2019 Achievable Potential Study Advisory Group Meeting #2

May 31, 2018

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Meeting Agenda

Time	Topic	Lead
1:30-1:40	Welcome & Introductions	Nik Schruder (IESO) & Pascale Duguay (OEB)
1:40-1:50	Review and confirmation of: • March 21, 2018 meeting minutes • Final Advisory Group ToR • Final Project Charter • Final Engagement Plan	Nik Schruder
1:50-2:15	Review of APS SOW Comments and Responses	Katelyn Margerm (IESO)
2:25-2:50	Lessons Learned from previous Ontario APS'	Bronwen Smith (IESO) Valerie Bennett (OEB)
2:50-3:00	Break	
3:00-3:50	Experience from other jurisdictions	Christine Gustafson (Expert Panel member)
3:50-4:00	Next steps and action items	Nik Schruder

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Meeting Objectives

- Reconnect with members and observers to the 2019 APS Advisory Group
- Finalize Advisory Group establishing documents
- Close the loop on stakeholder comments on the project Scope of Work
- Build a common understanding of key issues and lessons learned from APS work in Ontario and other jurisdictions

Review and confirmation of minutes and establishing documents

- On May 25, 2018 the Project Team circulated the following documents:
  - March 21, 2018 meeting minutes
  - Final Advisory Group ToR
  - Final Project Charter
  - Final Engagement Plan
- Thank you for your input and comments to date.
- Any final comments for discussion?

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Review of Feedback on the Project Scope of Work

Review of SoW Feedback

- The Project Team presented a draft scope of work for the 2019 Achievable Potential Study to the project's Advisory Group on March 21st and on a public webinar on March 28th and invited stakeholders to provide written feedback.
- The Project Team received written feedback from the following stakeholders:

Project Advisory Group members

- Enbridge Gas Distribution
- Enerlife Consulting
- Ministry of Environment and Climate Change
- Thunder Bay Hydro
- Union Gas
- Waterloo North Hydro

Other stakeholders

- ICF Canada
- Navigant
- QUEST
- The Atmospheric Fund

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Review of SoW Feedback

- The Project Team appreciates the feedback received and has incorporated comments where appropriate into the final 2019 APS RFP, which was posted on Merx on May 8, 2018.
- Project Team responses to stakeholder feedback have been posted on the 2019 APS engagement webpage.
- The following slides highlight some key themes and comments that led to more significant changes in the project SoW as well as some areas of clarification.

Review of SoW Feedback – Scope Changes

1. **Measures vs. building-based approach:** The measures-based approach fails to account for rapidly changing conditions under which consumers conduct business. Programs should be based on actual savings potential calculated using historic building energy use.
   - A new task has been added to the RFP to test a whole-building benchmarking approach.

2. **Data disaggregation:** Due to variability in customer consumption, needs/access to infrastructure, and availability in programs, the analyses should have a higher level of granularity (e.g., LDC territories or municipalities).
   - Data will be broken out by IESO zone and natural gas utility region.
   - A Support Services task has been added to allow for further analyses, if required, which could include further disaggregation of data to support policy and/or program development.

3. **NTG ratios:** All savings should be presented as gross savings net of natural conservation but not of the Net-to-Gross (NTG) factors.
   - NTG ratios are not included in the scope of this study.

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Review of SoW Feedback – Scope Changes

4. **Large final emitters:** Separate out large final emitters as a separate sub-sector and focus on segment-based operations vs. a measure-based approach.
   - Additional scope added requiring the consultant to recommend a methodology for highly customized measures that are industry or facility-specific for sub-sectors with a heterogeneous mix of consumers (e.g., industrial sub sectors).
   - The ability to separate out large final emitters from other sub-sectors may be limited by data availability but can be discussed further with the successful consultant.

5. **Dynamic model:** Create a dynamic model that can be regularly updated as new data become available and to conduct dynamic scenario analyses.
   - Dynamic APS Model task has been added as an additional service that may be requested by the Project Team.

6. **Additional scenario analyses:** Consider a retainer agreement where the consultant will carry out any additional scenario analysis on behalf of the Project Team.
   - A Support Services task has been added to allow for further analyses if needed, which could include development of alternate scenarios or other updates.

Review of SoW Feedback – Clarifications

7. **LDC data collection:** Data collection should consider what data has been provided for past studies and data requests to LDCs should be prioritized based on effects on study outputs.
   - The Project Plan will include a catalogue of data inputs and sources.
   - Level of effort required by LDCs to collect/prepare data is expected to be less than prior studies.

8. Fuel switching: Include explicit considerations of fuel switching for the proposed scope of work.
   - Clarified which fuel switching measures will be included.

9. Measure types in scope: Include transmission loss prevention and behind-the-meter generation (including electricity and thermal storage) in the project scope.
   - The scope of this study is only conservation and energy efficiency measures.

Review of SoW Feedback – Clarifications

10. Existing program data: Apply results of existing program results to determine costs for most effective energy efficient actions. The local utility should be consulted to determine the actual participation rates.

- Past evaluation reports will be provided, which include LDC-level data and potential impact of GreenON programs.
- Can discuss with the consultant whether additional data is required.

11. MACCs: MACCS developed as part of the 2019 APS will be too out of date to be used to inform gas utility Compliance Plan activities for the 2020 Compliance Period.

- The OEB is responsible for the development of a MACC at the beginning of each three-year Cap and Trade Compliance Term.
- Developing the MACC as part of the APS allows for a high quality product at a lower cost to ratepayers.
- The OEB will determine if additional updates to the MACC are required prior to the start of the next compliance period (January 2021).

2016 IESO APS

Bronwen Smith

APS Advisory Group

May 31, 2018

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Agenda

- 2016 IESO APS
  - Direction
  - Scope
- Successes
- Areas for future improvement
- Other considerations

2016 APS Direction

The APS is a requirement of:

- Ministry of Energy directive (Mar 31, 2014)
  - … conduct an achievable potential study for electricity efficiency in Ontario every three-years …
  - … be coordinated with the natural gas efficiency achievable potential study …
- Energy Conservation Agreement (ECA)
  - … confirm the aggregate achievable electricity savings for all distribution companies in the province by December 31, 2020 and the allocation of that aggregate achievable electricity savings to the LDCs …
  - … will be binding on the parties for purposes of establishing the "MTI Threshold" …

2016 APS Objectives

- develop an estimate of LDC-aggregate and LDC-specific achievable potential between 2015 and 2020 to inform the mid-term review of the 2015- 2020 CFF and to provide insights to assist LDCs with program planning and design; and
- develop a 20 year provincial achievable potential forecast to inform long term resource planning and energy efficiency program design.

2016 APS Scope of Work

- Short-term analysis (2015-2020)
  - Dx customers only; and
  - all commercially available technology-based and energy management-based EE measures
- Long-term analysis (2015-2035)
  - all Tx and Dx customers within Ontario; and
  - all commercially available and anticipated new and emerging technology-based and energy management-based EE measures
- Separate BMG analysis

Methodology

- LDC Level Granularity
  - short term analysis
- Program Level Analysis
  - short term analysis
- Adoption Curve Development
- Achievable Potential Scenarios
  - Achievable Potential
    - Budget Constrained
    - Budget Unconstrained and
    - Market (maximum AP for long term analysis)

Study Governance

- IESO project team
- Working group
  - LDCs, gas utilities, OEB, Ministry, ECO
- Expert panel
- Consultant

2016 APS Feedback

- Feedback on the 2016 APS was obtained from the following stakeholders:
  - Consultant (Nexant)
  - LDC Working Group members
    - HONI
    - THESL
    - Enbridge
  - OEB
  - Ministry of Energy
  - IESO staff

2016 APS Successes / Achievements

- LDC and Stakeholder Engagement
- Transparency
- Scope of work and methodology was consistent with study objectives (short term requirements)
  - Development of LDC profiles
  - Archetype programs
  - Budget constrained scenario
- Early data collection

Areas for Improvement

- Project management
  - Ensuring adequate review time throughout the study
- Data
  - Granularity (e.g., LDC segmentation, local/regional EUIs)
  - Availability (e.g., equipment saturation, MURB common area load)
  - Quality (e.g., accuracy of secondary data sources)

Areas for Improvement (cont.)

- Methodology
  - Achievable potential scenarios
    - Budget constrained, unconstrained and maximum
    - TRC prioritization
    - Incentive rate assumptions
  - Measure vs. customer (benchmarking) approach
- Other
  - More dynamic and adaptable output or model
  - Further collaboration with the gas potential study
  - Include peak demand impacts
  - Include a range of reference forecasts outlooks

Areas for Improvement (cont.)

- Other feedback from Advisory Group members?

2016 OEB Natural Gas Achievable Potential Study – Lessons Learned

Pascale Duguay & Valerie Bennett

Overview

- 2016 OEB Natural Gas Conservation Potential Study
  - Background / Objectives
  - Scope of Work / Methodology
  - Study Governance
- Lessons Learned:
  - Successes
  - Recommended Improvements

Background / Objectives

- March 26, 2014 Direction to the OEB:

  > “an achievable potential study for natural gas efficiency in Ontario should be conducted every three-years, with the first study completed by June 1 2016, to inform natural gas efficiency planning and programs. The achievable potential study should, as far as is appropriate and reasonable having regard to the respective characteristics of the natural gas and electricity sectors, be coordinated with the OPA with regard to the OPA's requirement to conduct an electricity efficiency achievable potential study every three-years.”

- The study’s objectives were:
  - Inform natural gas Demand Side Management (DSM) program design and delivery at the midterm review of the 2015-2020 DSM Framework
  - Provide guidance to utilities for DSM program design and delivery beyond 2020
  - Support the assessment of the role that DSM may serve in future distribution infrastructure planning processes at the regional and local levels

Scope of Work / Methodology

- Study Period: 2014-2030
- Enbridge Gas and Union Gas franchise areas
- Residential, Commercial, Industrial sectors
- Included natural gas energy efficiency technologies, heat pumps, and operations, maintenance, and control measures
- Developed the following scenarios for each sector:
  - Technical Potential
  - Economic Potential
    - Used TRC-plus to test for cost-effectiveness
  - Achievable Potential
    - Constrained Scenario (current DSM budgets remain in place through study period)
    - Semi-constrained Scenario (DSM budgets increase gradually from current DSM)
    - Unconstrained Scenario (no budget constraints)

Study Governance

- OEB staff
- Technical Working Group (TWG) provided input and advice
  - Included experts and representatives from the utilities, IESO, MOE, and ECO
- Consultant
  - ICF International

Successes – ICF

ICF noted the following successes (summarized by OEB staff from Chapter 9 of ICF's Report):

General

- The TWG was dedicated to producing a good study, and provided review and constructive feedback from a variety of perspectives that the consultants found extremely valuable

Data

- The development of TRM documents prior to the beginning of the study was a valuable contribution
- The availability of recent end use surveys from the gas utilities was valuable for both the residential and commercial sectors

Successes – OEB

OEB staff also identified additional successes of the 2016 Study.

General

- Planned and executed an achievable potential study covering most of Ontario
- Valuable input provided by the Technical Working Group

Results

- Study results were repurposed to develop a Marginal Abatement Cost Curve (MACC)
  - Since this study and the MACC rely on much of the same data, developing the MACC using achievable potential study data allowed for a high quality product at a lower cost to ratepayers

Collaboration

- OEB collaborated with IESO to coordinate the study where possible:
  - IESO provided electricity avoided costs for the OEB to use with measures that save both electricity and gas
  - Common energy efficiency measures that save both natural gas and electricity were reviewed and compared and not found to have significant discrepancies
  - Both studies considered the impact of existing and planned codes and standards in their achievable potential results

Recommended Improvements – ICF

ICF made the following recommendations (also summarized by OEB staff from Chapter 9).

General

- Provide a longer timeframe for completion of the study (e.g., 12 months rather than 9 months)

Data

- End-use surveys should be designed to reflect the sub-sectors/end-uses that are used in the Potential Study (e.g., residential end use surveys targeting the low-income sector specifically would be useful if the potential study is to include a low-income residential sub-sector)
- More measure variants could be included in future savings to reflect niche markets where baseline efficiencies are differ from the average

Methodology

- Consider a modified Delphi workshop approach to leverage with varying viewpoints on market penetration rates
- In establishing Program Costs:
  - Place clear limits on the level of detail and accuracy expected
  - Consider grouping measures into program bundles to simplify estimates

Recommended Improvements – ICF (cont'd)

Results

- Compare achievable potential savings to empirical data on existing programs and projects to "ground truth" the savings that are achievable
- Sensitivity analysis on results would be enhanced by including more parameters and points for each parameter
- Results do not include the impact of the Climate Change Action Plan, subsequent studies / updated studies should account for the impacts of CCAP

Collaboration

- If the natural gas and electricity conservation potential studies will be occurring simultaneously next time, the next study should include some opportunities for collaboration between them, such as:
  - The reference case could include improved estimates of the effects of conservation activities by other actors, particularly the electric utilities
  - More comprehensive electricity and water savings could be included in the assumptions about the measures
  - Measures that save both electricity and gas could be included in programs operated jointly between the gas and electric utilities could have lower program costs could be reduced if part is to be paid by the electric utility
  - Fuel switching should be included in the scope of the study

Recommended Improvements – OEB

OEB also identified a number of additional recommended improvements for future studies.

General

- Other uses of the achievable potential study (e.g., development of the MACC) should be considered in advanced and/or included to achieve efficiencies, as appropriate
- Include impact of cap and trade on reference forecast and avoided costs

Collaboration

- The 2016 IESO and OEB potential studies used different methodologies since they had different objectives (e.g., program archetypes vs. measures approach) – these differences should be addressed and/or reconciled in advance, if possible
- IESO and OEB should consider working with the gas and electricity utilities to coordinate end-use surveys to reduce customer disruption and ensure the data required for the achievable potential studies is collected
- To the extent possible, the natural gas and electricity forecasts used to inform the potential studies should use the same assumptions around GDP growth, industrial activities, population growth, housing starts, etc., and any significant differences should be noted
- Consistent methodology for establishing gas and electricity costs, including carbon pricing, should be used across electricity and natural gas studies, if possible
- OEB, IESO and the government, with input as required, should coordinate the development of any assumptions regarding the impacts of carbon pricing / electrification

Approaches to Addressing Key APS Issues

Experiences from other studies

Prepared by :

Christine Gustafson, P.Eng. , Dave Shipley, P.Eng, Chris Neme, and Danielle Sass Byrnett

Overview

- Background
  - Objectives and uses of APS
  - Overview of APS tasks
  - What can we learn from past APS
- Discussion of Approaches to Addressing Key APS Issues:
  - Base Case Calibration – Top-down and Bottom Up
  - Base Case Calibration – Industrial Facilities
  - Forecasting Emerging Technologies
  - Forecasting Market Adoption

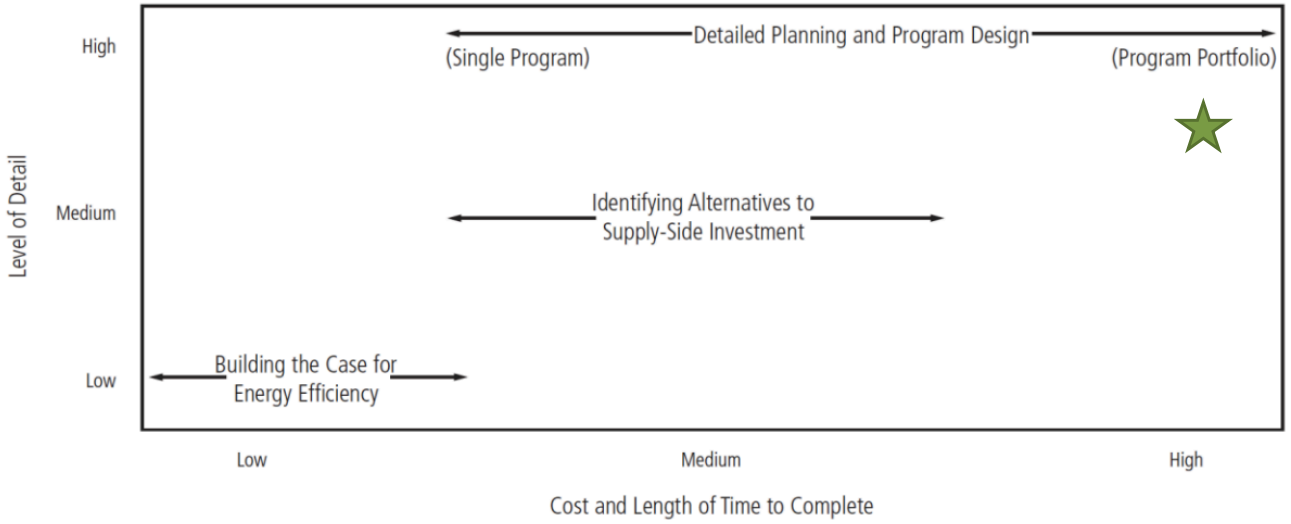
Objectives of APS

- The main objective of an APS is usually to identify and quantify energy savings (electricity or natural gas) and possibly GHG emission reductions and associated costs from energy efficiency and conservation over the study period.

Uses for APS

- There are many potential audiences and uses for an APS:
  - Regulatory or legislative requirements;
  - Supporting resource planning;
  - Policy, codes, and standards design; and
  - Program design, including the targeting specific measures.
- APS can also inform load forecasting and provide valuable insights on customer groups.
- How the information will be used dictates the level of detail and accuracy needed.
  - This is important to keep in mind when assigning resources.
  - This information can be helpful in understanding why another jurisdiction chose the approach they did.

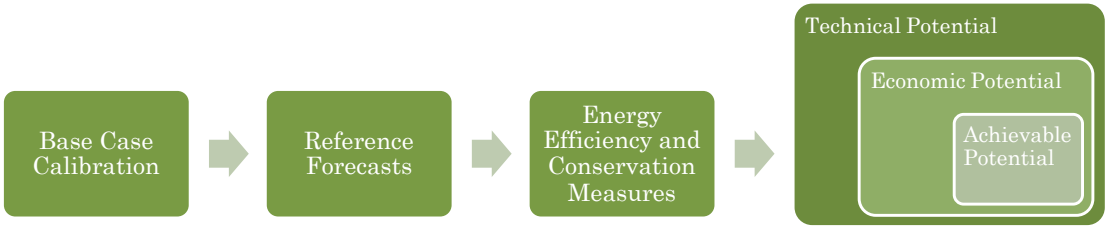
Uses for APS cont…



SOURCE: EPA 2007

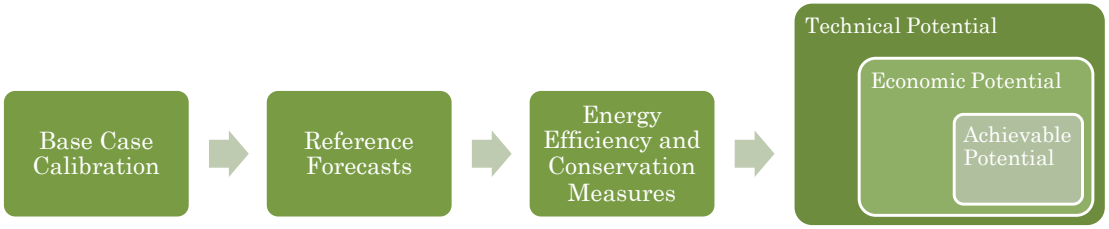
- The cost and length of the study increase in step with the level of detail required.
- In order to support program and portfolio level planning a significant amount of detail is required both as inputs and outputs to the study.
- The outputs of the study are only as good as the data inputs and research basis for assumptions.
- In general, an approach that makes use of local data and information will be produce more relevant results.

Overview of APS Tasks



- Base Case Calibration
  - Choosing a base year, disaggregate consumption by sector, sub-sector and end-use.
- Reference Forecasts
  - Develop reference forecasts for the study period via an end-use based model that is calibrated against the utilities' forecasts.
- Energy Efficiency and Conservation Measures
  - Develop a comprehensive list of and assumptions for all energy efficiency and conservation measures including current and future technology-based and behavioral measures.

Overview of APS Tasks

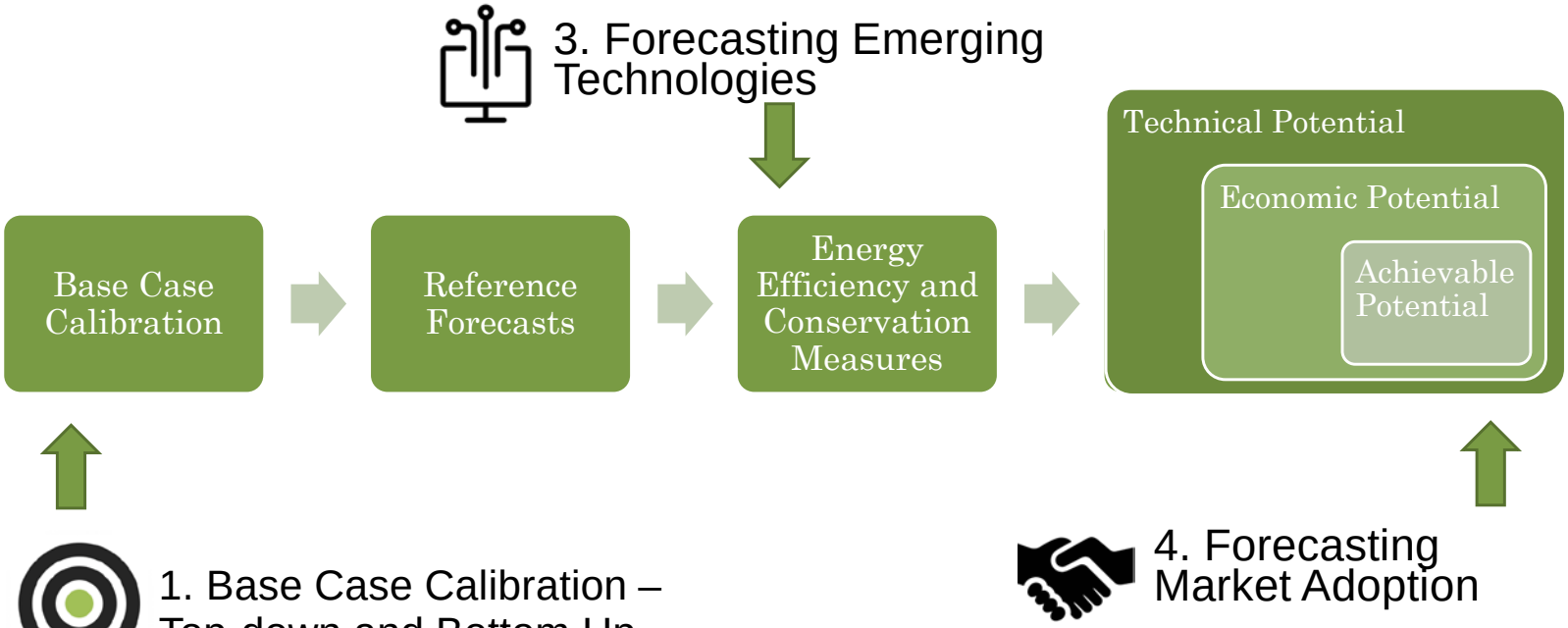


- Technical Potential
  - Technical assessment of all energy efficient measures, including annual energy, water, demand, and carbon savings and cost estimates for the study period.
- Economic Potential
  - Estimated savings potential for the study period assuming that 100% of customers implement all applicable ***cost effective*** measures.
- Achievable Potential
  - Estimated savings potential for the study period taking into account realistic market penetration rates of cost-effective measures over the study period based on: market barriers, customer preferences and acceptable payback periods/ROI, marketing efforts, historic program experience, etc.

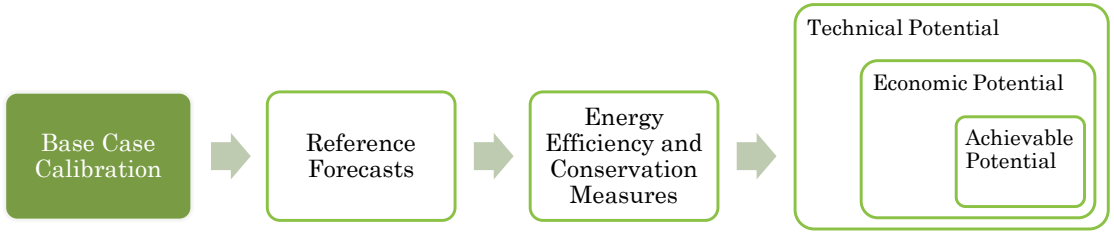
What can we learn from past APS?

- Potential Studies have been part of energy efficiency and conservation planning for ~30 years. Many studies are publicly available.
  - In 2017, U.S. DOE published an energy efficiency potential studies catalog of roughly 80 studies conducted in the past 10 years.
- A few ”how to” guides have been created:
  - 2007 National Action Plan for Energy Efficiency Guide for Conducting Energy Efficiency Potential Studies
  - 2010 BPA Guidebook for Potential Studies in the Northwest
  - 2012 Regulatory Assistance Project 10 Pitfalls of Potential Studies
- While the overall sequence of tasks remains relatively constant, new and innovative approaches to get better estimates of potential are being explored for some tasks.

Discussion of Approaches to Addressing 4 Key APS Issues



1. Base Case Calibration – Top-down and Bottom Up



- There are two generally accepted approaches to accomplish this:
  - Bottom Up and
  - Top Down

1. Base Case Calibration – Bottom Up

- Bottom Up Approach --- data intensive
  - Estimates the energy saved from the installation of a measure and multiplies that amount by the total number of measures expected to be installed.
  - Used by the majority of potential studies that are completed for the purposes of program and portfolio design.
  - May underestimate or miss some process-related, commissioning, and other less tangible measures.
- *NREL 2017 Electric End-Use Energy Efficiency Potential in the U.S. Single-Family Housing Stock used a data intensive approach to model packages of measures for 350,000 different home types to determine cost-effective potential for homeowners based on net present value greater than 0 but this analysis did not factor in actual market adoption.*

1. Base Case Calibration – Top-down

- Top Down Approach --- simpler, faster, less data intensive
  - Uses a load forecast and then disaggregates it by end-use. Energy savings by measure, end-use, program, or sector are then expressed as a percent of the total energy consumption.
  - Used in studies covering a large jurisdiction (Canada, US) where the purpose of the study is to build the case for energy efficiency and conservation in supply side planning and macro policy design.
  - Has some application in industrial, and some large commercial sectors.
  - Advantage of capturing more operational efficiencies.

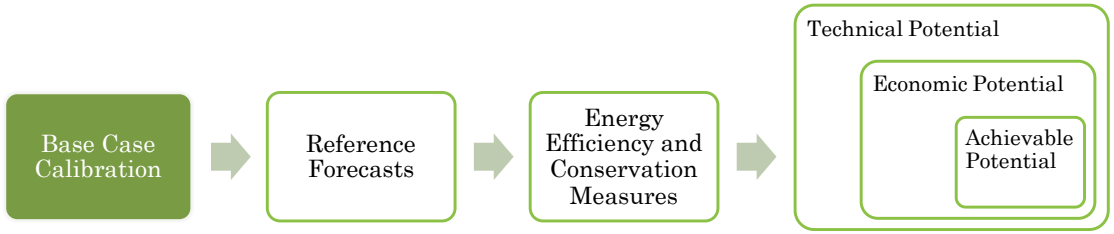
- *2008 LBNL US Buildings study used a top down approach that began with Energy Information Administration's Annual Energy Outlook (AEO) 2007 Reference Case as business-as-usual (BAU) scenario, segmented by fuel and end use (US DOE 2007b).*
- *2016 U.S. DOE Industrial Energy Efficiency Potential Analysis used a top down approach based on historical growth rates of shipments and energy intensity projections to estimate future scenarios, including one for doubling rates of energy productivity.*

1. Base Case Calibration – Top-down

- Whole-building benchmarking of energy performance to estimate achievable potential is an extension of the Top Down Approach that makes use of detailed commercial energy data available in Ontario.
  - Good application in program design, when used in combination with bottom up data.
  - Leverage actual energy consumption data collected.
  - Better account of rapidly changing technology, behaviours, and operating conditions.
  - Expert Panel has not seen this approach used in utility-led studies in other jurisdictions.

- *2016 OEB Natural Gas Conservation Potential Study used whole building approach in the commercial sector to ground truth the bottom up approach and make some adjustments.*
  - The numbers came out “reasonably similar”. The consultant’s conclusion was that this is a valid approach, but not necessarily a superior approach. The risk of *not* using it for ground-truthing is a tendency to miss operational and commissioning-related savings potential

2. Base Case Calibration – Industrial Facilities

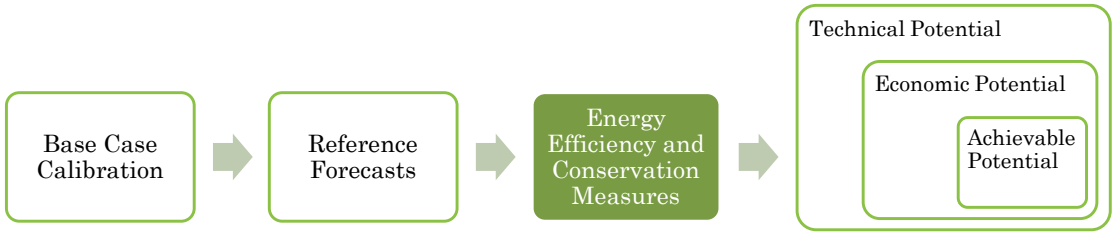


- Facility types can't be developed in the same way as is done in the residential and commercial sectors due to the unique operations of each facility.
- Some measure identification and counts can be made, but these provide an incomplete picture.

2. Methods of Base Case Calibration – Industrial Facilities

- A combination of bottom up and top down approaches is needed to capture the potential.
  - Bottom Up - “plant utilities” – Many measures can follow a standard approach: motor efficiency, fans, pumps, and blowers, compressed air systems, HVAC, water and steam boilers and distribution systems.
  - Top Down - “process-related” – Industrial processes need to be treated on a more custom basis.
    - *Ex. Asphalt plant, Beef Jerky plant*
- Insight from site experts is key: including energy managers, industrial reviews, industrial energy assessments, professional experience, literature review, equipment inventories, and ongoing audit and market assessments

3. Forecasting Emerging Technologies

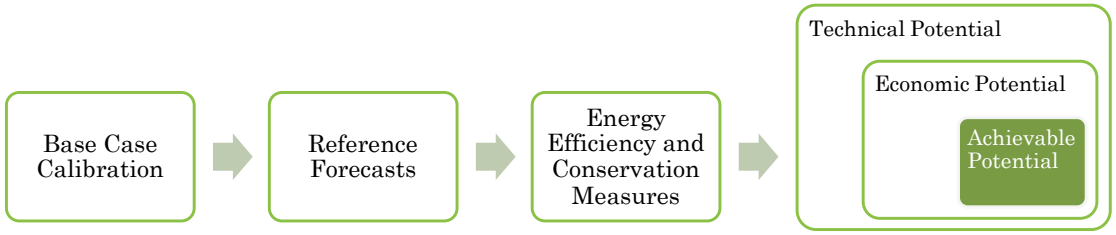


- This task is to develop a comprehensive list of and assumptions for all energy efficiency and conservation measures, including current and future technology-based emerging technologies (ET) and behavioral measures.
- Many studies deal with forecasting ET in a cursory and/or opaque way.
- Many studies have included a qualitative section in the report, but "how much" is not usually included.
- 2014 ACEEE Cracking the TEAPot:
  - *Where savings potential from ETs is provided… the impacts are considerable.*
  - *For the most part, if studies report that ETs are included, it is difficult to determine which measures they assume to be emerging, how prices change over time, and the year in which they are assumed to become cost effective.*
  - *Interviewees noted that the degree to which ETs are included also depends on a client's needs or goals…*

3. Methods of Forecasting Emerging Technologies

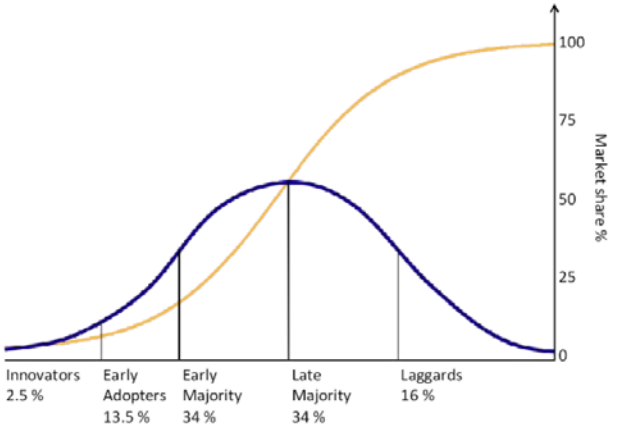
- Current methodologies generally only include known technologies.
- Alternate methodologies in this area are new and untested. These include:
  - Review past potential studies and assess how much new potential emerges over time that was not on the radar 5, 10, or 15 years before.
  - Review past project experience to identify savings potential and cost effectiveness values from the custom programs offered by utilities.
  - Compare conservation achievements to past forecasts to develop an ET “adder” that could be applied.
- *2013 OPA study made placeholder assumptions for cost and savings and used the model to estimate savings.*
- *2007 BCHydro study developed a list of emerging measures based on a literature review and previous study team experience, as well as discussions with both BC Hydro and ERP members, and then presented qualitative descriptions for each.*
- *2017 EPRI analysis assumed future technologies would phase in beginning in 2020 and used a coarse representation of technology cost decreases over time.*

3. Forecasting Market Adoption



- Estimate what portion of the measures that are cost effective the will market adopt.
  - It is easy to calculate payback periods or return on investment (ROI) but most consumers don't make decisions based on payback periods, other than some industrial customers.
  - Non-energy benefits (comfort, ease of use, safety, societal norms, aesthetics) are often the driver for decision making.
  - Few resources are available to address the behavioural elements of decision making at this point.
- Six models for forecasting market adoption might be considered by the APS team.

3. Methods of Forecasting Market Adoption



- Market penetration curves and/or ramp rates
  - Based on anticipated consumer response
  - *2007 BC Hydro and 2013 ComEd used market penetration curves together with the Delphi approach.*
- Delphi approach
  - Experts give informed judgments based on actual program experiences with similar markets.
  - *2015 Newfoundland used sector specific workshops to gather insights from industry professionals.*
- Bass diffusion model
  - Simulates market adoption by first estimating awareness leading to participation and then factoring in the economics of the decision.
  - *2013 California IOUs used this approach together with program portfolio data and other historical experience.*

3. Methods of Forecasting Market Adoption

- Economic choice models
  - Market adoption is based on measure payback periods.
  - *2016 OEB used payback to estimate market adoption, and then adjusted it based on interviews with industry professionals*.
- Experience in leading jurisdictions
  - Literature review of experiences in other jurisdictions
  - *2009 EPRI Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the US*
- Historic program experience
  - Literature review of in house programs and/or programs of a similar description.
  - *2012 Yukon used this approach together with the Delphi approach*

Thank you.


POSTERITY
GROUP


ENERGY FUTURES GROUP


NATIONAL ASSOCIATION OF REGULATORY UTILITY COMMISSIONERS
DEDICATED TO PUBLIC SERVICE

Action Items and Next Steps

APS Advisory Group Action Items & Next Steps

- June 8th — 2019 APS RFP window closes
- Mid-July — Target to have consultant in place
- July 26th — Hold for next Advisory Group meeting
  - » Aim to review and discuss Consultant's Project Plan
- Thank you for your engagement with the 2019 APS project to date.
- We are working to consider and address your input and balance the needs of our respective stakeholders.
- Please continue to contact us with any major concerns or considerations from your organizations as they arise.

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