NAVIGANT

Joint Utility Affordable Housing New Construction Impact Evaluation Report

Energy Efficiency / Demand Response Plan: Program Year 2018 (CY2018) (1/1/2018-12/31/2018)

Presented to
ComEd
Nicor Gas
Peoples Gas
North Shore Gas

DRAFT

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Prepared by:

Marion Cundari
Opinion Dynamics

Mallorie Gattie-Garza
Opinion Dynamics

Itron

Opinion Dynamics

MichaelsEnergy

www.navigant.com

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Joint Utility AHNC Impact Evaluation Report

Submitted to:

ComEd
Three Lincoln Centre
Oakbrook Terrace, IL 60181

Nicor Gas Company
1844 Ferry Road
Naperville, IL 60563

Peoples Gas and North Shore Gas
200 East Randolph Street
Chicago, IL 60601

Submitted by:

Navigant Consulting, Inc.
150 N. Riverside Plaza, Suite 2100
Chicago, IL 60606

Contact:

Randy Gunn, Managing Director	Kevin Grabner Associate Director	Chelsea Lamar, Managing Consultant
312.583.5714	608.497.2322	312.583.2673
Randy.Gunn@Navigant.com	Kevin.Grabner@Navigant.com	Chelsea.Lamar@Navigant.com

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1. Introduction

This report presents the results of the impact evaluation of the Joint Utility CY2018 Affordable Housing New Construction (AHNC) Program. It presents a summary of the program structure as well as both program total and measure-level energy and demand impacts. The appendix presents the impact analysis methodology. CY2018 covers January 1, 2018 through December 31, 2018.

2. Program Description

The AHNC Program provides incentives for energy efficient construction and major renovation of affordable housing. The program offers technical assistance and incentive funding and serves both single-family and multi-family housing. The program targets income eligible customers in ComEd, Peoples Gas (PGL), North Shore Gas (NSG) and Nicor Gas service territories with incomes at or below 80% of the Area Median Income. An additional goal of the program is to educate housing developers on cost-effective energy efficient building practices. Slipstream (formerly known as Seventhwave) implemented the program and husARchitecture began serving as a technical subcontractor to Slipstream in May 2018. Slipstream is responsible for overseeing day-to-day operations and providing technical assistance to participants while husARchitecture provides additional support by conducting site visits and developing incentive calculations for projects.

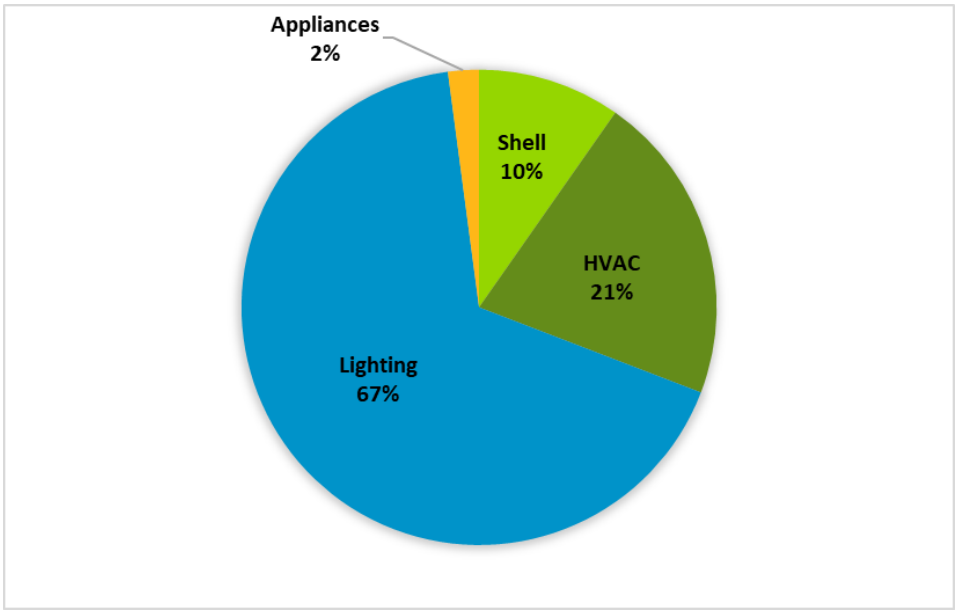
The AHNC Program had nine participants in CY2018 and distributed measures to 689 income eligible residential units as shown in the following table and graph. The program has three participation levels: major renovation, new multi-family, and new single-family.

Table 2-1. CY2018 Volumetric Findings Detail

Participation	Quantity	Units
Participants (ComEd)	9	Projects
Participants (Nicor Gas)	3	Projects
Participants (Peoples Gas)	6	Projects
Participants (North Shore Gas)	0	Projects
Number of Units	689	Residential units
Shell	1,254,032	Varies*
HVAC	1,258	HVAC system
Lighting	9,367	Lamps
Appliances	1,002	Appliance†
Hot Water	94	Water heater

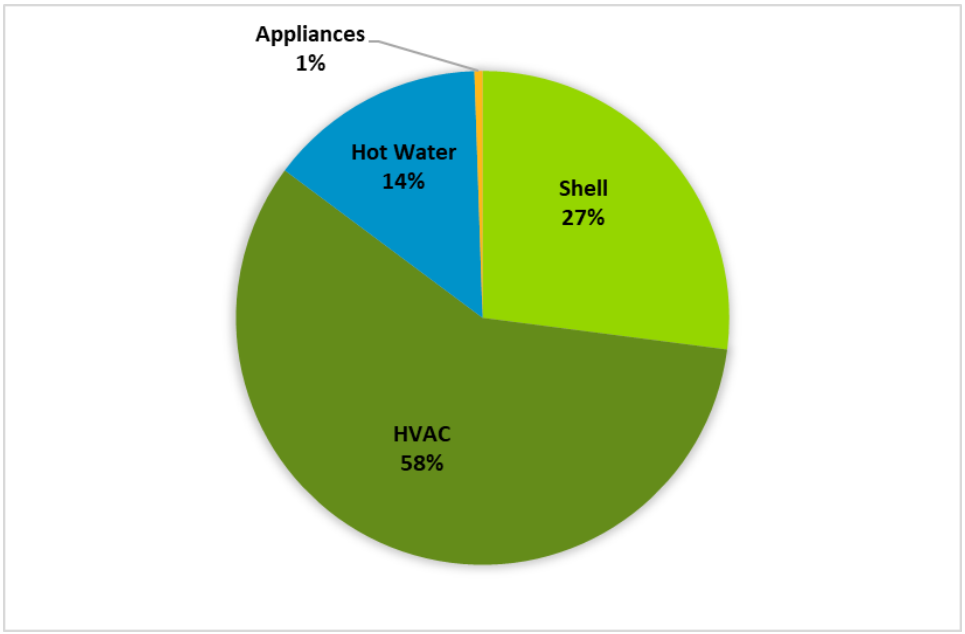
* Includes combination of measures (e.g., windows, thermal bridging, and infiltration) provided in units of square footage and cubic feet per minute (cfm)
† Includes combination of measures (Dishwashers, Clothes washers and Refrigerators)
Source: ComEd, Nicor Gas, Peoples Gas, and North Shore Gas tracking data and Navigant team analysis.

Figure 2-1. AHNC Distribution of Measures Installed by Verified Electric Savings



Source: Navigant Analysis

Figure 2-2. AHNC Distribution of Measures Installed by Verified Gas Savings



Source: Navigant Analysis

3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the AHNC Program achieved in CY2018.

Table 3-1. CY2018 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Summer Peak Demand Savings (kW)
Electricity			
Ex Ante Gross Savings	2,054,612	2,365	383
Program Gross Realization Rate	0.92	0.91	0.80
Verified Gross Savings	1,897,305	2,156	305
Program Net-to-Gross Ratio (NTG)	1.00	1.00	1.00
Verified Net Savings	1,897,305	2,156	305
Converted from Gas*			
Ex Ante Gross Savings	NA	NA	NA
Program Gross Realization Rate	NA	NA	NA
Verified Gross Savings	NA	NA	NA
Program Net-to-Gross Ratio (NTG)	NA	NA	NA
Verified Net Savings	NA	NA	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	2,054,612	2,365	383
Program Gross Realization Rate	0.92	0.91	0.80
Verified Gross Savings	1,897,305	2,156	305
Program Net-to-Gross Ratio (NTG)	1.00	1.00	1.00
Verified Net Savings	1,897,305	2,156	305

NA = Not applicable
* Gas savings converted to kWh by multiplying therms * 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh).
Note: The coincident Summer Peak period is defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August.
Source: ComEd tracking data and Navigant team analysis.

Table 3-2 summarizes the incremental gas savings the AHNC Program achieved in CY2018.

Table 3-2. CY2018 Total Annual Incremental Therm Savings

Savings Category	Nicor Gas (therms)	Peoples Gas (Therms)
Natural Gas*		
Ex Ante Gross Savings	26,033	48,252
Program Gross Realization Rate	1.56	1.18
Verified Gross Savings	40,517	57,058
Program Net-to-Gross Ratio (NTG)	1.00	1.00
Verified Net Savings	40,517	57,058

* Natural gas savings with electric interactive effects removed.
Source: ComEd, Nicor Gas, and Peoples Gas tracking data and Navigant team analysis.

4. Cumulative Persisting Annual Savings

The measure-specific and total ex ante gross savings for the AHNC Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 are shown in the following tables

and figure. The total CPAS across all measures is 1,897,305 kWh. There are no CPAS equivalent of gas savings converted to electricity for this program that may be counted towards ComEd's goal.

Table 4-1. Cumulative Persisting Annual Savings (CPAS) – Electric

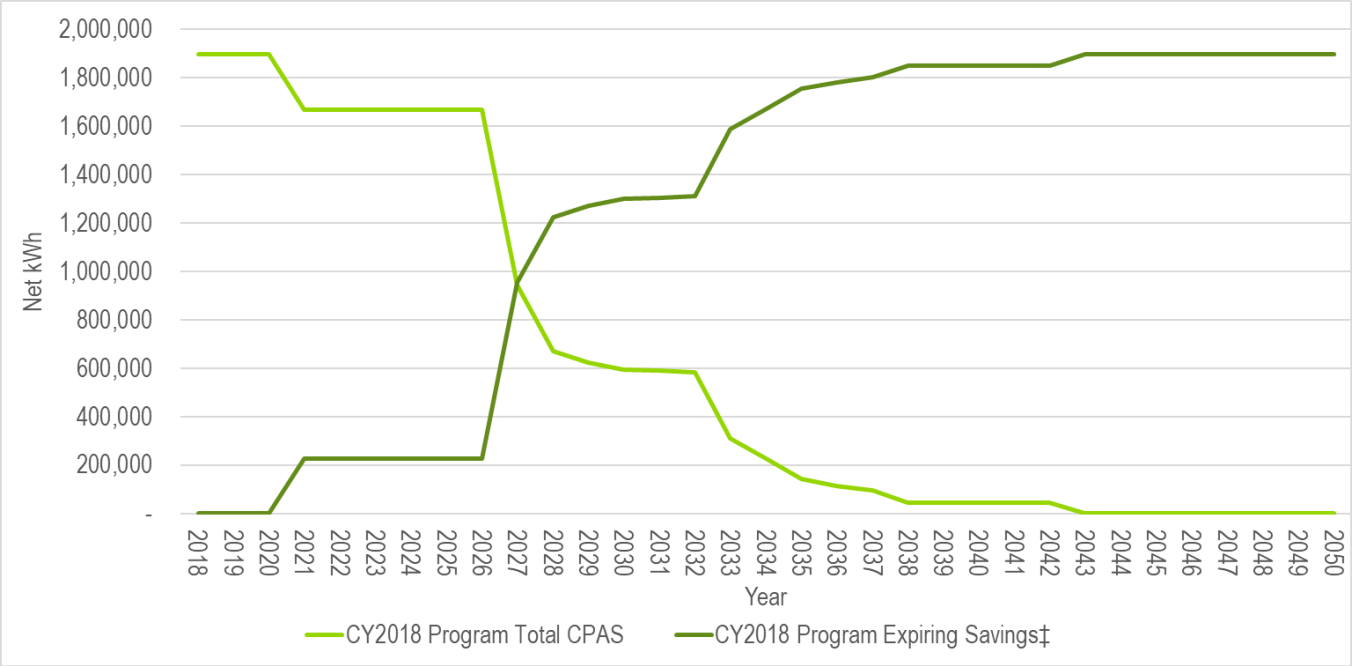
End Use Type	Research Category	EUL	CY2018 Verified Gross Savings	NTG*	Lifetime Net Savings†	Verified Net kWh Savings 2018	2019	2020	2021	2022	2023	2024	2025	2026
Shell	High Performance Windows	25.0	25,661	1.00	641,530	25,661	25,661	25,661	25,661	25,661	25,661	25,661	25,661	25,661
Shell	Reduced Infiltration	15.0	137,837	1.00	2,067,555	137,837	137,837	137,837	137,837	137,837	137,837	137,837	137,837	137,837
Shell	Reduced Thermal Bridging	25.0	20,943	1.00	523,581	20,943	20,943	20,943	20,943	20,943	20,943	20,943	20,943	20,943
HVAC	Air Source Heat Pump (Residential)	18.0	4,250	1.00	76,497	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250
HVAC	Air Source Heat Pump (Commercial)	15.0	136,954	1.00	2,054,314	136,954	136,954	136,954	136,954	136,954	136,954	136,954	136,954	136,954
HVAC	Furnace	16.5	167,628	1.00	2,765,862	167,628	167,628	167,628	167,628	167,628	167,628	167,628	167,628	167,628
HVAC	Central Air Conditioning	18.0	22,178	1.00	399,196	22,178	22,178	22,178	22,178	22,178	22,178	22,178	22,178	22,178
HVAC	Chiller	20.0	49,084	1.00	981,677	49,084	49,084	49,084	49,084	49,084	49,084	49,084	49,084	49,084
HVAC	High Performance Fans	19.0	20,371	1.00	387,050	20,371	20,371	20,371	20,371	20,371	20,371	20,371	20,371	20,371
Lighting	High Performance Interior Lighting	9.1	1,035,346	1.00	8,031,215	1,035,346	1,035,346	1,035,346	807,406	807,406	807,406	807,406	807,406	807,406
Lighting	High Performance Exterior Lighting	10.2	237,143	1.00	2,418,862	237,143	237,143	237,143	237,143	237,143	237,143	237,143	237,143	237,143
Appliance	ENERGY STAR Clothes Washer	14.0	6,918	1.00	96,852	6,918	6,918	6,918	6,918	6,918	6,918	6,918	6,918	6,918
Appliance	ENERGY STAR Dishwasher	13.0	3,549	1.00	46,138	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549	3,549
Appliance	ENERGY STAR Refrigerator	12.0	29,442	1.00	353,301	29,442	29,442	29,442	29,442	29,442	29,442	29,442	29,442	29,442
CY2018 Program Total Electric CPAS			**1,897,305**		**20,843,629**	**1,897,305**	**1,897,305**	**1,897,305**	**1,669,364**	**1,669,364**	**1,669,364**	**1,669,364**	**1,669,364**	**1,669,364**
CY2018 Program Expiring Electric Savings‡							**-**	**-**	**227,941**	**227,941**	**227,941**	**227,941**	**227,941**	**227,941**

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Shell	High Performance Windows	25,661	25,661	25,661	25,661	25,661	25,661	25,661	25,661	25,661	25,661	25,661	25,661
Shell	Reduced Infiltration	137,837	137,837	137,837	137,837	137,837	137,837						
Shell	Reduced Thermal Bridging	20,943	20,943	20,943	20,943	20,943	20,943	20,943	20,943	20,943	20,943	20,943	20,943
HVAC	Air Source Heat Pump (Residential)	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250	4,250			
HVAC	Air Source Heat Pump (Commercial)	136,954	136,954	136,954	136,954	136,954	136,954						
HVAC	Furnace	167,628	167,628	167,628	167,628	167,628	167,628	167,628	83,814				
HVAC	Central Air Conditioning	22,178	22,178	22,178	22,178	22,178	22,178	22,178	22,178	22,178			
HVAC	Chiller	49,084	49,084	49,084	49,084	49,084	49,084	49,084	49,084	49,084	49,084	49,084	
HVAC	High Performance Fans	20,371	20,371	20,371	20,371	20,371	20,371	20,371	20,371	20,371	20,371		
Lighting	High Performance Interior Lighting	80,741											
Lighting	High Performance Exterior Lighting	237,143	47,429										
Appliance	ENERGY STAR Clothes Washer	6,918	6,918	6,918	6,918	6,918							
Appliance	ENERGY STAR Dishwasher	3,549	3,549	3,549	3,549								
Appliance	ENERGY STAR Refrigerator	29,442	29,442	29,442									
CY2018 Program Total Electric CPAS		**942,699**	**672,243**	**624,815**	**595,373**	**591,824**	**584,906**	**310,115**	**226,301**	**142,487**	**116,059**	**95,688**	**46,604**
CY2018 Program Expiring Electric Savings‡		**954,606**	**1,225,061**	**1,272,490**	**1,301,932**	**1,305,481**	**1,312,399**	**1,587,190**	**1,671,004**	**1,754,818**	**1,781,245**	**1,801,616**	**1,850,700**

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Shell	High Performance Windows	25,661	25,661	25,661	25,661								
Shell	Reduced Infiltration												
Shell	Reduced Thermal Bridging	20,943	20,943	20,943	20,943								
HVAC	Air Source Heat Pump (Residential)												
HVAC	Air Source Heat Pump (Commercial)												
HVAC	Furnace												
HVAC	Central Air Conditioning												
HVAC	Chiller												
HVAC	High Performance Fans												
Lighting	High Performance Interior Lighting												
Lighting	High Performance Exterior Lighting												
Appliance	ENERGY STAR Clothes Washer												
Appliance	ENERGY STAR Dishwasher												
Appliance	ENERGY STAR Refrigerator												
CY2018 Program Total Electric CPAS		**46,604**	**46,604**	**46,604**	**46,604**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CY2018 Program Expiring Electric Savings‡		**1,850,700**	**1,850,700**	**1,850,700**	**1,850,700**	**1,897,305**	**1,897,305**	**1,897,305**	**1,897,305**	**1,897,305**	**1,897,305**	**1,897,305**	**1,897,305**

Note: The green highlighted cell shows program total first year electric savings.
* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
† Lifetime savings are the sum of CPAS savings through the EUL.
‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.
Source: Navigant analysis

Figure 4-1. Cumulative Persisting Annual Savings



‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.
Source: Navigant analysis

5. Program Savings by Measure

The AHNC Program provides incentives for a variety of measures such as lighting, HVAC, water heating, shell, and appliances, as shown in the following tables. Lighting and HVAC measures contribute 87% of the total program ex ante gross electric savings.

Table 5-1. CY2018 Energy Savings by Measure – Electric

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG *	Verified Net Savings (kWh)	Effective Useful Life
Lighting	High Performance Interior Lighting	1,036,311	1.00	1,035,346	1.00	1,035,346	9.1
HVAC	High Performance HVAC Equipment	518,116	0.73	380,094	1.00	380,094	18.0
Lighting	High Performance Exterior Lighting	237,692	1.00	237,143	1.00	237,143	10.2
Shell	Reduced Infiltration	139,936	0.99	137,837	1.00	137,837	15.0
Appliance	Efficient Aplliances	52,665	0.76	39,909	1.00	39,909	12.0
Shell	High Performance Windows	25,907	0.99	25,661	1.00	25,661	25.0
HVAC	High Performance Fans	25,215	0.81	20,371	1.00	20,371	19.0
Shell	Reduced Thermal Bridging	18,770	1.12	20,943	1.00	20,943	25.0
	Total	**2,054,612**	**0.92**	**1,897,305**	**1.00**	**1,897,305**	

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
Source: ComEd tracking data and Navigant team analysis.

Table 5-2. CY2018 Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (kW)	NTG *	Verified Net Demand Reduction (kW)
Lighting	High Performance Interior Lighting	1,630	1.00	1,628	1.00	1,628
HVAC	High Performance HVAC Equipment	413	0.62	255	1.00	255
Appliance	Efficient Appliances	193	0.78	150	1.00	150
Shell	Reduced Infiltration	102	0.96	98	1.00	98
Shell	High Performance Windows	9	0.96	9	1.00	9
HVAC	High Performance Fans	9	0.63	6	1.00	6
Shell	Reduced Thermal Bridging	8	1.26	10	1.00	10
	Total	**2,365**	**0.91**	**2,156**	**1.00**	**2,156**

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
Source: ComEd tracking data and Navigant team analysis.

Table 5-3. CY2018 Summer Peak Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Realization Rate*	Verified Gross Peak Demand Reduction (kW)	NTG*	Verified Net Peak Demand Reduction (kW)
HVAC	High Performance HVAC Equipment	192	0.62	119	1.00	119
Lighting	High Performance Interior Lighting	120	1.00	120	1.00	120
Shell	Reduced Infiltration	48	0.96	46	1.00	46
HVAC	High Performance Fans	9	0.63	6	1.00	6
Appliance	Efficient Appliances	6	1.00	6	1.00	6
Shell	High Performance Windows	4	0.96	4	1.00	4
Shell	Reduced Thermal Bridging	4	1.26	5	1.00	5
	Total	**383**	**0.80**	**305**	**1.00**	**305**

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
Source: ComEd tracking data and Navigant team analysis.

Table 5-4. CY2018 Natural Gas Energy Savings by Measure – Nicor Gas

End Use Type	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross Realization Rate	Verified Gross Savings (Therms)	NTG*	Verified Net Savings (Therms)
HVAC	Furnace	23,480	1.04	24,471	1.00	24,471
Shell	Reduced Infiltration	10,194	1.00	10,194	1.00	10,194
Hot Water	High Performance Hot Water Heating	4,470	1.00	4,470	1.00	4,470
Shell	Reduced Thermal Bridging	645	1.00	645	1.00	645
Shell	High Performance Windows	442	1.00	442	1.00	442
Appliance	ENERGY STAR Clothes Washer	441	0.46	204	1.00	204
Appliance	ENERGY STAR Dishwasher	199	0.46	92	1.00	92
HVAC	Boiler	0	N/A	0	1.00	0
Lighting	High Performance Interior Lighting	-13,837	0.00	0	1.00	0
	Total†	**26,033**	**1.56**	**40,517**	**1.00**	**40,517**

* A deemed value. Source: Nicor_Gas_GPY7_NTG_Values_2017-03-01_Final.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
† The total excludes the electric interactive effects on the total therms.
Source: Nicor Gas tracking data and Navigant team analysis.

Table 5-5. CY2018 Natural Gas Energy Savings by Measure – Peoples Gas

End Use Type	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross Realization Rate	Verified Gross Savings (Therms)	NTG*	Verified Net Savings (Therms)
HVAC	Furnace	18,077	1.03	18,708	1.00	18,708
HVAC	Boiler	13,097	N/A	13,554	1.00	13,554
Shell	Reduced Infiltration	11,237	1.00	11,237	1.00	11,237
Hot Water	High Performance Hot Water Heating	10,003	0.95	9,463	1.00	9,463
Shell	High Performance Windows	1,382	1.00	1,382	1.00	1,382
Shell	Reduced Thermal Bridging	1,212	2.06	2,494	1.00	2,494
Appliance	ENERGY STAR Clothes Washer	152	0.77	118	1.00	118
Appliance	ENERGY STAR Dishwasher	132	0.77	102	1.00	102
Lighting	High Performance Interior Lighting	-7,042	0.00	0	1.00	0
	Total†	**48,252**	**1.18**	**57,058**	**1.00**	**57,058**

* A deemed value. Source: PGL_NSG_GPY7_NTG_Values_2017-03-01_Final.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
† The total excludes the electric interactive effects on the total therms.
Source: Peoples Gas tracking data and Navigant team analysis.

6. Impact Analysis Findings and Recommendations

6.1 Impact Parameter Estimates

The implementer provided project savings calculations and documentation for the evaluation team to review. Project documentation included program forms and applications; architectural, landscape, mechanical, and plumbing drawings; and appliance, lighting, HVAC, and window specifications. The implementer also provided photos and reports from site visits and testing results. The evaluation team analyzed all documentation and verified that savings and measure counts reported in the project calculators aligned with the provided project documentation and program tracking data.

The evaluation team applied algorithms outlined in the Illinois Technical Reference Manual (IL TRM), version 6.0 to calculate verified gross savings for the AHNC Program. The evaluation team verified that these algorithms and appropriate deemed input parameters were applied correctly and validated any custom parameters through project documentation and actual equipment specifications. The evaluation team calculated verified net savings by multiplying the verified gross savings by a deemed net-to-gross (NTG). The NTG for the AHNC Program was approved through a consensus process managed through the Illinois Stakeholder Advisory Group (IL SAG).

Table 6-1. Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed * or Evaluated?	Source
Measure Quantity	Varies	# Measures	Evaluated	Tracking Database
NTG	100	%	Deemed	IL SAG Consensus†
Gross Savings per Unit, Deemed Measures	Varies	kWh	Deemed	IL TRM v6.0
Gross Savings per Unit, Non-Deemed Measures	Varies	kWh	Evaluated	Project Documentation
Effective Useful Life (EUL)	Varies	Years	Deemed	IL TRM v6.0

* State of Illinois Technical Reference Manual version 6.0 from http://www.ilsag.info/technical-reference-manual.html.
† A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.

6.2 Other Impact Findings and Recommendations

The evaluation team has developed several recommendations based on findings from the CY2018 evaluation, as follows:

6.2.1 Verified Gross Impacts and Realization Rate

The CY2018 AHNC Program achieved 1,897,305 kWh of verified gross energy savings, 2,156 kW of verified gross demand reduction, 305 kW of verified gross peak demand reduction, and 97,575 therms of verified gross gas savings. The overall verified gross program realization rate was 92% for electric energy savings, 80% for peak demand savings, and 131% for gas savings. The evaluation team was unable to calculate a realization rate for gross demand savings since ComEd does not track gross demand reduction.

Recommendation 1. The evaluation team recommends ComEd track gross demand reduction.

6.2.2 High-Performance Interior Lighting

6.2.2.1 Electric

High-performance interior lighting has energy and demand realization rates of 100%.

6.2.2.2 Gas

The ex ante calculations include interactive effects for gas space heating penalties resulting from installing energy efficient lighting.

Recommendation 1. Exclude gas heating penalties when calculating gas savings. This is consistent with how heating penalties are managed in other areas within the state. Since heating penalties account for 28% of the total ex ante therm savings, including them has a significant impact on the overall program realization rate. Had ex ante savings excluded heating penalties, the gas realization rate would be closer to 102%.

6.2.3 High-Performance HVAC Equipment

6.2.3.1 Electric

High-performance HVAC equipment has energy and demand realization rates of 73% and 62% respectively. These realization rates are primarily due to an error in ex ante assumptions for three large projects (AH0003-Apart, AH0010, AH0034-55 unit). For project AH0003, ex ante savings were calculated by multiplying by the number of apartments (n=80) instead of the number of installed furnaces (n=9), resulting in an overestimate in electric savings from the more efficient motors. For project AH0010, ex ante cooling calculations included both a chiller and 180 individual split air conditioning systems. The evaluation team removed the 180 split system units as the project specifications only include a chiller system. It is likely these calculations were initially used as a placeholder, with the intent to remove once final chiller calculations were added. For project AH0034, the evaluation team updated baseline EER and COP values according to IECC 2015 baselines in the IL TRM v6.0 for the nine commercial heat pump units.

Recommendation 2. The evaluation team does not recommend revising savings in retrospect for project specific savings discrepancies, but instead recommends all savings calculations undergo additional QC checks to reduce calculation errors and to assess whether the magnitude of savings is reasonable.

Recommendation 3. The evaluation team recommends updating equipment-specific baseline efficiencies to align with federal minimum standards and/or energy codes in effect at the time of equipment install.

Project level realization rates are also driven by other factors including equipment efficiencies, baseline efficiencies, full load hours (EFLH), and system capacities.

Recommendation 4. For all residential grade HVAC equipment serving multi-family dwelling units, the evaluation team recommends using the multi-family full load hours, as specified in the TRM for all multi-family projects, regardless of whether the building is permitted under the residential or commercial energy code.

Recommendation 5. For commercial grade HVAC equipment, the evaluation team recommends using the multi-family mid-rise or high-rise full load hours depending on the number of stories in the building, as specified in the TRM.

Recommendation 6. The evaluation team recommends applying the appropriate unit of efficiency given its application (i.e., varies based on HVAC type, building type, and calculation type) as specified in Sections 4.4 and 5.3 of the IL TRM, including:

- SEER
  - Residential grade central air conditioning cooling savings
  - Commercial grade central air conditioning (<65 kBtuh) cooling savings
  - Residential grade heat pump kWh cooling savings
  - Commercial grade heat pump (<65 kBtuh) cooling savings
- HSPF
  - Residential grade heat pump kWh heating savings
  - Commercial grade heat pump kWh heating savings
- CEER
  - Residential grade room air conditioner

- EER
  - Commercial grade room air conditioners
  - Commercial grade heat pumps (≥ 65 kBtuh)
  - Packaged terminal air conditioner (PTAC) kWh cooling savings
  - Packaged terminal heat pump (PTHP) kWh cooling savings
  - Calculate demand savings

- IEER
  - Commercial grade air conditioners (≥ 65 kBtuh)

- COP
  - PTHP kWh heating savings

- IPLV (kW/ton)
  - Chillers

6.2.3.2 Gas

High-performance HVAC equipment has a gas realization rate of 104%. This realization rate is due to the combination of algorithmic errors for boilers and full load hours. For projects with commercial grade boilers, the ex ante savings calculation formula divides by the efficiency of the installed boiler instead of the baseline efficiency.

Recommendation 7. In the savings calculation for commercial grade boilers, update savings calculations for commercial grade boilers by dividing by the baseline efficiency, instead of by the installed efficiency, as specified in the energy savings algorithm in section 4.4.10 in the TRM.

Recommendation 8. For residential grade HVAC equipment serving multi-family dwelling units, the evaluation team recommends using the multi-family full load hours, as specified in the TRM for all multi-family projects, regardless of whether the building is permitted under the residential or commercial energy code.

Recommendation 9. For commercial grade HVAC equipment, the evaluation team recommends using the multi-family mid-rise or high-rise full load hours depending on the number of stories in the building, as specified in the TRM.

6.2.4 High-Performance Exterior Lighting

High-performance exterior lighting has an energy realization rate of 100%.

6.2.5 Reduced Infiltration

Reduced infiltration has energy, demand, and therm realization rates close to 100%. No discrepancies merit mention.

6.2.6 High-Performance Water Heating Equipment

High-performance water heating equipment has a gas realization rate of 96%. This realization rate is driven by differences in water heater input ratings, rated volume, and the number of people per household.

For residential grade water heaters, the baseline energy factor is based on the water heater tank volume, where ex ante calculations use a default value of 40 gallons.

> **Recommendation 10.** For residential grade water heaters, the evaluation team recommends using the actual water heater rated volume to determine the baseline energy factor.

Ex ante calculations apply single-family assumptions if the building is residential (three stories or less) and multi-family assumptions if the building is commercial from the IL TRM for the number of people per household variable.

> **Recommendation 11.** The evaluation team recommends applying the multi-family assumption of 2.1 people per household for all multi-family projects, regardless of whether the building is permitted under the residential or commercial energy code.

6.2.7 Efficient Appliances

6.2.7.1 Electric

Efficient appliances have an energy and demand realization rate of 76% and 77%, respectively. These realization rates are primarily due to an error in ex ante assumptions for two large projects (AH0005 and AH0006). For project AH0005, the evaluation team updated clothes washer configurations to front loading and used the actual washer and refrigerator capacities from the project specifications and site verification documents leading to project level realization rate of 53%. For project AH0006, ex ante savings calculations multiplying by the number of apartments (n=53) instead of the number of installed clothes washers (n=6) results in an overestimate in electric savings. Ex ante savings also assumed all clothes washers were top loading instead of front loading, resulting in an additional overestimate of savings and ultimately a project level realization rate of 32%.

> **Recommendation 12.** The evaluation team recommends using actual appliance specifications when known.

6.2.7.2 Gas

Efficient appliances have gas realization rates of 77% and 46% for Nicor Gas and PGL, respectively. The Nicor Gas realization rates are driven by the discrepancies discussed for the above projects (AH0005 and AH0006). The PGL realization rate reflects updates to actual capacity and loading configurations for projects (AH0008 and AH0047).

> **Recommendation 13.** The evaluation team recommends using actual appliance specifications when known.

6.2.8 Reduced Thermal Bridging

6.2.8.1 Gas

The PGL realization rate for reduced thermal bridging is 206%. The realization rate is driven by U-value updates made to two of the three project files for project AH0007. For both the 3-unit and 6-unit components of the AH0007 project, ex ante estimates assumed a wall assembly U-value that produced negative therm savings. The evaluation team updated U-values to align with the third component of the AH0007 project (“6unitPHIUS”) and align with the ASHRAE 90.1 which provided U-values to correctly account for therm savings.

Recommendation 14. The evaluation team recommends using wall assembly U-values that adhere to ASHRAE 90.1.

6.2.9 Program Participation

The program had nine ComEd participants, three Nicor Gas participants, six Peoples Gas, and zero NSG participants, servicing over 689 income eligible housing units.

7. Appendix 1. Impact Analysis Methodology

The evaluation team calculated gross verified savings for the AHNC Program by applying savings algorithms from the IL TRM v6.0. The team prioritized project specific documentation[1] to inform savings calculations where the IL TRM advises to use actual values. For variables where project documentation did not provide this information, the evaluation team relied on defaults from the IL TRM v6.0.

The evaluation team calculated verified net energy and demand savings by multiplying the verified gross savings estimates by a deemed NTG of 1.0. In CY2018, the NTG estimates used to calculate the verified net savings were based on past evaluation research and approved through a consensus process managed through the IL SAG.

8. Appendix 3. Total Resource Cost Detail

Table 8-1, below, shows the Total Resource Cost (TRC) table. It includes only the cost-effectiveness analysis inputs available at the time of finalizing this impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to evaluation later.

Table 8-1. Total Resource Cost Savings Summary for ComEd

End Use Type	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (kWh)	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)
Shell	High Performance Windows	sq ft	107,168	25.0	25,907	4.39	25,661	4.22
Shell	Reduced Infiltration	cfm	697,445	15.0	139,936	47.58	137,837	45.80
Shell	Reduced Thermal Bridging	sq ft	449,419	25.0	18,770	3.62	20,943	4.56
HVAC	Air Source Heat Pump (Residential)	Each	6	18.0	5,793	0.91	4,250	0.56
HVAC	Air Source Heat Pump (Commercial)	Each	19	15.0	186,686	57.26	136,954	35.41
HVAC	Furnace	Each	229	20.0	228,498	88.96	167,628	55.02
HVAC	Central Air Conditioning	Each	229	18.0	30,231	32.29	22,178	19.97
HVAC	Chiller	Each	1	20.0	66,908	12.83	49,084	7.94
HVAC	High Performance Fans	Each	772	19.0	25,215	9.22	20,371	5.77
Lighting	High Performance Interior Lighting	Each	8,725	9.0	1,036,311	120.65	1,035,346	120.49
Lighting	High Performance Exterior Lighting	Each	642	10.0	237,692	0.00	237,143	0.00
Appliance	ENERGY STAR Clothes Washer	Each	77	14.0	9,129	1.15	6,918	0.89
Appliance	ENERGY STAR Dishwasher	Each	218	13.0	4,683	0.47	3,549	0.37
Appliance	ENERGY STAR Refrigerator	Each	707	12.0	38,852	5.72	29,442	4.44

Source: ComEd tracking data and Navigant team analysis.

[1] Project documentation included program forms and applications; architectural, landscape, mechanical, and plumbing drawings; equipment specifications; and site visit photos and testing results

Table 8-2. Total Resource Cost Savings Summary for Nicor Gas

End Use Type	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (therms)	Verified Gross Savings (therms)	Verified Net Savings (therms)
Shell	High Performance Windows	sq ft	12,469	25.0	442	442	442
Shell	Reduced Infiltration	cfm	251,278	15.0	10,194	10,194	10,194
Shell	Reduced Thermal Bridging	sq ft	148,363	25.0	645	645	645
HVAC	Furnace	Each	127	20.0	23,480	24,471	24,471
Lighting	High Performance Interior Lighting	Each	2,684	9.1	-13,837	0	0
Hot Water	High Performance Hot Water Heating	Each	18	16.0	4,470	4,470	4,470
Appliance	ENERGY STAR Clothes Washer	Each	56	14.0	441	204	204
Appliance	ENERGY STAR Dishwasher	Each	103	13.0	199	92	92

Source: Navigant analysis of tracking data.

Table 8-3. Total Resource Cost Savings Summary for Peoples Gas

End Use Type	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (therms)	Verified Gross Savings (therms)	Verified Net Savings (therms)
Shell	High Performance Windows	sq ft	94,699	25.0	1,382	1,382	1,382
Shell	Reduced Infiltration	cfm	446,166	15.0	11,237	11,237	11,237
Shell	Reduced Thermal Bridging	sq ft	301,056	25.0	1,212	2,494	2,494
HVAC	Furnace	Each	102	20.0	18,077	18,708	18,708
HVAC	Boiler	Each	2	20.0	13,097	13,554	13,554
Lighting	High Performance Interior Lighting	Each	6,041	9.1	-7,042	0	0
Hot Water	High Performance Hot Water Heating	Each	76	16.0	10,003	9,463	9,463
Appliance	ENERGY STAR Clothes Washer	Each	21	14.0	152	118	118
Appliance	ENERGY STAR Dishwasher	Each	115	13.0	132	102	102

Source: Navigant analysis of tracking data.