

2019 Achievable Potential Study Advisory Group Meeting #6

November 08, 2018



Meeting Agenda

| Time | Topic | Lead |
|-------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| 10:00-10:10 | Welcome & Introductions | Tina Nicholson (IESO) & Pascale Duguay (OEB) |
| 10:10-10:20 | Review and confirmation of: <ul style="list-style-type: none"> Mtg #5 minutes Action items from Mtg #5 | Valerie Bennett (OEB) |
| 10:20-10:30 | Status Updates & Current Project Schedule Overview | Peter Steele-Mosey (Navigant) |
| 10:30-11:00 | Task 3: Reference Forecast | Farhad Daruwala (Navigant) |
| 11:00-11:30 | Task 4: Measure Characterization | Divya Iyer (Navigant) |
| 11:30-12:00 | Task 5: Technical Potential | Ben Grunfield (Navigant) |
| 12:00-12:30 | Lunch | |
| 12:30-1:00 | Task 5: Technical Potential Continued | Ben Grunfield (Navigant) |
| 1:00-1:10 | Next steps and 30 day outlook | Peter Steele-Mosey |
| 1:10-1:15 | Wrap-up | Tina Nicholson |

Meeting Objectives

- Provide project schedule and status updates
- Clarify key reference forecast drivers and alignment of assumptions
- Share updates on measure list development and measure characterization review
- Overview technical potential modeling process and assumptions and discuss measure stacking approach

Action Items from October 11th Meeting

| Action Items Identified | Status/Timing |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Review reference forecast drivers including weather normalization and economic growth and confirm alignment. | To be addressed by Navigant at this meeting. |
| Engage with natural gas utilities when IESO alternative forecasts (and fuel switching assumptions) become available to provide utilities time to comment on assumptions & how they will be reflected in Navigant forecast adjustments. | The Project Team will engage with the natural gas utilities regarding the alternative forecasts when they become available. |
| Connect with Michael Lio (Buildability) to discuss residential baseline measures. | Michael shared his insights with Navigant and the Project Team on 2018-10-25. |

Action Items from October 11th Meeting

| Action Items Identified | Status/Next Steps |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Explore availability of alternative data sets to support whole building benchmarking tasks, including:</p> <ul style="list-style-type: none">• Tower Renewal building data• BOMA BEST data• Green Hospitals Scorecard (Canadian Coalition for Green Health Care)• Greening Healthcare (Toronto Regional Conservation Authority) | <p>Navigant and the Project Team are looking into datasets suggested:</p> <ul style="list-style-type: none">• Tower Renewal – does not collect building level energy use data• BOMA BEST – not able to share building level data due to privacy restrictions• Green Hospital Scorecard – Canadian Coalition for Green Health Care are looking into request• Greening Healthcare – reaching out to TRCA |

INTEGRATED NATURAL GAS AND ELECTRICITY CONSERVATION ACHIEVABLE POTENTIAL STUDY

UPDATES FROM NAVIGANT

2018-11-08



NAVIGANT

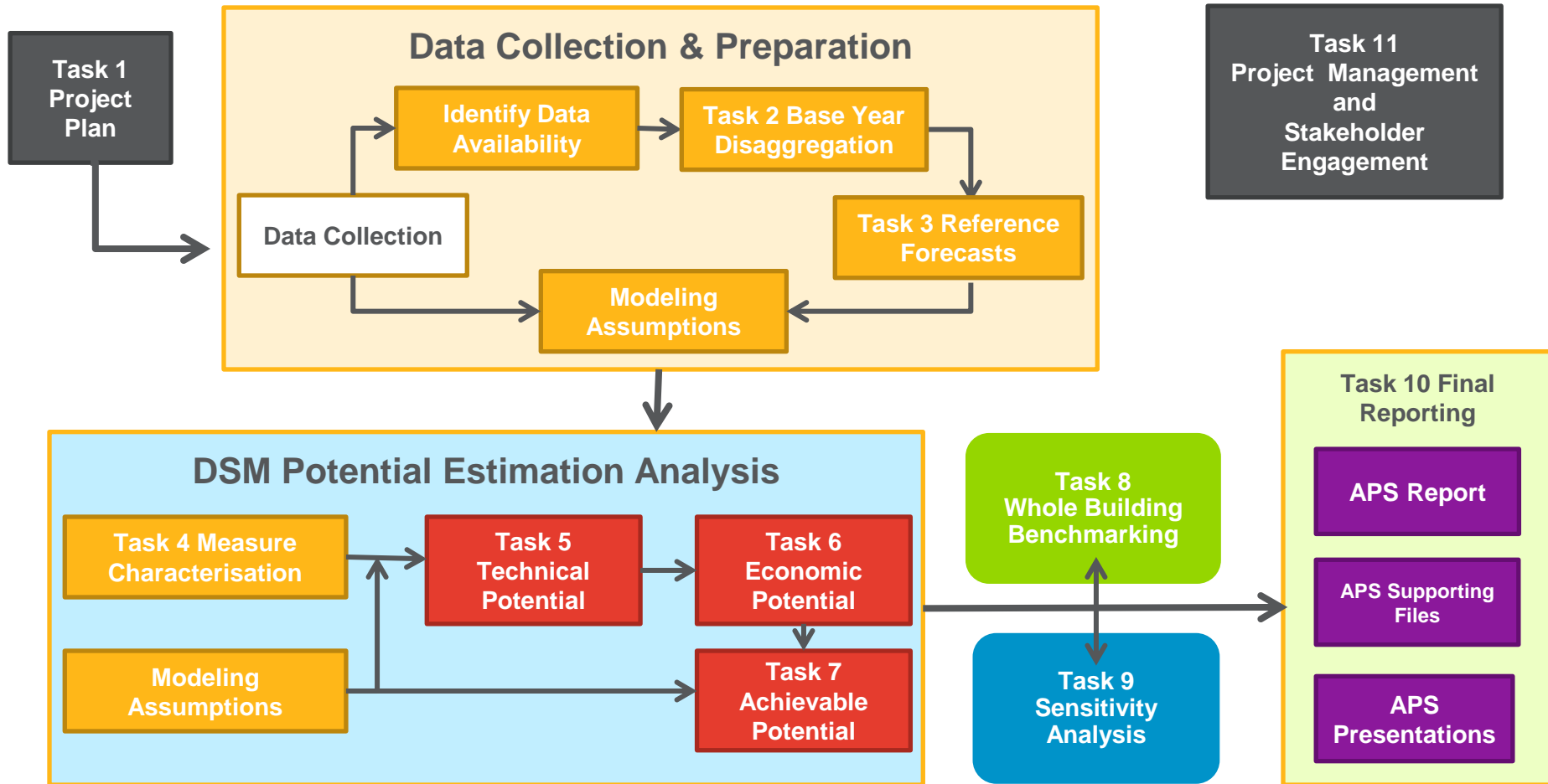
The logo for Navigant features the word "NAVIGANT" in a bold, sans-serif font, with a green leaf-like shape integrated into the letter "V".



SCHEDULE &
STATUS UPDATES

SCHEDULE & STATUS UPDATES

REVIEW PROJECT OVERVIEW

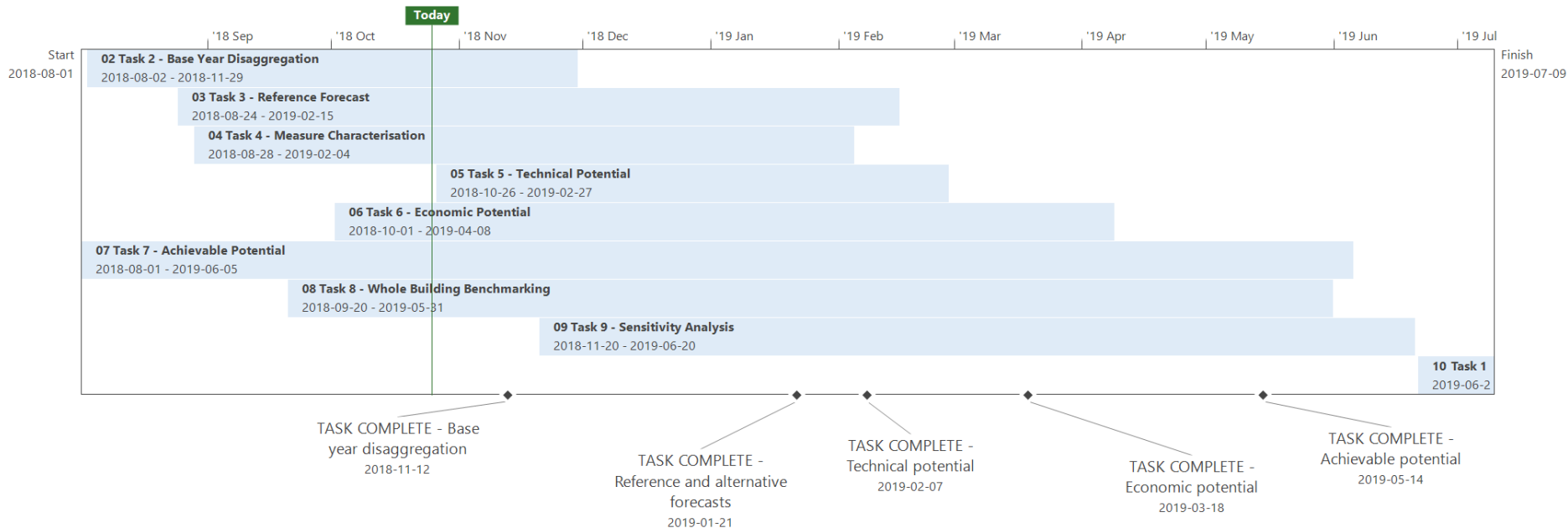


SCHEDULE & STATUS UPDATES

PROJECT TIMELINE

Project schedule still fluid:

- **IESO reference forecast to be delivered Dec. 17** – final assumptions uncertain until then, for reference and alternative forecasts
- **Timeline remains aggressive** – the timeline includes periods for review and comment by the Project Team, but is tight, with little room for flexibility.



SCHEDULE & STATUS UPDATES

PROJECT TIMELINE

| Task | % Completion | Start Date | End Date |
|----------------------------------|--------------|------------------|--------------------------------------------|
| 01 – Project Plan | 100% | 2018-08-01 | 2018-09-13 |
| 02 – Base Year Disaggregation | 90% | 2018-09-01 | 2018-11-09 (electricity) / 2018-11-23 (NG) |
| 03 – Reference Forecast | 35% | 2018-09-01 | 2019-01-21 |
| 04 – Measure Characterisation | 20% | 2018-09-01 | 2019-01-16 |
| 05 – Technical Potential | 5% | 2018-10-26 | 2019-02-16 |
| 06 – Economic Potential | 0% | 2018-12-03 (TBC) | 2019-03-18 |
| 07 – Achievable Potential | 10% | 2018-09-27 | 2019-05-14 |
| 08 – Whole Building Benchmarking | 10% | 2018-09-10 | 2019-05-07 |
| 09 – Sensitivity Analysis | 0% | 2018-11-20 (TBC) | 2019-05-30 |
| 10 – Final Report | 0% | 2018-11-15 | 2019-07-09 |

SCHEDULE & STATUS UPDATES

SUMMARY OF ACTIVITIES UNDERTAKEN SINCE LAST AG

- **Task 2 (Base Year Disaggregation) Activities**

- Draft electricity base year disaggregation complete and under review by Project Team
- Draft NG base year disaggregation complete and under review by Project Team

- **Task 3 (Reference Forecast) Activities**

- Compatibility analysis updated to reflect AG and Project Team feedback
- Development of code for reference forecast begun (placeholder values)

- **Task 4 (Measure Characterisation) Activities**

- Measure list being finalized based on AG input and Project Team review
- Measure characterisation in progress
- Initial group of measure worksheets delivered to Project Team and sub-committee for review

- **Task 5 (Technical Potential) Activities**

- Task initiation meeting with Project Team

SCHEDULE & STATUS UPDATES

SUMMARY OF ACTIVITIES UNDERTAKEN SINCE LAST AG

- **Task 7 (Achievable Potential) Activities**

- Delphi panel Terms of Reference under review by Project Team
- Delphi panel questionnaire under development
- AG suggestions incorporated into Delphi panel candidate list for consideration
- Delphi panel candidate list currently being finalized with Project Team

- **Task 8 (Whole Building Benchmarking) Activities**

- Follow-up on data sources recommended by AG in process
- Expect finalization of segment selection following review of all requested data

SCHEDULE & STATUS UPDATES

SUMMARY OF ACTIVITIES UNDERTAKEN SINCE LAST AG

Next Steps from AG Meeting #5 (2018-10-11)

NEXT STEPS AND 30 DAY OUTLOOK

Task 2: Base Year Disaggregation

1. Complete electricity base year disaggregation ✓

Task 3: Reference Forecast

1. Continue to discuss compatibility of forecasts ✓

Task 4: Measure Characterisation

1. Finalize measure list ✓
2. Characterise measures

Task 7: Achievable Potential

1. Draft Delphi panel Terms of Reference ✓
2. Invite potential participants to join Delphi panel
3. Develop and finalize Delphi panel questionnaire/survey ✓

Task 8: Whole Building Benchmarking

1. Finalize building type for analysis
2. Evaluate data available to support analysis & begin updating WBB approach based on those data

Measure characterisation begun

Invitations to be sent after questionnaire finalized

Questionnaire under development

Data intake of AG-recommended data sets still in progress – segment finalization to be completed after data evaluated



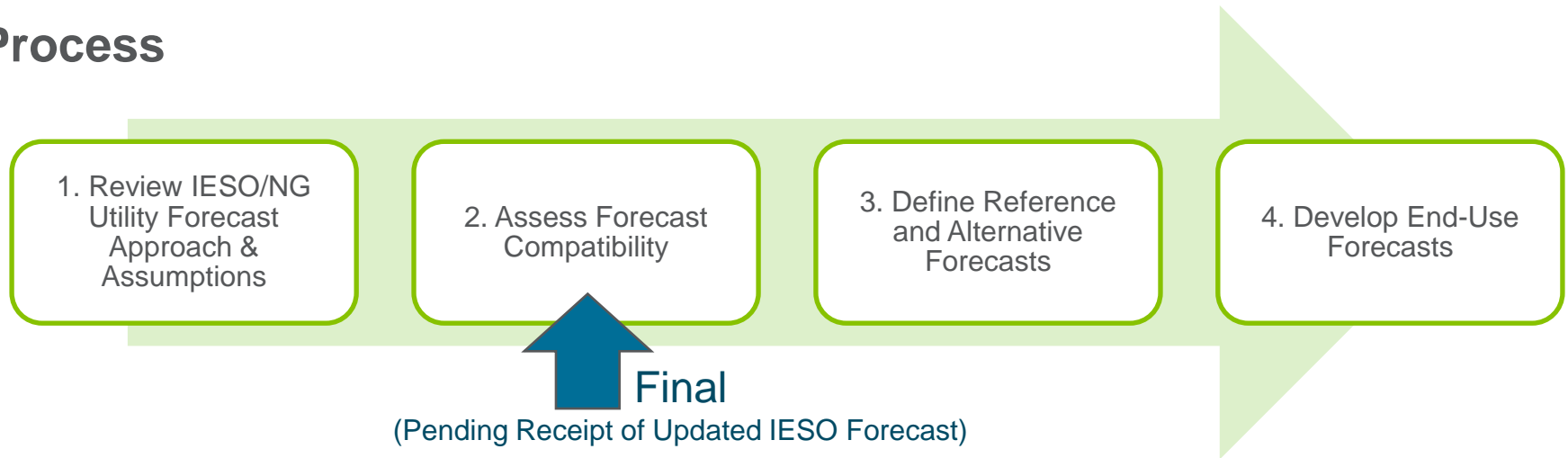
TASK 3: REFERENCE FORECAST

- Forecast Compatibility Clarifications and Updates

TASK 3: REFERENCE FORECAST

OVERVIEW

Process



Purpose of Task 3

- The **Reference Forecast** is a 20-year forecast of electricity and natural gas consumption by: sector, segment, and end use, based on reference consumption forecasts provided by the NG utilities and IESO, as well as the outputs of Task 2.
- The end use forecast is a key input to the DSMsim™ model that delivers projected achievable potential.
- The electricity and NG forecasts can be used together without modification only if their assumptions are consistent. Navigant has **assessed the compatibility of the two sets of forecasts**. This assessment may need to be updated when the updated IESO forecast assumptions are finalized.

Purpose of Today's Update (Compatibility Analysis)

Provide clarification and additional detail requested by AG and Project Team following last AG meeting:

- What does “compatibility” mean in the context of this Potential Study?
- Are sector-level and global forecast driver assumptions compatible across forecasts?

TASK 3: REFERENCE FORECAST

TIMELINE

| Month | September 2018 | | | | October 2018 | | | | | November 2018 | | | | December 2018 | | | | | January 2019 | | | |
|---------------------------------------------------------|----------------|--------|--------|--------|--------------|--------|--------|--------|--------|---------------|--------|--------|--------|---------------|--------|--------|--------|--------|--------------|--------|--------|--------|
| Week Starting | 3 Sep | 10 Sep | 17 Sep | 24 Sep | 1 Oct | 8 Oct | 15 Oct | 22 Oct | 29 Oct | 5 Nov | 12 Nov | 19 Nov | 26 Nov | 3 Dec | 10 Dec | 17 Dec | 24 Dec | 31 Dec | 7 Jan | 14 Jan | 21 Jan | 28 Jan |
| 1. Review Forecast Methodology & Assumptions | Active | Active | Active | Active | | | | | | | | | | | | Active | | | | | | |
| 2. Assess Forecast Compatibility | | Active | Active | Active | | | | | | | | | | | | Active | | | | | | |
| 3. Define Reference & Alternative Forecasts | | | | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | | | | | |
| 4. Develop End Use Forecasts | | | | | | | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active | Active |

NB: Task schedule is highly dependent on finalization of IESO forecast assumptions and delivery of IESO forecast and subject to change as IESO assumptions evolve

Task Complete ↑

Purpose of the Compatibility Analysis:

The primary goal of the compatibility analysis is:

To ensure that IESO and NG utility planners have a *broadly consistent view of the future*, acknowledging that:

- They are forecasting different commodities that have different end-uses
- They are forecasting over different geographies and different groups of customers.

Challenge of Comparing Forecasts

| Forecast Element | Enbridge | Union | IESO |
|-------------------|------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------|
| Service Territory | Central Ontario, Ottawa region | South-Western Ontario, Eastern Ontario, narrow strip of Northern Ontario | Province |
| Forecast Approach | Top-down | | Bottom-up |
| Major End-Uses | Space, water, and process heat. Cooking. | | Lighting, plug loads, space heating/cooling, motors, pumps, |

“Apples-to-apples” comparison is impossible

What does “compatibility” mean in the context of this Potential Study?

- “Compatibility” does not mean an unqualified perfect alignment in forecast assumptions.
- Assessing Compatibility: Do forecast input assumptions indicate that forecasters from all groups have a broadly consistent vision of the future?

Example Assessment:

| Forecast A’s Assumptions | Forecast B’s Assumptions | Assessment |
|------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Increasing GDP forecast | Decreasing GDP forecast | Not compatible – inconsistent directional view. |
| GDP forecast of 2% | GDP forecast of 10% | Not compatible – overall magnitude inconsistent. |
| GDP forecast of 2% | GDP forecast of 2.5% | Compatible – overall magnitude is consistent. |
| Explicitly uses some GDP forecast | Does not explicitly include GDP forecast | Compatible if underlying assumptions about future economic performance are similar. |
| EGD 10 year average projected GDP growth rate: 1.97% | IESO 10 year average projected GDP growth rate: 2.09% | Compatible. The two visions of the future are reasonably consistent. |

Global Assumptions I - Summary

| | Enbridge | Union | IESO | Comments |
|---------------------------------------|----------------------------------------------------------------------|-------------------------------|------------------------------------------|-----------------------------------------------|
| Existing CDM/DSM (Persistence) | Embedded in historical trend. | Embedded in historical trend. | Explicitly accounted for. | All forecasts account for historical CDM. |
| Codes and Standards | Existing embedded in historical trend, new explicitly accounted for. | Embedded in historical trend. | New & existing explicitly accounted for. | All forecasts account for codes and standards |
| Natural Conservation | Embedded in historical trend. | Embedded in historical trend. | Embedded in historical trend. | Compatible |

TASK 3: REFERENCE FORECAST
COMPATIBILITY ANALYSIS: GLOBAL ASSUMPTIONS

Global Assumptions II - Summary

| | Enbridge | Union | IESO | Comments |
|------------------------|-------------------------------|-------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| Carbon Pricing | Federal Carbon Floor | Cap & Trade | <i>IESO assumption not yet final.</i> Federal Carbon Floor | Difference in impact from differing carbon pricing assumptions very small. |
| Fuel Switching | Embedded in historical trend. | Embedded in historical trend. | <i>Assumptions under development.</i> | IESO assumptions likely to reflect historical trends. (i.e., almost certainly compatible). |
| Weather Effects | Weather Normalized | Weather Normalized | Weather Normalized | Compatible |

TASK 3: REFERENCE FORECAST

COMPATIBILITY ANALYSIS: GLOBAL ASSUMPTIONS – SELECTED DETAIL

All forecasts share a sufficiently consistent view of the future to regard the forecasts as compatible.

- **DSM/CDM Persistence.** NG utilities and IESO forecasts both account for persistence of programmatic savings.
 - NG utilities do not explicitly control for historic DSM. Persistence is embedded in the trends carried forward in the forecast.
 - IESO calculates persistence of historical programs based on verified savings that have a determined expected useful life.
- **Codes and Standards (C&S).** NG utilities and IESO forecasts both account for the effects of codes and standards.
 - NG utilities do not explicitly control* for the effects C&S. C&S are embedded in trends carried forward in the forecast.
 - IESO applies modeled C&S savings to forecast.
- **Weather Effects.** NG utilities and IESO both use “normal” weather for projecting consumption and account for changes in weather patterns over time:
 - NG utilities use 10 – 20 years of history that explicitly or implicitly accounts for weather trends over time (varies by region)
 - IESO uses a 31-year moving median average.

**EGD makes a very small adjustment for 2017 building code. Magnitude of adjustment not material for purposes of this analysis.*

Sectoral Assumptions – Summary

| | Enbridge | Union | IESO | Comments |
|--------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------------------------------|-----------------|
| Residential | Projected customer growth rate: 1.32% | Projected customer growth rate: 1.1% | Projected household growth rate: 1.43% | Compatible |
| Commercial | Employment forecast consistent with recent history (slightly optimistic). | Unemployment rate consistent with recent history (slightly optimistic) | Employment forecast consistent with recent history. | Compatible |
| Industrial | Customer and segment specific assumptions. | Customer and segment specific assumptions. | Segment specific assumptions. | Compatible |

TASK 3: REFERENCE FORECAST

COMPATIBILITY ANALYSIS: FINDINGS

Key Finding: The IESO, Enbridge, and Union’s forecasts reflect a vision of the future that is sufficiently consistent for them to be considered compatible.

| Forecast Element | | Compatible? |
|-------------------------|--------------------------------------------------|-------------|
| Global Drivers | Historical/New DSM and CDM | ✓ |
| | Codes and Standards | ✓ |
| | “Natural” Conservation | ✓ |
| | Carbon Pricing | ✓ |
| | Weather Effects | ✓ |
| | Fuel Switching | ✓ |
| Sector-Specific Drivers | Households (RES) | ✓ |
| | Employment (COM) | ✓ |
| | GDP/Output & Consumer Information (IND) | ✓ |

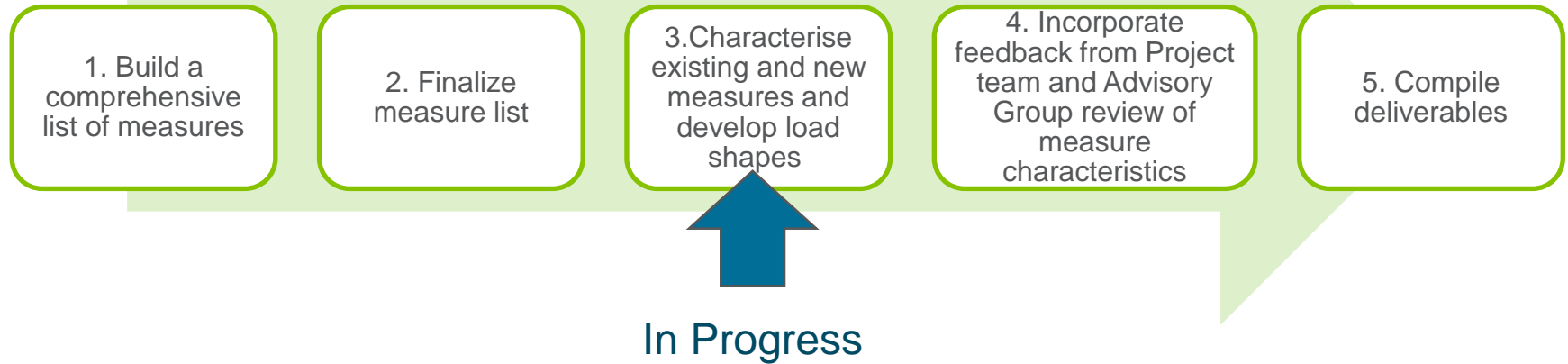


TASK 4: MEASURE CHARACTERISATION

TASK 4: MEASURE CHARACTERISATION

OVERVIEW

Process



Purpose

- The DSMSim is a bottom-up model. Aggregated potential by end use and segment is derived from individual measure potential.
- Measure characterisation is the process of specifying the key characteristics of each energy efficiency measure included in the model (savings, cost, density, saturation, etc.)

At the last AG meeting, members provided feedback regarding the measure list developed by Navigant. Today, Navigant is providing responses to that feedback.

TASK 4: MEASURE CHARACTERISATION

MEASURE LIST FEEDBACK

| Action Items Identified | Status/Timing |
|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Assess the recommendations for residential measures: | |
| <ul style="list-style-type: none">Pool pumps should not be 0 | This measure has been reintroduced with a priority of 1. |
| <ul style="list-style-type: none">Duct installation should be lower priority than 2 | Agreed. Navigant has changed the prioritization of this measure to 2. |
| <ul style="list-style-type: none">High Efficiency windows should be lower priority than 3 | Agreed. Navigant has changed the prioritization of this measure to 2. |
| <ul style="list-style-type: none">Furnaces should lower priority than 3 | Agreed. Navigant has changed the prioritization of this measure to 2. |
| <ul style="list-style-type: none">Water heating should lower priority than 3 | Agreed. Navigant has changed the prioritization of this measure to 2. |
| <ul style="list-style-type: none">Heat reflector panels should not be priority zero. | Navigant has changed the prioritization of this measure to 1. |

TASK 4: MEASURE CHARACTERISATION

MEASURE LIST FEEDBACK

| Action Items Identified | Status/Timing |
|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assess the recommendations for commercial measures: | |
| <ul style="list-style-type: none">• Add a ventilation optimization measure | Navigant has added a measure that includes Demand Controlled Ventilation as well as Energy Recovery Ventilation. This measure is bundled to represent optimization/control measures that enhance systems that have single zone constant volume ventilation with no heat recovery. The savings, costs and densities of these comprising measures will be aggregated to the bundled measure. |
| <ul style="list-style-type: none">• Add a measure to convert steam circulation to hot water circulation | In Navigant's experience, steam to hot water conversion measures/controls would require pumping unless it is a radiator system. This measure is under review. |
| <ul style="list-style-type: none">• Add a behavioural measure | Agreed. Navigant has added a behavioural measure for the commercial sector. |
| <ul style="list-style-type: none">• Revise efficient transformers priority (currently zero) | This measure is currently under review in light of recent updates to the code regulated for transformers. |

TASK 4: MEASURE CHARACTERISATION

MEASURE LIST FEEDBACK

| Action Items Identified | Status/Timing |
|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assess the recommendations for commercial measures: | |
| <ul style="list-style-type: none">Other measure bundling (update) | Chilled Water Optimization: This measure includes Chiller water reset, Chiller Tune-up/Diagnostics as well as Cooling Tower Optimization. These were measures in the previous APS. The baseline is a facility where there have been no controls or tune-up or diagnostics conducted. The savings, costs and densities of the comprising measures will be aggregated to the bundled measure. |
| <ul style="list-style-type: none">Other measure bundling (update) | Ventilation Optimization: This measure includes Demand Controlled Ventilation and Energy Recovery Ventilation. This measure will also be bundled to represent an optimization/control measure that enhances systems that have single zone constant volume ventilation with no heat recovery. Variable Frequency Drives on fans is not included in this bundle. |

TASK 4: MEASURE CHARACTERISATION

MEASURE LIST FEEDBACK

| Action Items Identified | Status/Timing |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Assess the recommendations for industrial measures: | |
| <ul style="list-style-type: none">• Add thermal oxidiser measure | There is limited data available for this measure to characterise it for this study, so it will be excluded. |
| <ul style="list-style-type: none">• Add axial fan measure | The potential for this measure is covered under fan upgrades. |
| <ul style="list-style-type: none">• Add destrat fan measure | Destratification fan is covered under the HVAC fan measure. |
| <ul style="list-style-type: none">• Add a cogeneration optimization measure | Unfortunately, cogen measures are out of the scope of this study. |
| <ul style="list-style-type: none">• Split up some of the larger measure categories (e.g. boilers) | We have separated industrial equipment and control measures into bundles based on data availability for characterising these measures. |
| <ul style="list-style-type: none">• Increase the priority of greenhouses to 3 | Agreed. Navigant has changed the prioritization of all greenhouse gas measures to 3. |

TASK 4: MEASURE CHARACTERISATION

MEASURE LIST FEEDBACK

| Action Items Identified | Status/Timing |
|---------------------------------------------------------------------------|---------------------------------------------------------------------|
| Assess the recommendations for new measures: | |
| • Add a residential gas heat pump measure | There is a gas fired heat pump as a part of the existing list. |
| • Add industrial air source and ground source heat pump measures | We have a high efficiency heat pump in the Industrial measure list. |
| • Remove measures that recommend switching to electric resistance heating | Agreed. Navigant has removed these measures. |

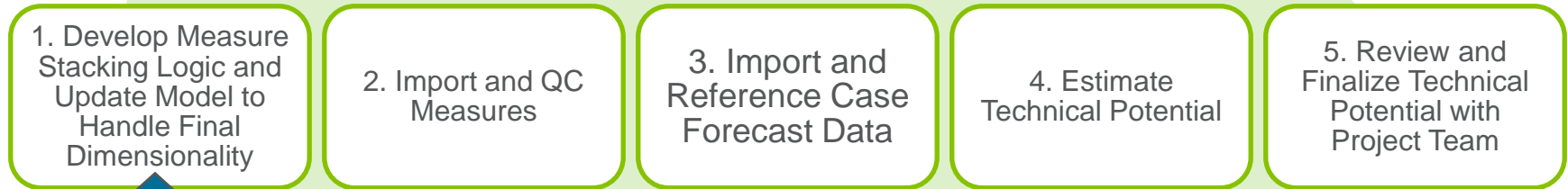


TASK 5: TECHNICAL POTENTIAL

TASK 5: TECHNICAL POTENTIAL

OVERVIEW

Process



In Process

Purpose

- The **Technical Potential** is an estimate of energy efficiency and fuel-switching potential that delivers two parallel tracks of results:
 - **Upper bound of technically feasible conservation** potential that could be attained if all baseline measures were replaced by the technology with the highest unit savings, regardless of economics.
 - **Upper bound of technically feasible gas-to-electric fuel-switching potential** that could be attained if all technically feasible gas-to-electric fuel-switching considered by the study took place, regardless of economics.
- This output provides users of the APS with valuable context for evaluating the magnitude of its ultimate output: achievable potential.

Discussion Questions

- Does the AG have feedback regarding the possible approaches for measure stacking?
- Does the AG have any comments on Navigants proposed QC checks?
- Does the AG have any comments on Navigants proposed benchmarking checks?

TASK 5: TECHNICAL POTENTIAL

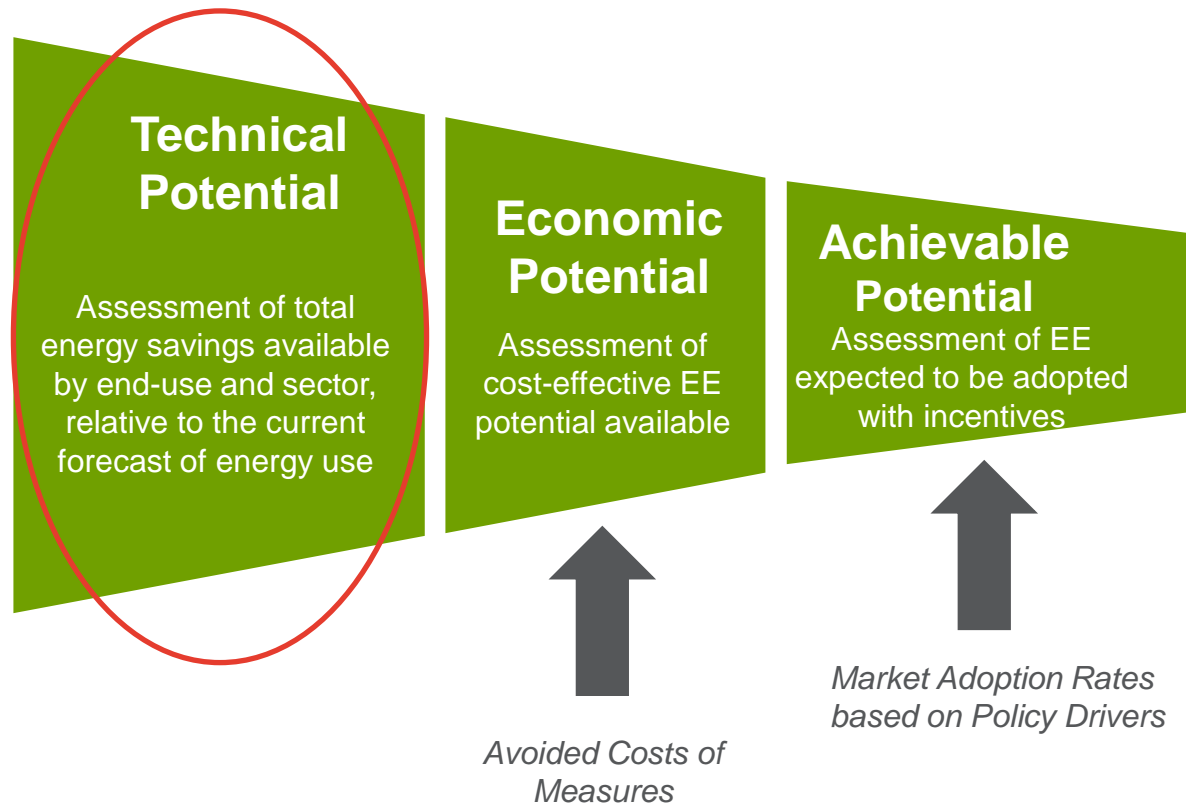
TIMELINE

| Month | Oct 2018 | | | | November 2018 | | | | December 2018 | | | | January 2018 | | | | February 2019 | | | |
|------------------------------------------------------------|----------|--------|--------|--------|---------------|--------|--------|--------|---------------|--------|--------|--------|--------------|--------|--------|--------|---------------|--------|--------|--|
| | 22 Oct | 29 Oct | 5 Nov | 12 Nov | 19 Nov | 26 Nov | 3 Dec | 10 Dec | 17 Dec | 24 Dec | 31 Dec | 7 Jan | 14 Jan | 21 Jan | 28 Jan | 4 Feb | 11 Feb | 18 Feb | 25 Feb | |
| 1. DSMSim Updates (dimensionality, new logic, etc.) | Shaded | Shaded | Shaded | Shaded | | | | | | | | | | | | | | | | |
| 2. Iterative Measure QC | | Shaded | Shaded | Shaded | Shaded | Shaded | Shaded | Shaded | Shaded | Shaded | Shaded | Shaded | Shaded | | | | | | | |
| 3. Iterative Reference Forecast QC | | | | | | | | | Shaded | Shaded | Shaded | Shaded | Shaded | | | | | | | |
| 4. Benchmark and Output Technical Potential | | | | | | | | | | | | | Shaded | Shaded | Shaded | Shaded | | | | |

TASK 5: TECHNICAL POTENTIAL

INTRODUCTION AND CONTEXT

What is Technical Potential? How does it compare to Economic and Achievable?



TASK 5: TECHNICAL POTENTIAL

KEY CONSIDERATIONS: TERMINOLOGY PRIMER

Terminology Primer: Different potential studies capture interactions between measures in different ways. Navigant controls for three distinct types of interaction.

Interactive Effects

One measure's savings affect another end-use's consumption.

Example:

LEDs replacing incandescent bulbs:

- *Increase space-heating consumption*
- *Decrease space-cooling consumption*

Competing Measures (Competition Groups)

Measures are mutually exclusive – only one or the other can be installed.

Example:

- *Cold-climate air-source HP*
- VS
- *Ground-source HP*

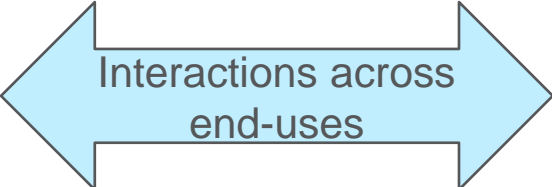
Measure Stacking

Measures can be installed together, but total savings are less than the sum of individual savings.

Example:

- *Cold-climate air-source HP. Savings = X*
- *Attic insulation. Savings = Y*

Combined Installation Total Savings < X + Y



Interactions across end-uses



Interactions within a single end-use

TASK 5: TECHNICAL POTENTIAL

KEY CONSIDERATIONS: TIMING OF AG INPUT

Not all modeling decisions made for Technical Potential carry through to Economic or Achievable Potential

- Today, Navigant and the Project Team are requesting AG input on key considerations that affect the Technical Potential.
- In many cases, additional consultation will be required at future meetings for key considerations that affect Economic or Achievable Potential
- Some decisions made on the basis of today's consultation for Technical Potential may be revisited for Economic and Achievable Potential.

Navigant has mapped these key considerations by potential type to make it clear where modeling mechanics may change for other types of potential.

Key Considerations Mapping Legend

Existing model mechanics **not** requiring AG input.

Existing or under development model mechanics requiring AG input.

TASK 5: TECHNICAL POTENTIAL

KEY CONSIDERATIONS: PERSISTENCE OF DECISIONS – WHERE IS AG INPUT REQUIRED?

| | Technical | Economic | Achievable |
|------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Fuel-Switching | Modeled in parallel to EE potential. Independent streams, no competition. | | Should measures compete across fuels? |
| Competing Measures | Measure with most savings always selected. | Measure with most savings <i>that is also cost-effective</i> always selected. | How do competing measures split market share? |
| Measure Stacking | How do individual measure potential values reflect effect of stacking? | How are measure benefits (avoided costs, bill savings) distributed across stacked measures? Do consumers account for impacts on total savings of stacking when purchasing them? | |
| Interactive Effects | Determined as part of measure characterisation. | | |
| Persistence (Programmatic Savings) | Not applicable. Assumption of maximum technical or economic potential achievement implies indefinite persistence | | How is the re-participation decision modeled? |
| Natural Conservation | Accounted for in reference and alternative forecasts. | | |

TASK 5: TECHNICAL POTENTIAL

KEY CONSIDERATIONS: SUMMARY OF ADDITIONAL DETAIL

Additional detail on *some* of these key considerations provided in slides that follow

- 1. Fuel Switching:** rationale for parallel modeling, and example of mechanics.
- 2. Natural Conservation:** how the dynamics of “evolving baselines” due to natural conservation are controlled for. Also addresses “evolving baseline” effects of codes and standards and programmatic conservation
- 3. Measure Stacking:** explanation of how the measure stacking approach affects Technical Potential, and a preview of the considerations for how measure stacking affects Economic and Achievable Potential.

TASK 5: TECHNICAL POTENTIAL

KEY CONSIDERATIONS: CONSIDERATION 1 – FUEL SWITCHING

Key Consideration 1: Fuel Switching

In prior studies, Navigant has modelled the technical potential for fuel switching measures separately from same-fuel efficiency measures.

For this study fuel switching will be modeled separately from same-fuel efficiency measures for Technical and Economic Potential.

Why does Navigant typically model fuel switching and EE potential separately?

Policy Objectives are Different

Fuel switching and energy efficiency programs tend to have different policy objectives (GHG vs. energy savings)
Programs could also be funded in parallel through different means / sources

More Valuable Insights

If fuel switching measures are treated as part of the same competition group for same-fuel measures, the negative savings values (i.e. increases in consumption from fuel switching measures) will skew same-fuel measure efficiency potential results

Fuel Switching Measures Not Exhaustive

Fuel switching measures considered as part of this study do not represent an exhaustive list of fuel switching options for consumers, biasing results

TASK 5: TECHNICAL POTENTIAL

KEY CONSIDERATIONS: CONSIDERATION 1 – FUEL SWITCHING

Does the AG have any feedback regarding the approach used to model fuel switching for Technical Potential?

Thinking ahead, some questions to consider for Achievable Potential fuel switching:

- Do consumers consider fuel switching investments in the same way as same fuel efficiency investments?
- Are the program costs for fuel switching funded through the same mechanism as energy efficiency?
- Do the fuel switching measures reflect the full range of options available to consumers?

TASK 5: TECHNICAL POTENTIAL

KEY CONSIDERATIONS: CONSIDERATION 2 –NATURAL CONSERVATION, BASELINES, AND MEASURE SAVINGS

Key Consideration 2: Natural Conservation and Measure Baselines

DSMSim™ outputs savings potential that:

- A. Is net of free riders. Natural conservation is accounted for.
- B. Includes only potential incremental to savings achieved by codes and standards.
- C. Avoids double-counting by tracking measure uptake over time.

The dynamics of these three factors are each controlled for in different ways.

Natural Conservation

*Captured by:
Reference
Forecast*

- Reference forecast includes natural conservation.
- Natural conservation is not static – it grows over time, eroding potential.
- This is accounted for in corresponding changes to end-use intensities over time.
- Changing intensities change the ceiling for conservation potential, implicitly capturing changes in efficient measure saturation in the calibration process.

Codes and Standards

*Captured by:
Measure
Characterisation*

- The effects of codes and standards are captured as part of measure characterisation.
- Changes in codes and standards are reflected in measure baselines (the “but-for” technology), which results in measure unit savings decreasing in response to the introduction of new codes and standards over time.

Programmatic Savings

*Captured by:
Modeled Changes
in Saturation*

- Efficient measure uptake due to programs in each year reduces incremental potential available in future years.
- DSMSim tracks measure uptake to ensure against any double-counting.

TASK 5: TECHNICAL POTENTIAL

KEY CONSIDERATIONS: KEY CONSIDERATION 3 - MEASURE STACKING

Key Consideration 3: Measure Stacking

- Measure stacking captures interactions of non-competing measures of measures within the same end-use.
- Measure stacking addresses the fact that in some cases, two measures combined save less than the sum of their individual savings.
- The different approaches proposed by Navigant for accounting for this effect differ only in their impact on *measure-level* potential. Aggregated end-use potential is the same under all approaches.

Terminology Primer: For the purposes of measure stacking, Navigant assigns each measure a category: “engine” or “envelope”.

“Engine” Measures

Measures that reduce the end-use *input* energy requirements.

For Example:

- LED bulbs
- Air-source heat pumps, etc.

“Envelope” Measures

Measures that reduce the end-use *output* energy requirements.

For Example:

- Lighting controls
- Attic insulation

TASK 5: TECHNICAL POTENTIAL
KEY CONSIDERATIONS: MEASURE STACKING

Different approaches to measure stacking affect individual measure potential, but *not* aggregate end-use potential

Example:

- LED lighting – reduces consumption by 40%
- Lighting controls – reduces consumption by 25%

| Approach | Engine Savings | Envelope Savings | End-Use Savings |
|--------------------|-------------------------------------------------|-------------------------------------------------|----------------------------|
| Priority: Engine | 40% | $(100\% - 40\%) \times 25\% = 15\%$ | $40\% + 15\% = 55\%$ |
| Priority: Envelope | $(100\% - 25\%) \times 40\% = 30\%$ | 25% | $30\% + 25\% = 55\%$ |
| Shared Savings | $40\% \div (40\% + 25\%) \times 55\% = 33.85\%$ | $25\% \div (40\% + 25\%) \times 55\% = 21.15\%$ | $33.85\% + 21.15\% = 55\%$ |

TASK 5: TECHNICAL POTENTIAL

KEY CONSIDERATIONS: MEASURE STACKING

Discussion Question:

Does the AG have feedback regarding the possible approaches for measure stacking?

NB: The approach selected does not necessarily affect the approach to be used for Economic or Achievable.

Thinking ahead – measure stacking in Economic and Achievable Potential:

- **Economic Potential:** Order matters – if engine or envelope measures have priority, there are implications for measure cost-effectiveness, depending on the approach used.
- **Achievable Potential:** Do consumers consider the stacking impact on savings? Do stacking effects impact on purchase decisions?

Navigant recommends the “Shared Savings” approach:

- It imposes fewer structural assumptions (e.g., agnostic to measure installation order).
- It results in greater consistency in the comparison of individual measure-level savings to measure-level Technical Potential (i.e., symmetric reductions in potential across measures within a stack)

Input QC: Reference Forecast & Characterised Measures

A key component of Task 5 is an additional layer of quality control (QC) applied to the Reference Forecast and Measure Characterisation inputs.

For the **Reference Forecast**, the DSMSim™ QC Module checks:

- Sector, segment, and end-use consumption in absolute value and as a percentage of total.
- Identifies discontinuous values or unusual trends.
- Benchmarks values against other studies.

For the **Measure Characterisation**, the DSMSim™ QC Module checks:

- Measures with unusual or unexpected savings (e.g., zero savings, saving > 90% of baseline consumption, etc.)
- Measure savings potential as a proportion of total end-use consumption, and benchmarking to results from other studies.

| Measure Characterization Import and Quality Control Module | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| Instructions | |
| This module will help you upload energy efficiency measure characterization data from an Excel template into Analytica, and will help guide you through the process of ensuring measure data quality and consistency. You should follow the following sections in numerical order, beginning with import of the raw measure data. | |
| The following outline gives a general overview of the import/QC process: | |
| Error Checking | |
| Click on each of the buttons below for a series of error checks to make sure various hard constraints are respected by the input data. For example, Baseline and Energy Efficient initial saturations should sum to 1 within competition groups. Note that not all values returned necessarily indicate an issue. | |
| Enable error messages when checking imported measure data? | <input checked="" type="checkbox"/> |
| Subscripts of Measures with Overlap | <input type="button" value="Calc"/> <small>msd</small> |
| Subscripts of Measures with Negative Initial Savings | <input type="button" value="Calc"/> <small>msd</small> |
| Subscripts of Measures with Sign Change in Savings Across Study Horizon | <input type="button" value="Calc"/> <small>msd</small> |

TASK 5: TECHNICAL POTENTIAL

QUALITY CONTROL: INPUT REVIEW

Discussion Question:

Are there any additional checks the AG would like Navigant to consider for Technical Potential?

TASK 5: TECHNICAL POTENTIAL

QUALITY CONTROL: BENCHMARKING RESULTS

Results will be benchmarked against studies in comparable jurisdictions and to previous studies in Ontario to ensure accuracy.

Comparison to previous Ontario studies will allow strong comparison of potential in the early years. Comparison to similar jurisdictions will help guide understanding of results and trends over the entire study period.

Studies for Comparison

nationalgrid



ONTARIO
ENERGY
BOARD



ieso

Connecting Today.
Powering Tomorrow.

BC Hydro



Pacific
Northern
Gas Ltd.



FORTIS BC

Standard Metrics for Comparison:

- Sector-level technical and economic potential over time
- Technical potential as percent of end use consumption
- Incremental (annual) achievable potential as a percent of sales
- Cumulative (total at end of study period) achievable potential as percent of sales

Discussion Question:

Are there any additional checks the AG would like Navigant to consider for Technical Potential?

NEXT STEPS (~NEXT 30 DAYS)

Demand Response Potential:

- Identify measures that may also have demand response potential
- Update model logic to accommodate updated measure characterization

Measure Stacking:

- Finalize logic
- Incorporate logic in to model

Begin QC'ing Technical Potential:

- Import measure list and use placeholder reference forecast values
- Use embedded import QC checks to see if measures pass “laugh test” while waiting for actual reference forecast values



Next Steps & 30 Day Outlook

NEXT STEPS AND 30 DAY OUTLOOK

Task 2: Base Year Disaggregation

1. Complete natural gas base year disaggregation

Task 3: Reference Forecast

1. Complete compatibility analysis.
2. Begin development of code to output alternative forecasts.

Task 4: Measure Characterisation

1. Continue to characterise measures & address reviewers comments

Task 7: Achievable Potential

1. Finalize Delphi panel Terms of Reference
2. Invite potential participants to join Delphi panel
3. Finalize Delphi panel questionnaire/survey & distribute to panel members

Task 8: Whole Building Benchmarking

1. Finalize building type for analysis
2. Evaluate data available to support analysis & begin updating WBB approach based on those data

Wrap-Up

- Thank you for your continued input and discussions today.
- Next meeting is December 13th.
- Please continue to reach out to the Project Team with any new issues that may arise between meetings.