



Focused Demand Response and behind-the-meter Distributed Energy Resource engagement session for Provincial DSM Achievable Potential Study

FEBRUARY 27, 2026

Welcome and Introduction

- Today's session will be recorded and available for viewing online following the session
- All documents associated with this session can be found on the [2026 Provincial eDSM Achievable Potential Study](#) webpage

Participation

- For questions and comments click on the “raise hand” icon (hand symbol) at the top of the application window. This will indicate to the host you would like to speak
- To unmute audio, click on the microphone icon at the top of the application window
- Audio should be muted when not asking a question

Territory Acknowledgement

The IESO acknowledges the land we are delivering today's webinar from is the traditional territory of many nations including the Mississaugas of the Credit, the Anishnawbe, the Chippewa, the Haudenosaunee and the Wendat peoples and is now home to many diverse First Nations, Inuit and Métis peoples. We also acknowledge that Toronto is covered by Treaty 13 with the Mississaugas of the Credit First Nation.

As we have attendees from across Ontario, the IESO would also like to acknowledge all of the traditional territories across the province, which includes those of the Algonquin, Anishnawbe, Cree, Oji-Cree, Huron-Wendat, Haudenosaunee and Métis peoples.

Cadmus Project Team



Agenda

- Timeline and Stakeholder Engagement
- Demand Response
- Behind-the-Meter Solar & Storage
- Thermal Energy Storage
- Input Assumptions Workbooks
- Q&A
- Next Steps



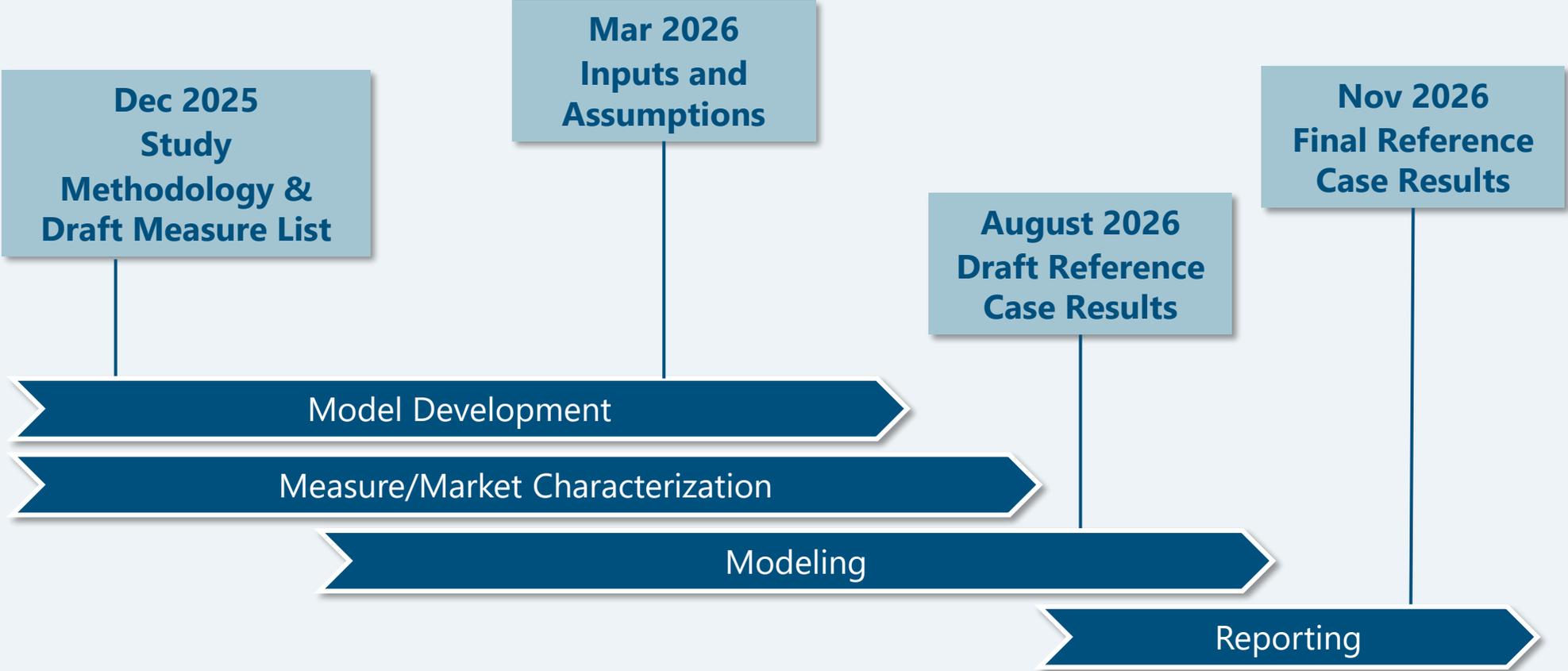
We will pause at each icon throughout the presentation for discussion



Timeline and Stakeholder Engagement

Planning Study Timeline and Key Milestones

Stakeholder Presentation Schedule





Demand Response



Inputs & Data Sources

Data Sources and Inputs

Data hierarchy

- IESO data (evaluations, program data, research, and other)
- Utility data (if available)
- Stakeholder input
- Cadmus evaluation and research
- Secondary sources

Data	Primary Source(s)	Secondary Source
Peak Definition (may vary by year)	<ul style="list-style-type: none"> • IESO Annual Demand Forecast (LEAF model output) 	<ul style="list-style-type: none"> • Benchmarking data from demand response programs in North America • Non-regional evaluations • Peak Load Management Alliance presentations and research
Demand Response Impact Characterization	<ul style="list-style-type: none"> • Base end-use load shapes from IESO forecasts • IESO/Ontario program data • Cadmus evaluations 	
Market Size	<ul style="list-style-type: none"> • IESO/Ontario program data • Cadmus' prior research 	
Demand Response Competition Factors	<ul style="list-style-type: none"> • Stakeholder input • Cadmus' prior research 	
Economic Inputs	<ul style="list-style-type: none"> • IESO data 	
Demand Response Program Costs / Incentives	<ul style="list-style-type: none"> • IESO/Ontario program data • Cadmus' prior research 	
Maximum Rate of Adoption	<ul style="list-style-type: none"> • IESO/Ontario program data • Stakeholder input • Cadmus' prior research 	
Annual Ramp Rate	<ul style="list-style-type: none"> • IESO/Ontario program data • Stakeholder input • Cadmus' prior research 	
Event Participation	<ul style="list-style-type: none"> • Program evaluations/program data • Stakeholder input • Cadmus' prior research 	



Methodology & Assumptions

Demand Response Methodology Overview

Purpose: Produce estimates of electric demand response technical, achievable, and economic potential

Sectors: Residential, commercial, industrial, and agriculture

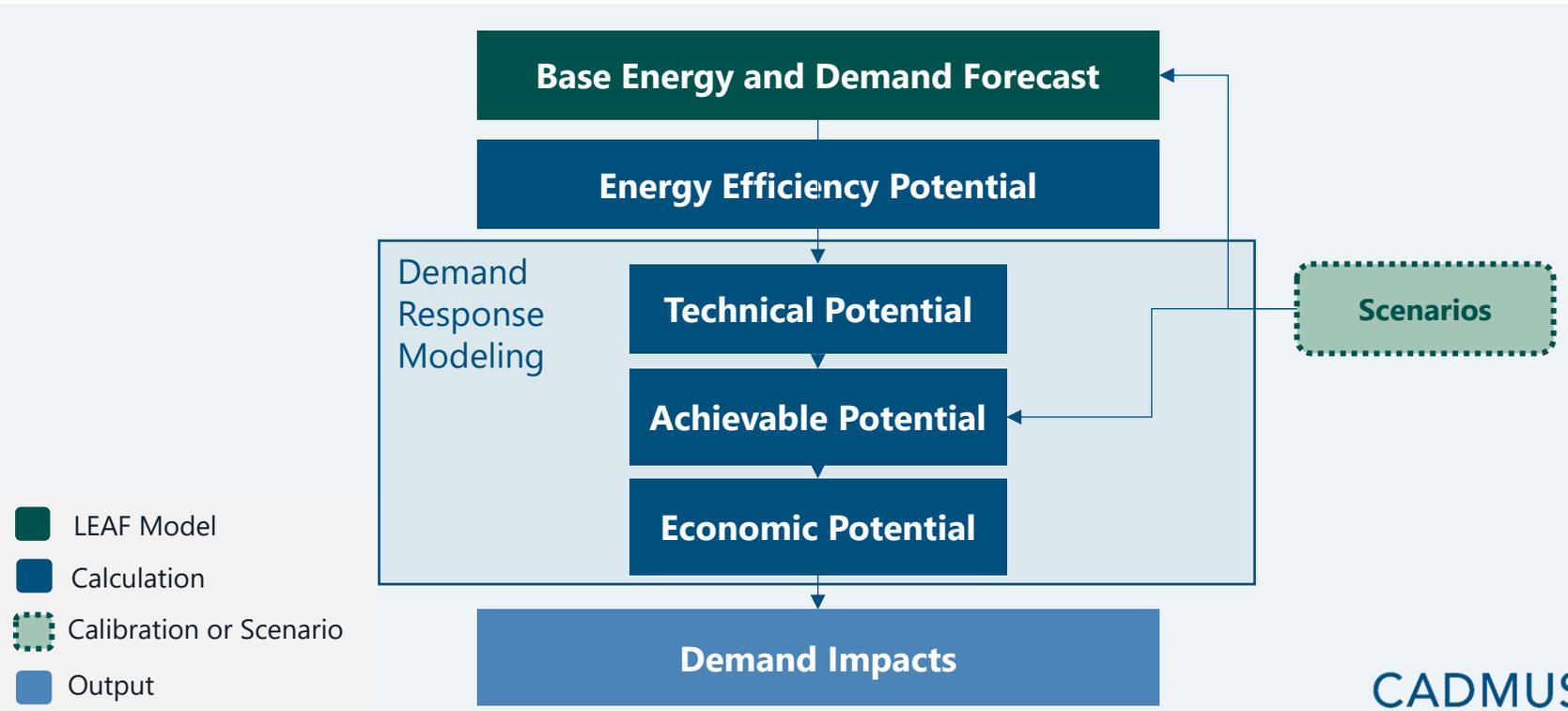
Period: 2026 base year with potential 2027 to 2050

Location: For each of the 10 IESO electric zones as well as for the overall system

Reporting: Stand-alone report from energy efficiency

General Demand Response Product Categories by Sector

Sector	Product Demand Response Category
Residential, Commercial	Electric Vehicle DLC
Residential	Water Heat DLC
Residential	Pool Pump DLC
Residential, Commercial	Heating and Cooling DLC
Commercial, Industrial	Demand Curtailment
Agriculture	Irrigation Demand Response



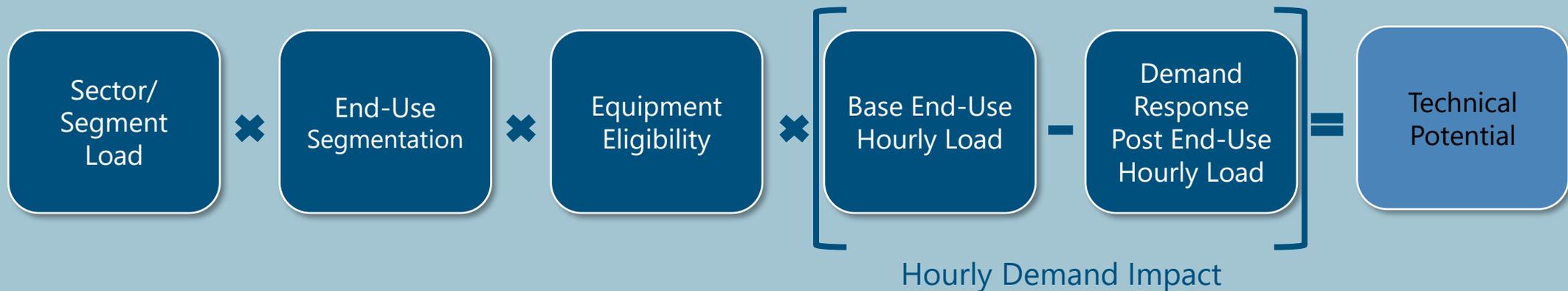
Demand Response Technical Potential

Technical potential assumes 100% participation and represents a theoretical limit for unconstrained potential

Methodology: Technical Potential

Each demand response opportunity will be characterized with the following steps:

- Reference load and peak coincidence
- Product design and impact
- Eligible market size
- Product competition



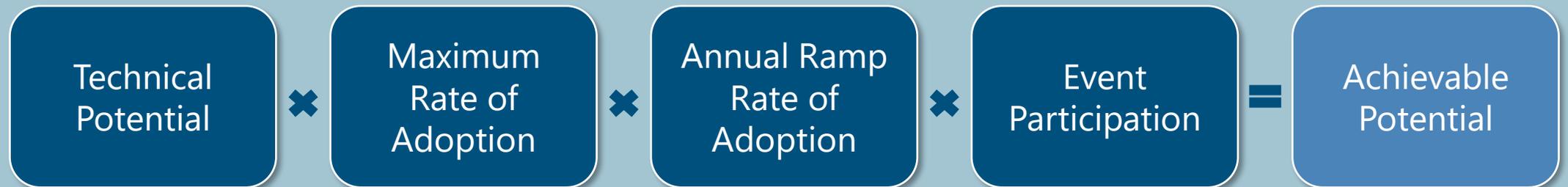
Demand Response Achievable Potential

Achievable potential is a subset of technical potential that accounts for real-world market barriers to the adoption of demand response opportunities

Methodology: Achievable Potential

The achievable potential will account for three assumptions:

- The maximum rate of adoption is the market maximum for a given price (incentive)
- The adoption ramp rate is the expected annual rate of incremental product enrollment to reach program maturity (also known as the maximum rate of adoption)
- Event participation represents the percentage of program customers who are expected to participate in an individual event



Adoption Approach

Assuming a customer is eligible and aware of a program offer, two main factors influence the decision to participate:

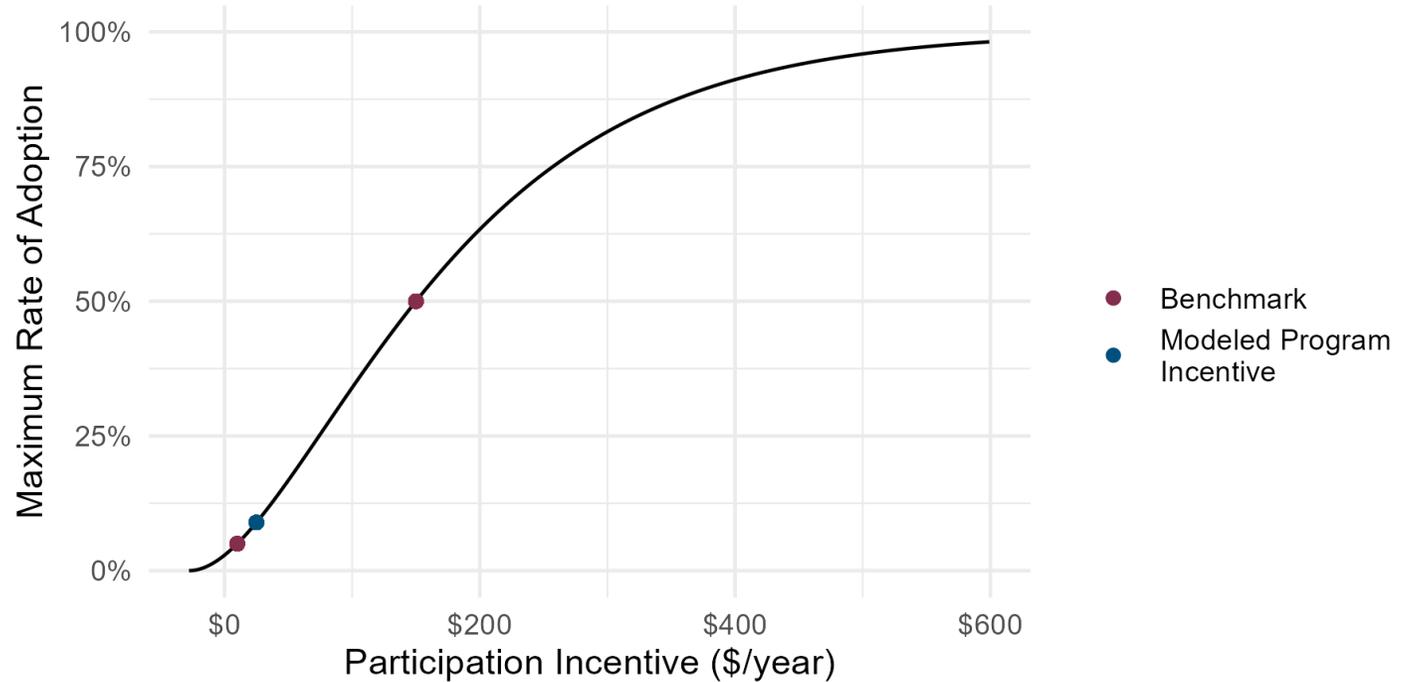
- Participation incentives
- Perceived cost of participation (including enrollment burden, discomfort, loss of privacy, loss of productivity, etc.)

The cost is subjective and varies across the population.

Using benchmarks, we can characterize the preference distribution and predict adoption at various incentive levels.



Methodology: Maximum Rate of Adoption



- For each program, using two benchmark points, we fit a curve using the CDF of a gamma distribution.
- This approach is flexible. We can take any incentive/adoption pair as benchmark points.
- This approach also allows us to calibrate to elasticity data. In this example the average elasticity is ~0.64 between benchmark points.

Point	Incentive Level	Max Adoption
Benchmark #1	\$10	5%
Benchmark #2	\$150	50%
Modeled Program Incentive	\$25	8.9%

Demand Response Economic Potential

Economic potential is a subset of achievable potential that represents potential from cost-effective measure applications

Methodology: Economic Potential

Four key factors affect the cost-effectiveness of demand response programs:

- The expected load reduction (in kW) provided by each participant
- The avoided capacity, transmission, and distribution costs
- Key financial assumptions such as discount rate, T&D line loss, and analysis period
- The fixed and variable costs of each program

The direct program costs of a demand response option can include setup costs, program operation and maintenance costs, equipment cost, marketing cost, and incentives



Feedback Requests

DR - Product Inputs and Assumptions

We have provided a workbook with draft assumptions for each DR product

- We are requesting feedback on the following inputs
 - Eligibility Criteria
 - Admin Cost
 - Marketing Cost
 - Participation Incentives
 - Product Impact
 - Adoption Benchmarks and Maximum Rate of Adoption
 - Attrition Rate
 - Maturity (start year and adoption ramp)

Sector	Demand Response Product	Season Impact
Residential, Commercial	Electric Vehicle DLC	Summer / Winter
Residential	Water Heat DLC	Summer / Winter
Residential	Pool Pump DLC	Summer
Residential, Commercial	Heating and Cooling DLC	Summer / Winter
Commercial, Industrial	Demand Curtailment	Summer / Winter
Agriculture	Irrigation Demand Response	Summer

Feedback Workbook Example – Cost/Participation

Product:	Heating and Cooling DLC
Sector:	Residential
Description/Eligibility	Thermostat DLC (BYOT) for centrally controlled electric heating and cooling systems

Cost/Participation Assumptions

Parameter Group	Parameter	Unit Definition	Value	Source/Note	Stakeholder Feedback
Administrative Costs	Setup Cost	\$	\$500,000	Sunk cost. Program currently operational.	
Administrative Costs	O&M Cost	\$/year	\$1,750,000	Prior evaluation data indicates total annual administrative cost of \$4.8 million in 2023 and \$5.6 million in 2024. Assuming a meaningful portion is marketing, subtract ~\$2,000,000. Remaining value is \$3.5 mil. Shared 50:50 with commercial program.	
Administrative Costs	Equipment Cost	\$/new participant	\$0	None for BYOT model	
Administrative Costs	Marketing Cost	\$/new participant	\$25	Industry benchmark	
Administrative Costs	Incentive (recurring)	\$/participant-year	\$20	Current program offer	
Administrative Costs	Incentive (one-time)	\$/new participant	\$75	Current program offer	
Participation	Attrition	% of existing participants per year	8%	Assumption	
Participation	Expected Annual Incentive Level for 5% Participation	\$/participant-year	\$10	% reflects share of the eligible population, assuming 100% program awareness.	
Participation	Expected Annual Incentive Level for 50% Participation	\$/participant-year	\$150		
Participation	Event Participation	% (dispatch success rate)	85%	Prior evaluation indicates opt-out rates between 15-30%. Opt-outs typically occur partway through the event, so we are assuming an overall success rate at the higher end of this spectrum.	
Participation	Ramp Period (years to maturity)	Years	5	Assumption	

Source/Note: https://www.ieso.ca/-/media/Files/IESO/Document-Library/conservation/EMV/2024/PY2024_2021-2024-CDM-Framework_Peak-Perks-Program_Evaluation-Report.pdf



The numbers included in this example are draft values subject to additional review and feedback.

Feedback Workbook Example – Impacts

Product:	Heating and Cooling DLC
Sector:	Residential
Description/Eligibility	Thermostat DLC (BYOT) for centrally controlled electric heating and cooling systems

Event Impacts

Event Hour	Impact (% of eligible end-use load)	Reference Benchmark Impact per participant (kW)	Reference Eligible End-use Load (kW)	Stakeholder Feedback
1	80%	0.8	1	
2	70%	0.7	1	
3	60%	0.6	1	



The numbers included in this example are draft values subject to additional review and feedback.



Behind-the-Meter Solar & Storage



Inputs & Data Sources

Data Sources and Inputs: BTM Solar and Storage

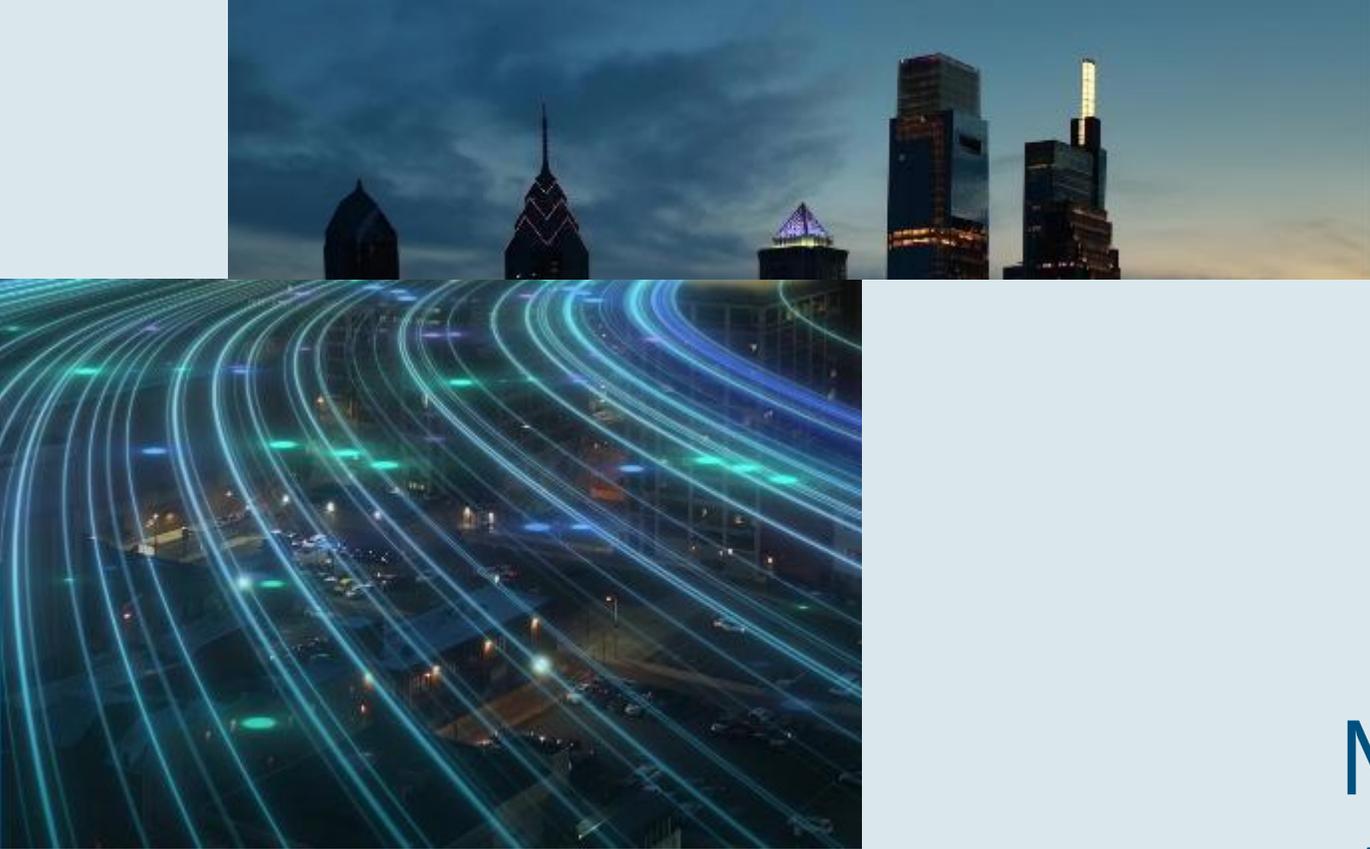
Data hierarchy

- IESO data (evaluations, program data, research, and other)
- Utility data (if available)
- Stakeholder input
- Cadmus evaluation and research
- Secondary sources

Solar Data	Primary Source	Secondary Source
Energy Savings	<ul style="list-style-type: none"> • Calculated 	<ul style="list-style-type: none"> • Benchmarking data from programs in North America • NLR • Lazard levelized cost analysis • IESO Pilot Data
Equipment and Labor Costs	<ul style="list-style-type: none"> • National Lab of the Rockies (NLR) 	
Measure Life	<ul style="list-style-type: none"> • DSM MAL (20 years) 	
Measure Applicability	<ul style="list-style-type: none"> • DSM MAL; NLR; Cadmus targeted research of rooftop applicability 	

Battery Data	Primary Source	Secondary Source
Energy Savings	<ul style="list-style-type: none"> • Calculated 	<ul style="list-style-type: none"> • Benchmarking data from programs in North America • NLR • Lazard levelized cost analysis • IESO pilot programs analysis • IESO Pilot Data
Equipment and Labor Costs	<ul style="list-style-type: none"> • National Lab of the Rockies (NLR) • IESO Pilot Data 	
Measure Life	<ul style="list-style-type: none"> • Calculated based on Charge cycles 	
Measure Applicability	<ul style="list-style-type: none"> • DSM MAL; Ontario Electrical Safety Code; Cadmus Research 	

Load Shift Data	Primary Source	Secondary Source
Energy Savings	<ul style="list-style-type: none"> • DSM MAL; IESO Pilot Data; Cadmus Analysis 	<ul style="list-style-type: none"> • Utility studies and forecasts • NLR • IESO Pilot programs
Equipment and Labor Costs	<ul style="list-style-type: none"> • National Lab of the Rockies (NLR) • IESO Pilot Data 	
Measure Life	<ul style="list-style-type: none"> • DSM MAL; EE IESO data; Cadmus Research 	
Measure Applicability	<ul style="list-style-type: none"> • DSM MAL; IESO Annual Demand Forecast (LEAF model output); Cadmus Research 	



Methodology & Assumptions

Behind-the-Meter Solar and Storage Methodology Overview

Purpose: Produce hourly estimates of technical, economic, and achievable potential for behind-the-meter solar and storage, rooftop solar with battery, and battery without rooftop solar

Sectors: Residential, commercial, and industrial

Period: 2026 base year with potential 2027 to 2050

Location: For each of the 10 IESO electrical zone as well as for the overall system

Primary Tasks	Solar	Battery Storage
Segment building stock	✓	✓
Apply technical resource characteristics to calculate total available roof area and system capacities	✓	
Develop battery size bins by sector		✓
Determine adjustable load criteria (peak hours, 4-hour discharge capacity, charge period)		✓
Calculate cost-effectiveness	✓	✓
Forecast market adoption based on Bass diffusion and project economics (same as LEAF model)	✓	✓
Estimate technical, economic, and achievable potential	✓	✓
Develop hourly results and hourly load shifts	✓	✓
Reporting (this will be part of energy efficiency report)	✓	✓

Technical

Key Output:

Total accounts possible under each measure

Key Assumptions:

Prototypical systems are assigned to customers based on customer electricity consumption

Technical

Segment Accounts

Consumption Buckets			Rate Structures	
Small	Medium	Large	TOU	ULO
			Tiered	Commercial

Assign System Sizes

Map system size ranges to each consumption bucket

Solar & Storage Optimization

Optimal	Sub-Optimal
Sub-Optimal 2	Non-Optimal

Example of System Design Bucket Segmentation

- System design buckets are used to capture the range of roof top characteristics
- We are utilizing prototypical system sizes connected to each of the consumption buckets
- In sloped roofs buckets indicate what share of the installed system is facing South, East, or North
- In Flat roofs all systems are assumed to face south
- Buckets indicate reductions in total system size based on obstructions and the orientation of the building

Optimal

Sloped Roofs: 100% South

Flat Roofs: Building South/North Orientation with little to no obstructions



Sub Optimal

Sloped Roofs: 50% South 25% East; 25% West

Flat Roofs: Building South/North Orientation with obstructions limiting system size



Sub Optimal 2

Sloped Roofs: 20 % South, 40% East, 40% West

Flat Roofs: Non-South/North Orientation with little to no obstructions limiting system size



Non-Optimal

Sloped Roofs: No South Facing space available

Flat Roofs: Non-South/North Orientation with obstructions limiting system size



Simple Example of Technical Segmentation

Sector	Segment	Customer Electric Energy Usage Size Bucket	Rate Class	System Design Bucket	Efficiency Description	Solar Target System Size (kW)	Battery Target System Size (kW)	2025 (accounts)
Residential	Single Family	Small	TOU	Optimal	Solar (net metered)	4	0	244
Residential	Single Family	Small	TOU	Optimal	Solar (Non-net metered)	4	0	244
Residential	Single Family	Small	TOU	Optimal	Battery (net metered)	0	5	244
Residential	Single Family	Small	TOU	Optimal	Battery (Non-net metered)	4	5	244
Residential	Single Family	Small	TOU	Optimal	Battery with Solar (net metered)	4	5	244
Residential	Single Family	Small	TOU	Optimal	Battery with Solar (Non-net metered)	4	5	244

Simplified Fields, more granularity exists

These measures compete against each other

Solar system sizes remain the same for all measures that compete against each other

Sample account numbers to show that the number of accounts stays the same



Economic and Achievable

Key Output:

Adoption Curves for technologies that pass the economic screen

Key Assumptions:

Measures compete against each other as outlined in previous slide

Economic and Achievable

Economic Screen

- Estimate potential for cost-effective measure adoption
- Use IESO existing economic screen

Adoption Screen

- Counterfactual: Assume no system installed
- Model adoption based on payback period, sentiment, technology maturity, and key barriers
- Calculate benefits from offset load and net metering

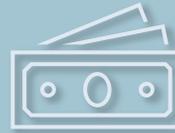
Compare System Types

Modeling Adoption

Net-meter vs Non-net-meter



Customer choice modeling valuing benefits (pay back) between net-meter vs non-net-meter applications



Non-net-meter customers receive incentives (net-metered do not)



Modeling competition allows for assessing adoption impacts as incentives change





Feedback Requests

We assume:

- Battery systems being used for peak shaving.
- Battery systems offset specific end use loads like HVAC and lighting loads in commercial buildings and communal HVAC and lighting, rather than individual unit consumption.

BTM - Feedback Requests

What end uses are battery systems typically offsetting in industrial and commercial applications?

We assume 4-hour discharge periods for all sector/segments.
Should we be modelling different battery discharge periods for different sector/segments?

Solar Input Assumptions

Product:	Solar
Sector:	Residential, Commercial, Industrial
Description/Eligibility	Solar System

Cost/Participation Assumptions

Parameter Group	Parameter	Unit Definition	Value	Source/Note	Stakeholder Feedback
Residential and Small Business (<50kW peak demand) Measure Costs	CAPEX (Labor and Overnight Capital Costs)	\$/kW	\$2,484.62	Based IESO APO Resource Costs and Trends March 2024. Used 2024 values and projected to 2026 (shown here) based on APO forecasted data. Values are scaled linearly between base date 2024 and end forecast date 2050. APO Resource Costs and Trends March 2024: https://www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/Mar2024/Resource-Costs-and-Trends.pdf	
Residential and Small Business (<50kW peak demand) Measure Costs	Customer O&M	\$/kW	\$26.08		
Residential and Small Business (<50kW peak demand) Incentives	Non-net Metered Solar	\$/kW	\$1,000		Up to \$5,000. \$1,000/kW, up to 50% of total costs (current IESO program incentives). Incentive recipients cannot participate in net metering.
Commercial & Industrial Measure Costs	CAPEX (Labor and Overnight Capital Costs)	\$/kW	\$1,714.71	Based IESO APO Resource Costs and Trends March 2024 and adjusted to represent nonresidential system cost. Used 2024 APO values and projected to 2026 (shown here) then scaled inline with NLR2024 Annual Technology Baseline to show the difference between Residential and commercial PV System Capex.	
Commercial & Industrial Measure Costs	Customer O&M	\$/kW per Year	\$10.27		
Commercial & Industrial Incentives	Incentive	\$/kWac	\$860	IESO and SaveOnEnergy Program. Up to \$860,000 or 50% of total Project Cost, minimum system size of 10kWac. Non-Net Metered	
Commercial & Industrial Incentives	Incentive	Share of CAPEX	30%	Federal Investment Tax Credit (ITC) Stackable	
All	Effective Useful Life	Years	25	IESO Solar PV Workbook. Based on PV module manufacturers offering 25-year power production warranties.	
All	Degradation Rate	% per year	0.50%	IESO Solar PV Workbook. National Laboratory of the Rockies (NLR)	
All	DC to AC Ratio	DC_to_AC	1.2	IESO Solar PV Workbook. Industry standard	
All	Inverter Efficiency	%	96%	IESO Solar PV Workbook. Supported by a wide range of inverter technologies available in industry research (range 95% to 98%)	
All	Total System Losses	%	18.37%	IESO Solar PV Workbook. Derived from an analysis of multiple components (i.e. soiling, shading, etc)	
All	Hourly solar generation curves	Profiles	Varies by zone	Use NLR's PVWatts Module in SAM consistent with IESO Solar PV Workbook.	

Solar Input Assumptions - Measure Benefit

Product:	Solar
Sector:	Residential, Commercial, Industrial
Description/Eligibility	Solar System

Measure Benefit Assumptions

Measure	Rate	Net Metered vs Non-Net Metered	IESO Incentivized	Logic	Stakeholder Feedback
Solar	All	Non-Net Metered	Yes	Solar generation only offsets load. Generation above hourly consumption (when current hour consumption - current hour generation is negative) generates no benefit	
Solar	All	Net Metered	No	Solar generation only offsets load. Net meter credits are generated when generation exceeds consumption. Net meter credits are equivalent to current hour rate price	
Battery with Solar	All	Non-Net Metered	Yes	Solar generation offsets load. Generation above hourly consumption charges the linked battery system when battery can charge	
Battery with Solar	All	Net Metered	No	Solar generation only offsets load. Net meter credits are generated when generation exceeds consumption. Net meter credits are equivalent to current hour rate price	

Battery Input Assumptions

Product:	Battery
Sector:	Residential, Commercial, Industrial
Description/Eligibility	Battery System

Cost/Participation Assumptions

Parameter Group	Parameter	Unit Definition	Value	Source/Note	Stakeholder Feedback
Residential and Small Business (<50kW peak demand) Measure Costs	CAPEX (Labor and Overnight Capital Costs)	\$/kWh	\$2,955.46	Based IESO APO Resource Costs and Trends March 2024. Used 2024 values and projected to 2026 (shown here) based on APO forecasted data. Values are scaled linearly between base date 2024 and end forecast date 2050. APO Resource Costs and Trends March 2024: https://www.ieso.ca/-/media/Files/IESO/Document-Library/planning-forecasts/apo/Mar2024/Resource-Costs-and-Trends.pdf	
Residential and Small Business (<50kW peak demand) Measure Costs	Customer O&M	\$/kWh	\$73.62	Based IESO APO Resource Costs and Trends March 2024. Used 2024 values and projected to 2026 (shown here) based on APO forecasted data. Values are scaled linearly between base date 2024 and end forecast date 2050.	
Residential and Small Business (<50kW peak demand) Incentives	Non-net Metered Solar	\$/kWh	\$300	Up to \$5,000. \$300/kWh, up to 50% of total costs (current IESO program incentives). Incentive recipients cannot participate in net metering.	
Commercial & Industrial Measure Costs	CAPEX (Labor and Overnight Capital Costs)	\$/kWh	\$1,370	Based IESO APO Resource Costs and Trends March 2024 and adjusted to represent nonresidential system cost. Used 2024 APO values and projected to 2026 (shown here) then scaled inline with NLR2024 Annual Technology Baseline to show the difference between Residential and commercial PV System Capex.	
Commercial & Industrial Measure Costs	Customer O&M	\$/kWh per year	\$44.50		
Commercial & Industrial Incentives	Incentive	\$/kWh	\$860	IESO and SaveOnEnergy Program. Up to \$860,000 or 50% of total Project Cost, minimum system size of 10kWac. Non-Net Metered. Systems must be designed to offset load, not export to the grid.	
Commercial & Industrial Incentives	Incentive	Share of CAPEX	30%	Federal Investment Tax Credit (ITC) Stackable	
All	Effective Useful Life	Years	15	NLR Annual Technology Baseline default assumption	
All	Inverter ratio to capacity	Designed number of storage hours	4	The prototypical systems assume a discharge period of 4 hours. Inverters are sized to total kWh storage capacity to enable 4 hours of discharge at peak capacity	
All	Inverter Efficiency	Inverter_Eff	96%	Inverter assumption within the MSS	
All	Roundtrip efficiency	Total_System_Loss	85%	NLR Annual Technology Baseline default assumption	
All	Hourly battery charge and discharge curves	Profiles	Varies by application	Using the IESO rate definitions (TOU, ULO, Tiered) and application loads to determine charge and discharge cycles.	

Battery Input Assumptions – Measure Benefit

Product:	Battery
Sector:	Residential, Commercial, Industrial
Description/Eligibility	Battery System

Measure Benefit Assumptions

Measure	Rate	Net Metered vs Non-Net Metered	IESO Incentivized	Logic	Stakeholder Feedback
Battery	All	Non-Net Metered	Yes	Battery charges during off peak hours, and discharges during on-peak hours. Depth of Discharge 15% Depth of Charge 80%	
Battery	All	Net Metered	No	Battery charges during off peak hours, and discharges during on-peak hours. Depth of Discharge 15% Depth of Charge 80%	
Battery with Solar	All	Non-Net Metered	Yes	Generation above hourly consumption charges the linked battery system when battery can charge. Battery supplements charge from solar system with grid electricity during off peak hours. Battery can discharge during On and Mid peak periods	
Battery with Solar	All	Net Metered	No	Battery charges during off peak hours, and discharges during on- and mid-peak hours. Depth of Discharge 15% Depth of Charge 80%	
Battery with Solar	Tiered	Non-Net Metered	Yes	Generation above hourly consumption charges the linked battery system when battery can charge. Battery does not supplement charge from solar system with grid electricity during off peak hours. Battery can discharge during any period.	



Thermal Energy Storage

Thermal Energy Storage (TES)

Primary Tasks	Thermal Storage
Segment building stock	✓
Apply non-adjustable load shifts to applicable existing building end-uses (consistent with LEAF model)	✓
Calculate cost-effectiveness	✓
Forecast market adoption based on Bass diffusion and project economics (same as LEAF model)	✓
Estimate technical, economic, and achievable potential	✓
Develop hourly results and hourly load shifts	✓
Reporting (this will be part of energy efficiency report)	✓

Sector	TES Type/Application	Load Shift Impact
Residential	Thermal Water Storage Heat Pump	Summer / Winter
Commercial	Thermal PCM Ice-water Storage HVAC Cooling	Summer
Commercial	Thermal PCM Saltwater-Ice Storage Refrigeration	Summer
Industrial	Thermal PCM Ice-water Storage HVAC Cooling	Summer
Industrial	Thermal Sensible Storage Process Heat	Summer / Winter

PCM = Phase Change Material

TES Considerations

- TES systems still emerging in the market. Study approach plans to use slow rates of adoption.
- Most common and typically least cost are sensible heat (water, solid, salt, etc.) followed by latent heat or phase change materials (ice, salt hydrates, aqueous solutions, etc.)
- Chemical reaction (thermochemical) show promise in high temperature applications but too expensive (more R&D needed)
 - Study does not assess this type of TES
- Following input assumptions may evolve as more information becomes available



Feedback requests on input assumptions

*Three examples shown (see workbook for all measure details)

Residential TES HVAC Input Assumptions

Product:	Thermal Water Storage
Sector:	Residential
Description/Eligibility	Air-to-Water Heat Pump (Heating and Cooling) System

Application Assumptions

Application	End Use	Load Shift	Participation Assumption
Residential sector and segments	Air-to-water heat pump	Summer and winter season: remove load from peak periods. Shift space heating and cooling load to off-peak hours. Shifted load is redistributed to off peak hours of that day.	Program participation (a participant can opt at the time of equipment replacement) that has the eligible equipment. Considered as emerging technology adoption rate (slow). Adoption dependent on incentive costs to overcome high upfront costs. Benchmark utilities frequently pair rebates with participation in time of use programs.

Parameter Group	Parameter	Unit Definition	Value	Source/Note	Stakeholder Feedback
End Use Savings	Summer Demand Savings (Peak Load Shift)	% kW reduction	49%	Metered pilot project. Load shift 28% to 66% summer end-use load over 2- to 4- hour period. Based on Technical Evaluation of Air-to-Water Heat Pumps with Thermal Storage, CALNEXT report ET22SWE0050. Prepared by VEIC April 2025. Benchmarked saving of 25% total demand building load (~50% end-use load) "Role of Thermal Energy Storage in Reducing Peak Load from Building Electrification" Navius 2025 report for Natural Resources Canada.	
End Use Savings	Winter Demand Savings (Peak Load Shift)	% kW reduction	55%	Load shift 17% to 82% winter load over 2- to 4- hour period. Based on Technical Evaluation of Air-to-Water Heat Pumps with Thermal Storage, CALNEXT report ET22SWE0050. Prepared by VEIC April 2025.	
End Use Savings	Energy Savings	% kWh savings	0%	Assume no energy savings. Based on Technical Evaluation of Air-to-Water Heat Pumps with Thermal Storage, CALNEXT report ET22SWE0050. Prepared by VEIC April 2025.	
Measure Life	Measure Life	EUL	15	Based on Technical Evaluation of Air-to-Water Heat Pumps with Thermal Storage, CALNEXT report ET22SWE0050. Prepared by VEIC April 2025.	
Customer Incremental Cost	Equipment Cost (Full replacement cost)	\$/kW	\$2,775	Assume 5 kW system. Based on Technical Evaluation of Air-to-Water Heat Pumps with Thermal Storage, CALNEXT report ET22SWE0050. Prepared by VEIC April 2025. Assumes equipment and labor (80% equipment/20% labor).	
Customer Incremental Cost	Labor Cost (Full replacement cost)	\$/kW	\$694	Assume 5 kW system. Based on Technical Evaluation of Air-to-Water Heat Pumps with Thermal Storage, CALNEXT report ET22SWE0050. Prepared by VEIC April 2025. Assumes equipment and labor (80% equipment/20% labor).	
Customer Incentive	Incentive	\$/kW	\$3,468	Assume that significantly more incentive is needed to move the market, assume 100% of incremental cost consistent with the IESO energy efficiency program APO modeling.	
Program Administration Cost	Program Admin	% of incentive	20%	Estimated	

Commercial TES HVAC Input Assumptions

Product:	Thermal Storage (Ice-water phase change storage)
Sector:	Commercial
Description/Eligibility	Cooling

Application Assumptions

Application	End Use	Load Shift	Participation Assumption
Commercial sector and segments	Cooling	Summer seasons: Load-shifting measure; transferring cooling system energy use from afternoon peak hours to night-time operation using cooler outside air and store within ice/water system. Provides both energy and demand savings.	Program participation typically installed during equipment replace cycles. Considered as commercially available systems with a low adoption rate. Adoption dependent on incentive costs to overcome high upfront costs. Benchmark utilities frequently pair rebates with participation in time of use programs.

Parameter Group	Parameter	Unit Definition	Value	Source/Note	Stakeholder Feedback
End Use Savings	Demand Savings (Peak Load Shift)	% kW reduction	75%	Inferred from NLR building simulations and research. NLR, Space Conditioning Tech Team Webinar: Thermal Energy Storage, the lowest cost storage.	
End Use Savings	Energy Savings	% kWh savings	20%	Based on NLR building simulations and research. NLR, Space Conditioning Tech Team Webinar: Thermal Energy Storage, the lowest cost storage.	
Measure Life	Measure Life	EUL	20	Assume consistent EUL as baseline equipment (Chiller IESO MSS)	
Customer Incremental Cost	Equipment Cost (Incremental cost)	\$/kW	\$1,184	Inferred from NLR building simulations and research. NLR, Space Conditioning Tech Team Webinar: Thermal Energy Storage, the lowest cost storage. Cost per \$1660/kW or \$275/kWh (full system).	
Customer Incremental Cost	Labor Cost (Incremental cost)	\$/kW	\$296	Assumes equipment and labor (80% equipment/20% labor). Base equipment (Chillers > 300 tons (centrifugal) ~\$180/kW (Northeast Energy Efficiency Partnerships. Incremental Cost Study Phase Two Final Report)	
Customer Incentive	Incentive	\$/kW	\$1,480	Assume 100% of incremental cost consistent with the IESO energy efficiency program APO modeling. Other programs provide 10% of project total costs.	
Program Administration Cost	Program Admin	% of incentive	20%	Estimated	

Industrial TES Process Heat Input Assumptions

Product:	Thermal Sensible Storage (solid or liquid material)
Sector:	Industrial
Description/Eligibility	Sensible Heat Storage System for Industrial Electric Boilers and Other Process Heating Devices

Application Assumptions

Application	End Use	Load Shift	Participation Assumption
Commercial sector and segments	Cooling	Summer seasons: Load-shifting measure; transferring cooling system energy use from afternoon peak hours to night-time operation using cooler outside air and store within ice/water system. Provides both energy and demand savings.	Program participation typically installed during equipment replace cycles. Considered as commercially available systems with a low adoption rate. Adoption dependent on incentive costs to overcome high upfront costs. Benchmark utilities frequently pair rebates with participation in time of use programs.

Parameter Group	Parameter	Unit Definition	Value	Source/Note	Stakeholder Feedback
End Use Savings	Demand Savings (Peak Load Shift)	% kW reduction	40%	Industrial scale. 2022 Industrial Thermal Energy Storage report by European Energy Research Alliance (Energy Efficiency in Industrial Processes)	
End Use Savings	Energy Savings	% kWh savings	-50%	Requires energy for the storage process. Varies sources range from 60% to 40% in round-trip efficiency. Assume an efficiency value in the middle of this range.	
Measure Life	Measure Life	EUL	25	Assumed consistent with molten salt thermal energy storage system, deployed at scale.	
Customer Incremental Cost	Equipment Cost (Full replacement cost)	\$/kWh (delivered)	\$13	Average sensible TES costs - range from less than \$1.6 to \$35 per kWh delivered. 2022 Industrial Thermal Energy Storage report by European Energy Research Alliance (Energy Efficiency in Industrial Processes). Assumes equipment and labor (80% equipment/20% labor). Benchmarked with Development of Energy Storage: Cost models 2021 (Argonne National Laboratory)	
Customer Incremental Cost	Labor Cost (Full replacement cost)	\$/kWh (delivered)	\$3		
Customer Incentive	Incentive	\$/kWh (delivered)	\$16	Assume 100% of incremental cost consistent with the IESO energy efficiency program APO modeling.	
Program Administration Cost	Program Admin	% of incentive	20%	Estimated	

Q & A

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Next steps

- Interested stakeholders are invited to review the draft Demand Response, Solar Storage and Thermal Storage Input Assumption Excel files and provide feedback in the "Stakeholder Feedback" column
- Stakeholders may also provide broader feedback on relevant Demand Response and behind-the-meter DER trends/developments (e.g. cost trends, impact of recent regulatory changes) using the feedback form template
- The IESO requests written stakeholder feedback by **March 13th, 2026** to ensure consideration
- If you have any questions on the information shared today, please contact engagement@ieso.ca



Thank You

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