



CONSERVATION FRAMEWORK MID-TERM REVIEW

DEFINITION OF CDM

APRIL 27, 2017

NAVIGANT

DISCLAIMER

This report was prepared by Navigant Consulting Ltd. (Navigant) for the Independent Electricity System Operator. The work presented in this report represents Navigant's professional judgment based on the information available at the time this report was prepared. Navigant is not responsible for the reader's use of, or reliance upon, the report, nor any decisions based on the report. NAVIGANT MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESSED OR IMPLIED. Readers of the report are advised that they assume all liabilities incurred by them, or third parties, as a result of their reliance on the report, or the data, information, findings and opinions contained in the report.

TABLE OF CONTENTS

- 1. Executive Summary.....4
 - I. Policy Context
 - II. Introduction and Methodology
 - III. Current State Summary
- 2. Current State of Affairs.....23
 - I. Segmentation and Definitions
 - II. CDM in Ontario
 - III. Jurisdictional Scan
- 3. Summary Observations and Next Steps.....60
- Appendix A: Glossary.....64



SECTION 1: EXECUTIVE SUMMARY

- I. Policy Context
- II. Introduction and Methodology
- III. Current State Summary

SECTION 1: EXECUTIVE SUMMARY

I. POLICY CONTEXT

TOPIC 2: DEFINITION OF CDM

Policy Context – 2013 Long-Term Energy Plan (LTEP) & Conservation First Framework/Industrial Accelerator Program Ministerial Directions

LTEP refers simply to “Conservation” as a broad term. The current landscape of demand response (DR) initiatives was laid out in the 2013 LTEP which charged the former-IESO with evolving current programs and integrating DR into the grid:

- “Ontario is aiming to use DR to meet 10% of peak demand by 2025, equivalent to approximately 2,400 MW under forecast conditions. To encourage further development of DR in Ontario, the IESO will evolve existing programs and introduce new initiatives. [...] The IESO, as the system operator, is in the best position to enable these large consumers to provide DR to the grid in a manner that puts DR on par with comparable generation options.”

2014 Ministerial Directions to OPA (now IESO) for Conservation First Framework and Industrial Accelerator Program provide the following definition of CDM:

- *Conservation First Framework*
 - “The OPA shall consider CDM to be inclusive of activities aimed at reducing electricity consumption and reducing the draw from the electricity grid, such as geothermal heating and cooling, solar heating and small scale (i.e. <10MW) behind the meter customer generation. However, CDM should be considered to exclude those activities and programs related to a Distributor’s investment in new infrastructure or replacement of existing infrastructure, any measures a Distributor uses to maximize the efficiency of its new or existing infrastructure, activities promoted through a different program or initiative undertaken by the Government of Ontario or the OPA, such as the OPA Feed-in Tariff (FIT) Program and micro-FIT Program and activities related to the price of electricity or general economic activity.”
- *Industrial Accelerator Program*
 - “The OPA shall consider CDM to be inclusive of activities aimed at reducing electricity consumption and reducing draw from the electricity grid, including behind the meter customer generation.”

Dec. 2016 Ministerial Direction to IESO

- “The final FIT application period will be held in 2016. The IESO shall cease accepting applications under the FIT program by December 31, 2016 and any unallocated procurement target at the end of the procurement process will remain unallocated.”

SECTION 1: EXECUTIVE SUMMARY
II. INTRODUCTION AND METHODOLOGY

MID-TERM REVIEW

Navigant was engaged by the IESO to complete the mid-term review for the Conservation First Framework and Industrial Accelerator Program. Issues were identified by the IESO and grouped into eight major topics that will guide the Framework Review through four key activities outlined below. This report is the topic-based report communicating the current state of **Definition of CDM**.



FOCUS AREAS AND KEY QUESTIONS

This report will analyze available information and begin to explore the issues and opportunities of the key questions and focus areas listed below pertaining to the **Definition of CDM** topic.

Key Questions

- How has the definition of CDM changed over time in Ontario?
- Is the current definition appropriate to achieve the policy objectives of the framework and to align with Ontario’s broader GHG reduction goals?
- How does the definition of CDM in Ontario align with the definition of CDM/DSM in other jurisdictions?

Focus Areas

- I. Conservation First Framework:
 - Defining CDM
- II. Industrial Accelerator Program:
 - Defining CDM

Note: the definition of CDM topic crosses other topics. Some examples include:

Topic 1: Customer and market engagement and satisfaction	How does the inclusion or exclusion of certain technologies impact customer engagement with the framework?
Topic 5: Planning integration	How does the definition of CDM interact with system planning? How are planning and CDM goals impacted by technologies that are included or excluded?
Topic 7: Climate change	Do the technologies included support climate change goals?
Topic 8: Budgets, targets, cost effectiveness	What is the impact of adding or removing technologies on the ability to cost-effectively reach targets?

SECTION 1: EXECUTIVE SUMMARY

II. INTRODUCTION AND METHODOLOGY

REPORT ORGANIZATION

This report will be organized by the sections outlined in the table below. The sections are designed to address one or more of the focus areas identified.

Section	Description	Focus Area
Segmentation and Definitions	Review the segmentation of the technologies investigated and define each technology and the benefits it typically brings to customers and system operators.	<ul style="list-style-type: none"> Defining CDM
CDM in Ontario	Description of the technologies currently included in the definition of CDM and those that are excluded. Review of the evolution of the definition of CDM in Ontario and policies that impact the definition and adoption of CDM.	<ul style="list-style-type: none"> Defining CDM
Jurisdictional Scan	Description and justification of the jurisdictions considered in the review. High-level review of the selected jurisdictions from a broader policy perspective. Matrix of technologies and methods by jurisdiction followed by observations and key findings.	<ul style="list-style-type: none"> Defining CDM

SECTION 1: EXECUTIVE SUMMARY

III. CURRENT STATE SUMMARY

TECHNOLOGIES AND APPROACHES ASSESSED

- Demand side management (DSM) is an umbrella term that typically refers to energy efficiency and demand response
- This review will investigate all major DSM activities and also includes distributed energy resources (DER) given the increasing importance of distributed energy resources and the fact that much of this activity happens behind the meter
- For the purpose of this report, each technology and approach assessed was mapped to a category for ease of review

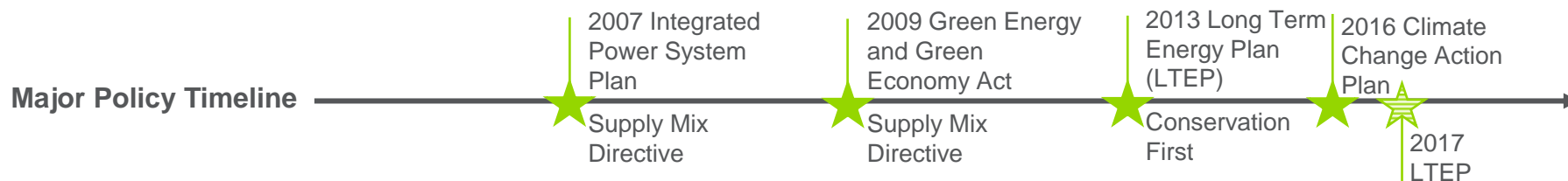
Category	Category Description	Technology/Approach	
Energy Efficiency	Technology or approaches that result in less energy to perform the same function.	<ul style="list-style-type: none"> • Resource acquisition • Market transformation • Behavioural • Voltage reduction 	<ul style="list-style-type: none"> • Performance-based funding • Pilots/Research & Development
Demand Response	Technology or approaches that enable energy shifting or reduction during certain times.	<ul style="list-style-type: none"> • Direct load control • Time-of-use pricing 	<ul style="list-style-type: none"> • Demand Response capacity • Critical peak pricing
Distributed Energy Resources	Behind-the-meter or distribution-connected generation or storage resources that supply all or part of a customer's electricity use.	<ul style="list-style-type: none"> • Solar • Solar-storage • Storage • Combined Heat & Power 	<ul style="list-style-type: none"> • Electric Vehicles • Microgrids • R&D, pilots

SECTION 1: EXECUTIVE SUMMARY

III. CURRENT STATE SUMMARY

EVOLUTION OF THE DEFINITION OF CDM IN ONTARIO – LONG TERM VIEW

- The definition of CDM is set by guiding policies which specify overarching, long-term CDM goals/targets at the provincial level, these goals/targets have historically included a broad range of CDM activities



	2005-2007	2008-2010	2011-2014	2015-2020
Guiding policy	<ul style="list-style-type: none"> 15 specific directives 	<ul style="list-style-type: none"> Integrated Power System Plan Supply Mix Directive 	<ul style="list-style-type: none"> Green Energy and Green Economy Act Supply Mix Directive 	<ul style="list-style-type: none"> Long Term Energy Plan Conservation First
Long term goals/targets	N/A	3,600 MW by 2025	7,100 MW and 28 TWh by 2030	30 TWh by 2032

Definition of CDM	2005-2007	2008-2010	2011-2014	2015-2020				
Energy Efficiency								
Conservation Behaviour								
Fuel Switching								
Self/Co Generation					< 10 MW	< 10 MW	< 10 MW Excl. FIT and mFIT	< 10 MW
Demand Management								
Natural Conservation								

SECTION 1: EXECUTIVE SUMMARY

III. CURRENT STATE SUMMARY

EVOLUTION OF THE DEFINITION OF CDM IN ONTARIO – SHORT TERM VIEW (DX)

- The definition of CDM for the purposes of short-term targets is set by specific directives, these targets have historically included a subset of CDM activities that are included in long term goals/targets
- The table below outlines the targets for distribution connected (Dx) customers programs over time and the activities both included in the definition of CDM and supported through programs

	2005-2007	2008-2010	2011-2014	2015-2020
Primary target responsibility	Former OPA (IESO)	Former OPA (IESO)	LDCs	LDCs
Short term goals/targets	1,350 MW	Additional 1,350 MW	1,330 MW and 6,000 GWh between 2011 and 2014	7 TWh by 2020

Definition of CDM		2005-2007	2008-2010	2011-2014	2015-2020
Energy Efficiency	Other programs				
	LDC programs*				
	IESO programs				
Conservation Behaviour					
Fuel Switching					
Self/Co Generation	Renewables	<500 kW			<10 MW
	CHP**	<10 MW			<10 MW
Demand Management					
Natural Conservation					

SECTION 1: EXECUTIVE SUMMARY

III. CURRENT STATE SUMMARY

EVOLUTION OF THE DEFINITION OF CDM IN ONTARIO – SHORT TERM VIEW (TX)

- The definition of CDM for the purposes of short-term targets is set by specific directives, these targets have historically included a subset of CDM activities that are included in long term goals/targets
- The table below outlines the targets for transmission connected (Tx) customers programs over time and the activities both included in the definition of CDM and supported through programs

	2005-2007	2008-2010	2011-2014	2015-2020
Primary target responsibility	N/A	N/A	Former OPA (IESO)	IESO
Short term goals/targets	N/A**	N/A**	300 MW by June 2015	1.7 TWh by 2020

Definition of CDM	2005-2007	2008-2010	2011-2014	2015-2020
Energy	Other programs			
Efficiency	LDC programs			
	IESO programs			
Conservation Behaviour				
Fuel Switching				
Self/Co Generation	Renewables			<10 MW
	CHP*			<10 MW
Demand Management				
Natural Conservation				

SECTION 1: EXECUTIVE SUMMARY

III. CURRENT STATE SUMMARY

ELIGIBILITY AND ALIGNMENT WITH POLICY OBJECTIVES

- The following table outlines whether a particular technology or approach is currently eligible to be considered CDM within Conservation First Framework and Industrial Accelerator Program per Directions and which policy objectives the technology or approach aligns with

Technology/ Approach	Eligible as CDM?	Policy Objective					
		Integration with Regional Planning	Greenhouse gas reductions	Customer Choice	Peak Reduction	Innovation	Market Transformation
Resource acquisition	Y	✓	✓	✓	DEPENDS		
Market transformation	Y	✓	✓	✓	DEPENDS		✓
Behavioural	Y	✓	✓	✓	DEPENDS	✓	✓
Performance-based funding	Y	✓	✓	✓	DEPENDS	✓	✓
R&D, pilots	Y		✓	✓	DEPENDS	✓	
Direct load control	N	✓	✓	✓	✓		
Demand Response Capacity	N	✓	✓	✓	✓		
Time-of-use pricing	N		✓	✓	✓		✓
Critical peak pricing	N	✓	✓	✓	✓		

SECTION 1: EXECUTIVE SUMMARY

III. CURRENT STATE SUMMARY

ELIGIBILITY AND ALIGNMENT WITH POLICY OBJECTIVES

- The following table outlines whether a particular technology or approach is currently eligible to be considered CDM within Conservation First Framework and Industrial Accelerator Program per Directions and which policy objectives the technology or approach aligns with

Technology/ Approach	Eligible as CDM?	Policy Objective					
		Integration with Regional Planning	Greenhouse gas reductions	Customer Choice	Peak Reduction	Innovation	Market Transformation
Voltage reduction	N	✓	✓			✓	
Solar	Y ¹	✓	✓	✓	✓	✓	
Solar-storage	N	✓	✓	✓	✓	✓	
Storage	N	✓	✓	✓	✓	✓	
Combined Heat and Power	Y	✓	DEPENDS	✓	✓		
Electric Vehicles	N	✓	✓	✓		✓	
Microgrids	N	✓	DEPENDS	✓	✓	✓	
R&D, pilots		DEPENDS					

PRELIMINARY OBSERVATIONS

How has the definition of CDM changed over time in Ontario?

- Targets have shifted from province-wide peak demand to LDC-level energy targets driven by larger policy goals which, in turn, lead to government directives
 - In the past (pre-2008), progress included savings funded outside of IESO (then OPA) CDM programs (Renewable Energy Standard Offer Programs, Enwave, third tranche funding for LDCs)
 - Combined Heat and Power was formally added to be considered as progress to targets
 - Savings from time-of-use was previously included
- The definition of CDM that is counted towards targets has changed over time and targets have shifted from broad, province-wide energy and demand reduction targets to localized, LDC energy targets

Is the current definition appropriate to achieve the policy objectives of the framework and to align with Ontario's broader GHG reduction goals?

- There are several technologies and approaches currently not included in the definition of CDM that have both customer and system benefits and align with one or more of the Government's policy objectives
 - Interactions with other policies must also be taking into consideration (e.g., net metering, industrial conservation initiative)
- All technologies and approaches align with some policy objectives, but not all align with GHG reduction goals
 - Interaction with other policies should be considered

SECTION 1: EXECUTIVE SUMMARY

III. CURRENT STATE SUMMARY

JURISDICTIONS REVIEWED

- IESO is unique among system operators in its role with CDM programs that go beyond energy efficiency activities (e.g., long-term system planning, demand response, regional planning, procurement)
- As it pertains specifically to CDM activities, Navigant selected six jurisdictions that are among the most mature and progressive worldwide

Canada	Nova Scotia British Colombia	<ul style="list-style-type: none"> • Nova Scotia and BC Hydro have historically had the highest DSM spending per customer in Canada
USA	California Massachusetts Vermont New York	<ul style="list-style-type: none"> • California, Massachusetts, and Vermont placed 1st, 2nd, and 3rd respectively in the ACEEE (American Council for an Energy-Efficient Economy) <i>2016 Energy Efficiency Scorecard</i> • New York placed 5th on the scorecard, but is a meaningful addition as it is one of the most progressive jurisdictions with respect to expanding investment in DER • All of these jurisdictions have diverse and mature program portfolios and a high level of energy savings achievement (as a % of sales)
Not Selected	Europe PJM Australia	<ul style="list-style-type: none"> • Certain jurisdictions in Europe, such as Germany, are leaders in CDM activities, however they are generally poor comparables to North American jurisdictions <ul style="list-style-type: none"> • EE in Europe is generally defined more broadly as inclusive of transportation and all fuel types. In addition, the lead delivery and reporting agents are typically governmental bodies, with a priority focus on building codes and appliance standards, as opposed to measure level incentives • PJM Interconnection does not <u>oversee</u> DSM or DER programming or investment. • Australia did not rank highly on the ACEEE international scorecard

TYPICAL FUNDING SCHEMES - CONTEXT

- Each technology and approach was assessed against three funding categories listed below. In addition, the assessment specified whether the technology or approach is fully funded or if the funding is uncertain (e.g., pilot programs, changing funding mechanisms, or retiring funding mechanisms)

Funding Category	Description	
DSM	Funding is primarily sourced from an energy efficiency/demand-side management plan that is typically regulator approved. Plans generally cover 1-3 years. Costs are typically recovered as an operating expense included in tariffs, but may also be recovered via a special charge (e.g., Vermont).	DSM
Other Ratepayer	“Other ratepayer” is used to represent funding that is not approved as part of a DSM budget, but rather is separately approved as part of a different filing request or operating budget. ‘Separate filings’ may include e.g. required smart grid plans or grid modernization plans. Costs are typically recovered as an operating expense included in tariffs, but may also be recovered via a special charge (e.g., California).	OR
Other Funding (Including typically a mix of public/taxpayer, non-utility, and ratepayer)	Particularly for new Distributed Energy Resource (DER) investments, there may be special public funding used by a utility partner that is leading the investment. For instance, BC Hydro’s Field, BC grid storage project was developed with support from the Canada Clean Energy Fund, or cap and trade revenues in California. This category indicates that funding for existing or newly planned activities has been sourced from what may be a combination of ‘other public’ and varying levels of ratepayer funds. Funding support may also be derived from non-utility revenue streams that are linked to specific DER initiatives (e.g. digital platform advertising).	OF

SECTION 1: EXECUTIVE SUMMARY

III. CURRENT STATE SUMMARY

ENERGY EFFICIENCY – TYPICAL FUNDING SCHEMES

- Customer EE programs are typically funded as part of DSM regulatory plans
- Voltage reduction is funded outside of DSM budgets, and is generally viewed by utility commissions as a prudent operational enhancement and not a DSM activity

Predominant Funding Source

DSM

Other Ratepayer

Other (e.g., taxpayer)

Indicator

DSM

OR

OF

EE Activity	Ontario	British Columbia	Nova Scotia	Massachusetts	California	Vermont	New York
Resource acquisition	DSM	DSM	DSM	DSM	DSM	DSM	DSM
Market transformation	DSM	DSM	DSM	DSM	DSM	DSM	DSM
Behavioural	DSM	DSM	DSM	DSM	DSM	DSM	DSM
Performance-based funding	DSM	-	-	DSM	DSM	-	DSM
Pilots/R&D	DSM	DSM	DSM	DSM	DSM	DSM	DSM
Voltage reduction	OF, OR	OR	OR	OR	OR	OR	OR

SECTION 1: EXECUTIVE SUMMARY

III. CURRENT STATE SUMMARY

DEMAND RESPONSE – TYPICAL FUNDING SCHEMES

- DLC is typically a DSM activity, bundled as part of e.g. a ‘Smart A/C’ program, however it can also separately be introduced as a smart grid initiative outside of DSM plans and proceedings
- Most jurisdictions offer TOU and CPP tariffs (Yes indicates that a pricing program is available to customers either on a mandatory or voluntary basis)

Predominant Funding Source	Indicator
DSM	DSM
Other Ratepayer	OR
Other (e.g., taxpayer)	OF

DR Activity	Ontario	British Columbia	Nova Scotia	Massachusetts	California	Vermont	New York
Direct load control (DLC)	OR	DSM ^	DSM *	DSM	DSM	-	DSM
Demand Response Capacity	OR	DSM	-	OR, DSM	OR, DSM	OR, DSM	OR, DSM
Time of Use Rates (TOU)	YES	NO	YES	YES	YES	YES	YES
Critical Peak Pricing (CPP)	YES ^T	NO	YES ^{**}	YES	YES	YES	YES

[^] New pilot activity in 2015 using 103 homes and 4 businesses focused on residential hot water.

^{*} This has been piloted in collaboration with Nova Scotia Power and New Brunswick Power, and is also offered by the Berwick Electric Commission in Berwick, NS. (<http://www.nrcan.gc.ca/energy/funding/current-funding-programs/cef/4975>)

^{**} Nova Scotia Power offers ‘one-part real time pricing’ and interruptible tariffs for very large customers that are categorically similar to CPP.

^T Ontario has a program allowing large customers with certain NAICS codes and peak demand greater than 500 kW to offset peak during the top 5 hours of the year and pay lower rates. In addition, there are CPP pricing pilots underway for residential customers.

SECTION 1: EXECUTIVE SUMMARY

III. CURRENT STATE SUMMARY

DISTRIBUTED ENERGY RESOURCES – TYPICAL FUNDING SCHEMES

- CHP may fall under either DSM or as part of broader initiatives that include state or provincial funding
- EV incentives directly to customers are uncommon, these incentives are more generally captured in the form of purchase rebates and charging infrastructure initiatives

Predominant Funding Source	Indicator
DSM	DSM
Other Ratepayer	OR
Other (e.g., taxpayer)	OF

DER Activity	Ontario	British Columbia	Nova Scotia	Massachusetts	California	Vermont	New York
Solar	OR	-	-	OF	OR, OF	-	OF
Storage	^	-	%	#	OR	OR	OR
CHP	DSM	OR	OF *	DSM	OF	DSM	OF
Microgrids	OF	-	-	-	OF	-	OF
Electric Vehicles (EVs)	OF	-	-	-	OF **	-	-

^ PowerStream Ontario is running a solar storage pilot.

** As part of the Nova Scotia Community Feed in Tariff Program (COMFIT), administered by the Nova Scotia DOE but no longer accepting applications. <https://energy.novascotia.ca/renewables/programs-and-projects/comfit>*

*** Southern California Edison, for example, offers a special metered EV rates.*

Massachusetts is currently developing an energy storage target, 2020 mandates expected to be set in July 2017.

% Very small pilot project <http://www.nspower.ca/en/home/newsroom/news-releases/clean-energy-project.aspx>

PRELIMINARY OBSERVATIONS


How does the definition of CDM in Ontario align with the definition of CDM/DSM in other jurisdictions?

- IESO is unique among system operators given its oversight of DSM activities conducted by constituent LDCs
- In other jurisdictions (not Ontario), DSM plans and the funding allocated to them, focus primarily on energy efficiency and demand response programs, although CHP may be included as well as pilot/R&D budgets
- In other jurisdictions (not Ontario), DR investments are typically part of DSM plans, including e.g. direct load control programs, smart appliance programs, and behavioural programs
- DER investments are supported most commonly by a combination of ratepayer (operating expense, specific/required funding request*, or surcharge) and public (e.g. provincial/state/federal) clean energy grants and funds, as well as non-utility revenue streams and operational cost savings. *E.g. requirements to develop and submit ‘smart grid’ or ‘grid modernization’
- In most other jurisdictions, Voltage reduction (VR) is funded outside of DSM budgets, and is generally viewed by regulators as a prudent operational enhancement and not a DSM activity. In Massachusetts VR has been funded as part of ‘grid modernization’, and in California, where many utilities have been actively pursuing voltage reduction for decades, voltage reduction studies to find additional incremental savings have been part of smart grid pilot initiatives. Navigant is aware, however, of jurisdictions/utilities that have included CVR in DSM budgets (e.g. PECO in Pennsylvania)
- Generally, DSM includes the technologies included under “customer energy efficiency” and “dispatchable demand response” (as defined in this report)
- DER and smart grid investments are typically funded outside of DSM
- The treatment of both combined heat and power and voltage reduction varies across jurisdiction

NEXT STEPS

Based on the preliminary assessment of the current state of definition of CDM, the following areas will be considered in the market research phase:

- Understand the interactions between this report and other topic reports (e.g., collaboration, climate change, planning integration, budgets and targets)
- Consider policy interactions during market research phase (e.g., net metering and Industrial Conservation Initiative) and the impact on adoption of different technologies and approaches
- Where a technology/approach should be funded is not a simple policy question and there are many considerations, for example:
 - Scale (cross with topic 3 - collaboration):
 - DERs are promoted in many jurisdictions through both government and private funding which may require scale to successfully promote adoption
 - Demand response can be funded both locally and through the IESO with different objectives. The structure of the jurisdiction and local vs. system needs have a large impact on how the funding/program administration is structured
 - Cost/benefit equity (alignment between those who fund a resource and those benefit from a resource on a time and geographic scale)
 - Market/System (cross with topic 5 - planning integration):
 - The degree to which (1) the resource is needed (e.g., renewable integration and the need for balancing resources); and (2) the market can support the ability to earn revenues (e.g., capacity costs and reserve margins, ancillary services markets, technology to provide automated demand response, dynamic pricing (rate structures)
 - Policy goals (cross with climate change + planning integration):
 - Is grid modernization a goal and/or promoted elsewhere?
 - What is the role of the regulator?



SECTION 2: CURRENT STATE OF AFFAIRS

- I. Segmentation and Definitions
- II. CDM in Ontario
- III. Jurisdictional Scan



I. SEGMENTATION AND DEFINITIONS

OVERVIEW

Section	Segmentation and Definitions
Description	Review the segmentation of the technologies investigated and define each technology and the benefits it typically brings to customers and system operators
Focus area	<ul style="list-style-type: none">Defining CDM
Source(s)	<ul style="list-style-type: none">Navigant expertise, IESO data, ACEEE, DOE

- 22 Technologies and approaches were selected by Navigant and IESO
- Technologies and approaches are segmented into three categories (energy efficiency, demand response, distributed energy resources) for the purposes of this report

TECHNOLOGIES AND APPROACHES ASSESSED

- Demand side management (DSM) is an umbrella term that typically refers to energy efficiency and demand response
- This review will investigate all major DSM activities and also includes distributed energy resources (DER) given the increasing importance of distributed energy resources and the fact that much of this activity happens behind the meter
- The categories, technologies/approaches outlined below will be investigated within Ontario followed by six jurisdictions
- For the purpose of this report, each technology and approach assessed was mapped to a category for ease of review

Category	Category Description	Technology/Approach	
Energy Efficiency	Technology or approaches that result in less energy to perform the same function	<ul style="list-style-type: none"> • Resource acquisition • Market transformation • Behavioural • Voltage reduction 	<ul style="list-style-type: none"> • Performance-based funding • Pilots/Research & Development
Demand Response	Technology or approaches that enable energy shifting or reduction during certain times	<ul style="list-style-type: none"> • Direct load control • Time-of-use pricing 	<ul style="list-style-type: none"> • Demand Response capacity • Critical peak pricing
Distributed Energy Resources	Behind-the-meter or distribution-connected generation or storage resources that supply all or part of a customer's electricity use	<ul style="list-style-type: none"> • Solar • Solar-storage • Storage • Combined Heat & Power 	<ul style="list-style-type: none"> • Electric Vehicles • Microgrids • R&D, pilots

ENERGY EFFICIENCY DEFINITIONS

- The following table outlines the definition of each energy efficiency technology and approach investigated including some examples of each

Technology/Approach	Description	Examples
Resource acquisition	Programs that promote products and practices used by energy consumers that drive investments in the short-term	Retrofit program, small business lighting program, coupon program
Market transformation	Programs that create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of energy efficiency measures	Voluntary standards, new approaches to building management
Behavioural	Programs focused on behavioral transformation of energy use of end consumers	Social benchmarking, home energy reports
Performance-based funding	Performance-based incentive payment calculated via use of whole-building advanced metering infrastructure (AMI) and associated analytics	ESCO model whereby project is financed and developed by the ESCO and payment is per unit of saving
R&D, pilots	Trial initiatives to test new approaches and strategies for delivering energy efficiency to customers	IESO Pay for Performance for multi-site customers, building optimization
R&D, pilots	Trial initiatives to test new approaches and strategies for delivering energy efficiency to the grid	Conservation Fund pilot for Conservation Voltage Reduction
Voltage reduction	Reduction of energy consumption resulting from a reduction of feeder voltage/voltage optimization	Voltage optimization through reactive power compensation, ground wire loss reduction

DEMAND RESPONSE DEFINITIONS

- The following table outlines the definition of each demand response technology and approach investigated including some examples of each

Technology/Approach	Description	Examples
Direct load control	Programs focused on automatically shifting customer load in response to signals from the system operator or aggregator	Ontario's <i>peaksaver</i> PLUS program
Demand Response Capacity	Programs focused on customers shifting load in response to signals from the system operator or aggregator	Ontario's former Demand Response programs (DR1, DR2)
Time-of-use pricing	Programs that modify customer-facing pricing into pricing tiers based on the time of day (and/or season)	Ontario's time-of-use pricing regime
Critical peak pricing	Programs that align the highest system peaks with customer-facing pricing	Critical peak pricing, critical peak rebates

CUSTOMER DISTRIBUTED ENERGY RESOURCE DEFINITIONS

- The following table outlines the definition of each distributed energy resource technology and approach investigated for the customer type including some examples of each

Technology/Approach	Description	Examples
Solar	Solar cited on customer premise, delivered via a utility or 3 rd party partner	Micro feed-in-tariff programs
Solar-storage	Combination of solar and storage technologies into a customer-sited nanogrid	PowerStream's POWER.HOUSE
Storage	Utility incentives designed to accelerate adoption of storage technology. Programs may enable the utility to utilize stored power during peak events	TESLA Powerwall
Combined Heat and Power	Also called co-generation is behind-the-meter generation that involves the production of both electricity and useful thermal energy in an integrated system ¹	Natural gas powered CHP for hospitals, waste energy recovery for pulp and paper facilities
Electric Vehicles	Plug-in electric vehicles as they relate to the ability to shift and manage customer load or use as storage	Electric vehicle charging rates, direct load control devices on charging
Microgrids	Programs or pilots that promote microgrids (combination of storage technology and generation resources). Can consider resiliency/islanding in response to physical or economic conditions	Customer-sited microgrids (solar, storage, combined heat and power)
R&D, pilots	Trial initiatives to test new approaches and strategies for delivering distributed energy resources to the grid	Smart grid fund intelligent electric vehicle charging stations



II. CDM IN ONTARIO

OVERVIEW

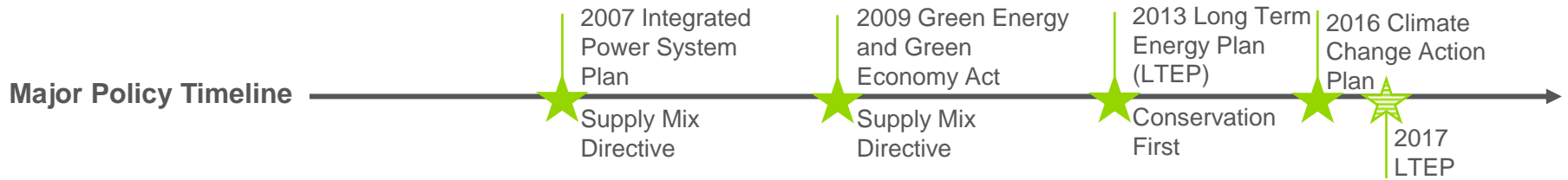
Section	CDM in Ontario
Description	Review of the evolution of the definition of CDM in Ontario and policies that impact the definition and adoption of CDM.
Focus area	<ul style="list-style-type: none"> Defining CDM
Source(s)	<ul style="list-style-type: none"> Government directives, Integrated Power System Plan, IESO website, Long Term Energy Plan

Summary:

- Targets have shifted from province-wide peak demand to LDC-level energy targets driven by larger policy goals which, in turn, lead to government directives
- In the past (pre-2008), progress included savings funded outside of IESO (formerly OPA) CDM programs (Renewable Energy Standard Offer Programs, Enwave, third tranche funding for LDCs)
- Combined Heat and Power was formally considered eligible as part of the Process and Systems program and could be considered as progress to targets in 2014
- Savings from time-of-use was previously included
- Technologies and approaches currently not included in the definition of CDM have both customer and system benefits and align with one or more policy objectives
- Interactions with other policies must also be taking into consideration (e.g., net metering, industrial conservation initiative)

EVOLUTION OF THE DEFINITION OF CDM – LONG TERM VIEW

- The definition of CDM is set by guiding policies which specify overarching, long-term CDM goals/targets at the provincial level, these goals/targets have historically included a broad range of CDM activities



Goals	2005-2007	2008-2010	2011-2014	2015-2020				
Guiding policy	<ul style="list-style-type: none"> 15 specific directives 	<ul style="list-style-type: none"> Integrated Power System Plan Supply Mix Directive 	<ul style="list-style-type: none"> Green Energy and Green Economy Act Supply Mix Directive 	<ul style="list-style-type: none"> Long Term Energy Plan Conservation First 				
Long term goals/targets	N/A	3,600 MW by 2025	7,100 MW and 28 TWh by 2030	30 TWh by 2032				
Definition of CDM	2005-2007	2008-2010	2011-2014	2015-2020				
Energy Efficiency								
Conservation Behaviour								
Fuel Switching								
Self/Co Generation					< 10 MW	< 10 MW	< 10 MW Excl. FIT and mFIT	< 10 MW
Demand Management								
Natural Conservation								

EVOLUTION OF THE DEFINITION OF CDM IN ONTARIO – SHORT TERM VIEW (DX)

- The definition of CDM for the purposes of short-term targets is set by specific directives, these targets have historically included a subset of CDM activities that are included in long term goals/targets
- The table below outlines the targets for distribution connected (Dx) customers programs over time and the activities both included in the definition of CDM and supported through programs

	2005-2007	2008-2010	2011-2014	2015-2020
Primary target responsibility	Former OPA (IESO)	Former OPA (IESO)	LDCs	LDCs
Short term goals/targets	1,350 MW	Additional 1,350 MW	1,330 MW and 6,000 GWh between 2011 and 2014	7 TWh by 2020

Definition of CDM		2005-2007	2008-2010	2011-2014	2015-2020
Energy Efficiency	Other programs				
	LDC programs*				
	IESO programs				
Conservation Behaviour					
Fuel Switching					
Self/Co Generation	Renewables	<500 kW			<10 MW
	CHP**	<10 MW			<10 MW
Demand Management					
Natural Conservation					

EVOLUTION OF THE DEFINITION OF CDM IN ONTARIO – SHORT TERM VIEW (TX)

- The definition of CDM for the purposes of short-term targets is set by specific directives, these targets have historically included a subset of CDM activities that are included in long term goals/targets
- The table below outlines the targets for transmission connected (Tx) customers programs over time and the activities both included in the definition of CDM and supported through programs

	2005-2007	2008-2010	2011-2014	2015-2020
Primary target responsibility	N/A	N/A	Former OPA (IESO)	IESO
Short term goals/targets	N/A**	N/A**	300 MW by June 2015	1.7 TWh by 2020

Definition of CDM	2005-2007	2008-2010	2011-2014	2015-2020
Energy	Other programs			
Efficiency	LDC programs			
	IESO programs			
Conservation Behaviour				
Fuel Switching				
Self/Co Generation	Renewables			<10 MW
	CHP*			<10 MW
Demand Management				
Natural Conservation				

CURRENT DEFINITION OF CDM

- The current definition of CDM (considered towards targets) is defined by government Directive

Conservation First Framework

- Inclusive of activities aimed at reducing electricity consumption and reducing the draw from the electricity grid; for example:
 - geothermal heating and cooling
 - solar heating
 - small scale (i.e. <10MW) behind the meter customer generation
- CDM should be considered to exclude those activities and programs related to:
 - a Distributor's investment in new infrastructure or replacement of existing infrastructure
 - any measures a Distributor uses to maximize the efficiency of its new or existing infrastructure
 - activities promoted through a different program or initiative undertaken by the Government of Ontario or the OPA, such as the OPA Feed-in Tariff (FIT) Program and micro-FIT Program
 - activities related to the price of electricity or general economic activity

Industrial Accelerator Program

- Inclusive of activities aimed at reducing electricity consumption and reducing draw from the electricity grid, including behind the meter customer generation

ELIGIBILITY AND ALIGNMENT WITH POLICY OBJECTIVES

- The following table outlines whether a particular technology or approach is currently eligible to be considered CDM within Conservation First Framework and Industrial Accelerator Program per Directions and which policy objectives the technology or approach aligns with

Technology/ Approach	Eligible as CDM?	Policy Objective					
		Integration with Regional Planning	Greenhouse gas reductions	Customer Choice	Peak Reduction	Innovation	Market Transformation
Resource acquisition	Y	✓	✓	✓	DEPENDS		
Market transformation	Y	✓	✓	✓	DEPENDS		✓
Behavioural	Y	✓	✓	✓	DEPENDS	✓	✓
Performance-based funding	Y	✓	✓	✓	DEPENDS	✓	✓
R&D, pilots	Y		✓	✓	DEPENDS	✓	
Direct load control	N	✓	✓	✓	✓		
Demand Response Capacity	N	✓	✓	✓	✓		
Time-of-use pricing	N		✓	✓	✓		✓
Critical peak pricing	N	✓	✓	✓	✓		

ELIGIBILITY AND ALIGNMENT WITH POLICY OBJECTIVES

- The following table outlines whether a particular technology or approach is currently eligible to be considered CDM within Conservation First Framework and Industrial Accelerator Program per Directions and which policy objectives the technology or approach aligns with

Technology/ Approach	Eligible as CDM?	Policy Objective					
		Integration with Regional Planning	Greenhouse gas reductions	Customer Choice	Peak Reduction	Innovation	Market Transformation
Voltage reduction	N	✓	✓			✓	
Solar	Y ¹	✓	✓	✓	✓	✓	
Solar-storage	N	✓	✓	✓	✓	✓	
Storage	N	✓	✓	✓	✓	✓	
Combined Heat and Power	Y	✓	DEPENDS	✓	✓		
Electric Vehicles	N	✓	✓	✓		✓	
Microgrids	N	✓	DEPENDS	✓	✓	✓	
R&D, pilots		DEPENDS					

THERE ARE SIGNIFICANT POLICIES IN PLACE THAT CAN INFLUENCE AND/OR CONFLICT WITH CURRENT PROGRAMS

- The following policies can improve the economics for certain technologies, in particular for distributed energy resources
- These policies and programs can also influence a customer's participation in energy efficiency programs

Policies/Programs	Description
Net Metering	<p>Credit for electricity customers when excess renewable generation is exported to the grid. Net metering regulation was recently passed in Ontario allowing customers with renewable generation to sell excess energy back to the grid at retail electricity rates. Customers receive a “net” bill.</p> <p>Improves the business case for customer sited solar and storage resources. Phase II of the regulation is anticipated to include a position on virtual net metering enabling behind-the-meter resources to be aggregated to provide, for example, ancillary services to the grid.</p>
Industrial Conservation Initiative	<p>Customers who are eligible to participate pay a global adjustment (GA) charge based on their percentage contribution to the top five peak Ontario demand hours over a 12 month base period. Recent announcement to reduce eligibility to customers with >500 kW of peak demand.</p> <p>Improves the business case for customer sited storage, combined heat and power, and microgrids which can help the customer reduce their load during potential critical peak hours.</p> <p>Can prevent participation in energy efficiency programs – if a customer's load drops below the eligibility criteria as a result of implementing energy efficiency measures, there is a lost financial opportunity.</p>
Industrial Electricity Incentive	<p>Eligible customers that are accepted into the program can receive reduced electricity rates.</p> <p>Can reduce the case (increased payback periods) for customer sited energy efficiency and distributed energy resources.</p>



III. JURISDICTIONAL SCAN

OVERVIEW

Section	Jurisdictional Scan
Description	Description of the technologies and methods considered in the review. High-level review of the selected jurisdictions. Matrix of technologies and methods by jurisdiction followed by observations and key findings.
Focus area	<ul style="list-style-type: none"> Defining CDM
Source(s)	<ul style="list-style-type: none"> Desk research including utility filed plan review, docket searches, and utility websites.

Summary:

- IESO is unique among system operators given its oversight of DSM activities conducted by constituent LDCs
- DSM plans, and the funding allocated to them, focus primarily on energy efficiency and demand response programs, although CHP may be included as well as pilot/R&D budgets
- DR investments are typically part of DSM plans, including e.g. direct load control programs, smart appliance programs, and behavioural programs
- DER investments are supported most commonly by a combination of ratepayer (operating expense, specific/required funding request*, or surcharge) and public (e.g. provincial/state/federal) clean energy grants and funds, as well as non-utility revenue streams and operational cost savings
 - *E.g. requirements to develop and submit 'smart grid' or 'grid modernization' plans
- Voltage reduction is funded by reviewed jurisdictions outside of DSM budgets, and is generally viewed by regulators as a prudent operational enhancement and not a DSM activity
 - In Massachusetts it has been funded as part of 'grid modernization', and in California, where many utilities have been actively pursuing voltage reduction for decades, voltage reduction studies to find additional incremental savings have been part of smart grid pilot initiatives. Navigant is aware, however, of jurisdictions/utilities that have included CVR in DSM budgets, such as PECO in Pennsylvania

JURISDICTIONS REVIEWED

- IESO is unique among system operators in its role with CDM programs that go beyond energy efficiency activities (e.g., long-term system planning, demand response, regional planning, procurement)
- As it pertains specifically to CDM activities, Navigant selected six jurisdictions that are among the most mature and progressive worldwide

Canada	Nova Scotia British Columbia	<ul style="list-style-type: none"> • Nova Scotia and BC Hydro have historically had the highest DSM spending per customer in Canada
USA	California Massachusetts Vermont New York	<ul style="list-style-type: none"> • California, Massachusetts, and Vermont placed 1st, 2nd, and 3rd respectively in the ACEEE (American Council for an Energy-Efficient Economy) <i>2016 Energy Efficiency Scorecard</i> • New York placed 5th on the scorecard, but is a meaningful addition as it is one of the most progressive jurisdictions with respect to expanding investment in DER • All of these jurisdictions have diverse and mature program portfolios and a high level of energy savings achievement (as a % of sales)
Not Selected	Europe PJM Australia	<ul style="list-style-type: none"> • Certain jurisdictions in Europe, such as Germany, are leaders in CDM activities, however they are generally poor comparables to North American jurisdictions <ul style="list-style-type: none"> • EE in Europe is generally defined more broadly as inclusive of transportation and all fuel types. In addition, the lead delivery and reporting agents are typically governmental bodies, with a priority focus on building codes and appliance standards, as opposed to measure level incentives • PJM Interconnection does not <u>oversee</u> DSM or DER programming or investment. • Australia did not rank highly on the ACEEE international scorecard

JURISDICTIONS – QUANTITATIVE COMPARISON

2015 Averages	Ontario (Average)	British Columbia (BC Hydro)	Nova Scotia (NS Power)	Massachusetts (All Utilities)	California (All Utilities)	Vermont (All Utilities)	New York (All Utilities)
C&I Rate (\$/kWh)*	\$0.125	\$0.09	\$0.12	\$0.09	\$0.13	\$0.13	\$0.08
Res Rate (\$/kWh)*	\$0.165	\$0.11	\$0.16	\$0.16	\$0.17	\$0.17	\$0.16
Res Customer Count (All Utilities in Jurisdiction) Millions	4.5	1.7	0.5	3.4	13.7	0.3	8.4
C&I Customer Count (All Utilities in Jurisdiction) Millions	0.49	0.2		0.56	1.9	0.05	1.4
Peak (GW)	21	11.5	2.4	16.9	64.9	0.8	38.3

US jurisdictions are presented in 2015 \$USD, Canadian in 2015 \$CAD. US States are summed into an all utility average, Province of British Columbia represents 2014 BC Hydro Annual Report Data, Province of Nova Scotia represents data from nspower.ca. US utilities represent a weighted average across respective jurisdictions.

US data Source: EIA Form 861, FERC Form 1.

NEW YORK – JURISDICTION OVERVIEW

- New York is a leading jurisdiction with respect to embracing and encouraging innovation in the energy marketplace via a large initiative known as 'Reforming the Energy Vision' (REV) spearheaded by Governor Andrew Cuomo
- This initiative has been developing for several years and supports development of DER pilots and a suite of major policy objectives including affordability, reduced GHG emissions, customer choice, job growth, and clean transit
- REV demo/pilot projects are typically proposed by 3rd parties and/or utilities, and are funded by a combination of non-utility revenue streams (varies by project, e.g. digital platform advertising), utility cost savings (e.g. reduction in DSM budget), and one-time and/or annual utility operational expenses

Key Players	Description of Role
NYSERDA (New York State Energy Research and Development Authority)	<p>Promotes energy efficiency and the use of renewable energy sources. Partners with stakeholders to develop and invest to foster the conditions that:</p> <ul style="list-style-type: none"> • Attract the private sector capital investment needed expand New York's clean energy economy • Overcome barriers to using clean energy at a large-scale in New York • Enable New York's communities and residents to benefit from energy efficiency and renewable energy
IOUs (Investor Owned Utilities)	7 privately owned utilities in New York
NYP&A (New York Power Authority)	Public power authority, owns generation and transmission, only statewide electricity supplier, Promote energy efficiency and the development of clean energy technologies and electric vehicles
New York Public Utilities Commission (PUC)	Leads state policy implementation (largely shaped by the mission of REV) and regulates utility program administrators

NEW YORK – JURISDICTION OVERVIEW

- The table below outlines the agents involved in advancing each of the segmented categories of technologies and approaches, critical policies and recent developments are also outlined

EE	Primary Administrator	<ul style="list-style-type: none"> IOUs, NYSEDA, and NYPA (public power authority). New York Public Utilities Commission (PUC) leads state policy implementation (largely shaped by the mission of REV) and regulates utility program administrators
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> Utility revenue decoupling permitted, utilities can also propose “earnings adjustment mechanisms” based on goal attainment NY REV commission proceedings Commission encourages utilities to move from a rebate-centric acquisition approach to one that more broadly focuses on market transformation Increasing focus on innovation -- e.g. in 2016 ConEdison proposed a "Test and Learn" budget to "identify new measures, uses, and delivery mechanisms for existing offerings"
DR	Primary Administrator	<ul style="list-style-type: none"> ~8 Utilities offer DR programs including ConEd, LIPA, National Grid, and NYPA. NYISO offers both reliability based and economic based DR payments. ~20 non-utility aggregators procure DR from customer groups
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> NY Public Utilities Commission has noted support and encouragement for DR & it is well aligned with REV policy goals REV goals encouraging participation of 3rd party market participants NYISO (New York System Operator) accepts DR capacity bids from qualified load resources
DER	Primary Administrator	<ul style="list-style-type: none"> Third party technology and software providers, IOUs, NYSEDA, and NYPA
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> NY REV process is enabling and encouraging new market participants (typically funded by utilities) to develop and publically propose innovative DER pilot projects across a variety of customer segments Virtual power plant aggregated solar and DR, community solar, and AMI-based customer information portals are example pilot projects New York has very supportive net metering and interconnection policies

VERMONT – JURISDICTION OVERVIEW

- Vermont is a small jurisdiction in the Northeastern U.S. with clear policy goals to encourage innovation and energy efficiency
- The jurisdiction has been long supportive of load reduction and comprehensive efficiency programs
- Vermont was a pioneer in developing the 3rd party EE administration model, now Efficiency Vermont, funded by volumetric surcharges
- Energy efficiency resource standard goal is among the highest in North America at 2.5% savings as a percent of sales/year

Key Players	Description of Role
Efficiency Vermont (EVT)	3 rd Party DSM Administrator operated by the Vermont Energy Investment Corporation (VEIC) Regulated by the Vermont Public Service Commission
Green Mountain Power (GMP)	Vermont's largest investor-owned electric utility. Recognized as an innovative utility with a strong commitment to DER (ran the first TESLA Powerwall pilot, now has a Powerwall program)
ISO-NE	New England grid operator, market administrator, and system planner Does not own infrastructure or deal with retail power

VERMONT – JURISDICTION OVERVIEW

- The table below outlines the agents involved in advancing each of the segmented categories of technologies and approaches, critical policies and recent developments are also outlined

EE	Primary Administrator	<ul style="list-style-type: none"> Efficiency Vermont (EVT, 3rd Party Administrator), Burlington Electric, Vermont Gas EVT delivers DSM solutions to the majority of the state's electric customers but does not manage or own T&D
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> Utility revenue decoupling permitted Energy Efficiency Resource Standard (EERS) among the highest in North America at 2.5% of sales/year. This goal has become more difficult to reach cost effectively as programs have become increasingly mature Supportive regulatory environment; Efficiency Vermont pioneered the 3rd party energy efficiency administrator role Large catalog of energy efficiency measures and delivery strategies Able to organize customer financing through a 3rd party financial institution. Long support for market transformation
DR	Primary Administrator	<ul style="list-style-type: none"> Efficiency Vermont, Green Mountain Power (the states' largest electric utility), and Opower (now Oracle) have worked together to pilot retail-side DR initiatives
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> 2016 statewide comprehensive energy plan (developed by the Department of Public Service) encourages both the energy efficiency utility (Efficiency Vermont) and the distribution utilities to develop 'smart (variable) rates' informed by smart meters. Smart appliances are also encouraged ISO-NE (New England system operator) accepts DR capacity bids from qualified load resources
DER	Primary Administrator	<ul style="list-style-type: none"> Green Mountain Power and other municipal or cooperative utilities
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> 2016 statewide comprehensive energy plan (developed by the Department of Public Service) encourages the transition from centralized dispatch to greater volumes of distributed, local energy generation The DPS encourages the PUC (primary regulator) to adjust its rules to encourage this policy goal over time Vermont has very supportive net metering and interconnection policies

CALIFORNIA – JURISDICTION OVERVIEW

- California is a leading jurisdiction with a progressive policy environment that prioritizes GHG mitigation, innovation/customer choice, and long-run affordability
- California's Electric Program Investment Charge (EPIC) is a unique customer surcharge funded mechanism for California's top IOUs (Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), and Southern California Edison Company (SCE)) to invest in a broad range of innovative technologies and programs spanning EE, DR, and DER. EPIC's policy goals include:
 - "GHG emissions mitigation and adaptation in the electricity sector at the lowest possible cost, following the state's loading order for energy, low-emission vehicles/transportation, economic development, and efficient use of ratepayer monies." (CA Energy Commission)

Key Players	Description of Role
PG&E, SCE, SDG&E	California's largest investor-owned utilities, heavily involved in DER and grid modernization
SMUD, LADWP	Large municipal utilities also heavily involved in DER and grid modernization
CAISO	California grid operator, market administrator, and system planner Does not own infrastructure or deal with retail power

CALIFORNIA – JURISDICTION OVERVIEW

- The table below outlines the agents involved in advancing each of the segmented categories of technologies and approaches, critical policies and recent developments are also outlined

EE	Primary Administrator	<ul style="list-style-type: none"> EE is administered by electric utilities, including both large IOUs (such as PG&E, SDG&E, and SCE) and public power entities such as Los Angeles Department of Water and Power (LADWP) and Sacramento Municipal Utility District (SMUD) Additionally, IOU funded EE is delivered by two Regional Energy Networks (REN), one in the SF bay area and one in Southern California
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> Utility revenue decoupling is permitted and required by the California Public Utilities Commission (CPUC). Electric Program Investment Charge (EPIC) PG&E's new pay for performance program marks a shift in EE resource acquisition program design, SCE is piloting a similar initiative. These developments are driven by new legislation that focuses on metered energy savings
DR	Primary Administrator	<ul style="list-style-type: none"> Many utilities, including large municipals such as LADWP or SMUD, offer demand response programs and incentives. 3rd party aggregators and large energy users may submit qualified capacity bids to CA ISO (CA system operator)
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> Due to high levels of renewable generation, peak demand is shifting to ~5-8pm and DR programs may evolve to seek evening reduction Electric Program Investment Charge (EPIC) supports innovative programs
DER	Primary Administrator	<ul style="list-style-type: none"> Many utilities, including large municipals such as LADWP or SMUD, are investing in DERs and also actively engaged with 3rd party providers to develop new initiatives
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> Electric Program Investment Charge (EPIC) DER investment is widely supported and encouraged by the CPUC, which is requiring IOUs to file DER plans Southern California Gas has implemented an opt-in distributed energy resources tariff (GO-DERS) to plan, design, procure, construct, own, operate, and maintain distributed energy equipment on customer premises California has very supportive net metering and interconnection policies

MASSACHUSETTS – JURISDICTION OVERVIEW

- Massachusetts utilities currently procure the highest relative amounts of energy efficiency of any jurisdiction in North America at ~2.5% savings as a percent of sales/year
- These targets are part of a longstanding commitment to efficiency and low long-run costs
- MA utilities have high avoided costs and high exposure to natural gas infrastructure limitations
- These factors enforce the business case for DSM, DR, and DER

Key Players	Description of Role
MASS Save	DSM services provider; initiative of Massachusetts electric and gas utilities, functions as a 'one-stop-shop' under a uniform brand to provide efficiency services to retail residential and commercial customers
IOUs	National Grid, Eversource, & Unitil are the primary IOUs. Responsible for developing grid modernization plans and DSM investment
ISO-NE	New England grid operator, market administrator, and system planner Does not own infrastructure or deal with retail power

MASSACHUSETTS – JURISDICTION OVERVIEW

- The table below outlines the agents involved in advancing each of the segmented categories of technologies and approaches, critical policies and recent developments are also outlined

EE	Primary Administrator	<ul style="list-style-type: none"> A 3rd party entity, Mass Save, contracts with all electric utilities and leverages funding from a system benefit bill surcharge, ISO-NE forward capacity payments, and payments from participation in the Regional Greenhouse Gas Initiative (RGGI). Mass Save is designed to be a single, 'one stop shop' for customer EE services. IOUs (including Eversource and National Grid) also offer their own EE/DR services in addition to Mass Save
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> Highest Energy Efficiency Resource Standards (EERS) in N. America, IOUs are currently required to achieve ~2.5% savings as percent of annual sales, National Grid has achieved as high as 3.1% (2014-2015 average) Green Communities Act is the enabling legislation, includes prescriptive detail and strong policy support for EE/DR, focusing on "all cost effective and achievable"
DR	Primary Administrator	<ul style="list-style-type: none"> National Grid and Eversource (IOUs) manage DR programs ENERNOC, one of the largest DR aggregators is based in Boston ISO-NE (New England system operator) accepts DR capacity bids from qualified load resources
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> Strong policy support (Green Communities Act) & available value from ISO-NE
DER	Primary Administrator	<ul style="list-style-type: none"> Large IOUs, primarily National Grid and Eversource
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> Massachusetts has very supportive net metering and interconnection policies

NOVA SCOTIA – JURISDICTION OVERVIEW

- Efficiency Nova Scotia, the 3rd party DSM implementer for the province, implements a broad portfolio of DSM services across the province
- Nova Scotia has historically had among the highest levels of DSM spending per customer in Canada
- Nova Scotia Power, the province's T&D utility, has not seriously engaged in demand response activities with its customers, and the community feed-in-tariff program that has been successful in developing DER projects is not currently accepting additional applications

Key Players	Description of Role
Efficiency One	3 rd Party DSM Administrator funded by Nova Scotia Power ratepayers
Nova Scotia Power	Nova Scotia's largest and primary utility. Owns generation, transmission, and distribution

NOVA SCOTIA – JURISDICTION OVERVIEW

- The table below outlines the agents involved in advancing each of the segmented categories of technologies and approaches, critical policies and recent developments are also outlined

EE	Primary Administrator	<ul style="list-style-type: none"> Efficiency Nova Scotia (ENS, 3rd party administrator)
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> ENS most recent 2016-2018 DSM spending levels and continuation of pilot activities were challenged by a 2014 amendment to the Public Utilities Act to that place greater emphasis on short term affordability ENS has a history of delivering a broad portfolio of programs and measures, and is a leader in energy efficiency in Canada Nova Scotia Utility and Review Board (NSUARB – regulator) remains persuaded that energy efficiency is a public good
DR	Primary Administrator	<ul style="list-style-type: none"> N/A
	Critical Policy Drivers	<ul style="list-style-type: none"> N/A
DER	Primary Administrator	<ul style="list-style-type: none"> Nova Scotia Power
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> Nova Scotia Community Feed-in Tariff (COMFIT) is part of Nova Scotia's effort to achieve 40% renewable by 2020 COMFIT has developed ~150MW of community owned capacity, however the program is not currently accepting additional applications

BRITISH COLUMBIA – JURISDICTION OVERVIEW

- British Columbia set standards between '08-'11 to ensure all new capacity is clean or renewable and prioritizes cost effective DSM, however BC Hydro forecast an energy surplus in '12/'13, leading to a DSM moderation strategy that lowered spending by ~40% vs. planned over 2014-2016
- The jurisdiction overall remains supportive of innovative pilots and R&D, and released a climate leadership plan in 2016 that affirms its commitment to clean energy policies

Key Players	Description of Role
BC Hydro	Commercial Crown corporation owned by the Province of British Columbia, serves 95% of BC electric customers Owns generation, transmission, and distribution
Fortis BC	Largest IOU in BC, primarily a natural gas utility, owns natural gas <i>and</i> electric transmission and distribution
BC Ministry of Energy and Mines, BC Utilities Commission (BCUC)	Energy and Mines: BC Hydro regulator, BCUC: Fortis regulator

BRITISH COLUMBIA – JURISDICTION OVERVIEW

- The table below outlines the agents involved in advancing each of the segmented categories of technologies and approaches, critical policies and recent developments are also outlined

EE	Primary Administrator	<ul style="list-style-type: none"> Utility administered: BC Hydro (Elec), Fortis BC Inc. (Elec), Fortis BC Energy Inc. (Gas)
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> BC Hydro is regulated by the BC Ministry of Energy and Mines, Fortis is regulated by the BC Utilities Commission. Support for utility investment in innovative technologies and delivery methods as part of DSM plans Fortis BC was asked by the regulator in 2015 to document actions taken to support innovative DSM after not including a specific funding request BC Hydro and FortisBC offer a suite of traditional DSM rebates and programs Navigant completed a Conservation Potential Review for all BC utilities in 2017 that indicated significant DSM potential. Province is currently increasing efficiency standards for packaged boilers, gas fireplaces, air source heat pumps, and natural gas space and water heating equipment over the 2018-2020 period BC Hydro has a long track record of implementing voltage reduction programs
DR	Primary Administrator	<ul style="list-style-type: none"> Utility administered
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> BC Hydro is currently leading DR pilots including a residential hot water direct load control (DLC) program and voluntary commercial and industrial load curtailment
DER	Primary Administrator	<ul style="list-style-type: none"> BC Hydro
	Critical Policy Drivers & Recent Developments	<ul style="list-style-type: none"> Ongoing microgrid project in partnership with BC Institute of Technology 2013 grid scale battery storage installation completed in partnership with the Canada Clean Energy Fund BC Hydro has led installation of ‘dozens’ of electric vehicle charging stations in BC

TYPICAL FUNDING SCHEMES - CONTEXT

Funding for energy efficiency, demand response, and distributed energy can come from a variety of outlets and strategies that vary by jurisdiction.

- Navigant reviewed the six selected jurisdictions across three categories:
 - Energy efficiency (EE)
 - Demand Response (DR)
 - Distributed Energy Resources (DER)
- Our research sought to identify the *primary* funding schemes used for reviewed EE/DR/DER activities
- The policy landscapes and technologies themselves are evolving along with a transforming energy sector
- Critically, funding schemes are developing constructs – particularly for DER the funding strategies and regulatory frameworks in use are evolving, or expected to evolve, for most jurisdictions
- For that reason, our results are indicative of the current state and direction
- Furthermore, particularly for some of the Canadian jurisdictions, many DER investments and DR strategies are new (or pilot) endeavours—it should be anticipated that funding strategies and/or program design may change
 - Our funding categories treat pilot programs in the same way as mature programs

TYPICAL FUNDING SCHEMES - CONTEXT

- Each technology and approach was assessed against three funding categories listed below
- In addition, the assessment specified whether the technology or approach is fully funded or if the funding is uncertain (e.g., pilot programs, changing funding mechanisms, or retiring funding mechanisms)

Funding Category	Description	
DSM	Funding is primarily sourced from an energy efficiency/demand-side management plan that is typically regulator approved. Plans generally cover 1-3 years. Costs are typically recovered as an operating expense included in tariffs, but may also be recovered via a special charge (e.g. VT).	DSM
Other Ratepayer	“Other ratepayer” is used to represent funding that is not approved as part of a DSM budget, but rather is separately approved as part of a different filing request or operating budget. ‘Separate filings’ may include e.g. required smart grid plans or grid modernization plans. Costs are typically recovered as an operating expense included in tariffs, but may also be recovered via a special charge (e.g. CA).	OR
Other (Including typically a mix of public/taxpayer, non-utility, and ratepayer)	Particularly for new DER investments, there may be special public funding used by a utility partner that is leading the investment. For instance, BC Hydro’s Field, BC grid storage project was developed with support from the Canada Clean Energy Fund. This category indicates that funding for existing or newly planned activities has been sourced from what may be a combination of ‘other public’ and varying levels of ratepayer funds. Funding support may also be derived from non-utility revenue streams that are linked to specific DER initiatives (e.g. digital platform advertising).	OF

ENERGY EFFICIENCY – TYPICAL FUNDING SCHEMES

- Customer EE programs are typically funded as part of DSM regulatory plans
- Voltage reduction is funded outside of DSM budgets, and is generally viewed by utility commissions as a prudent operational enhancement and not a DSM activity

Predominant Funding Source

DSM

Other Ratepayer

Other (e.g., taxpayer)

Indicator

DSM

OR

OF

EE Activity	Ontario	British Columbia	Nova Scotia	Massachusetts	California	Vermont	New York
Resource acquisition	DSM	DSM	DSM	DSM	DSM	DSM	DSM
Market transformation	DSM	DSM	DSM	DSM	DSM	DSM	DSM
Behavioural	DSM	DSM	DSM	DSM	DSM	DSM	DSM
Performance-based funding	DSM	-	-	DSM	DSM	-	DSM
Pilots/R&D	DSM	DSM	DSM	DSM	DSM	DSM	DSM
Voltage reduction	OF, OR	OR	OR	OR	OR	OR	OR

DEMAND RESPONSE – TYPICAL FUNDING SCHEMES

- DLC is typically a DSM activity, bundled as part of e.g. a ‘Smart A/C’ program, however it can also separately be introduced as a smart grid initiative outside of DSM plans and proceedings
- Most jurisdictions offer TOU and CPP tariffs (Yes indicates that a pricing program is available to customers either on a mandatory or voluntary basis)

Predominant Funding Source	Indicator
DSM	DSM
Other Ratepayer	OR
Other (e.g., taxpayer)	OF

DR Activity	Ontario	British Columbia	Nova Scotia	Massachusetts	California	Vermont	New York
Direct load control (DLC)	OR	DSM ^	DSM *	DSM	DSM	-	DSM
Demand Response Capacity	OR	DSM	-	OR, DSM	OR, DSM	OR, DSM	OR, DSM
Time of Use Rates (TOU)	YES	NO	YES	YES	YES	YES	YES
Critical Peak Pricing (CPP)	YES ^T	NO	YES ^{**}	YES	YES	YES	YES

[^] New pilot activity in 2015 using 103 homes and 4 businesses focused on residential hot water.

^{*} This has been piloted in collaboration with Nova Scotia Power and New Brunswick Power, and is also offered by the Berwick Electric Commission in Berwick, NS. (<http://www.nrcan.gc.ca/energy/funding/current-funding-programs/cef/4975>)

^{**} Nova Scotia Power offers ‘one-part real time pricing’ and interruptible tariffs for very large customers that are categorically similar to CPP.

^T Ontario has a program allowing large customers with certain NAICS codes and peak demand greater than 500 kW to offset peak during the top 5 hours of the year and pay lower rates. In addition, there are CPP pricing pilots underway for residential customers.

DISTRIBUTED ENERGY RESOURCES – TYPICAL FUNDING SCHEMES

- CHP may fall under either DSM or as part of broader initiatives that include state or provincial funding
- EV incentives directly to customers are uncommon, these incentives are more generally captured in the form of purchase rebates and charging infrastructure initiatives

Predominant Funding Source

DSM

Other Ratepayer

Other (e.g., taxpayer)

Indicator

DSM

OR

OF

DER Activity	Ontario	British Columbia	Nova Scotia	Massachusetts	California	Vermont	New York
Solar	OR	-	-	OF	OR, OF	-	OF
Storage	^	-	%	#	OR	OR	OR
CHP	DSM	OR	OF *	DSM	OF	DSM	OF
Microgrids	OF	-	-	-	OF	-	OF
Electric Vehicles (EVs)	OF	-	-	-	OF **	-	-


^ PowerStream Ontario is running a solar storage pilot.

* As part of the Nova Scotia Community Feed in Tariff Program (COMFIT), administered by the Nova Scotia DOE but no longer accepting applications. <https://energy.novascotia.ca/renewables/programs-and-projects/comfit>

** Southern California Edison, for example, offers a special metered EV rates.

Massachusetts is currently developing an energy storage target, 2020 mandates expected to be set in July 2017.

% Very small pilot project <http://www.nspower.ca/en/home/newsroom/news-releases/clean-energy-project.aspx>



SECTION 4:
SUMMARY
OBSERVATIONS
AND NEXT STEPS

PRELIMINARY OBSERVATIONS

How has the definition of CDM changed over time in Ontario?

- Targets have shifted from province-wide peak demand to LDC-level energy targets driven by larger policy goals which, in turn, lead to government directives
 - In the past (pre-2008), progress included savings funded outside of IESO (then OPA) CDM programs (Renewable Energy Standard Offer Programs, Enwave, third tranche funding for LDCs)
 - Combined Heat and Power was formally added to be considered as progress to targets
 - Savings from time-of-use was previously included
- The definition of CDM that is counted towards targets has changed over time and targets have shifted from broad, province-wide energy and demand reduction targets to localized, LDC energy targets

Is the current definition appropriate to achieve the policy objectives of the framework and to align with Ontario's broader GHG reduction goals?

- There are several technologies and approaches currently not included in the definition of CDM that have both customer and system benefits and align with one or more of the Government's policy objectives
 - Interactions with other policies must also be taking into consideration (e.g., net metering, industrial conservation initiative)
- All technologies and approaches align with some policy objectives, but not all align with GHG reduction goals
 - Interaction with other policies should be considered

PRELIMINARY OBSERVATIONS

How does the definition of CDM in Ontario align with the definition of CDM/DSM in other jurisdictions?

- IESO is unique among system operators given its oversight of DSM activities conducted by constituent LDCs
- In other jurisdictions (not Ontario), DSM plans and the funding allocated to them, focus primarily on energy efficiency and demand response programs, although CHP may be included as well as pilot/R&D budgets
- In other jurisdictions (not Ontario), DR investments are typically part of DSM plans, including e.g. direct load control programs, smart appliance programs, and behavioural programs
- DER investments are supported most commonly by a combination of ratepayer (operating expense, specific/required funding request*, or surcharge) and public (e.g. provincial/state/federal) clean energy grants and funds, as well as non-utility revenue streams and operational cost savings. *E.g. requirements to develop and submit 'smart grid' or 'grid modernization'
- In most other jurisdictions, Voltage reduction (VR) is funded outside of DSM budgets, and is generally viewed by regulators as a prudent operational enhancement and not a DSM activity. In Massachusetts VR has been funded as part of 'grid modernization', and in California, where many utilities have been actively pursuing voltage reduction for decades, voltage reduction studies to find additional incremental savings have been part of smart grid pilot initiatives. Navigant is aware, however, of jurisdictions/utilities that have included CVR in DSM budgets (e.g. PECO in Pennsylvania)
- Generally, DSM includes the technologies included under "customer energy efficiency" and "dispatchable demand response" (as defined in this report)
- DER and smart grid investments are typically funded outside of DSM
- The treatment of both combined heat and power and voltage reduction varies across jurisdiction

NEXT STEPS

Based on the preliminary assessment of the current state of definition of CDM, the following areas will be considered in the market research phase:

- Understand the interactions between this report and other topic reports (e.g., collaboration, climate change, planning integration, budgets and targets)
- Consider policy interactions during market research phase (e.g., net metering and Industrial Conservation Initiative) and the impact on adoption of different technologies and approaches
- Where a technology/approach should be funded is not a simple policy question and there are many considerations, for example:
 - Scale (cross with topic 3 - collaboration):
 - DERs are promoted in many jurisdictions through both government and private funding which may require scale to successfully promote adoption
 - Demand response can be funded both locally and through the IESO with different objectives. The structure of the jurisdiction and local vs. system needs have a large impact on how the funding/program administration is structured
 - Cost/benefit equity (alignment between those who fund a resource and those benefit from a resource on a time and geographic scale)
 - Market/System (cross with topic 5 - planning integration):
 - The degree to which (1) the resource is needed (e.g., renewable integration and the need for balancing resources); and (2) the market can support the ability to earn revenues (e.g., capacity costs and reserve margins, ancillary services markets, technology to provide automated demand response, dynamic pricing (rate structures))
 - Policy goals (cross with climate change + planning integration):
 - Is grid modernization a goal and/or promoted elsewhere?
 - What is the role of the regulator?



APPENDIX A: GLOSSARY

GLOSSARY

Term	Description
DSM	Demand Side Management – an umbrella term that typically refers to energy efficiency and demand response
EE	Energy efficiency - Technology or approaches that result in less energy to perform the same function.
DR	Demand Response - Technology or approaches that enable energy shifting or reduction during certain times.
DER	Distributed Energy Resources - Behind-the-meter or distribution-connected generation or storage resources that supply all or part of a customer's electricity use
Dx	Distribution connected (connected to the distribution system)
Tx	Transmission connected (connected to the transmission system)
Resource acquisition	Programs that promote products and practices used by energy consumers that drive investments in the short-term.
Market transformation	Programs that create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of energy efficiency measures.
Behavioural	Programs focused on behavioral transformation of energy use of end consumers.
Performance-based funding	Performance-based incentive payment calculated via use of whole-building advanced metering infrastructure (AMI) and associated analytics.
R&D, pilots	Research and development, trial initiatives to test new approaches and strategies.

GLOSSARY

Term	Description
Voltage reduction	Reduction of energy consumption resulting from a reduction of feeder voltage/voltage optimization.
Direct load control	Programs focused on automatically shifting customer load in response to signals from the system operator or aggregator.
Demand Response Capacity	Programs focused on customers shifting load in response to signals from the system operator or aggregator.
TOU	Time-of-use pricing, Programs that modify customer-facing pricing into pricing tiers based on the time of day (and/or season).
Critical peak pricing	Programs that align the highest system peaks with customer-facing pricing.
Solar	Solar cited on customer premise, delivered via a utility or 3 rd party partner
Solar-storage	Combination of solar and storage technologies into a customer-sited nanogrid.
Storage	Utility incentives designed to accelerate adoption of storage technology. Programs may enable the utility to utilize stored power during peak events.
Combined Heat and Power	Also called co-generation is behind-the-meter generation that involves the production of both electricity and useful thermal energy in an integrated system.
Electric Vehicles	Plug-in electric vehicles as they relate to the ability to shift and manage customer load or use as storage.
Microgrids	Programs or pilots that promote microgrids (combination of storage technology and generation resources). Can consider resiliency/islanding in response to physical or economic conditions.