solution Architecture	Builder	Provide solution architecture design, solution integration expertise, vendor evaluation, etc. Create documentation
ITS – Business Service & Solution Delivery – Quality Assurance	Builder	QA Lead - Identifies QA needs; reviews requirements, specifications and technical design documents for change initiatives for testability; and assists with test planning. Test Lead – Assists the project team to plan, monitor and control testing activities and tasks.
Procure to Pay	Builder	Procurement Subject Matter Expert – Provide input for procurement strategy. Prepare and issue procurement.
Enterprise Change – Project Management	Builder	Project Manager – Manages each phase of the project (initiation, planning, risk management, status reporting, etc.).

Stakeholder	Stakeholder Role	How They Are Affected or How They Are Participating
Office and Business Analysis Services		Business Analyst – Facilitates, elicits and secures approval for business objectives, performance measures, business process and information design, and requirements.

5 Project Governance Structure



6 Delivery Approach

This project will be delivered as per the Portfolio Project Management Life Cycle (PPMLC) and Solution Delivery Life Cycle (SDLC) processes. The detailed approach with steps for delivery will be defined in the Integrated Project Plan document.

Vendor services will be procured to assist the IESO in developing requirements documentation and detailed solution design.

7 Assumptions, Constraints and Potential Risks

7.1 Project Assumptions

- [redacted]
- MAST can leverage the existing vendor Master Services Agreement (MSA)
- Integration and user interface development will be covered under the existing vendor MSA

7.2 Project Constraints

- MAST will be resource constrained by MRP vendors and MRP SME availability, MRP project work will be prioritized requiring MAST to use contingency in the event of schedule conflicts
- Due to support of MRP, the vendor recommends waiting until MRP enters Factory Acceptance Testing before engaging them for solution development
- Completion of the MAST solution will be dependent on the successful delivery of MRP's Study Environment

7.3 Potential Project Risks and Mitigation Actions

The following table outlines project risks known to date that have a high or critical inherent risk level and identifies mitigation actions planned or taken in order to reduce the risk level to an acceptable level.

Table 2: Risk Summary

Risk ID	Risk Description	Inherent Risk Level	Mitigation Tasks	Mitigation Tasks Implemented (Yes/No)	Mitigated Risk Level
#1	Procurement and negotiation with vendor is unsuccessful because tool development is infeasible at expected cost/timeline or presents a significant risk to MRP timeline.	Critical	Engage vendor to participate in requirements definition and detailed design in order to provide schedule, cost and resource constraints estimates earlier in the planning phase. This will	No	High

Risk ID	Risk Description	Inherent Risk Level	Mitigation Tasks	Mitigation Tasks Implemented (Yes/No)	Mitigated Risk Level
			allow the project team to perform alternative analysis for other potential solutions in the event procurement and negotiation is unsuccessful.		
#2	Prioritization of MRP deliverables results in key internal or external SMEs becoming unavailable to support the delivery of the MAST solution for extended periods of time leading to significant schedule delays.	Critical	MRP is the organization's first priority and the MAST project accepts the risk of having critical resource constraints with MRP. The project will add schedule and cost contingency to its approved schedule and budget to address these risks if they materialize.	No	High
#3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
#4	The MAST solution is dependent on the successful build of the DSO and Study Environment. Any delays in these two deliverables will likely result in a schedule delay to MAST.	High	The MAST project will add schedule and cost contingency to address any potential delays in MRP's schedule that impact dependent systems.	No	High

[redacted]

[redacted]

Note: The project team will maintain a comprehensive risk log which will include a complete list of project risks including those with a medium or low risk level. New or modified risks and mitigation plans will be highlighted to the Project Sponsor and Project Steering Committee members via monthly progress reporting.

8 Change Controls

Changes in the project that will impact/exceed tolerance levels for objectives, time and cost will be managed through the formal Project Change Management Process resulting in the Project Exception Report. The Project Exception Report (if approved) will result in the re-baselining of the project. Refer to the Project Exception Procedure for reference and additional details.

Appendix A: NPV Analysis and Cash Flow

Appraisal of alternatives and NPV will be completed in the subsequent version of the project charter.

Appendix B: Alternative Analysis

Identified Alternatives Summary

Alternative 1 – Do Nothing (Not Viable)

The experience with the current market was for each department to build End User Computing (EUC) tools that have been supported by their respective staff, such as Market Analysis staff. As the current market is less complex with one uniform price, EUC tools is sufficient. The new market will require the ability to fully analyze a constrained market with prices for each market participant for different settlement time frames (I.e. day-ahead and real-time). This complexity and sophistication cannot be built using EUC tools alone.

For example, one large change between today's market and MRP that significantly increases EUC complexity is the creation of a Single Schedule Market; i.e. the use of scheduling pass results in the pricing pass which cannot be modelled using internally developed End User Computing tools.

Alternative 2 – Implement MAST Solution (Recommended)

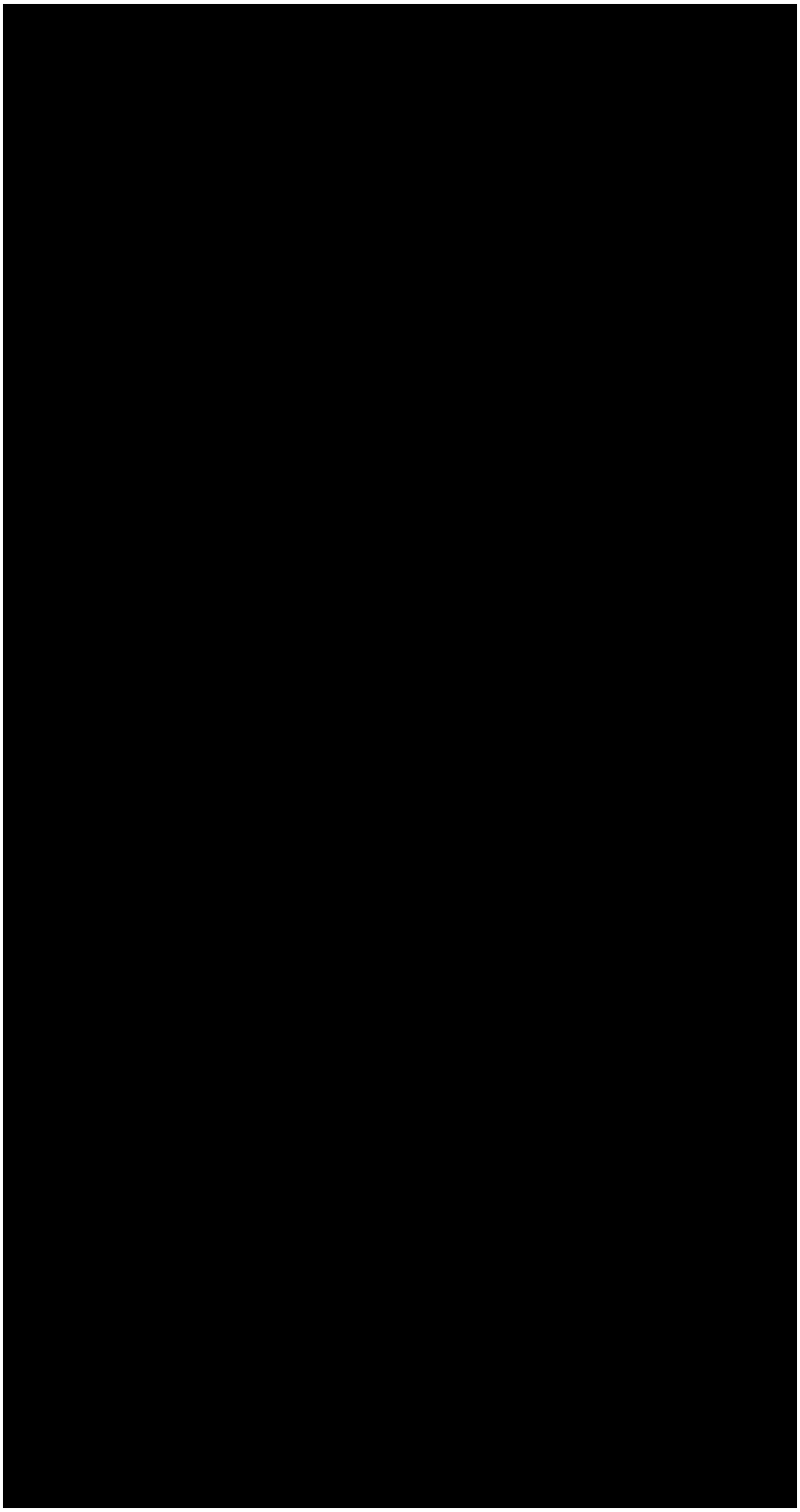
The recommended option is to engage the current vendor to augment the functionality of the DSO Study Environment delivered by the Market Renewal Program. The DSO Study Environment has base functionality suitable for Operational Assessments (OA) and Market Power Mitigation (MPM) teams at the IESO. The MAST solution will add additional functionality that includes the ability to see and manipulate the underlying mathematical objective functions, inputs and constraints in an offline environment.

Secondary vendor(s) may be used for user interface development and integration with the DSO study environment capability.

Appraisal of Alternatives

Appraisal of alternatives and NPV will be completed in the subsequent version of the project charter once the requirements with the vendor are validated.

Appendix C: Project Cost Worksheet



Appendix D: Benefits from the Use of Existing Simulation Tools

In the 20 years of administering the existing market, the monitoring and analysis of the market using simulation tools have resulted savings to the ratepayer of well over several hundred million dollars.

Without the use of the existing simulation tools, market initiatives implemented to eliminate irrational market outcomes, improve efficiency, augment competition, and remove unwarranted windfall gains would not have been justified. The table below lists examples of market initiatives that resulted in millions of dollars of ratepayer savings.

Market Initiative	Estimated Ratepayer Savings To-Date
Ramp rate reduction from 12x to 3x	$40+ millions of CMSC payment reductions
Enhanced Day-Ahead Commitment Program	$100+ millions of savings in resource commitment costs
Renewal Integration Initiative to require variable generation dispatchability	$50+ millions of savings from reduced nuclear manoeuvres
Export bid and floor price rules	$10+ millions of CMSC payment reductions
Flexibility Operating Reserve	$10+ millions of savings from reduced manual commitments of resources to meet flexibility needs

[redacted]

Document Control

Note: * indicates which roles will be required to approve in [redacted] workflow, however, document will be reviewed by all other roles identified.

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Financial Review:

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Distribution List

Name	Organization
[redacted]	IESO
PMO	IESO
Finance	IESO

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1.0	Initial release	February 7, 2022

References

Document Title	Document ID
Project Intake Document	[redacted]
Project Roles and Responsibilities	[redacted]

Related Documents

Document Title	Document ID
Integrated Project Plan	[redacted]

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