Guidehouse
Outwit Complexity

To: Erin Daughton, ComEd

CC: Elizabeth Horne, David Brightwell, ICC Staff; Christopher Frye, Alviez Chagan, Neil Curtis, Jeff Erickson Guidehouse

From: Nancy Iden, Jason Foster, Guidehouse

Date: September 1, 2023

Re: ComEd 2022 Contractor/Midstream Rebates Program, Free-Ridership, Spillover and NTG Research Results

1. Executive Summary

This memo presents the results of the Contractor/Midstream Rebates Program Free-Ridership (FR) and Spillover (SO) research conducted by Guidehouse (termed the "Home Heating & Cooling Offering" in the distributor and EESP (Energy Efficiency Survey Providers) participation agreements). Guidehouse emailed survey invitations to 296 contractors and 27 distributors that participated during the 2022 program year. Survey fielding took place between June 2023 and July 2023. We received 50 surveys for contractors and 15 for distributors. Some respondents did not complete the entirety of the survey and therefore their responses could not be used in the analysis. 46 contractor surveys and 13 distributor surveys were included in the analysis. The respondents that were included in the analysis account for 40.1% of distributor savings and 17.1% of contractor savings. The completed surveys represent a response rate of 15.5% for contractors and 55.6% for distributors

The results shown in Table 1 will inform Guidehouse's recommendations to the Illinois Stakeholder Advisory Group (SAG) of Net-to Gross (NTG) values to be used for this program in CY2024. The research included four different measures split into two categories, midstream central air conditioner is listed independently, and the heat pump measure consists of all heat pump-related measures (midstream ductless mini-split heat pump (DMSHP), midstream air source heat pump (ASHP), and midstream ground source heat pump (GSHP).

150 North Riverside
Suite 2100 | Chicago, IL 60606
guidehouse.com

Table 1. Net-to-Gross Research Results

Measure	FR	Participant SO	Non-Participant SO	NTG Ratio
Midstream Central AC	0.306	0.162	0	0.856
Heat pumps (including midstream DMSHP, ASHP, and GSHP)	0.163	0.096	0	0.933

Source: Guidehouse Analysis

2. Free-Ridership and Spillover Survey Disposition

The evaluation team emailed survey invitations to 27 distributors and 296 contractors from the CY2022 program year. The survey was completed online by the participating distributor or contractor. The survey contained separate FR and SO sections for both central ACs and heat pumps. Respondents were only asked the sections that applied to them based on which equipment they had sold. All respondents were asked the program satisfaction questions. Note that Actual Completes includes fully completed surveys as well as partial surveys in which the requisite questions for conducting analysis were completed. Table 2**Error! Reference source not found.** contains the number of contractors and distributors that competed the online survey in addition to the number of usable responses for the analysis.

Table 2. Free-Ridership Decision Maker Survey Disposition

Population	Target Completes	Actual Completes	Analyzed Completes
Contractors	56	50	46
Distributors	20	15	13

Source: Guidehouse Analysis

Error! Reference source not found. details the number of responses included in the analysis. Responses were excluded from the analysis if the participant did not complete the specific questions associated with the analysis or if their response triggered and failed a consistency check.

Table 3. Survey Disposition

Response Disposition	Central ACs	Heat Pumps
Measure installations in sample	**45**	**34**
Excluded: Invalid	0	0
Excluded: Non-response	3	3
Excluded: Triggered and failed consistency check	0	0
Total of excluded responses	**3**	**3**
Analyzed sample	**42**	**31**

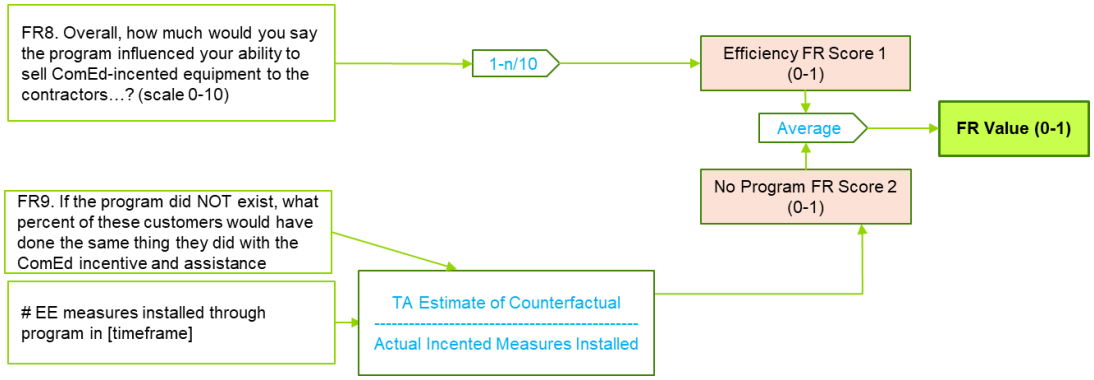
Source: Guidehouse Analysis

3. Free-Ridership and Spillover Protocols

The evaluation team applied the relevant FR and SO protocols from Illinois TRM Version 11.

Participant Free-Ridership Estimation

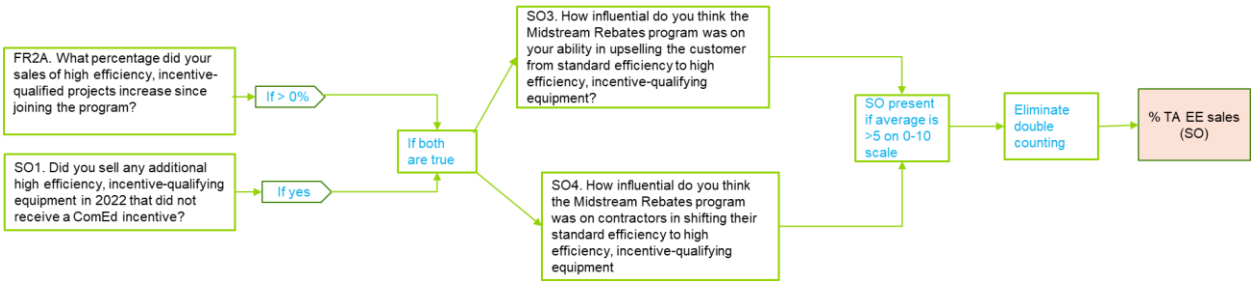
Figure 1. Free-Ridership Protocol from TRM V11.0



Source: TRM V11.0

Participant Spillover Estimation

Figure 2. Spillover Protocol from TRM V11.0



Source: TRM V11.0

4. Detailed NTG Results

This section details the research analysis and CY2024 NTG recommendations.

4.1 FreeRidership Consistency Check Analysis

To address the possibility of conflicting responses, the TRM specifies consistency checks that ask participants open ended questions to address a program's influence. This survey included an open-ended question to address the possibility of conflicting responses. The TRM recommends using the responses to the open-ended questions to resolve inconsistencies in the closed-ended numeric program influence and counterfactual scores. For contractors, two No Program (NP) scores were excluded, and zero Program Efficiency scores were excluded. For

distributors, one NP Score was excluded. Table 4 lists the count of each score that was excluded from analysis based on the consistency check calculation.

Table 4. Consistency Check Adjustments

Adjustment	Central ACs	Heat pumps
Evaluated to require no exclusion	39	28
Evaluated to exclude NP score	3	3
Evaluated to exclude program efficiency score	0	0

Source: Guidehouse Analysis

4.2 Free-Ridership Component Scores

Guidehouse applied the core free ridership protocol which was revised by the SAG NTG working group in May 2023. Table 5 shows the savings weighted average component scores following the protocol in Figure 1 and Figure 2. The final FR score was weighted by the amount of central AC or heat pump savings as a fraction of total savings for each participant. Table 5 shows the program influence, no program, and FR scores segmented by central ACs and heat pumps.

Table 5. Free-Ridership Component Scores

Measure	Program Influence Score	No Program Score	Participant FR	Weighted FR
Midstream Central AC	0.417	0.300	0.374	0.306
SO	0.333	0.115	0.272	0.163

Source: Guidehouse Analysis

4.3 Spillover Estimation

Table 6 outlines the energy efficiency improvements that respondents made that were influenced by the program but did not receive any program rebates. These improvements contributed to total program SO. The SO rates were calculated by dividing the SO by the Contractor/Midstream Program savings for the respondents that completed the SO section of the online survey.

Table 6. Spillover Research Results by Measure

Participant	Participants Contributing to SO	SO kWh	SO Rate for kWh
Midstream Central AC	18	26,437	16.2%
Heat pumps (including midstream DMSHP, ASHP, and GSHP)	7	61,899	9.6%

Source: Guidehouse Analysis

4.4 Free-Ridership and Spillover to Create Program Net-to-Gross Ratio

Table 7 shows the FR, participant SO, and final NTG ratio value for both central ACs and heat pumps. The NTG value was calculated using the formula:

1 – Free-ridership + Participant Spillover = NTG

Table 7. Free-Ridership and Participant Spillover for the Midstream Program

Measure	Participant FR	Participant SO	NTG
Midstream Central AC	0.306	0.162	0.856
Heat pumps (including midstream DMSHP, ASHP, and GSHP)	0.163	0.096	0.933

Source: Guidehouse Analysis

4.4.1 Confidence and Precision Analysis

The measure or program-level FR values, along with precision estimates, are shown below in Table 8. Relative precision (at 90% confidence interval) is 7% percent for central ACs and 32% percent for heat pumps.

Table 8. Free Ridership and Relative Precision at 90% Confidence Level

Measure Installed	Relative Precision (%)	Participant FR (Low)	Participant FR (Mean)	Participant FR (High)
Midstream Central AC	6%	0.26	0.31	0.35
Heat pumps (including midstream DMSHP, ASHP, and GSHP)	7%	0.10	0.16	0.23

Source: Guidehouse Analysis

4.5 NTG Comparison with Previous Research

Guidehouse has conducted no previous primary NTG research conducted for the midstream program.

Guidehouse conducted secondary research in 2021 of comparable jurisdiction HVAC midstream programs. That research found no recent measure- or program-specific NTG values of residential HVAC programs with midstream air source heat pump and ductless mini-split heat pump measures. Guidehouse recommended in 2021 the IL default NTG value of 0.80 for the midstream ASHP and midstream DMSHP measures in the Residential HVAC Program.

Table 9 shows CY2023 program NTG values, including downstream measures and specified midstream measures.

Table 9. CY2023 NTG values

Measure	FR	SO	NTG	FR Source	SO Source
Downstream Advanced Thermostat			0.80 [cool] 0.90 [heat]	Cooling: Policy Manual default Heating: SAG consensus. TRM savings are between net and gross therefore NTG should be between the default value (0.8) and 1.0.	See FR
ASHP Tune-Up (Downstream)			0.80	IL TRM v8.0; secondary research	IL TRM v8.0; secondary research
Downstream CAC Tune-Up			0.80	IL TRM v8.0; secondary research	IL TRM v8.0; secondary research
Downstream Central Air Conditioner	0.25	0.08	0.83	CY2018 participating customer survey	PY8 participating customer survey
Downstream Air Source Heat Pump			0.57	SAG consensus value	SAG consensus value
Downstream Ductless Mini-Split	0.45	0.08	0.63	CY2018 participating customer survey	PY8 participating customer survey
Duct Sealing (Downstream)	0.14	0.02	0.88	PY9 and CY2018 participating customer survey	PY9 participating customer survey
ECM Furnace Motor--with Furnace Upgrade (Downstream)	0.30	0.08	0.78	CY2018 participating customer survey	PY8 participating customer survey
ECM Furnace Motor--without Furnace Upgrade (Downstream)	0.30	0.08	0.78	CY2018 participating customer survey	PY8 participating customer survey
Ground Source Heat Pump (Downstream)			0.59	SAG consensus value	SAG consensus value
Midstream Air Source Heat Pump			0.80	Secondary research presented in the CY2021 Program NTG Memo found no recently researched NTG value from a comparable program, indicating the TRM default NTG ratio of 0.80.	Secondary research presented in the CY2021 Program NTG Memo found no recently researched NTG value from a comparable program, indicating the TRM default NTG ratio of 0.80.
Midstream Ductless Mini-Split			0.80	Secondary research presented in the CY2021 Program NTG Memo found no recently researched NTG value from a comparable program, indicating the TRM default NTG ratio of 0.80.	Secondary research presented in the CY2021 Program NTG Memo found no recently researched NTG value from a comparable program, indicating the TRM default NTG ratio of 0.80.

Measure	FR	SO	NTG	FR Source	SO Source
Midstream Central Air Conditioner			0.80	IL TRM v8.0; secondary research	IL TRM v8.0; secondary research

Source: IL SAG ComEd CY2021 Residential HVAC Secondary NTG Research Memo (August 3, 2021), IL SAG Final NTG Ratios for 2023 Program Year (Jan. 1 – Dec. 31, 2023)

5. Final NTG Results and Recommendations

The CY2024 recommended NTG values including new NTG values for central AC, DMSHP, ASHP, and GSHP are shown in Table 10.

Six measures (including advanced thermostat, HVAC tune up, duct sealing, and ECM furnace motor) comprise less than 5% of total program savings in 2022 and were not included in the 2022 NTG research surveys. Guidehouse recommends retaining the historical NTG values (shown in Table 9) for these measures.

Table 10. Recommended CY2024 NTG Values

Measure or Sub-Component	FR	SO	NTG	Same as CY2023?
Advanced Thermostat			0.80 [cool] 0.90 [heat]	TRUE
ASHP Tune-Up			0.80	TRUE
CAC Tune-Up			0.80	TRUE
Duct Sealing	0.14	0.02	0.88	TRUE
ECM Furnace Motor--with Furnace Upgrade	0.30	0.08	0.78	TRUE
ECM Furnace Motor--without Furnace Upgrade	0.30	0.08	0.78	TRUE
Ground Source Heat Pump	0.162	0.096	0.933	FALSE
Midstream Air Source Heat Pump	0.162	0.096	0.933	FALSE
Midstream Ductless Mini-Split	0.162	0.096	0.933	FALSE
Midstream Central Air Conditioner	0.306	0.162	0.856	FALSE

Source: IL SAG Final NTG Ratios for 2023 Program Year (Jan. 1 – Dec. 31, 2023) and Guidehouse Analysis