
Business Plan 2022-2024

Independent Electricity System Operator
December 9, 2021

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Letter from the President & CEO

Ontario's electricity system is at a pivotal moment in many ways.

Cyber threats, extreme weather and pandemic recovery are some of the broader changes taking place, shaping the context within which we are operating. More specific to Ontario, we face growing electricity supply needs this decade as demand is forecast to increase steadily, generation contracts expire, nuclear refurbishments continue and the Pickering nuclear plant retires.

Despite these challenges, or in some cases because of them, there are also many opportunities. As our supply needs grow, there is an opportunity to do better – to secure the resources we need more cost-effectively through competition, and with more flexibility to adapt to changing conditions through shorter commitment periods than in years past.

Technological advancements are also creating opportunities. Businesses and communities are meeting more of their own energy needs using solar panels, energy storage, and demand management tools, among other sources. This is contributing to economic development, providing businesses with new sources of revenue, and helping communities achieve their sustainability goals. Emerging technologies are also creating more competition in our provincial electricity markets, driving down costs.

As Ontario's Independent Electricity System Operator, it is our job to integrate all of these changes and ensure that electricity remains reliable and affordable for years to come.

In addition to sustaining our core business, investments are needed in several areas to help us prepare for the future.

One area is the Market Renewal Program. As we near the 20-year anniversary of the opening of Ontario's wholesale electricity markets, work is underway to implement redesigned markets that will be more efficient and better suited for the worlds of today and tomorrow. Our current market was designed for a different time, with far fewer participants and resource types. Since then, coal has been phased out, renewables have entered the market, consumers are providing demand response, conserving energy is making an impact and technologies like energy storage are taking root.

Over \$20 billion now flows through our markets each year. What were once small inefficiencies have grown in magnitude, and by correcting them through our market redesign, we will save \$800 million over 10 years. These are bottom-line savings that take into account \$178 million in amortized costs to implement, making this a clear winner for Ontario ratepayers.

As we implement fundamental changes to our markets, we are also focused on securing the resources needed to maintain a reliable supply of electricity this decade. With many generation contracts expiring, we have an opportunity to recommit them more cost-efficiently.

Over this business planning period, the IESO anticipates issuing a Request for Proposals (RFP) for up to 750 megawatts (MW) in early 2022, for three-year commitment periods with optional two-year extensions, and a longer-term RFP for at least 1,000 MW in late 2022. We will secure only the resources we are certain we need, with annual capacity auctions enabling us to respond to changing circumstances and secure the remainder of what is needed.

This multipronged approach, which continues the move toward more frequent procurements with shorter commitment periods, will provide flexibility to adapt to changing conditions and help facilitate participation from new technologies in the years ahead. By doing this competitively, we will reduce costs for Ontario ratepayers.

To drive greater cost-effectiveness, we are also focused on enabling more resources to participate in our markets. With so much innovation happening across the sector, and technology costs coming down, our focus is on small and targeted investments, leveraging partnerships where possible, to help ensure our electricity system is prepared to reliably integrate these emerging technologies into our markets.

We are also conscious of the work done by communities to take care of their own energy needs, which is blurring the lines between the provincial and local grids. The IESO is collaborating with communities on a number of fronts to help them meet local sustainability and economic development goals and contribute to the reliability and resilience of the grid.

In the coming years, the IESO will also undertake several new initiatives in support of government policy that help to address system needs and customer preferences. These projects span a number of areas and include developing an achievable pathway to zero emissions in Ontario's electricity system, taking steps toward creating a market for clean energy credits, re-contracting some small hydro and biomass generation facilities, and assessing the feasibility of several project proposals submitted to the government.

Additional resources have been identified in this plan in order to develop these projects up to the point of implementation. As these projects move forward, the IESO would in future plans assess what support would be needed to take them through to completion. In addition to electricity system benefits, these initiatives will also help achieve other policy objectives such as economic development. The scope and magnitude of this new work will require some additional resources with expertise in a number of areas, including research and analysis, modelling and simulations, system operations, contract management and other critical functions.

Lastly, investments are required in our people and processes. After years of deferring certain upgrades to our infrastructure, targeted investments are needed in aging IT assets and tools to maintain sustainable operations, and to prepare for the renewed electricity markets going live at the end of 2023.

And, as for our people, I am personally committed to ensuring our workplace supports equity, diversity and inclusion. Consequently, we will continue to engage employees and re-assess how we are progressing. We owe this to our staff, and we know a safe, respectful and supportive work environment is essential to attracting the talent we need to carry out our important mandate.

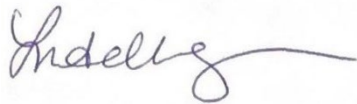
The pandemic has caused many organizations across many industries to take stock. As we prepare for the changes that will take place in Ontario's electricity system over the next few years, we see a clear path forward that will help us keep the grid reliable and operate cost-effectively. This is not a path we walk alone, and we will continue to work transparently with industry stakeholders, communities, First Nations and Métis, and others to prepare for the future, and ensure that our electricity service continues to meet the needs of all Ontarians.

It is within this context that we present the IESO's 2022-2024 Business Plan. This plan outlines the revenue requirements and capital spending needed to address the challenges facing the sector, and to take advantage of opportunities to drive down costs and keep our system reliable.

For the past five years, we've absorbed \$14 million of inflation and collective agreement impacts by deferring investments and finding efficiencies. This helped us keep our revenue requirements essentially flat during this time, with a reduction to our requirements in 2020 in response to the pandemic.

While the IESO continues to carefully review all expenditures and will find efficiencies where possible, investments are needed. To fully enable the sector of the future, we must invest in the people, tools and processes that underpin the reliable and cost-effective provision of electricity in the province. As a result, the IESO is proposing increases to its budget to ensure it can continue to meet Ontarians' expectations of an efficient – and resilient – electricity system.

This includes a revenue requirement of \$201.5 million in 2022, \$204.0 million in 2023, and \$209.3 million in 2024, translating to increases of 5.1%, 1.2%, 2.6%, respectively. For the average residential electricity bill, this translates to an increase of 2.3 cents per month over the 2022-2024 planning period, or 27 cents per year.

A handwritten signature in blue ink, appearing to read 'Lesley Gallinger', with a long horizontal flourish extending to the right.

Lesley Gallinger

President and CEO, IESO

2022-2024 Business Plan: IESO Priorities

A reliable, affordable and sustainable supply of electricity is one of the prerequisites of 21st century living. Whether it's used to power heavy equipment, home electronics or transportation systems, electricity has never been more important to Ontarians and their quality of life. Businesses, institutions, communities and residents depend on it being available at all times.

Operating Ontario's power system and administering its wholesale electricity markets is an important responsibility, but in a more integrated and complex world characterized by engaged consumers, decentralized resources and emerging technologies, the task has become increasingly challenging. It requires foresight and analytical capability, highly sophisticated systems and tools, as well as fully engaged employees with the skills and expertise to manage the changes while maintaining a laser-sharp focus on delivering value. In addition to some of our core functions, like operating the grid and administering the wholesale markets, our revenue requirements will go toward the following priorities over the 2022-2024 Business Plan period.

Planning for the Future

Power system planning is fundamental to maintaining a reliable electricity system. It's important that we have the right resources in the right places to meet demand for electricity. As we move into 2022 and beyond, the environment in which we operate is expected to continue changing rapidly. Effective planning requires us to examine demand trends, supply options and system needs up to 20 years in the future, integrating these changes into the decisions we make to keep the grid reliable and affordable.

All levels of government – federal, provincial and municipal – are collectively taking steps to manage and mitigate the impacts of environmental changes. Changes in customer preferences, emerging technologies, opportunities for electrification and other factors are expected to impact supply and demand in the years ahead. In addition, power systems everywhere are becoming more decentralized, with communities taking a larger role in meeting their own energy needs. This is blurring the lines between the provincial grid and local distribution networks, and adding to the complexity of power system planning.

The IESO's power system planners strive to provide highly credible forecasts and assessments through our core products, which include the Annual Planning Outlook, quarterly Reliability Outlooks and other products. Models are key to achieving this objective, but so too are data and technology research. As technology continues to evolve, we will invest in the most up-to-date research in order to incorporate this information into our forecasts and make it available to the sector to inform stakeholders' operations.

To support these efforts, the IESO will replace the existing Long-Term Demand Forecast tools which have reached end of life and update the end-use load profiles used to develop the long-term forecasts. These tools are essential to support the planning processes that forecast system needs and provide infrastructure investment advice for the next 20 years.

On a regional level, Ontario has 21 electricity planning regions, each with unique needs and priorities. Through our ongoing regional planning efforts, we consider conservation, generation, transmission and distribution, as well as non-wires-based innovative resources to determine the best options to meet these needs. Regional planning is a continual process with plans developed for a 20-year outlook, but evaluated every five years at minimum. We will continue to work closely with sector partners, municipal officials, local business owners and residents to ensure communities have a safe, reliable, affordable and sustainable supply of electricity for years to come.

Resource Adequacy

After more than a decade of strong supply, Ontario is now entering a period of emerging electricity system needs – most immediately and significantly in the system’s ability to meet peak capacity needs and additionally in the system’s ability to meet energy needs towards the end of the decade. These needs are driven by increasing demand, the retirement of the Pickering Nuclear Generating Station, the refurbishment of other nuclear generating units, as well as expiring contracts for existing facilities.

Over the past decade, Ontario’s electricity system has become more diverse and dynamic, and system needs have changed substantially, necessitating changes in the way we secure resources to meet them. The new Resource Adequacy framework is building on past procurement practices and aims to balance the need for certainty for investors with the IESO’s need to adjust to changing system needs that are expected to continue to evolve. The goal is to maximize competition to the greatest extent possible, secure resources based on transparent system needs, and introduce more flexibility with shorter commitment lengths for resources so that we can best match supply to those system needs. Evolving our resource adequacy approach ensures that we can deliver ratepayer savings by reducing total system costs over time.

Focusing on system needs in a transparent manner is a cornerstone of this new framework, alongside competition. Together these will be key in delivering value to ratepayers as it drives sector participants to be as effective, efficient and innovative as possible to respond to system needs. Procuring more frequently for shorter commitment terms means that resources will need to be competitive and efficient, not just at a single point in time but throughout the life of the asset and thereby providing ongoing value to ratepayers. By implementing flexible and competitive procurements, and acquiring our needed resources in a transparent manner, we will be taking important steps to ensure Ontario’s power system is as right-sized as possible.

The IESO’s 2020 Annual Planning Outlook shows that over 10 gigawatts (GW) of generation contracts are expiring by 2030, representing approximately \$1 billion in annual costs to acquire. The value of implementing competitive processes to secure supply resources has been demonstrated by IESO reports (i.e., the 2017 Market Renewal Benefits Case), IESO experience with the Demand Response and Capacity Auctions and experience in US jurisdictions.

To that end, the IESO is initiating the first in a series of medium-term RFPs in late 2021 for up to 750 MW, with a three-year commitment period beginning in 2026. A longer-term RFP with a commitment period of at least seven years is expected to launch in late 2022 for at least 1,000 MW. These procurements will acquire the resources necessary to meet system needs that we have forecasted over this period. The annual capacity auctions are an efficient tool for resources to bridge between procurement periods, while also enabling us to respond to changing circumstances.

Enabling Resources

In parallel with Resource Adequacy initiatives, the IESO has launched the Enabling Resources Program – an integrated set of projects to enable more resources to provide electricity system services that they are technically capable of providing but currently cannot, or only partially, provide under current market architecture.

Increasing the diversity of resources that can participate in the markets will deliver some important benefits: increasing competition that drives affordability; providing new revenue opportunities for Ontario businesses; and giving the IESO some additional tools to meet reliability needs this decade and beyond.

In recent years, tangible progress has been made on enabling resources and a foundation has been laid for future integration through research, pilots, and partnerships. The IESO has identified several opportunities to enable new and existing resources to provide required power system services. These include expanding participation in the capacity, energy and operating reserve markets; reducing the barriers to participation by energy storage resources; designing and implementing a market participation model for hybrid generation/storage for generation and storage resources; enhancing demand response participation and advancing the integration of distributed energy resources (DERs) into market models and tools; and other related work.

With finite resources, the IESO must carefully consider if, how, and when it implements identified opportunities to maximize the value of ratepayer investments and ensure the timely delivery of critical operations and projects. Over the next few years, we plan to take a staged approach to manage the work required to enable each resource type. This work will establish market participation models for hybrids, storage and DERs to be in place to meet future reliability needs and enable strong competition in Resource Adequacy procurements.

Enabling greater participation in Ontario's electricity markets is critical as it ensures that resources can provide maximum value to the system while minimizing inefficiencies. The IESO has continually strived to make changes to its participation models as our supply mix evolved and new resources emerged. For example, the original participation model for intermittent facilities enabled them to inject energy into the grid; however, as the volume of intermittent resources grew substantially, it highlighted key inefficiencies of this participation model and increased out-of-market actions that had to be taken to manage the change in supply mix.

The IESO's 2013 Renewables Integration Initiative enhanced the participation model by improving visibility of these resources, as well as the IESO's ability to forecast and dispatch them. This increased the overall effectiveness of the fleet, minimized out-of-market actions, and increased market efficiency and ratepayer savings. The Enabling Resources program continues this work. Its goal is to ensure that we have efficient participation models to derive value from all of our resources. The work will be done in conjunction with the Resource Adequacy initiatives to provide alignment and foster competition, when and where needed.

Enablement activities may include pilots, programs or changes to market design. The greatest value opportunities to leverage existing resources to meet system needs emerging in 2026 include the work on hybrids, DERs, storage and "fast" demand response, a service that requires a quicker response to signals from the IESO. Some of the enabling work is well underway, with full implementation of the various initiatives scheduled for 2022-2025 or as resources become available. While this

market/system integration work is consistent with integration requirements already mandated for American system operators by the Federal Energy Regulatory Commission, the IESO will undertake a cost-benefit analysis to assess which changes deliver the highest value to the system. Based on the current Enabling Resources work plan schedule, capital expenditures for design and implementation would begin to be incurred in the later second half of 2023.

Market Renewal Program

Through the Market Renewal Program – the most significant update since the electricity markets were designed in the late 1990s – the IESO is working on enhancements to create significant cost-efficiencies for Ontario’s energy consumers by redesigning electricity markets to correct inefficiencies and encourage greater competition. The program is expected to deliver approximately \$800 million in net benefits over the first 10 years following the program’s in-service date. The cost of around \$178 million will be amortized and is beginning to be recovered within this business planning period.

Most of the benefits – that extend to the system, the sector and ultimately consumers – are the result of aligning price and dispatch; reducing the need for out-of-market payments; addressing instances and causes of gaming; providing better information to incent system investments where they are needed most; building the foundation to enable future markets; and enabling greater competition between resources.

Significant progress has been made to date with the completion of the high-level design in 2019 and the detailed design in 2021. The focus now is on the implementation phase, and the work to ensure both the IESO and market participants are fully prepared for the launch of the renewed markets, targeted for Q4 2023. Activities include development of market rules, market manuals and internal business documentation, as well as IT solution development, testing, training and readiness activities. The IESO continues to work transparently across a variety of forums with stakeholders to ensure market renewal will deliver solutions that work for the sector and for consumers alike.

Driving Business Transformation

To ensure Ontario’s electricity grid and market continue to function reliably, the most important investment we make is in our people. The increasing complexity of the sector has reinforced the need to attract and retain a highly skilled workforce. A key part of this is ensuring equity, diversity and inclusion across our workforce. A survey of our staff revealed that, despite our efforts to create a supportive workplace where everyone feels safe and motivated to deliver peak performance, we can do better.

Therefore, we will continue to engage with staff and invest in training programs to create a better environment – an environment where talent is rewarded, people of all backgrounds are united in purpose, and everyone is treated with respect. Workforce research has shown that the happier and safer employees feel, the more likely it is that they will be productive, feel comfortable challenging the status quo, suggest new solutions, and feel fully invested in their work. Innovative thinking is a priority across the electricity sector, and the steps we’re taking will help drive positive change and position the IESO to deliver on our objectives.

In addition to our people, effective processes and tools are required to carry out our mandate. Complex IT programs and tools enable us to perform essential tasks that include forecasting

demand, dispatching resources and monitoring the grid for cyber threats. After years of deferring investments, many of the IESO's IT systems are near or at their end of life. Some of these upgrades will be made to control room systems to support the integration of emerging resources, and to improve situational awareness. In the coming years, we will continue to update or replace many of these key IT systems that help us maintain the reliability of the grid.

Settling the market, for example, is a critical function that requires sophisticated software. And after several years of ad-hoc changes and updates to solve specific business problems, replacing our settlement system has become urgent. Over \$20 billion in transactions occur each year through Ontario's wholesale electricity markets and it's imperative that these transactions be settled accurately. This mission-critical project will also address market re-design needs associated with implementation of the Market Renewal Program and ensure our systems meet current and future business needs.

Reinforcing the Resilience and Integrity of the Grid

Protecting the IESO grid against threats and vulnerabilities remains a high priority, both in the physical and cyber realms. All activities aimed at ensuring the reliability of the power system (e.g., long-term planning, operational planning, real-time operations, business continuity, emergency preparedness) consider a range of extreme events, including environmental changes as well as cyber threats.

Anticipating extreme weather scenarios has been part of the IESO's operational planning for many years. By considering these scenarios in depth, and by coordinating closely with other system operators across North America, we've been able to develop procedures and instructions for real-time operations with two goals: first, to ensure safe operations of the system when extreme events are expected; and second, to deal with any potential fallout of extreme events once they happen.

Given the interconnectedness of the North American power system – sometimes referred to as the world's largest machine – it's imperative that we know what's going on in other parts of the grid, and understand the nature of the challenges that are arising. For this reason, we continue to participate, monitor and implement actions recommended by the North American Electric Reliability Corporation and the Federal Energy Regulatory Commission.

After the Texas extreme cold weather event in February 2021, we initiated a new resilience review with a focus on extreme weather events. Preliminary results indicate that the IESO and the IESO-controlled grid are well prepared for extreme weather. We are working to finalize an extreme weather resilience work-plan that considers a variety of risks and mitigation options.

On the cybersecurity front, the IESO has made investments into advance threat detection and prevention technology to strengthen its core cybersecurity posture. This has been achieved through investments in intrusion prevention systems, web filtering technology and enterprise antivirus systems. These important investments continue to mitigate cybersecurity strategic risks and have been accommodated within our existing operating budget. The technologies continue to be fine-tuned to adapt to emerging cyber threats with the potential to impact the IESO's operations.

Our cybersecurity program continues to focus on expanding the IESO Lighthouse program membership and increasing the value delivery around situational awareness and information sharing as a service for members within Ontario's electricity sector. This includes near real-time incident

detection capability and the development of developing cybersecurity training and resources for the sector, strengthening our collective cyber posture.

As cybersecurity events, and ransomware attacks in particular, continue to increase across the sector, the IESO is also focused on bolstering its cyber incident response capability. These initiatives include developing cyber incident response playbooks and conducting regular tabletop exercises to practice the execution of these playbooks in an effort to reduce the potential impact and accelerate the resolution timelines.

Powering Change in First Nations Communities

The IESO works closely with Indigenous communities and organizations on projects that deliver economic, environmental and social benefits. For more than a decade, we've worked closely with them through a variety of channels and vehicles, including regional and bulk planning, energy-efficiency programming and the Indigenous Energy Support Programs. To ensure alignment with community-identified needs, interests and priorities, we engage regularly to ensure their ideas and recommendations are considered throughout our planning and decision-making processes.

Over the past few years, Indigenous communities and organizations across Ontario have become more actively involved in how they meet their energy needs. To meet objectives related to sustainability and self-sufficiency, a growing number have chosen to develop renewable resources and implement innovative solutions such as microgrids that combine small-scale local generation with storage and flexible control systems. The IESO has been able to provide some financial and technical support for these projects.

Our efforts in recent years have focused on capacity building as a way to ensure Indigenous communities and organizations have the knowledge and skills required to participate more fully and derive greater financial benefits from their efforts. On an annual basis, we launch a new intake of the Energy Support Programs and look for opportunities to improve program alignment with the needs of Indigenous communities and organizations. To maintain an ongoing dialogue and support capacity building, the IESO also hosts the First Nations Energy Symposium and Métis Nation of Ontario workshop.

The IESO also offers a suite of energy-efficiency programs for Indigenous customers on- and off-reserve, enabling them to reduce their consumption and the associated costs. Over the years, we've solicited feedback and updated the programs regularly to reflect recommendations for improvement. Going forward, we will continue to support the design and delivery of targeted energy-efficiency programs, including the launch of the new First Nation Community Buildings Retrofit Program and the expanded Remote First Nation Energy Efficiency Program, which enable communities and organizations to achieve their energy-efficiency objectives.

We continue to build on the principles outlined in our Corporate Indigenous Policy, which is focused on building the capacity of Indigenous peoples and communities and creating opportunities in support of fair and equitable participation in the electricity sector. To do so, we have established outreach plans that identify meaningful engagement opportunities for communities and that seek to build new strategic relationships, leveraging the momentum created by launching the policy in late 2020.

We also support the implementation of IESO's Equity, Diversity and Inclusion action plan, including updates to the Indigenous cultural awareness training for IESO staff, the establishment of the IESO Lighting the Way Award scholarship, and internal co-op positions for Indigenous youth. Formalizing an inclusive corporate procurement process will also create new opportunities for Indigenous-owned companies to earn revenue in the energy sector.

Engaging with Communities and Industry Stakeholders

Effective engagement with market participants and other industry stakeholders as well as communities has always been of paramount importance to the IESO. The input and feedback we receive plays a critical role in our decision-making processes and ensures we make fair and balanced decisions that consider multiple perspectives. As participation and interest in the electricity sector broadens, so too must our engagement efforts. Online platforms will continue to help us expand our reach, while recording and posting meetings online is allowing stakeholders and community members to listen and watch at their own convenience.

When it comes to electricity planning, understanding what's important to communities, businesses and regions is critical. Every region of the province has unique characteristics and energy needs, which the IESO must understand and consider. For this reason, we've launched IESO Connects (www.iesoconnects.ca), an online community engagement hub that enables regional electricity network members to follow developments and contribute their ideas and perspectives. It will remain an important engagement mechanism going forward, enabling active dialogue in a targeted and cost-effective manner.

The IESO has a critical role to play in ensuring market participants understand market and system operations, and know how to participate. Market participant training has always been important, but never more than now as we approach implementation of the renewed electricity markets, and as new and innovative companies continue entering the market. For the convenience of our participants and to reduce the costs associated with in-person training, we've been transitioning our training online. We're focused on developing technical videos and short Quick Takes that enable market participants to learn about tools and processes at a time that works for them.

Energy Efficiency

At less than two cents per kilowatt-hour, energy efficiency is Ontario's most cost-effective resource. It's also one of the most important contributors to ensuring Ontarians have the electricity they require – at a fair and affordable price. Energy efficiency plays an important part in meeting system needs at local, regional and province-wide levels. Efforts required to carry out this program are funded through the global adjustment mechanism rather than the IESO usage fee.

In 2021 the IESO celebrated 10 years of delivering energy-efficiency programming under the Save on Energy brand. Since Save on Energy was first introduced in 2011, over 250,000 Ontario electricity consumers have participated. Over the years, these programs have been available for all sectors, including residential, industrial, commercial and institutional customers as well as First Nations and income-qualified customers. Collectively, their efforts have resulted in nearly 16 TWh of electricity savings – enough to power 1.7 million homes for one year.

Ontarians have proven that energy efficiency can deliver strong results. It can reduce energy costs, improve operating processes and systems, enhance overall occupant comfort and lower total demand on the power system. The savings from Save on Energy programs are factored into the planning of Ontario's future energy needs, and are integral in helping Ontario businesses reduce operating costs and remain competitive in the global marketplace, especially as they recover from the impacts COVID-19.

The IESO is now working under the 2021-2024 Conservation and Demand Management (CDM) Framework, which focuses on cost-effectively meeting the needs of electricity consumers and Ontario's electricity system through the delivery of programs and opportunities to enable electricity consumers to improve the energy efficiency of their homes, businesses and facilities. With a budget of \$692 million, the current suite of programs is forecasted to achieve 440 MW of peak demand savings and 2.7 TWh of energy savings. As part of the current framework, local initiatives will also be developed to deliver CDM savings in targeted areas of the province with identified system needs. The local initiatives will use competitive mechanisms, such as open procurements. This approach will enable a broad range of participants to propose CDM programs and opportunities encouraging competition, innovation, cost savings and customer-driven solutions.

Supporting Decarbonization and Government Policy Objectives

Electricity plays a critical role in the province's economic and social wellbeing. A reliable, affordable and sustainable supply of electricity can fuel community growth, support job creation, stimulate economic development and facilitate decarbonization efforts in other sectors. The work of the IESO will continue to support these government policy objectives, especially as Ontario emerges from the COVID-19 pandemic.

In late 2020 and early 2021, a number of Ontario municipalities passed resolutions to phase out the province's gas-fired power plants by 2030. To determine whether this was feasible, the IESO undertook extensive analysis, which resulted in a Gas Phase-Out Impact Assessment that was released in October 2021.

Although the study showed that this date was not feasible without blackouts and substantial increases to customer bills, this work has furthered our shared understanding of Ontario's clean grid advantage. At 94 per cent emissions free in 2020, Ontario has the one of the lowest emitting electricity systems in North America, if not the world.

After the gas study was released, the Minister of Energy asked the IESO to evaluate a moratorium on procuring new natural gas generating stations and to develop a pathway to zero emissions in the electricity sector. This IESO will provide this additional analysis by November 2022.

Gas-fired generation plays an important role in the operation of the system by providing flexibility, particularly during times of peak demand. Reimagining and reorienting the grid to account for the phase-out of natural gas generation would be a highly complex undertaking. To do so, we would need to procure and integrate replacement supply with different operating characteristics, identify and assess the transmission infrastructure requirements to support the new supply, and determine ways in which local supply could contribute more actively to the system's real-time needs.

The analytical work required to determine the best path forward will necessitate effort from subject matter experts across the IESO. Properly assessing the operational, environmental and financial implications of a zero-emissions grid will be critical, and the work will not be done in isolation. Just as the gas phase-out study was informed by input from stakeholders and community feedback, the IESO will continue working with the sector – including businesses, academics, municipalities and other organizations in the broader electrification space – to explore the best approach to leverage the electricity sector to support decarbonization in Ontario. This effort is currently structured to support the development of a proposed pathway, but as yet does not account for the resources needed for implementation.

With just three per cent of all carbon emissions in the province currently coming from the electricity sector, there is the potential to reduce emissions across the broader economy by supporting electrification in other sectors with significantly higher emissions profiles. We are committed to supporting electrification and decarbonization and will be taking a deeper look at electrification potential and impacts in 2022.

Separately, the Minister of Energy has also asked the IESO to take steps toward creating a market for clean energy credits, re-contracting with some small hydro and biomass generation facilities, assessing the feasibility of several project proposals submitted to the government. Here, IESO work will also only encompass the assessment phases required before any project execution takes place.

In addition to electricity system benefits, these initiatives will also help achieve other policy objectives, such as economic development and job creation. The scope and magnitude of this new work will require some additional resources with expertise in a number of specific areas. These include research and analysis, modelling and simulations, system operations, contract management, communications, settlements, finance and other critical functions.

Financial Overview

The 2022-2024 Business Plan provides an overview of the resources required to maintain the high levels of performance necessary for the IESO to deliver on its core responsibilities, as well as to execute key strategies. These strategies include ensuring cost-effective system reliability, enabling competition, driving business transformation, advancing sector leadership and preparing for the future of the sector.

The IESO has maintained its revenue requirements at similar levels since 2017, absorbing \$14 million of inflation and collective agreement impacts by deferring investments in processes, tools and workspaces, and by finding efficiencies. However, after five years of holding funding requirements flat, the IESO now needs to move forward on key initiatives that are critical to maintaining its core operations, to continue modernizing Ontario's electricity sector, and to address various government initiatives including a pathway to zero emissions in the electricity sector.

While the IESO continues to carefully review all expenditures and will find efficiencies where possible, investments are now needed for initiatives in support of the future of the sector and in the people, tools and processes that underpin the reliable and cost-effective provision of electricity in the province. The IESO is therefore proposing increases to its revenue requirement of 5.1%, 1.2%, 2.6% over the three-year planning period. For the average residential electricity bill, this translates to an increase of 2.3 cents per month over the 2022-2024 planning period, or 27 cents per year.

In the 2022-2024 Business Plan, the IESO is proposing to:

- Maintain existing costs to run the business and complete existing initiatives, consistent with the approved 2021 budget.
- Complete the \$178 million Market Renewal Program investment by end of 2023, at which time the new market will begin to generate \$800 million in ratepayer savings over a 10-year span, a 3.5 benefit-to-cost ratio. The program investment will be amortized over a 20-year period, starting in late 2023.
- Embark on a large-scale effort to acquire resources to meet expected energy shortfalls later this decade, following a period of adequate supply, by implementing a competitive resource acquisition strategy for short-, medium- and long-term capacity needs and capacity auction enhancements.
- Ensure reliability over the long term through initiatives to enable existing and emerging resources such as storage, hybrid integration and demand response to compete in the market and help meet supply needs.
- Upgrade aging planning and operations tools that have been deferred for multiple years.

- Undertake several new initiatives to ensure reliability and government policy priorities are met, including: taking steps toward creating a market for clean energy credits, re-contracting some biomass generation and small hydroelectric facilities, assessing barriers to energy storage, and advancing several Unsolicited Project Proposals to the next phase of the framework. Develop a pathway to zero emissions in Ontario's electricity sector through a phase-out of gas generating facilities.
- The resource request in this plan for new initiatives and the zero emissions pathway will support the IESO's work on the assessment and development of these projects. This work will also help determine what additional resources would be needed to implement these projects and would be included in subsequent business plans.

In 2022, the IESO will start preparing for the new functions and services that the Market Renewal Program will introduce when it goes into service, and will undertake a number of initiatives to ensure reliability needs are met and resources that are important to other government policies remain in service, as well as to respond to growing interest in decarbonization. Operating costs for 2023 include the continuation of initiatives started in 2022, increase preparedness for post-Market Renewal Program implementation, and investments in core operations to upgrade tools and maintain critical functions required for the IESO to deliver on its mandate. 2024 is a step-change year for the IESO, driven by beginning to recover the Market Renewal Program investments through amortization and the impacts of operating the new market.

Further, the organization continues work to identify potential operating efficiencies within the 2022-2024 planning period. Internally, the IESO will drive business transformation by implementing a workplace strategy aimed at enhancing its culture and people practices to enhance performance, and by establishing a technology and data roadmap to enable better analytics, achieve new efficiencies and deliver value to the sector.

In order to support business and workforce transformation the IESO continues to examine its office space needs in support of introducing a hybrid work model and to recognize the evolving role the office plays in supporting employees and delivering the IESO's services; should this examination result in additional investments net of related savings, the IESO will bring it forward in the next business plan.

For 2022, the IESO anticipates an average of 827 full-time equivalent employees to deliver on core electricity system responsibilities and government new initiatives, as well as to support the Market Renewal Program. After rigorous review, core operations staffing levels will increase in 2022 to ensure delivery and execution of time-sensitive initiatives that are critical to meet Ontario's electricity goals, with other additions related to MRP support. In 2023, a number of strategic positions are added to support key initiatives (including the Market Renewal Program). Staffing levels will be reduced in 2024 after the Market Renewal Program and the Replacement of Settlement System project have gone into service, with certain program resources returning to core functions.

As part of its mandate, the IESO operates several programs that are funded from other sources and are not included in this business plan and these are: the smart metering entity, market rule enforcement and education, and energy-efficiency programs.

The IESO has approval from the Ontario Energy Board to maintain an operating reserve of \$10 million, to manage cost or revenue variances from budgets, as well as changes to the external

environment that impact the IESO and may not be within its control or reasonably foreseeable, a practice adopted by similar sector organizations. Given the scope and complexity of its mandate, the IESO recognizes the potential for additional unplanned work activities that may be material in scope and are beyond the control of management.

The IESO's operating reserve balance was drawn down in 2019 due to an accounting policy change and is currently at \$1.3 million. The IESO has deferred including additional revenue requirement in its budget to restore the \$10 million operating reserve in order to mitigate the impact of cost increases on market participants. The IESO is able to manage this risk, and any operating deficits in the near term, through its credit facility, and will look to restore its balance over time through retention of any operating surpluses, while it is committed to continuing to look for efficiencies to create capacity to support rebuilding of the operating reserve.

Detailed Financials

The following table outlines 2022-2024 business plan operating revenues and expenses:

Pro Forma Statement of Operations For the Year Ended December 31

(\$ Millions)	2021 Budget	2022 Budget	2023 Budget	2024 Budget
Revenue				
IESO Usage Fee	191.8	201.5	204.0	209.3
Total Revenue	191.8	201.5	204.0	209.3
Expenses				
Baseline Expenses	171.5	172.8	175.0	178.2
<i>Year over year variance</i>	-	0.7%	1.3%	1.8%
MRP Post-go-live	-	0.5	2.7	4.0
Resource Adequacy	-	1.7	1.9	1.3
Enabling Resources	-	0.4	0.6	0.5
Other initiatives	-	4.6	2.8	2.2
Pathway to zero emissions	-	1.3	-	-
Operating Expenses inclusive of Initiatives	171.5	181.3	183.0	186.2
Amortization	19.2	20.0	23.3	30.0
Net Interest	(2.5)	(5.0)	(7.2)	(7.8)
Market Renewal Program	3.6	5.2	4.9	0.9
Total Expenses	191.8	201.5	204.0	209.3
<i>Year over year variance</i>	-	5.1%	1.2%	2.6%
Operating Surplus/(Deficit)	-	-	-	-

Capital

As in previous years, the business planning process establishes an appropriate capital envelope for core operating initiatives over the business planning timeframe, with commitments approved individually, on an ongoing basis. The capital implementation stage of the Market Renewal Program, which began in 2018, will be concluded by the end of the planning period.

For 2022, in addition to delivering a number of core business projects which allow the IESO to maintain critical services, improve efficiency and meet regulatory compliance obligations, the IESO is continuing to deliver a significant number of strategic initiatives with the aim of: driving business transformation (with projects such as the Replacement of Settlement Systems, Data Excellence Program and Human Resource Workforce Planning and Analytics Project); ensuring system reliability (with projects such as the Resource Adequacy Program and Dynamic Limits in Real-Time Project) and enabling competition and advancing sector leadership through addressing Market Surveillance Panel recommendations.

Through its core business projects, the IESO will continue to ensure reliability by upgrading and replacing core applications, infrastructure and cyber security tools. In 2022, core business projects include a refresh of the Transmission Rights Auction platform, introduction of a Network Performance Management and Diagnostic Solutions and the completion of the SCADA/Energy Management System (EMS) Upgrade, to name a few. The IESO is also investing in a Market Analysis and Simulation Toolset to ensure availability of a tool to monitor, correct, improve or alter market design or operations over the day-ahead, pre-dispatch and real-time periods following the introduction of the Market Renewal Program.

The Market Renewal Program capital costs for 2022-2024 in the table below are the latest estimate of program spending and are in alignment with the revised schedule and in-service date approved by the IESO board in March 2021.

Project details and associated descriptions are included in Appendix 3.

Total Capital Envelope

Capital (\$ Millions)	2021 Budget	2022 Budget	2023 Budget	2024 Budget
Core Operations Initiatives	32.6	30.0	28.8	28.2
Market Renewal Program	44.6	41.2	33.6	1.9
Total Capital Envelope	77.2	71.2	62.4	30.1

Full-Time Equivalent (FTE) Staffing

In 2022, the average baseline FTEs decline slightly below 2021 levels due to staff attrition. Additional resources to support all of IESO's initiatives results in increasing core operations FTEs by about 17 average FTEs compared to 2021. Additionally, MRP implementation support is driving the increase of MRP program FTEs by 16 in 2022. Core operations FTE levels in 2023 increase to 724, mainly due to ramp-up of staff required to prepare for the new market functions/services, in order to develop processes, undertake analysis, assist with fixes, improvements and sector readiness, and eventually operate the new market. In 2024, core operations FTE levels decline to 741, driven by completion of the Replacement of Settlement System project.

Staffing levels required to support the Market Renewal Program implementation will reach 97 FTE in 2022, and are expected to increase slightly in 2023 for operations testing activities. In 2024 some staff are retained to provide market participants and internal staff with training, complete internal documentation, make tool changes post go-live and ensure that a framework is in place to measure the benefits post go-live.

Average FTEs

Full-Time Equivalents (FTEs)	2021 Budget	2022 Budget	2023 Budget	2024 Budget
Baseline	713	706	716	705
MRP Post-go live	-	3	18	21
Resource Adequacy	-	3	4	4
Enabling Resources	-	1	2	2
Other initiatives	-	10	11	9
Pathway to zero emissions	-	7	-	-
Core Operations	713	730	751	741
Market Renewal Program	81	97	101	10
Total FTEs	794	827	852	751

Market Renewal Financials

As of 2021, the Market Renewal Program has entered the final phase of the initiative: implementation. This phase of work will ensure both the IESO and market participants are prepared for the launch of the renewed market, targeted for Q4 2023.

Market Renewal Program Baseline Schedule, Budget Update and Funding

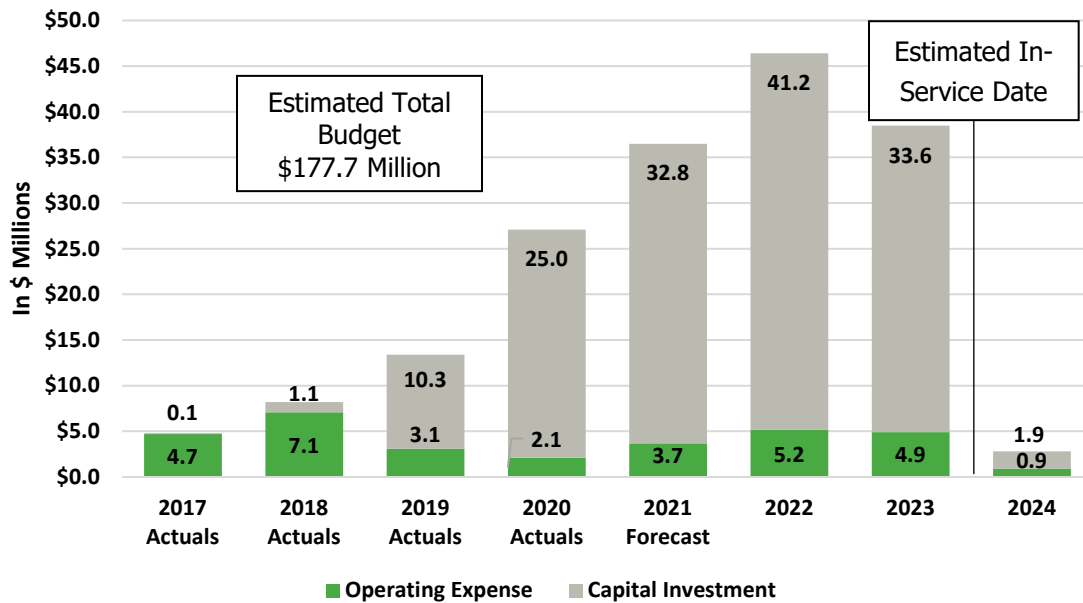
The business case for the Market Renewal Program was approved by the IESO Board in October 2019. The IESO's transition from detailed design to implementation provided a natural review point of the schedule, budget and risks – a common practice in the management of large-scale projects. In March 2021, the IESO Board approved revised program funding and schedule, including a new in-service date of November 2023, with six months of schedule contingency. The updated cost estimate for the delivery of Market Renewal is \$177.7 million, including contingency, which remains within the estimated range approved in the business case. With the final detailed designed documents published, the focus is now on codifying these designs into rules, manuals, processes and tools as part of the implementation phase.

The capital activities for Market Renewal will include solution development deliverables and testing, which will require contracting external vendors as well as broad support from across the organization, including a significant complement of IT resources, while managing the inter-related nature of other significant IESO initiatives. Market Renewal activities funded through operating costs include the development of market rules and related stakeholder activities, change management planning and coordination, and updates to internal and external manuals.

In 2024, the IESO will require funding post go-live to deliver market participant support and training, complete internal document updates, and start project closure activities while maintaining a capital budget for additional vendor support and internal IT costs for tool changes identified after the in-service date.

The annual Market Renewal Program project costs from 2022-2024 are consistent with the Board-approved revised schedule and in-service date and funding, with some adjustments in timing and dollars between years.

Projected Market Renewal Costing



Appendix 1 – IESO Performance Management – Measures and Targets

The IESO's performance management program provides an important level of oversight for the organization and its stakeholders, and helps to ensure accountability and course correction, as needed.

The IESO has established forward-looking, five-year performance measures and targets that align with strategy to drive action and progress toward the achievement of the organization's overall mandate and strategic objectives. As this Business Plan is intended to operationalize the execution of the IESO's strategy, these measures and targets reflect the desired outcome at the end of the five-year strategic planning period and align with our core strategies: Ensure System Reliability, Enable Competition, Advance Sector Leadership, and Drive Business Transformation.

5-year Strategic Objectives

Culture & Workforce Transformation

Measures	5-year Strategic Target
Employee engagement - Commitment to the execution of enterprise priorities	Annual employee pulse survey results sustain 4% increased performance.
Organizational Agility - Openness to Change	Annual employee survey results improve each year to a result of 71%.
Operational Efficiency - Percentage of Strategic Initiatives that are completed on time	90% of Strategic Initiatives are completed on time.

Stakeholder Trust

Measures	5-year Strategic Target
Stakeholder Satisfaction - Engagement process	A 5-year target of 84%.

Reliability, Affordability & Sustainability

Measures	5-year Strategic Target
Cost Effectiveness - Forecast accuracy	Have annual forecast error within +/- 2.5% (actual vs. forecast).
Cost Effectiveness - Resource balance: Energy Curtailments to total production	10% improvement to 'right size' the system and achieve resource adequacy and effectiveness of meeting energy and ancillary services needs for Ontario.
Cost Effectiveness - Resource balance: annual energy / operating reserve shortage frequency	10% improvement to 'right size' the system and achieve resource adequacy and effectiveness of meeting energy and ancillary services needs for Ontario.
Reliability - Number of forced outages to thermal resource fleet above 250 MW	Measure of probability that thermal facilities greater than 250 MW will be unavailable due to forced outages to thermal fleet below 9.2% annually.
Reliability - Number of extended forced outages to transmission facilities above 230 kV	Forced outages and extensions to outages over four hours in duration to significant transmission elements is below 334 annually which is the five-year historical high.
Market Efficiency - Market cost/revenue transparency index	The transparency index increases by 1% and represents the proportion of revenues received by suppliers (or payments from consumers) for electricity in the wholesale market to the total costs of supplying the electricity.

Appendix 2 – Enterprise Risk Management

At the IESO, risk management is an integrated discipline that supports informed decision-making throughout the organization. We recognize the pivotal role it plays in balancing strategic planning with business execution and compliance. This facilitates informed decision-making and a conscious evaluation of the upside opportunity and downside aspect of risk.

Our integrated approach to managing risk recognizes the need for clear, timely direction and support from our Board of Directors and senior, business unit and functional management.

Our starting point for managing risk is our strategic planning process, from which relevant external and internal threats and opportunities are derived and key risks are identified. Risks and opportunities are identified by observing, analyzing and anticipating trends along with macroeconomic, industry-specific, regional and local developments. Senior management assesses the risks to achieving our strategic objectives, and incorporates measures into corporate and operating plans to mitigate these risks if they exceed our target risk levels.

The IESO uses a risk management ranking methodology to assess the key risks specific to our achieving our strategic and business plan objectives. Our top strategic risks, aligned with the IESO's strategic objectives and their associated residual risk assessment, are as follows:

Stakeholder Trust Strategic Risks

Risk: Stakeholder Acceptance. Stakeholder acceptance of the IESO's resource adequacy mechanisms.

Risk Assessment: Critical

Risk Mitigation Approach

To competitively acquire capacity to meet short-, mid-, and long-term electricity system needs, we are in a multi-year process of implementing a Resource Adequacy Framework. Regular and proactive engagement with our many stakeholders to identify and address their concerns is being undertaken. We proactively communicate long-term value opportunities associated with the Resource Adequacy Framework and continue to enhance the transparency of our acquisition decisions.

Risk: Planning Credibility. Stakeholder support for the IESO’s determined acquisition quantities.

Risk Assessment: High

Risk Mitigation Approach

The IESO must balance a number of considerations as it acquires future resources. A perceived lack of credibility could undermine these efforts. New planning tools such as the Annual Acquisition Report enable the IESO to translate the statements of need in the Annual Planning Outlook into real acquisition targets. These, in turn, provide stakeholders with much-needed insights into opportunities for existing and emerging resources. Further efforts to finalize a new bulk planning process are underway as well as undertaking an update to our energy modelling and demand forecast tools, which will provide more transparency to stakeholders on how needs are set.

Affordability, Reliability, Sustainability Strategic Risks

Risk: Near-Term Reliability. Undersupply of system demand.

Risk Assessment: Medium

Risk Mitigation Approach

Ensuring near-term reliability is a core operational function of the IESO as the Provincial reliability coordinator. Adverse changes affecting demand or limiting available sources of capacity, energy or ancillary services as well as force majeure incidents can lead to undersupply scenarios. Real-time planning operations ensures that the wholesale market functions effectively and in a cost-efficient manner with adequate supply in the near term. Planning outlooks are being evolved to provide a more comprehensive view of system needs. We continuously update operating practices to mitigate potential shortfalls against near-term demand. We will continue to publish bulk and regional plans, update energy modelling and forecast tools and execute the annual capacity auction.

Risk: Long-Term Reliability. Oversupply of generation capacity.

Risk Assessment: Medium

Risk Mitigation Approach

To meet demand over the long term requires capital investment decisions by generators. We are working to ensure that planning tools and planning information regarding demand, resource mix and transmission capacity are current. To support accurate planning information, projects are underway to improve the energy modelling and demand forecast tools. Request for proposal work is underway to begin designing and mapping out a work-plan for the mid-term procurement to be launched later this year to replace capacity and energy (up to 750 MW) otherwise unavailable for existing off-contract resources.

Risk: Market Competitiveness. Competitive wholesale markets.

Risk Assessment: High

Risk Mitigation Approach

Increased market power directly leads to efficiency losses in the market. The Market Renewal Program will provide open, fair, non-discriminatory competitive opportunities for participants to help meet evolving system needs. The implementation of the Resource Adequacy framework supports the use of a variety of competitive mechanisms limit market power. Additionally, our Market Assessment and Compliance Division provides support and protection against anti-competitive practices through the application of various investigative and enforcement powers.

Risk: Cybersecurity. Information security and data governance.

Risk Assessment: High

Risk Mitigation Approach

Cybersecurity incidents may have an adverse impact on IESO's operations, employee safety, and reputation. Our overall approach is to promote the culture of cybersecurity awareness through policies, training, improving incident response capabilities and communications. The implementation of targeted solutions will help us to better identify and mitigate malicious threat actors from launching a successful attack. We will continue to enhance our threat intelligence capabilities and upgrade our network architecture, data management and security controls.

Risk: Cyber Security. Successful cyber attack on Ontario's grid reliability.

Risk Assessment: Medium

Risk Mitigation Approach

Cyber attacks targeting critical infrastructure on the IESO-administered grid are on the rise. A holistic view and understanding of market participants' cybersecurity postures and program objectives is required to develop an informed and coordinated approach to cyber resiliency for the Ontario electricity sector. We have implemented and continue to expand our Lighthouse program; a voluntary situational awareness and information-sharing initiative. We are developing an IESO Playbook for Cyber/Operations activity coordination to manage cyber events with reliability impact potential and improving overall emergency preparedness through Ontario's Electricity Emergency Plan.

Risk: Regulatory Change. A regulatory decision is made that impedes the ability of the IESO to enhance competition.

Risk Assessment: Medium

Risk Mitigation Approach

While the Ontario Energy Board (OEB) is typically aligned with IESO direction for achieving a more competitive electricity market, in making decisions, the OEB will give significant weight to past decisions which may impede market competition. The IESO will seek to engage the OEB in support of a coordination framework to enable ongoing education and strengthen the understanding of the foundational Market Renewal Program (MRP) or wider market or grid-operation changes.

Risk: Extreme Weather. An extreme weather event significantly damages generation or transmission assets.

Risk Assessment: Medium

Risk Mitigation Approach

Electricity supply can be negatively impacted by damage caused from extreme weather events namely, temperature, wind, fire, rain and flooding. We have a set of counter measures to mitigate impacts of extreme weather including proactive monitoring of weather conditions and advancing the resiliency framework with specific focus on extreme weather events while updating the Ontario Resource and Transmission Assessment Criteria (ORTAC). We have commenced multi-year projects to implement new platforms and tools to plan for a more resilient system that can withstand extreme weather conditions.

Risk: Information Technology System Failure. Critical information technology system failure impacting control room operations.

Risk Assessment: Medium

Risk Mitigation Approach

Failure of a critical information/operational technology system impacting the control room would have immediate effects on the ability to effectively manage the operation of the IESO's bulk electricity grid operations. The IESO's information technology division has centralized responsibility for management of all of the IESO's information and operational technology systems and is working to define a refreshed information technology strategy and initiatives plan. Additionally, the implementation of an information technology service management tool and process refresh will provide an enhanced view for the IESO to manage critical failures that have the potential to cause disruptions to control room operations.

Culture and Workforce Transformation Strategic Risks

Risk: Advancing Enterprise Priorities. Program and enterprise priority delivery.

Risk Assessment: High

Risk Mitigation Approach

Delivering business plan initiatives is central to meeting the IESO's strategic objectives. Mitigating this risk will involve prudent, risk-informed understanding of the trade-offs required to achieve desirable outcomes. Our executive leadership team supported by a refreshed strategy, up-to-date risk information and sound project portfolio management practices will help achieve the priorities defined in the business plan.

Appendix 3 – Capital Spending

Summary for 2022-2024 capital spending

Change Initiatives/Projects (\$ Millions)	2022 Plan	2023 Plan	2024 Plan
Centralized Alarm Management System Replacement	0.8	-	-
Replacement of the Settlement Systems	7.0	4.4	0.5
SCADA/Energy Management System (EMS) Upgrade	1.4	-	-
Data Excellence Program	0.7	1.0	-
Wide Area Visualization Environment (WAVE) - Phase 2	0.6	0.4	0.2
Enabling Resources Program	-	-	2.5
Addressing Market Surveillance Panel (MSP) Recommendations	0.5	0.9	0.5
Dynamic Limits in Real-Time	2.0	1.3	0.1
Network Performance Monitoring and Diagnostic (NPMD) Solution	2.8	-	-
Antivirus Replacement	2.3	0.1	-
Resource Adequacy	2.0	-	-
Market Analysis and Simulation Toolset (MAST)	2.0	2.2	-
Long-Term Demand Forecast Tool Replacement	0.8	1.0	-
Core Network Refresh	0.5	2.3	-
PMU Integration - Phase 3	0.3	1.0	2.0
Data Historian Expansion and Upgrade	1.0	-	-
Transmission Rights Auction (TRA) Platform Refresh	1.0	-	-
Enterprise Resource Planning (ERP)	-	2.0	4.2
Windows Infrastructure Refresh	-	2.0	-
Firewall Refresh	-	1.5	1.0
Advanced Malware Refresh	-	1.5	1.5
Meter Data Management System Replacement	-	1.0	5.5
Aruba Introspect Refresh	-	-	3.0
Capital (\$1 million and above)	25.7	22.6	21.0
Other Initiatives/Projects (Less than \$1 million)	4.3	6.2	7.2
Total Without Market Renewal Program	30.0	28.8	28.2
Market Renewal Program	41.2	33.6	1.9
Total Including Market Renewal Program	71.2	62.4	30.1

2022-2024 Capital Plan Details

Project Name	Project Description
Centralized Alarm Management System (CAMS) Replacement	The CAMS project will ensure IESO operators can continue to manage alarms and events that are important indicators of change by implementing a solution in place of software that will no longer be supported by the vendor.
Replacement of the Settlement Systems	In replacing settlement systems that have been in operation since market opening in 2002, this project will address market re-design needs associated with implementation of the Market Renewal Program and enable systems to meet current and future business needs. In 2020, the IESO settled approximately \$20B in the IESO-Administered Markets, Ministry of Energy supported programs, and Global Adjustment through the settlement systems.
Supervisory Control and Data Acquisition (SCADA) / Energy Management System (EMS) Upgrade	This project will upgrade the SCADA/EMS, the primary system operators use to monitor and manage the IESO-controlled grid. The resulting improvements will enable custom applications to run on the latest version of the vendor's software and improve the ability of energy storage resources to become integrated suppliers of regulation services.
Data Excellence Program	To help harness the full value of IESO data, this program establishes an evolved data management and analytics framework to support IESO business needs, and enhance third-party access to data and information. Data governance policies and tools (data catalogue), an updated data warehouse strategy and supporting applications for high-value use cases and a centre of excellence for advanced machine learning applications are in the scope of the program roadmap.
Wide Area Visualization Environment (WAVE) - Phase 2	This project will improve situational awareness and maintain ongoing compliance with NERC IRO standards by expanding modelling to neighbouring power systems (NYISO, PJM and Hydro-Quebec), improving the IESO's ability to monitor and respond to real-time conditions that may affect the IESO-controlled grid.
Enabling Resources Program	Through the program the IESO will prioritize and undertake the work required to increase the number of resources (e.g., hybrids, storage) that can participate in the IESO markets to deliver energy, capacity and ancillary services in order to increase options for reliability and competition to drive affordability.

Project Name	Project Description
Addressing Market Surveillance Panel (MSP) Recommendations	A portfolio of initiatives to develop, evolve and address inefficiencies in the electricity market in response to observations by the MSP and other stakeholders.
Dynamic Limits in Real-Time (DLRT)	In enabling the continuous assessment of real-time grid conditions, the DLRT Project will significantly improve the utilization of Ontario's transmission system, resulting in market and system operations efficiencies, and increased system security and resilience.
Network Performance Monitoring and Diagnostic (NPMD) Solution	The IESO's Core and Data Centre networks provide the backbone of the IESO's network infrastructure connecting all systems and locations in a robust and reliable high performance network. The NPMD solution will provide the capabilities to monitor network devices, analyze network packets for enhanced visibility, reducing troubleshooting effort and time to resolution and predictive failure analysis. This project builds on the foundation that was put in place with the acquisition and configuration of the Network Taps hardware that captures and centralizes network traffic.
Antivirus Replacement	The current antivirus solution which was commissioned in 2018 will no longer be supported beyond March 2022. The current vendor is moving to a cloud-based service offering only, which will not meet the current NERC Critical Infrastructure Protection (CIP) standards. This project will replace the current antivirus solution with a new on-premises solution that will maintain the IESO's security posture and continue to meet the NERC CIP requirements.
Resource Adequacy	As part of its commitment to transition to the long-term use of competitive mechanisms to meet Ontario's resource adequacy needs, the IESO is working with stakeholders to implement the Resource Adequacy framework to develop and execute mechanisms, such as the Capacity Auction and Requests for Proposals to procure capacity in three distinct time frames (short-, medium- and long-term).
Market Analysis and Simulation Toolset (MAST)	As the Market Renewal Program (MRP) is introducing wholesale market changes, current tools to monitor, assess and analyze the new market will be insufficient. MAST will deploy a common assessment tool environment that can be utilized in multiple business processes that will monitor, correct, improve or alter market design or operations over the day-ahead, pre-dispatch and real-time periods. The new tools are required after MRP go-live.

Project Name	Project Description
Long-Term Demand Forecast Tool Replacement	This project will replace the existing Long-Term Demand Forecast tools which have reached end of life and update the end-use load profiles used to develop the long-term forecasts. These tools are essential to support the planning processes that forecast system needs and provide infrastructure investment advice for the next 20 years.
Core Network Refresh	The IESO's Core and Data Centre networks provide the backbone of the IESO's network infrastructure, connecting all systems and locations in a robust and reliable high-performance network. The existing Core and Data Centre infrastructure needs to be refreshed as it is approaching the end of manufacturer support.
PMU Integration - Phase 3	Phasor Measurement Units (PMUs) can continuously deliver high-quality, time-synchronized real-time power system data at a high frequency (30-60 samples per second). Obtaining PMU data from across Ontario will improve real-time monitoring of the IESO-controlled grid; obtaining PMU data from other jurisdictions will improve wide-area view; and both will improve the IESO's overall situational awareness. PMUs also provide the IESO the ability to diagnose incidents and to more efficiently comply with several NERC reliability standards. Building on the earlier phases of this work, Phase 3 will integrate PMU data into the IESO's operations support tools and services, as well as live information into the Control Room.
Data Historian Expansion and Upgrade	The Data Historian is a real-time application that is currently used by the IESO for data collection, historicizing, finding, analyzing, delivering, and visualizing telemetry data from process control systems to assist in the operation of the IESO-Controlled Grid. The current version of the Data Historian is no longer supported by the vendor. This project will upgrade Historian and its desktop clients to the latest software release and provide sufficient capacity to support additional data points that are required to accommodate the additional data introduced by the WAVE Phase 2 project.
Transmission Rights Auction Platform Refresh	The IESO uses the Transmission Rights Auction (TRA) tool to administer the monthly Transmission Rights Market. The underlying technology (i.e., the platform) has reached end of life and is unable to support further enhancements to the TRA tool. This project will update the TRA platform, improve efficiency for support staff and introduce some high-value enhancements identified in the recent Transmission Rights Market Review

Project Name	Project Description
	performed by the IESO in response to a Market Surveillance Panel recommendation.
Enterprise Resource Planning (ERP)	The IESO's current financial applications and accounting ledgers are composed of several segregated systems (and tools) that interface together to provide comprehensive records for the IESO. The IESO must conduct a refresh of at least the accounting ledgers as these systems will become obsolete once the vendor's support ceases within the next few years. Through this project the IESO will replace the accounting ledgers and various other segregated systems (and tools) that interface together with the ledgers as part of more comprehensive and efficient system.
Windows Infrastructure Refresh	The current version of Microsoft Windows Server operating system is nearing end-of-life at which time Microsoft no longer provides support for the product, including critical security patches. This project will move us to the latest supported version of the Windows operating system and refresh the underlying hardware.
Firewall Refresh	The existing IESO firewalls which provide access control to critical parts of the network such as the NERC Electronic Security Perimeter (ESP) and DMZ are nearing the end of vendor support and need to be upgraded. This project seeks to build on the strengths of the existing security architecture by upgrading the key security controls at the firewall perimeter of IESO's data network and allow the IESO to take advantage of features which are used to reduce the risk of evolving cyber attacks and ensure mitigation of security concerns related to the industry.
Advanced Malware Refresh	The existing Advanced Malware appliances are nearing end of vendor support. This refresh project will upgrade the aging network threat prevention infrastructure and seeks to build on the strengths of the existing security architecture by upgrading the key security controls at the perimeter of the IESO's data network. Advanced malware protection complements the existing traditional security controls such as firewalls, intrusion prevention systems and endpoint protection by using advanced detection capabilities based on current threats.
Meter Data Management System Replacement	The current Meter Data Management solution that supports the IESO settlement processes is currently deployed on an application that does not have an upgrade path. As a result the IESO will need to invest in replacing the application when it reaches end of life.

Project Name	Project Description
Aruba Introspect Refresh	Aruba Introspect is a cybersecurity tool used to detect and monitor anomalies on user workstations and laptops. The tool is being discontinued and will no longer supported by the vendor. The solution will need to be replaced with a vendor-supported solution in order to ensure the effectiveness of the IESO's cybersecurity posture.

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