Achievable Potential Study
RFP Scope of Work

Objective

- The main objective of the APS is to identify and quantify energy savings (electricity and natural gas) and GHG emission reductions and associated costs from energy efficiency and conservation for the period of 2018-2038 disaggregated by:
    - Region (ten (10) IESO zones[1] and five (5) natural gas utility regions[2]); and
    - Sector and sub-sector[3] to be defined in consultation with the Project Team.
- The APS will provide data and analysis to inform the development of future conservation policy and/or frameworks; program design, implementation and evaluations; long-term resource planning; and system operations.
- As the first integrated APS in Ontario, the study aims to capture the dynamic relationship between electricity and natural gas use in order to better support emerging whole home and business energy efficiency and conservation measures and programs and also understand the impacts of electrification policies.

Tasks

The Service Provider shall be responsible for the following tasks:

Task 1 – Project Plan

Description:

- Establish a detailed project plan that provides a roadmap for the APS analysis, which will be reviewed by the Project Team, an advisory group comprised of stakeholders and government/agency observers (the "**Advisory Group**"), and an independent third-party panel of experts (the "**Expert Panel**") and approved by the Project Team before the APS analysis commences.
- The detailed project plan must describe all key components of the APS analysis including but not limited to: a catalogue of data inputs and sources, methodology for the analysis including key milestones, critical path and key dependencies, as well as scenarios to be considered and format of outputs.

[1] http://www.ieso.ca/localContent/zonal.map/index.html
[2] Union Gas service area includes Northern region (from Manitoba border to North Bay/Muskoka area and across Eastern Ontario from Port Hope to Cornwall) and Southern Regional (Southwestern Ontario from Port Hope to Cornwall). Enbridge Gas service area includes Central, Niagara and Eastern Regions.
[3] Sectors and subsectors used in previous APS are included in Appendix H

- The detailed project plan must also identify relevant potential studies from similar jurisdictions for comparisons of economic and achievable potential in Tasks 6 and 7.

Deliverables:
- Draft project plan, including a data catalogue, for review/comment
- Presentation to the Project Team and Advisory Group for feedback
- Final project plan, including a data catalogue, incorporating feedback

Task 2 – Base Year (2017) Disaggregation

Description:
- Using 2017 actual monthly gas consumption data and hourly electricity consumption data, normalized for weather, as outlined in Appendices H and I, the Service Provider shall establish a baseline year of natural gas and electricity consumption (m3 and kWh, respectively) disaggregated by region (natural gas utility regions and ten IESO zones), sector and sub-sector and end use. The baseline year will consider and address:
    - Any discrepancies between sectors and sub-sectors used by the IESO and natural gas utilities;
    - Strategies for mapping the boundaries of the ten IESO zones to the natural gas utility regions used for forecasting, using a methodology recommended by the Service Provider and approved by the Project Team; and
    - Allocation of electricity and natural gas consumption within each sub-sector to relevant end uses.
- Sectors, sub-sectors and end-uses shall be defined in consultation with and approved by the Project Team. The classification used in the previous APS is shown in Appendix H and Appendix I.

Deliverables:
- Disaggregated 2017 base year electricity and natural gas consumption by IESO zone and natural gas utility region, sector, and sub-sector, and end-use.
- Presentation to the Advisory Group for feedback
- Methodology, data sources and findings shall be summarized in one chapter of the final report.

Available data the Project Team will provide (see Appendix G for summary list and public report/data links):

- 2017 hourly electricity consumption data by IESO zone
- IESO zone profiles from IESO's end-use forecasting model with sub-sector and end-use breakdown
- 2017 gas utility sales data by region and sector
- LDC sub-sector profiles from 2016 IESO achievable potential study
- Natural gas sub-sector profiles from 2016 OEB achievable potential study

- IESO residential end use survey results
- Natural gas utilities' end use survey results
- Secondary sources of data:
    - Municipal Property Assessment Corporation local distribution company ("**LDC**") profile and Industrial Conservation Initiative property data
    - IESO Business Energy Efficiency Sales Tool (Dun and Bradstreet data)
    - Commercial sub-sector square footage baseline and forecast (2018 – 2045)
    - Public sector data from O. Reg 397/11
    - Ontario Planning Outlook and LTEP 2017 forecast data by sector, zones and end use
    - OEB year book
    - U.S. Energy Information Administration and Natural Resources Canada benchmarking studies

Task 3 – Reference Forecasts

Description:

- Develop a reference case forecast for electricity (distribution and transmission connected load) and natural gas for 2018-2038 using an end-use based model that is calibrated against IESO's and the gas utilities' forecasts.
    - The reference forecast must be net of the impact of existing and planned future codes and standards, the persistence of historical conservation program savings, naturally-occurring efficiency changes and fuel switching.
    - The reference forecast must represent the forecast of energy use that could be reduced through future energy efficiency and conservation programs.
- Identify all discrepancies between electricity and natural gas forecast assumptions and determine if/how they can be reconciled.
- In addition to the reference forecast, develop two (2) additional forecast scenarios ('**alternate forecasts**"). The scenario drivers for these alternate forecasts will be defined and provided by the Project Team and may be used to address, for example, any significant differences between IESO and gas utility projections (e.g., for buildings space, households and/or economic growth) and/or different policy and technology scenarios (e.g., high or low electrification or carbon prices).

Deliverables:

Reference case end use forecasts between 2018-2038 by IESO zone, natural gas utility region, sector, sub-sector, and end-use.

- Provide a description of discrepancies between electricity and natural gas forecast assumptions and if/how they could be reconciled.

- Provide two alternate end use forecasts between 2018-2038 by IESO zone, natural gas utility region, sector, sub-sector, and end-use
- Presentation to the Project Team and Advisory Group for feedback
- Methodology, data sources and findings shall be summarized in one chapter of the final report

Available data the Project Team will provide:

- IESO gross and net (of codes and standards and programs savings) load forecast by IESO zone, sector/sub sector and end use for the period of 2018-2038
- 10-year natural gas utility sales forecast (net of codes and standards and program savings)
- Commercial square footage baseline and forecast provided by IESO
- OEB's Long Term Carbon Price Forecast
- Residential household forecast provided by IESO

Task 4 – Energy Efficiency and Conservation Measures

Description:

- Develop a comprehensive database of all electricity and natural gas energy efficiency and conservation measures, including but not limited to measures that have the potential for fuel switching (i.e., displace existing natural gas or electricity consumption). The analysis must include technology-based, behavioral, operational, installation, commissioning and energy management measures.

    - In addition to measures that are currently commercially available, the Service Provider shall identify how to account for additional anticipated new and emerging measures for the 2024-2038 period that are not currently on the market, including quantifying energy savings and costs. *Proponents should propose an approach in their proposal.*
    - Measures must include advanced codes and standards and/or measures/activities that improve codes and standards compliance.
    - For sub-sectors with a heterogeneous mix of energy consumers (e.g., industrial sub sectors), the Service Provider shall recommend a methodology to identify and account for highly customized energy efficiency and conservation measures that are industry-specific or even facility-specific. *Proponents should propose an approach in their proposal.*
- Provide a description of each measure, and classify it as applicable to or not applicable to: new construction, natural end-of-life replacement, early retirement, retrofit, operational / maintenance / controls, or whole-building.

- Map all measures to applicable electricity and/or natural gas end-uses (e.g., residential space heating, commercial interior lighting, industrial steam and hot water systems, etc.).
- Map all measures to applicable sector and sub-sectors (e.g., single family, row house, MURB, food retail, hospital, large office, agriculture, chemical manufacturing, etc.).
- For each measure, estimate:
    - measure life
    - equipment costs
    - operating costs
    - energy (electricity and natural gas), demand (electricity), water and carbon savings
- Provide the simple payback period / return on investment associated with each measure.
- Assess other factors such as capital project hurdle rates that would affect a customer's decision to adopt the technology, including but not limited to a summary of any qualitative impacts such as comfort improvements and product quality improvements.
- Provide current market penetration or saturation estimates associated with each measure, where data is available.
- Consider interactive effects between measures where applicable and whether the measure costs will decline as market share or volume increases.
- For energy efficiency and conservation measures that can incorporate sufficient controls to enable electricity demand reduction, quantify the associated demand response potential.

Deliverables:

- Produce a comprehensive database of all energy efficiency and conservation measures to be included in the analysis.
- Measures mapped to end-uses and sector/sub-sector.
- Provide savings per measure per participant per end use, including but not limited to measure life, persistence and a description of major assumptions and data sources used for the analysis.
- Presentation to the Project Team and Advisory Group for feedback
- Methodology, data sources and findings summarized in the final report

Available data the Project Team will provide:

- OEB's Technical Reference Manual (TRM) list of measures
- IESO's Measures and Assumptions list
- Residential End Use Survey results
- Hourly emissions factors for electricity system and future forecast
- IESO's Evaluation Measurement and Verification ("**EM&V**") reports
- Natural Gas Demand Side Management (DSM) EM&V Reports

Task 5 – Technical Potential

Description:

- Calculate maximum technical potential of all measures ("**Technical Potential**") to determine annual electricity and natural gas, water, peak demand (electricity only), and carbon savings, and estimate associated costs for 2018-2038, for each region, segmented by end use, sector, and sub-sector.
    - Technical Potential must not consider cost effectiveness
    - The rate of adoption for end-of-life measures must be limited to the natural rate of equipment turn over
    - *Proponents should propose an approach for choosing the appropriate maximum rate of adoption for retrofit measures (e.g., attic insulation) to be used in the technical potential assessment.*
- The Service Provider shall utilize electricity load shapes to determine hourly coincident peak/capacity savings and hourly electricity savings.
- As part of the Technical Potential assessment, for energy efficiency and conservation measures that can incorporate sufficient controls to enable electricity demand reduction, the Service Provider shall also identify demand response potential from these measures.
- Technical assessment must address measure staking, interactive cross-effects and persistence.

Deliverables:

- Technical Potential by region, sector, sub-sector, and end-use, for the 2018-2038 period for the reference forecast and two alternate forecasts as developed as part of Task 3.
- Discussion of Technical Potential results and comparisons to previous studies conducted in Ontario and other similar jurisdictions (to be identified in consultation with the Project Team as part of Task 1).
- Presentation to the Project Team and Advisory Group for feedback.
- Methodology, data sources and results summarized in the final report.

Task 6 – Economic Potential

Description:

- Using the avoided electricity and natural gas costs provided by the Project team, calculate, for each measure included in the Technical Potential the Total Resource Cost (TRC) and Program Administrator Cost (PAC) at three varying incentive levels to be determined in consultant with the Project Team – e.g., 30%, 50% and 100% of incremental measure cost.

- The threshold for cost effectiveness will be defined by the Service Provider in consultation with the Project Team
    - *Proponents should include a recommendation in their proposal.*
- Estimate savings potential for the cost-effective measures by region, sector, sub-sector, and end-use, including annual energy, water, demand and carbon savings and cost estimates for 2018-2038, assuming that 100% of customers implement all applicable cost effective measures, regardless of market acceptance.
- Estimate economic potential to utilize electricity load shapes to determine hourly coincident peak/capacity savings and monthly energy savings ("**Economic Potential**").
    - For cost effective energy efficiency and conservation measures that can incorporate sufficient controls to enable electricity demand reduction, the Economic Potential assessment must identify demand response potential from these measures.
    - Economic Potential assessment should consider stacking of end-use measures, interactive cross-effects and persistence.

Deliverables:

- Updated natural gas avoided costs.
- Economic Potential by region, sector, sub-sector, and end-use, for the 2018-2038 period for the reference forecast and two alternate forecasts as developed as part of Task 3.
- Peak demand analysis results by region and sector.
- Discussion of Economic Potential results and comparisons to previous studies conducted in Ontario and other similar jurisdictions (to be agreed on in consultation with the Project Team as part of Task 1).
- Presentation to the Project Team and Advisory Group for feedback.
- Methodology, data sources and results summarized in the final report.

Available data the Project Team will provide:

- IESO Avoided Costs
- Natural Gas Utility Avoided Costs
- OEB Long Term Carbon Price Forecast

Task 7 – Achievable Potential

Description:

- The achievable potential analysis takes into account realistic market penetration rates of cost-effective measures over the study period.

- The Service Provider in consultation with the Project Team shall develop a methodology to determine market penetration rates for each cost-effective measure, by sub-sector, included in the Economic Potential.
- The market penetration rates must be developed considering factors including, but not limited to, the following:
    - Market barriers
    - Factors that affect a customer's decision to implement energy efficiency (e.g., customer preference, payback periods, return on investment (ROI), investment hurdle rates and/or other factors)
    - Incentive levels
    - Aggressiveness of marketing efforts
    - Historic program experience and program participation
    - Competing energy efficiency and conservation measures
    - Interaction between electricity and natural gas utilities
    - Experience in leading jurisdictions, and
    - Other factors or policy objectives affecting market acceptance as identified by the Service Provider in consultation with the Project Team.
- *Proponents should detail their recommended approach to developing the market penetration rates in their proposal*.
- The Service Provider's approach shall be aligned with best practice approaches for modeling market penetration in leading jurisdictions to ensure accurate achievable potential estimates. This may require primary data collection or interviews (e.g., from program administrators or other conservation or energy efficiency experts).
- Empirical research results, and how they are applied to the analysis, must be explicitly stated.
- Estimate the achievable potential savings by region, sector, sub-sector and end-use for the 2018-2038 period, for the reference forecast and two alternative forecasts as developed as part of Task 3, under three scenarios to be approved by the Project Team. These Scenarios may include:
    - Maximum achievable potential
    - Budget constrained achievable potential
    - Other scenarios
- Estimate total incentive and non-incentive program costs for each scenario using measure costs at incentive levels calculated in Task 4.
- Analyze peak electricity demand impacts associated with each of the three achievable potential scenarios.
- For energy efficiency and conservation measures that are included in each of the three achievable potential scenarios, which are capable of incorporating sufficient controls to

enable electricity demand reduction, the achievable potential analysis must identify the demand response potential from these measures.

- Develop nine (9) cost curves showing the achievable potential savings and associated costs between zero (e.g., no budget allocated and therefore no savings) and the maximum level of achievable potential (e.g., all available cost-effective savings considering market penetration rates) for three (3) specific years in the study period, to be defined in consultation with the Project Team.
    - Separate cost curves are to be provided for electricity, natural gas and an integrated curve provided for both electricity and natural gas for each of the specified years.
    - Cost curves should have the y-axis represent annual program budget, the x-axis energy savings and the associated measures plotted along the curve.

Deliverables:

- Achievable potential results by region, sector, sub-sector, and end-use, including but not limited to annual energy, water, demand and carbon savings and cost estimates for 2018-2038, for each scenario and for the reference forecast and two alternate forecasts as developed as part of Task 3.
- Peak demand analysis results for achievable potential scenarios by region and sector.
- An Excel-based dynamic cost curve tool with detailed measure level data for nine (9) cost curves, showing the achievable potential savings and associated costs between zero potential and the maximum level of achievable potential for three (3) specified years for electricity, natural gas and an integrated curve.
- Key findings for each sub-sector on the market impacts considered in the analysis and how they impact expected adoption that could be used to inform future program design.
- Discussion of results and comparison to previous studies conducted and actual levels of achievement both in Ontario and other similar jurisdictions to be approved by the Project Team.
- Present preliminary results to the Project Team and Advisory Group for feedback.

Methodology, data sources and results shall be summarized in the final report.

Task 8 – Whole Building Benchmarking

Description

- The Service Provider shall work with the Project Team to recommend and test a whole-building benchmarking approach to determine the achievable potential for one sub-sector.

    - The whole-building benchmarking approach will leverage actual energy consumption data collected on existing buildings from one commercial or institutional sub-sector to develop realistic achievable energy savings for other buildings in that sub-sector. **Note** that this sub-sector is still to be included in the analysis identified in Tasks 4-7.
    - The Service Provider shall recommend a sub-sector most suitable to the 'whole-building' benchmarking approach, to be approved by the Project Team.
    - The whole-building benchmarking approach shall identify and quantify potential energy savings (electricity and natural gas) and GHG emissions reductions using the most recent available data, adjusted to 2017.
- Develop a methodology to estimate associated equipment costs, operating costs, energy (electricity and natural gas), demand (electricity), water and carbon savings, and persistence of the savings.
- Provide the simple payback period / return on investment.
- Assess other factors, including but not limited to capital project hurdle rates that would affect a customer's decision.
- Ensure the methodology addresses market barriers and other building specific considerations.
- Disaggregate potential savings by region and end-use to inform program design and conservation action.

Deliverables:

- Achievable potential results for the approved sub-sector, by region and end-use, including but not limited to annual energy (electricity and natural gas), water, demand and carbon savings, and cost estimates for 2018-2038.
- Peak demand analysis results by region.
- Key findings for the approved sub-sector that could be used to inform future program design.
- Discussion of results and comparison to achievable potential identified in Task 7 for the approved sub-sector.
- Recommendations on if and how a 'whole building' benchmarking approach could be further employed in future achievable potential studies including, but not limited to, which other subsectors are most suitable and any limitations such as data gaps, data quality barriers, or other potential barriers.
- Present preliminary results to the Project Team and Advisory Group for feedback.
- Methodology, data sources and results shall be summarized in the final report.

Available Data the Project Team will provide:

- Public sector data from O. Reg 397/11

Task 9 – Marginal Abatement Cost Curve ("MACC")

Description:

- Based on the results from previous Tasks including the energy efficiency and conservation measures list, develop a marginal abatement cost curve for the 2021-2023 compliance period that ranks energy efficiency and conservation measures that provide natural gas GHG abatement according to their cost effectiveness (i.e., cost in comparison to a reference forecast of the forward cost of an Ontario cap and trade allowance, as defined by the OEB's Long Term Carbon Price Forecast).
    - Measures to be included in the MACC will either abate natural gas customer emissions or facility emissions (as defined in the OEB's Cap and Trade Framework), or decarbonize the gas supply (i.e. renewable natural gas ("**RNG**")):
        - Most customer abatement activities for residential, commercial, and industrial sectors are expected to be developed from Task 4 analysis.
        - Facility abatement activities and RNG are expected to require additional research.

- Develop a methodology for the MACC, including inputs and assumptions on:
    - what measure and end-use data resulting from the previous tasks will be used to build the MACCs
    - what the "cost" metric of the cost curve will include in terms of costs and benefits
    - other variables affecting the MACC as proposed by the Service Provider, with rationale (e.g., technology costs, adoption rates and market penetration)

Deliverables:

- One MACC that shows customer, facility, and RNG carbon abatement options, plus:
    - Customer Abatement: MACC for each sector and each gas utility
    - Facility Abatement: MACC for each gas utility
    - RNG: Single MACC for Ontario
- Data to be provided in the following formats:
    - Excel-based format with all data (excel data must allow for manipulation, e.g. pivot tables)

    - Visual MACC diagram (e.g., graph)
    - Written description of the development of the MACC, with an explanation of the methodology and input assumptions and the sensitivity analyses
- Presentation to the Project Team and Advisory Group for feedback
- Findings to be included in one chapter of the final report

Available Data the Project Team will provide:

- OEB's 2018 Long Term Carbon Price Forecast, leveraging the mid-range forecast
- OEB's 2017 MACC
- Cap and Trade Compliance Plans submitted to the OEB (available on the public record)

Task 10 – Sensitivity Analysis

Description:

- Identify, in consultation with the Project Team, the most sensitive inputs and/or assumptions on savings potential estimates looking at electricity, natural gas and maximum and minimum LTCPFs, measure costs, incentive rates, adoption curves, persistence, avoided costs as well as other key inputs.

Deliverables:

- Sensitivity analysis results for economic and achievable potential scenarios by region and sector
- Sensitivity analysis results for the MACC
- Sensitivity analysis shall be summarized in one chapter of the final report.
- Presentation to the Project Team and Advisory Group for feedback

Task 11 – Final Reporting

Description:

- Summarize the study results including but not limited to technical, economic and achievable potential results by region, sector, sub-sector and end-use in a final report and presentations.
- Provide key findings by end use for each sub-sector that highlights expected changes and evolutions in the sub-sector that could be used to inform future program design.
- Provide recommendations on how to improve future studies and identifications of priority areas for additional work in advance of the next achievable potential study.

Deliverables:

- Final report and recommendations
- Detailed summary presentation delivered to Advisory Group and Project Team
- High level summary presentation delivered via a public webinar
- Full, dynamic Excel spreadsheet, with documentation, and study results which include all datasets and crosstabs.

Task 12 – Project Management and Stakeholder Engagement

Description:

- Kickoff meeting (in person)
- Weekly status meetings (teleconference/webinar) with Project Team
- Updating and maintenance of an issue tracker
- Additional meetings (teleconference/webinar) with Project Team:
    - For each Task above (with the exception of the project plan) one meeting at each of the following stages of the Task, as required in the discretion of the IESO (these may be able to be combined with weekly status meetings):
        - Review/confirm approach for the Task;
        - Sample/format of models/tools/data that will be provided for the project;
        - 50% completion point of Task;
        - Draft results/report; and
        - Final results/report.
- Stakeholder engagement
    - Monthly meetings with the Advisory Group to provide updates and seek input where appropriate (12 anticipated in total)
        - In-person attendance is preferred and required for at least 50% of these meetings.
    - Quarterly public webinars to provide updates and seek input where appropriate (4 anticipated in total).

Deliverables:

- Regularly updated issues tracker
- Meeting summary notes
- Engagement session materials and meeting summary notes
- Consolidation and draft responses to comments received from the Advisory Group meetings and quarterly public webinars

Additional Services

Upon completion of the tasks outlined in Section 2.2 above, the Service Provider may be asked to provide the following services to support further work required by the Project Team.

Dynamic APS Model

Description:

- Provide the dynamic APS model to the Project Team in addition to the results/outputs produced by the model.
- Deliver the clean and final versions of the dynamic APS model and supporting tools developed over the course of the project to the Project Team with appropriate documentation.
    - Delivery of the model must allow for IESO and OEB staff to make changes to key assumptions including, but not limited to, load forecast, fuel share, avoided costs, and incentive levels.
- Walk through materials with the Project Team answering and address all staff questions.

Deliverables:

- Dynamic APS model and tools including all supporting datasets and crosstabs.
- Two workshops to provide training on the use and functionality of the model.
- Documentation of major assumptions, modeling procedures and instructions for use.

Support Services

Description:

The Project Team may require the Service Provider to provide additional on-going support services outside of the twelve (12) tasks outlined in this RFP for activities including, but not limited to, the following:

- Alternate scenario development
- Communications support
- Interpretation of data
- Updates to modeling
- Disaggregation of data
- On-going model support

If the Project Team directs the Service Provider to provide any of the support services, the Project Team would provide direction on the maximum number of hours required for each additional task requested.

Timelines

As per the Minister's Directives, the APS is required to be completed by June 1, 2019. The Agreement will have a term ending on June 30, 2019 to allow for project wrap-up. At the sole discretion of the IESO, the term of the contract may be extended by a period of up to one (1) year, to allow for potential follow up work required in the discretion of the IESO.

The table below provides a suggested project schedule. Proponents can adjust the schedule to appropriately reflect the approach that they recommend in their Proposal. However, the draft results for the analyses must be provided **no later than April 1, 2019** and final results must be provided **no later than May 1, 2019**.

Task	Expected Timeline
Target kick-off meeting	Week of July 23, 2018
Task 1: Project Plan	August 2018
Task 2: Base Case Calibration	Q3 2018
Task 3: Reference Forecast	Q4 2018
Task 4: Energy Efficiency and Conservation Measures	Q4 2018
Task 5: Technical Potential	Q4 2018
Task 6: Economic Potential	Q1 2019
Task 7: Achievable Potential	Q1 2019
Task 8: Whole Building Benchmarking	Q1 2019
Task 9: Marginal Abatement Cost Curve	Q1 2019
Task 10: Sensitivity Analysis	Q1 2019
Task 11: Final Reporting	May 1, 2019
Task 12: Project Management and Stakeholder Engagement	On-going
Additional Services: Dynamic APS Model (Optional Task at Project Team's discretion)	Anytime up until June 30, 2020
Additional Services: On-going Support Services (Optional Task at Project Team's discretion)	Anytime up until June 30, 2020

Summary of available data

Task 2: Base Year (2017) Disaggregation

- 2017 hourly electricity consumption data by IESO zone
- IESO zone profiles from IESO's end-use forecasting model with sub-sector and end use breakdown
- 2017 gas utility sales data by region, rate class, and sector
- LDC energy use profiles from 2016 IESO achievable potential study
- Natural gas energy use profiles from 2016 OEB achievable potential study
- IESO residential end use survey results
- Natural gas utilities' end use surveys
- U.S. Energy Information Administration and Natural Resources Canada benchmarking studies
    - https://www.eia.gov/consumption/commercial/about.php
    - http://www.nrcan.gc.ca/energy/efficiency/buildings/energy-benchmarking/3691
- Secondary sources of data:
    - Municipal Property Assessment Corporation (MPAC) LDC profile and Industrial Conservation Initiative property data
    - IESO Business Energy Efficiency Sales Tool (D&B data)
    - Commercial square footage baseline and forecast (2018 – 2045)
    - Public sector data from O. Reg 397/11: https://www.ontario.ca/data/energy-use-and-greenhouse-gas-emissions-broader-public-sector
    - Ontario Planning Outlook and LTEP 2017 forecast data by sector, zones and end use
    - OEB year book: https://www.oeb.ca/utility-performance-and-monitoring/natural-gas-and-electricity-utility-yearbooks

Task 3: Reference Forecasts

- IESO gross and net (of codes and standards and program savings) load forecast by IESO zone, sector/sub sector and end use for the period of 2018-2038
- 10-year natural gas utility sales forecast (net of codes and standards and program savings)
- Commercial square footage baseline and forecast provided by IESO
- OEB's Long Term Carbon Price Forecast: https://www.oeb.ca/sites/default/files/uploads/OEB-LTCPF-Report-20170531.pdf
- Residential household forecast provided by IESO

Task 4: Energy Efficiency and Conservation Measures

- OEB's Technical Resource Manual (TRM) list of measures: http://www.rds.oeb.ca/HPECMWebDrawer/Record/595009/File/document

- IESO's Measures and Assumptions list: http://www.ieso.ca/-/media/files/ieso/document-library/conservation/measures-and-assumptions/ieso-prescriptive-measures-assumptions-list-april-2018.pdf?la=en
- Residential End Use Survey results
- Hourly emissions factors for electricity system and future forecast
- IESO's Evaluation Measurement and Verification (EM&V) reports: http://www.ieso.ca/sector-participants/conservation-delivery-and-tools/evaluation-measurement-and-verification
- Natural Gas Demand Side Management (DSM) EM&V Reports: https://www.oeb.ca/industry/policy-initiatives-and-consultations/natural-gas-demand-side-management-dsm-evaluation

Task 6: Economic Potential

- IESO Avoided Costs
- Natural Gas Utility Avoided Costs
- OEB Long Term Carbon Price Forecast: https://www.oeb.ca/sites/default/files/uploads/OEB-LTCPF-Report-20170531.pdf

Task 8: Whole Building Benchmarking

- Public sector data from O. Reg 397/11: https://www.ontario.ca/data/energy-use-and-greenhouse-gas-emissions-broader-public-sector

Task 9: Marginal Abatement Cost Curve (MACC)

- OEB's 2018 LTCPF, leveraging the mid-range forecast: https://www.oeb.ca/sites/default/files/uploads/OEB-LTCPF-Report-20170531.pdf
- OEB's 2017 Marginal Abatement Cost Curve: https://www.oeb.ca/sites/default/files/OEB_MACC%20Report_20170720.pdf
- Cap and Trade Compliance Plans submitted to the OEB: https://www.oeb.ca/calendar/cap-and-trade-compliance-plans-1

2016 Achievable Potential Study Electricity and Gas sectors and sub-sectors

Enbridge Gas and Union Gas will provide natural gas forecasts for residential, commercial, and industrial sectors.
Data disaggregation beyond that level is subject to each utility's available data and its de-identification and aggregation standards.

Residential Sub-sectors		
2016 IESO APS (electricity)	**IESO Load Forecast**	**2016 OEB Potential Study (Gas)**
Single Family	Single Family	Single detached, gas-heated, pre-1980
Row House	Row House	Single detached, gas-heated, 1980-1996
MURB Low Rise	MURB Low Rise	Single detached, gas-heated, 1997-present
MURB High Rise	MURB High Rise	Low-income detached, gas-heated, all ages
Low Income	Other Residential Buildings	Attached, gas-heated, pre-1980
Other Residential Buildings		Attached, gas-heated, 1980-1996
		Attached, gas-heated, 1997-present
		Low-income attached, gas-heated, all ages
		Other/Mobile, gas-heated
Commercial Sub-sectors		
2016 IESO APS (electricity)	**IESO Load Forecast**	**2016 OEB Potential Study (Gas)**
Small office	Large office	Large office
Large office	Other office	Medium office
Non-food retail	Large non-food retail	Large non-food retail
Food retail	Other non-food retail	Medium non-food retail
Restaurant	Food Retail	Food retail
Lodging	Restaurant	Large hotel
Hospitals	Large Hotel	Medium hotel
Nursery home	Other hotel motel	Hospital

Schools	Hospital	Nursing home
Universities	Nursing Home	School
TCU	Schools	University/college
Warehouse wholesale	University colleges	Restaurant
Data center	Warehouse wholesale	Warehouse
Other commercial buildings	Other commercial buildings	Apartment
		Low-income apartment
		Other
Industrial Sub-sectors		
2016 IESO APS (electricity)	**IESO Load Forecast**	**2016 OEB Potential Study (Gas)**
Primary metals	Primary metals	Primary metal manufacturing
Paper manufacturing	Paper manufacturing	Pulp, Paper, and Wood Products Manufacturing
Auto parts manufacturing	Transportation and machinery	Transportation and Machinery Manufacturing
Chemical manufacturing	Chemical manufacturing	Chemical manufacturing
Plastic and rubber manufacturing	Plastic and rubber manufacturing	Cement and Asphalt Manufacturing
Food and beverage	Food and beverage	Food and Beverage Manufacturing
Fabricated metals	Fabricated metals	Fabricated metal manufacturing
Non metallic minerals	Non metallic minerals	Non-metallic mineral product manufacturing
Wood products	Wood products	Utilities Sub-sector
Petroleum refineries	Petroleum refineries	Petroleum and Coal Product Manufacturing
Mining	Mining	Mining, Quarrying, and Oil and Gas Extraction
Miscellaneous industrial	Miscellaneous industrial	Greenhouses
Agricultural		Miscellaneous manufacturing
Electronic manufacturing		

2016 APS Electricity and Gas end uses

End-use breakdowns are not available in gas utilities' load forecasts.

Residential End Uses		
2016 IESO APS (electricity)	**IESO Load Forecast**	**2016 OEB Potential Study (Gas)**
Space Heating	Forced Air Central Heating	Space heating
Space Cooling	Baseboards	Domestic water heating
Domestic Hot Water	Room space heaters	Cooking
Ventilation and Circulation	AC central	Fireplaces
Lighting	AC room	Clothes dryers
Cooking	Domestic Hot Water	Swimming pool heaters
Refrigerators	Ventilation and Circulation	Other
Freezers	Lighting	
Clothes Washers	Lighting Common Areas (MR)	
Clothes Dryers	Cooking	
Dishwashers	Refrigerators	
Plug Load	Freezers	
Miscellaneous	Clothes Washers	
Dehumidifiers	Clothes Dryers	
	Dishwashers	
	Computers	
	Televisions	
	Set Top Boxes	
	Elevators (MR)	
	Dehumidifiers	
	Swimming Pool Pumps	
	Other Consumer Electronics	
	Miscellaneous	

Commercial End Uses		
2016 IESO APS (electricity)	**IESO Load Forecast**	**2016 OEB Potential Study (Gas)**
Lighting Interior General	Lighting Interior General	Space heating
Lighting Interior High Bay	Lighting Interior Architectural	Service water heating
Lighting Exterior	Lighting Interior High Bay	CHP
Computer Equipment	Lighting Exterior	Food service
Other Plug Loads	Computer Equipment	Other
Cooking	Other Plug Loads	
Refrigeration	Cooking	
Heating (Baseboards, Central)	Refrigeration	
Cooling Chillers	Elevators	
Cooling DX	Miscellaneous Equipment	
HVAC Ventilation	Space Heating	
Domestic Hot Water	Cooling Chillers	
Miscellaneous Equipment	Cooling Direct Expansion	
	HVAC Fans Pumps	
	Domestic Hot Water	
Industrial Sub-sectors		
2016 IESO APS (electricity)	**IESO Load Forecast**	**2016 OEB Potential Study (Gas)**
Process Heating	Process Heating	Direct Heating
Process Cooling	Process Cooling	Steam and Hot Water Systems
Compressed Air	Compressed Air	Heating and Ventilation
Motors Pumps	Motors Pumps	Gas Turbine
Motors Fans Blowers	Motors Fans Blowers	Steam Turbine
Motors Other	Motors Other	CHP Steam
Process Specific	Process Specific	CHP Electricity
Lighting	Lighting	Other
HVAC	HVAC	
Electrochemical	Electrochemical	
Other	Other	