

OVERVIEW OF QUANTIFYING AND MONETIZING NEIS IN ILLINOIS

SAG Non-energy Impacts Working Group

May 5, 2020

OVERVIEW – NEI RESEARCH IN IL

Illinois evaluators are conducting research (prioritizing income eligible/income qualified programs) to quantify and monetize non-energy impacts (NEIs) associated with Illinois utilities' energy efficiency programs:

- Societal
- Utility
- Participant

OVERVIEW – TYPES OF NEIs



Societal: reduced public citizens' health impacts from reduced emissions from fossil-fuel generation



Utility: reduced utility costs from reduced arrearages, disconnections, reconnections, etc.



Participant: benefits accruing to participants i.e., reduced household members' health impacts like asthma and thermal stress due to air sealing and weatherization

OVERVIEW – MOTIVATION FOR NEI RESEARCH IN IL

FEJA:

“A total resource cost test compares the sum of avoided electric utility costs...with reduced water consumption, and avoided costs associated with reduced operation and maintenance costs, as well as other quantifiable social benefits...”

ComEd Stipulation:

“ComEd agrees to work in good faith to consult and reach consensus with the Income-Qualified Advisory Committee on issues of importance to the Committee, including but not limited to the following: Development of program information and practices for Income-Qualified programs, including the identification and reflection of non-energy benefits (“NEBs”) such as comfort, health and safety, reduced tenant turnover, reduced shut-offs, reduction in revenue collection costs, and lower energy burden in Income-Qualified measures and programs”

Public Act 099-0904
SB014 Enrolled
LSB000 16590 E07 44309 b

AN ACT concerning regulation.

Be it enacted by the People of the State of Illinois, represented in the General Assembly:

Section 1. Findings.

(a) In 2011, the General Assembly encouraged and enabled the State's largest electric utilities to undertake substantial investment to refurbish, rebuild, modernize, and expand Illinois' century-old electric grid. Among those investments were the deployment of a smart grid and advanced metering infrastructure platform that would be accessible to all retail customers through new, digital smart meters. This investment, now well underway, not only allows utilities to continue to provide safe, reliable, and affordable service to the State's current and future utility customers, but also empowers the citizens of this State to directly access and participate in the rapidly emerging clean energy economy while also presenting them with unprecedented choices in their source of energy supply and pricing.

To ensure that the State and its citizens, including low-income citizens, are equipped to enjoy the opportunities and benefits of the smart grid and evolving clean energy marketplace, the General Assembly finds and declares that Illinois should continue in its efforts to build the grid of the future using the smart grid and advanced metering

Commonwealth Edison Company
2018-2021 Energy Efficiency and Demand Response Plan
Settlement Stipulation

I. INTRODUCTION

This Settlement Stipulation ("Stipulation"), when fully executed and accepted, will constitute a valid settlement agreement enforceable among Commonwealth Edison Company, an Illinois corporation ("ComEd," or the "Company"), the Staff of the Illinois Commerce Commission ("Staff" or "ICC Staff"), the Illinois Attorney General's Office, the City of Chicago, the Citizens Utility Board, the Environmental Defense Fund, and the Natural Resources Defense Council (each a "Party" and collectively the "Parties").

The ComEd Energy Efficiency and Demand Response Plan for calendar years 2018 through 2021 (the "Plan" or "2018-2021 Plan") is required to be filed with the Illinois Commerce Commission ("ICC" or "Commission") on or before July 3, 2017, pursuant to Section 8-101B of the Public Utilities Act (the "Act"), 205 ILCS 5/8-101B. The Company's proposed 2018-2021 Plan has been the subject of lengthy discussion among the Parties with the goal of reaching consensus on the portfolio of energy efficiency programs to be implemented by ComEd for calendar years 2018 through 2021, which is the period from January 1, 2018 through December 31, 2021.

This Stipulation is intended to memorialize that each and all of the signatory Parties are in agreement that the Company's 2018-2021 Plan, which was filed on June 30, 2017, and is pending before the Commission in ICC Docket No. 17-0112, satisfies the requirements of Section 8-101B and, therefore, should be approved by the Commission. In addition, this Stipulation memorializes the compromise between and among the Parties regarding certain disputed issues raised during the course of settlement discussions as further detailed below. To the extent that any provisions in this Stipulation is not specifically memorialized in the filed Plan, ComEd agrees that it will implement the Plan consistent with the terms of this Stipulation. Compromise by any Party on any particular issue set forth in this Stipulation as to the 2018-2021 Plan shall not constitute, and shall not be construed or interpreted to constitute, an endorsement of the resolution achieved by that compromise for any purpose other than as set forth in this Stipulation.

This Stipulation is the result of negotiations at arms' length between and among the Parties, all of whom have been represented by counsel, and memorializes the Parties' agreements. Thus, the Parties, intending to be legally bound and acknowledging the benefits to be derived from the mutual promises and commitments contained herein, agree as follows:

II. STIPULATION OVERVIEW

The Parties agree that the compromise positions memorialized in this Stipulation allow for ComEd to achieve the statutory savings goals set forth in Section 8-101B of the Act, while ensuring

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OVERVIEW – NEIs AND THE IL TRM

NEIs currently in the IL TRM



Societal: Avoided use of water (water savings)

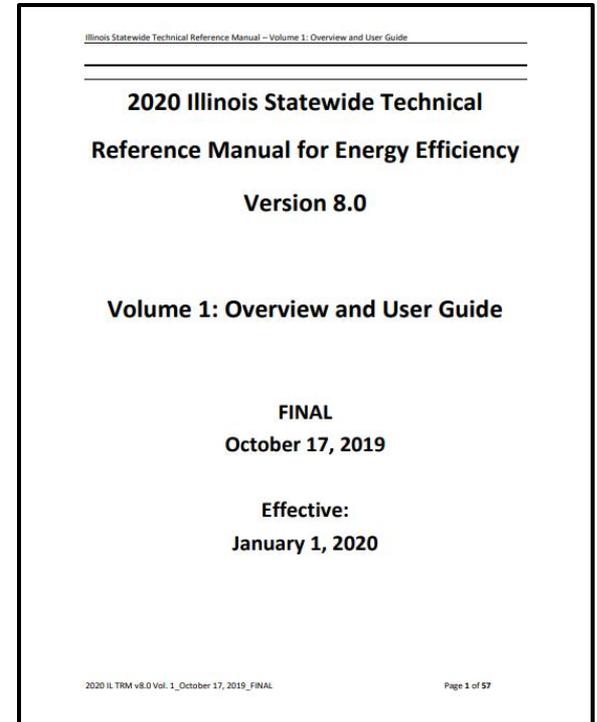


Utility: Avoided environmental costs, i.e., the dollar value of reduced carbon emissions associated with switching to renewable energy sources



Participant: Reduced O&M costs

This research expands the NEIs already deemed in the IL TRM.



BACKGROUND: SOCIETAL NEIS

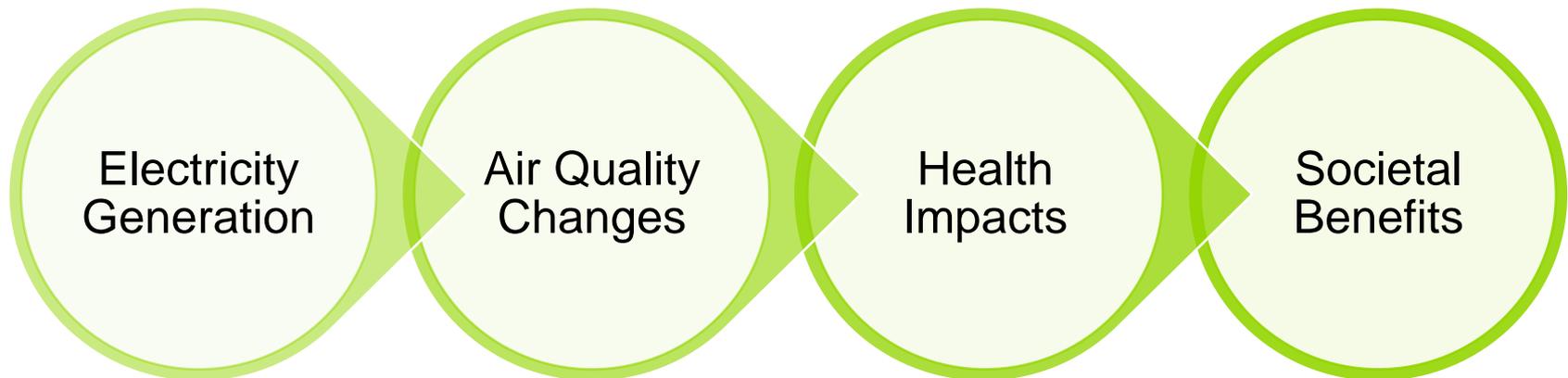


WHAT ARE SOCIETAL NEIS

- Benefits that society-at-large receives from the investments and energy savings of energy efficiency programs
- Societal benefit categories include:
 - **Air quality impacts**
 - **Public health and welfare effects**
 - Water quantity and quality impacts
 - Coal ash ponds and coal combustion residuals
 - Economic development and employment effects
 - Employment impacts
 - Economic development constraints
 - Other economic considerations
 - Societal risk and energy security
 - Benefits unique to low-income energy efficiency programs

Societal Health NEIs From Air Quality: Overview

- EE programs > reduce fossil fuel generation > reduce regional air emissions > improve societal health
 - Different than indoor air quality, which improves participant health
- Fine Particulate Matter (PM_{2.5}) has been linked to a variety of health problems



In 2018, ~60% of electricity generated in IL was produced through the combustion of coal and natural gas.*

Most PM_{2.5} forms from complex reactions of pollutants emitted from power plants, industries, and cars.

Reduced air emissions improves air quality and decreases respiratory and cardiovascular illnesses

Decreased illness leads to decreased medical costs, and gains in work and school days.

TOOLS TO ESTIMATE SOCIETAL HEALTH BENEFITS

- US EPA's Air Emissions Team developed two tools to quantify the societal impacts of air emissions
 - AVERT = **A**voided **E**mission and **G**eneration **T**ool
 - COBRA = **C**o-**B**enefits **R**isk **A**ssessment Health Impacts Screening and Mapping Tool
- These tools...
 - Are peer-reviewed, regulatory-quality, and customizable to IL
 - Are used for EE program evaluation, planning, policymaking – and gaining steam
 - Facilitate NEI assessment for all electric efficiency programs – not just IQ/IE

APPLYING AVERT AND COBRA FOR ELECTRIC EE PROGRAM EVALUATION

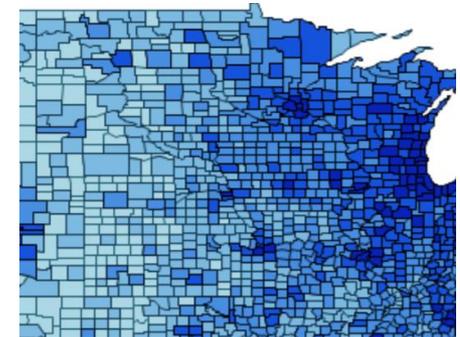
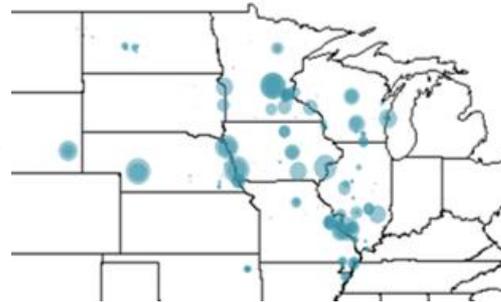
Input ex-post EE program kWh & kW reductions to AVERT



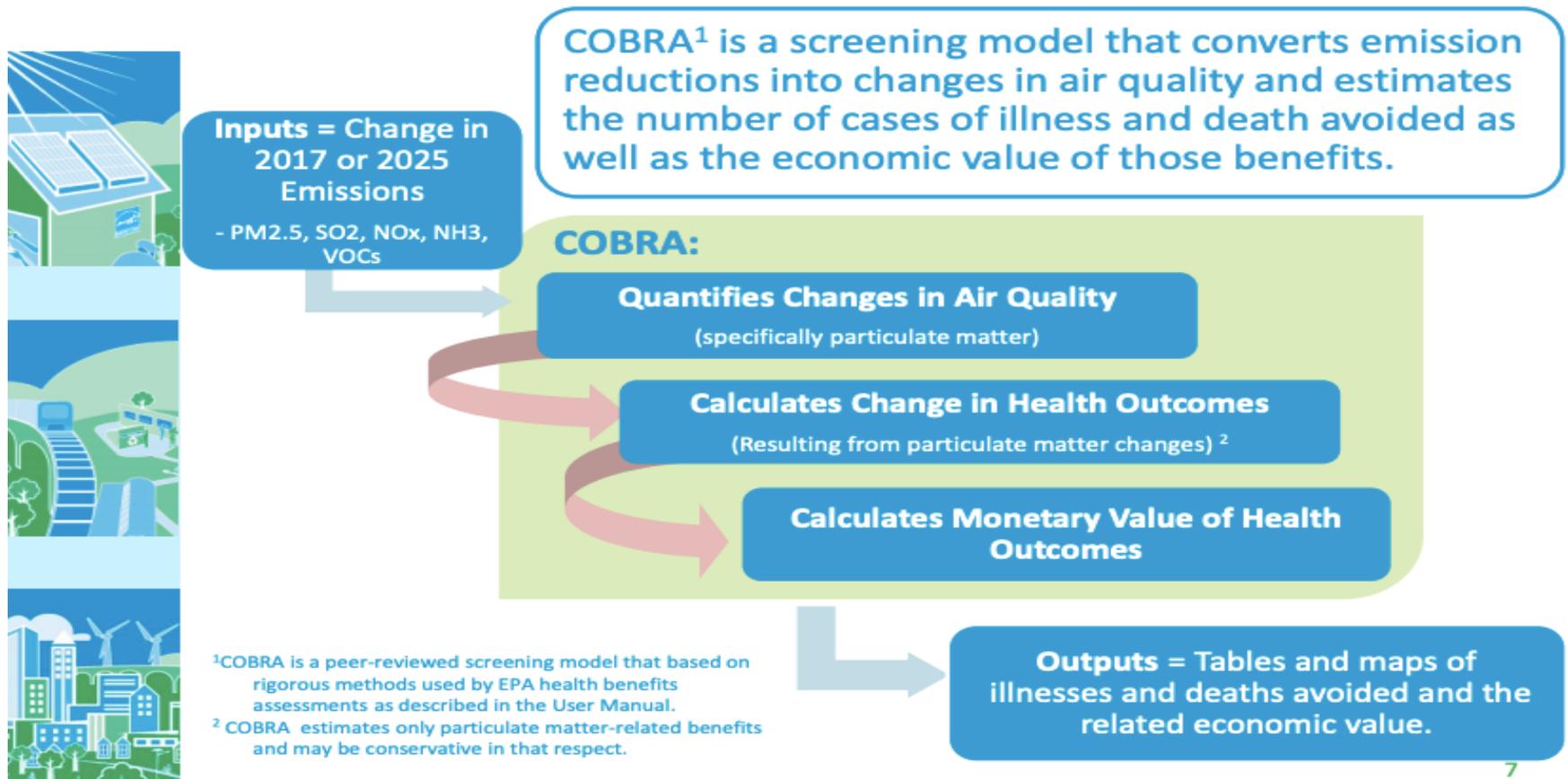
Run AVERT
AVERT simulates hourly changes in generation due to kWh savings and predicts emissions reductions (PM_{2.5}, NO_x, SO₂, CO₂)



Run COBRA
COBRA calculates changes in ambient PM_{2.5} concentrations, then predicts and monetizes changes in health outcomes



CO-Benefits Risk Assessment (COBRA) Model



Source: EPA (2020)

SOCIETAL HEALTH METRICS FROM AVERT AND COBRA

IL evaluators are applying these tools to model air quality and human health: energy efficiency program vs. counterfactual

Model	Key Outputs
AVERT	<ul style="list-style-type: none">▪ Change in annual generation and emissions▪ Change in heat input, PM_{2.5}, SO₂, NO_x, CO₂
COBRA	<ul style="list-style-type: none">▪ Change in ambient PM_{2.5} concentrations▪ Change in population-level health incidence of:<ul style="list-style-type: none">▪ Adult and infant mortality▪ Non-fatal heart attacks▪ Respiratory and cardiovascular related hospitalizations▪ Acute bronchitis▪ Upper and lower respiratory symptoms▪ Asthma-related emergency room visits▪ Asthma exacerbations▪ Minor restricted activity days▪ Workdays lost due to illness▪ Economic value of avoided health effects

Ameren Illinois Societal NEI Research Update



SOCIETAL NEI RESEARCH UPDATE: AMEREN ILLINOIS



Reviewed US EPA AVERT and COBRA model documentation



Identified key decisions to make with Ameren/IL Stakeholders



Ran screening analysis using US EPA “Benefit per kWh” estimates

SOCIETAL NEI RESEARCH UPDATE: AMEREN ILLINOIS

- Applied “Benefits per Kilowatt Hour” (derived from AVERT and COBRA)
- Results suggest AIC’s 2019 kWh savings provide \$9M - \$25M benefit
 - Reflects combined value of residential and commercial program kWh savings
 - Assumes 100% of AIC’s electric EE savings reduce fossil-fuel based generation

2019 Verified Net Savings (MWh)	Benefits-per-Kilowatt Value ^a	Health Benefit per kWh (2019 \$/kWh) ^b	NPV of AIC 2019 Health Benefits of Electric Efficiency (2019 \$)	% of 2019 Implementation Costs
328,643	Low Sensitivity, 3% Discount Rate	\$0.032	\$11,070,807	11%
	Low Sensitivity, 7% Discount Rate	\$0.029	\$9,871,184	10%
	High Sensitivity, 3% Discount Rate	\$0.073	\$25,089,259	25%
	High Sensitivity, 7% Discount Rate	\$0.065	\$22,381,538	23%

^a US EPA. 2018. Health Benefits per Kilowatt Hour Values – assumes uniform distribution of EE throughout year, for the Upper Midwest Region. <https://www.epa.gov/statelocalenergy/estimating-health-benefits-kilowatt-hour-energy-efficiency-and-renewable-energy>

^b Based on 2017 Benefit-per Kilowatt Values and adjusted to 2019 cost of living using BLS escalation rates

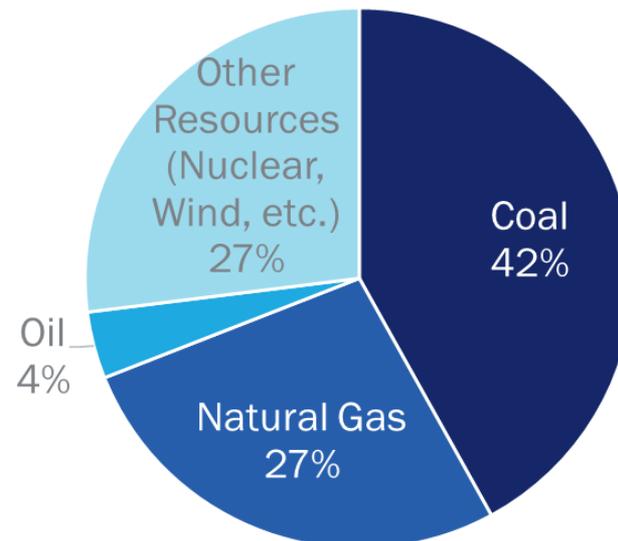


SOCIETAL NEI RESEARCH NEXT STEPS: AMEREN ILLINOIS

Working with AIC and IL Stakeholders to Refine Modeling Assumptions

- Considering grid response to kWh reductions in AIC's territory
 - Which kinds of generation sources would scale back production?
 - Where are they located?

AIC April 2020 electricity supply mix
(Source: MISO Monthly Market Assessment Report)



SOCIETAL NEI RESEARCH NEXT STEPS: AMEREN ILLINOIS

Reporting Recommendations

- Display the full range of monetized benefits (transparency)
- When a point estimate is needed, we recommend:
 - Low sensitivity model (conservative)
 - 3% discount rate (consistency with IL-TRM social discount rate)

Looking Ahead – Considerations for Future Years

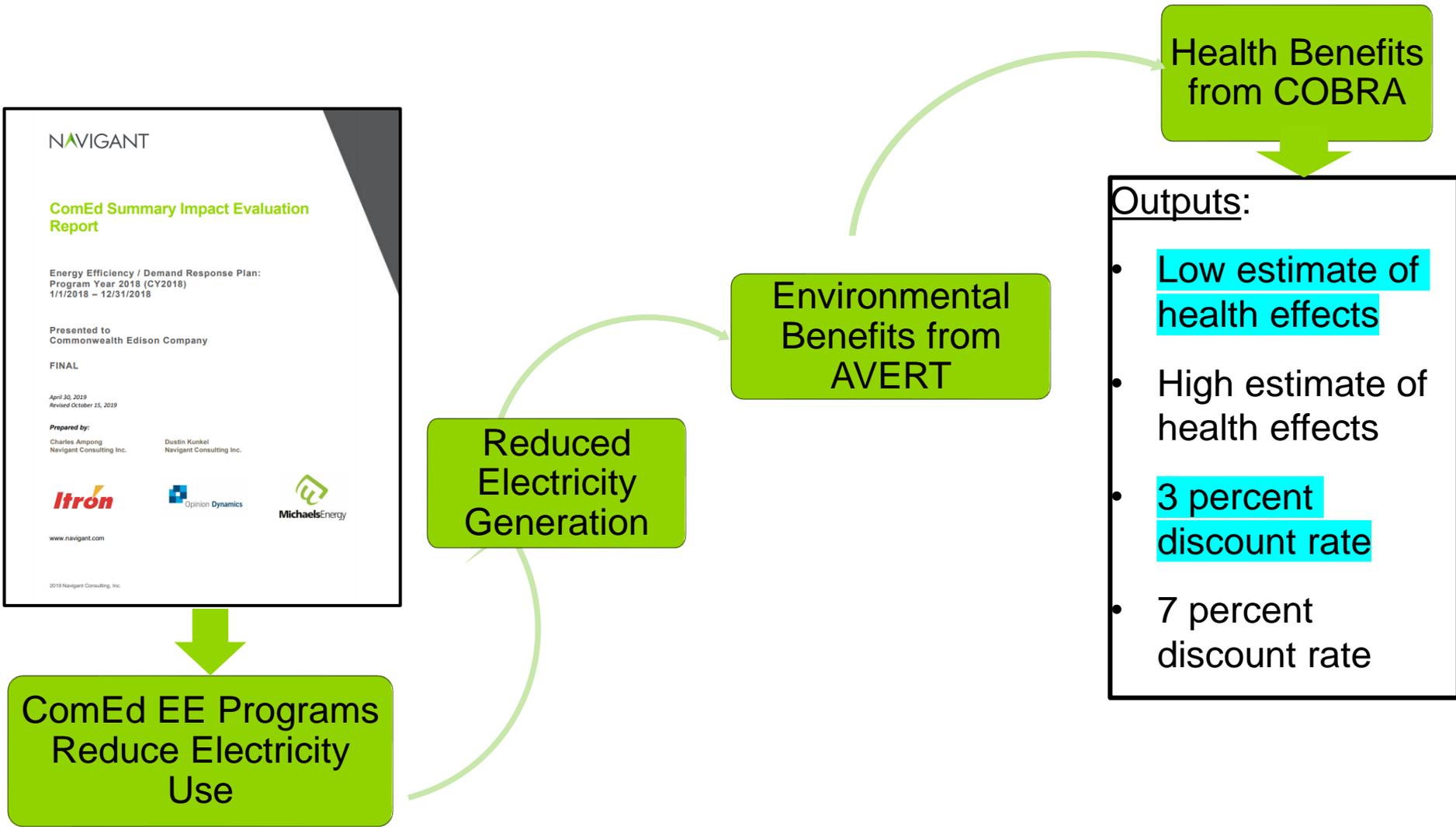
- Exploring approaches for fully capturing societal health benefits of AIC's dual-fuel programs (including gas energy savings)



COMED'S PRELIMINARY SOCIETAL NEI RESULTS FROM EPA'S AVERT AND COBRA TOOLS



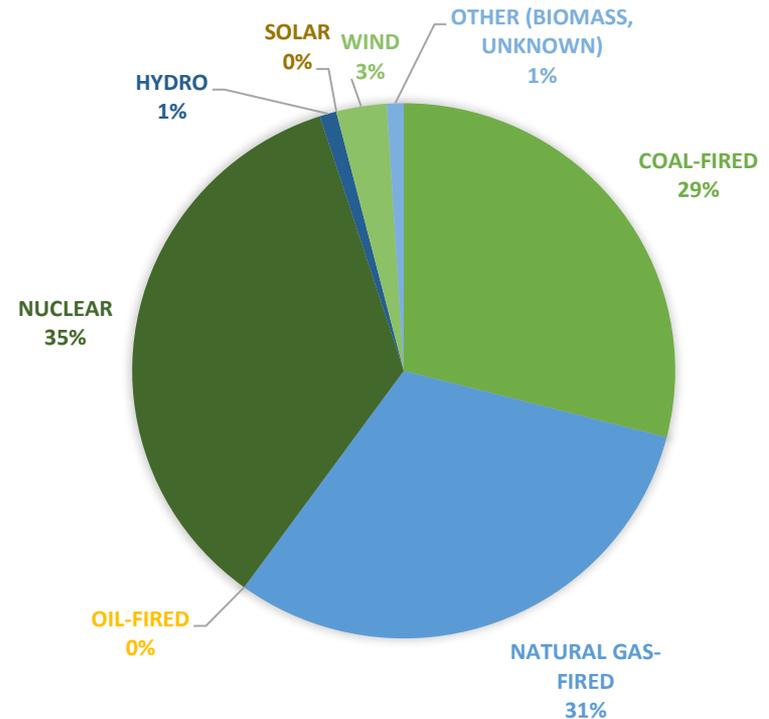
METHODOLOGY FOR DEVELOPING COMED SOCIETAL NEIS



SOURCES OF COMED GENERATION

- AVERT region of analysis closely overlaps the PJM region for electricity supplied to ComEd customers
- Guidehouse used a **40% reduction factor** to account for benefits for the electricity being generated from these non-air polluting sources
- Sources of Electricity for 2018 data obtained from ComEd's Environmental Disclosure Report.
- In estimating CY2018 ComEd program's reduced generation, we assumed constant reduction in demand throughout the year based on tests of lighting and HVAC loadshapes
- In monetizing health benefits, we used a discount rate of 3% for 20 years of health benefits discounted to a present value (consistent with TRC)

SOURCES OF ELECTRICITY FOR COMED CUSTOMERS, 2018



¹ This data is aggregated based on information provided by ComEd's wholesale energy suppliers, who indicated PJM Environmental Information Services, Inc. (www.pjm-eis.com) as their source.

AVERT OUTPUT

- Guidehouse generated preliminary results of reduction in emissions for the entire portfolio of CY2018 ComEd Residential, Business, and Income Eligible Programs, adjusted for generation supply mix.

Annual Regional Displacements: Great Lakes / Mid-Atlantic Region

	Original	Post-EE/RE	EE/RE Impacts
Generation (MWh)	550,627,760	549,500,750	-1,127,000
Total emissions of fossil EGUs			
SO ₂ (lbs)	700,761,870	699,384,230	-1,377,640
NO _x (lbs)	524,323,620	523,265,510	-1,058,110
CO ₂ (tons)	453,574,080	452,694,560	-879,520
PM _{2.5} (lbs)	105,084,960	104,884,010	-200,940
Emission rates of fossil EGUs			
SO ₂ (lbs/MWh)	1.27	1.27	
NO _x (lbs/MWh)	0.95	0.95	
CO ₂ (tons/MWh)	0.82	0.82	
PM _{2.5} (lbs/MWh)	0.19	0.19	

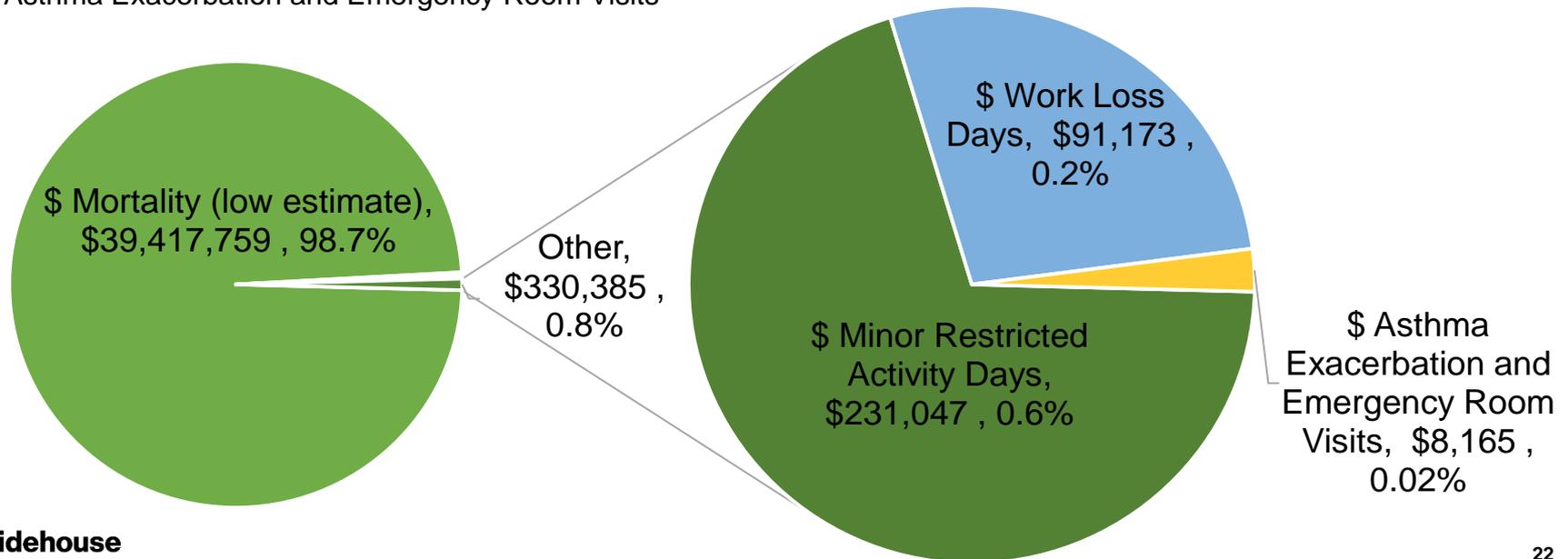
Negative numbers indicate displaced generation and emissions. All results are rounded to the nearest ten. A dash ('-') indicates a result greater than zero, but lower than the level of reportable significance.

PRELIMINARY RESULTS: COMED SOCIETAL NEIS

- Preliminary results show a conservative estimate of **\$40 million** in societal NEIs discounted at 3% rate.
- For reference: Societal NEIs corresponding with reduced asthma exacerbation and avoided emergency room visits are estimated at **\$8,197** for all programs.
- In addition, Participant NEIs which will be quantified from participant surveys, include benefits from reduced asthma symptoms associated with air sealing and insulation and are tallied separately.

COBRA Monetized Health Benefits

- \$ Mortality (low estimate)
- \$ Hospital Admits, All Respiratory
- \$ Acute Bronchitis
- \$ Minor Restricted Activity Days
- \$ Asthma Exacerbation and Emergency Room Visits
- \$ Nonfatal Heart Attacks (low estimate)
- \$ Hospital Admits, Cardiovascular (except heart attacks)
- \$ Lower and Upper Respiratory Symptoms
- \$ Work Loss Days



PRELIMINARY RESULTS: INCOME ELIGIBLE PROGRAMS

- COBRA estimates ~**\$2.4 million** in total health benefits for low sensitivity, discounted at 3% rate, due to emissions reduced by income eligible programs in 2018.
- The low estimates for health components contributing to the total mortality and health benefits by program are shown below.

ComEd Income Eligible Programs	COBRA Health Benefits (Low Estimates)				
	Total Benefits	Reduced Mortality	Reduced Asthma Exacerbation & Emergency Room Visits	Reduced Work Loss & Minor Restricted Activity Days	Reduced Other Health Impacts (bronchitis, other resp, heart attacks, etc.)
Affordable Housing New Construction (Joint /Nicor)	\$ 44,035	\$ 43,469	\$ 9	\$ 355	\$ 202
Food Bank LED Distribution	\$ 904,633	\$ 893,006	\$ 185	\$ 7,284	\$ 4,158
Multi-Family IHWAP	\$ 14,295	\$ 14,111	\$ 3	\$ 115	\$ 66
Multi-Family Retrofits (Joint /Nicor Gas & PGL-NSG)	\$ 87,022	\$ 85,903	\$ 18	\$ 701	\$ 400
Retail (Lighting) Discounts - Income Eligible	\$ 1,058,527	\$ 1,044,923	\$ 216	\$ 8,523	\$ 4,865
Single Family Retrofit - CBA (Joint /Nicor Gas & PGL-NSG)	\$ 46,447	\$ 45,850	\$ 9	\$ 374	\$ 213
Single Family Retrofit - IHWAP (Joint /Nicor Gas & PGL-NS)	\$ 22,279	\$ 21,992	\$ 5	\$ 179	\$ 102
UIC ERC Low Income Kits	\$ 239,821	\$ 236,738	\$ 49	\$ 1,931	\$ 1,102
Total	\$ 2,417,059	\$ 2,385,994	\$ 493	\$ 19,462	\$ 11,110

PRELIMINARY RESULTS: RESIDENTIAL PROGRAMS

- COBRA estimates ~**\$15.7 million** in total health benefits for low sensitivity, discounted at 3% rate, due to emissions reduced by residential programs in 2018.
- The low estimates for health components contributing to the total mortality and health benefits by program are shown below.

ComEd Residential Programs	COBRA Health Benefits (Low Estimates)				
	Total Benefits	Reduced Mortality	Reduced Asthma Exacerbation & Emergency Room Visits	Reduced Work Loss & Minor Restricted Activity Days	Reduced Other Health Impacts (bronchitis, other resp, heart attacks, etc.)
Appliance Rebates	\$ 779,855	\$ 769,832	\$ 159	\$ 6,279	\$ 3,584
Elementary Education Kits (Joint /Nicor Gas & PGL-NSG)	\$ 138,915	\$ 137,129	\$ 28	\$ 1,119	\$ 639
Fridge and Freezer Recycling	\$ 493,766	\$ 487,419	\$ 101	\$ 3,976	\$ 2,270
Heating and Cooling (HVAC) Rebates	\$ 210,611	\$ 207,904	\$ 43	\$ 1,696	\$ 968
Holiday Light Exchange	\$ 998	\$ 986	\$ 0	\$ 8	\$ 5
Home Energy Assessment (Joint /Nicor Gas & PGL-NSG)	\$ 549,562	\$ 542,498	\$ 112	\$ 4,425	\$ 2,526
Home Energy Reports	\$ 6,361,288	\$ 6,279,530	\$ 1,298	\$ 51,222	\$ 29,239
Lighting Discounts	\$ 6,861,796	\$ 6,773,604	\$ 1,400	\$ 55,252	\$ 31,539
Middle School Take-Home Kits	\$ 33,751	\$ 33,317	\$ 7	\$ 272	\$ 155
Multi-Family Market Rate (Joint w/Nicor Gas & PGL/NSG)	\$ 267,803	\$ 264,361	\$ 55	\$ 2,156	\$ 1,231
New Construction (Joint /Nicor Gas & PGL-NSG)	\$ 5,291	\$ 5,223	\$ 1	\$ 43	\$ 24
Weatherization - Market Rate	\$ 18,131	\$ 17,898	\$ 4	\$ 146	\$ 83
Total	\$15,721,765	\$ 15,519,701	\$ 3,208	\$ 126,594	\$ 72,263

PRELIMINARY RESULTS: BUSINESS PROGRAMS

- COBRA estimates ~**\$20.4 million** in total health benefits for low sensitivity, discounted at 3% rate, due to emissions reduced by business programs in 2018.
- The low estimates for health components contributing to the total mortality and health benefits by program are shown below.

ComEd Business Programs	COBRA Health Benefits (Low Estimates)				
	Total Benefits	Reduced Mortality	Reduced Asthma Exacerbation & Emergency Room Visits	Reduced Work Loss & Minor Restricted Activity Days	Reduced Other Health Impacts (bronchitis, other resp, heart attacks, etc.)
Air Care Plus	\$ 472,187	\$ 466,118	\$ 96	\$ 3,802	\$ 2,170
Custom	\$ 347,795	\$ 343,325	\$ 71	\$ 2,800	\$ 1,599
Data Centers	\$ 394,184	\$ 389,118	\$ 80	\$ 3,174	\$ 1,812
Energy Advisor Monitoring-Based Commissioning	\$ 185,433	\$ 183,050	\$ 38	\$ 1,493	\$ 852
Industrial Systems Optimization	\$ 409,402	\$ 404,140	\$ 84	\$ 3,297	\$ 1,882
Instant Discounts	\$ 5,762,401	\$ 5,688,340	\$ 1,176	\$ 46,400	\$ 26,486
New Construction (Joint /Nikor Gas & PGL-NSG)	\$ 506,096	\$ 499,591	\$ 103	\$ 4,075	\$ 2,326
Operational Efficiency / Facility Assessments	\$ 74,702	\$ 73,742	\$ 15	\$ 602	\$ 343
Public Housing Authority (Joint /Nikor)	\$ 56,256	\$ 55,533	\$ 11	\$ 453	\$ 259
Public Small Facilities (PSF)	\$ 182,564	\$ 180,218	\$ 37	\$ 1,470	\$ 839
Retrocommissioning (Joint /Nikor Gas & PGL-NSG)	\$ 785,542	\$ 775,446	\$ 160	\$ 6,325	\$ 3,611
Rural Small Business Kits	\$ 46,641	\$ 46,042	\$ 10	\$ 376	\$ 214
Small Business (Private Sector)	\$ 4,482,153	\$ 4,424,546	\$ 914	\$ 36,091	\$ 20,602
Standard	\$ 4,392,842	\$ 4,336,382	\$ 896	\$ 35,372	\$ 20,191
Strategic Energy Management (Joint /Nikor Gas)	\$ 319,495	\$ 315,388	\$ 65	\$ 2,573	\$ 1,469
Street Lighting	\$ 1,958,035	\$ 1,932,869	\$ 399	\$ 15,766	\$ 9,000
Total	\$20,375,727	\$ 20,113,848	\$ 4,157	\$ 164,068	\$ 93,654

PRELIMINARY RESULTS: VOLTAGE OPTIMIZATION

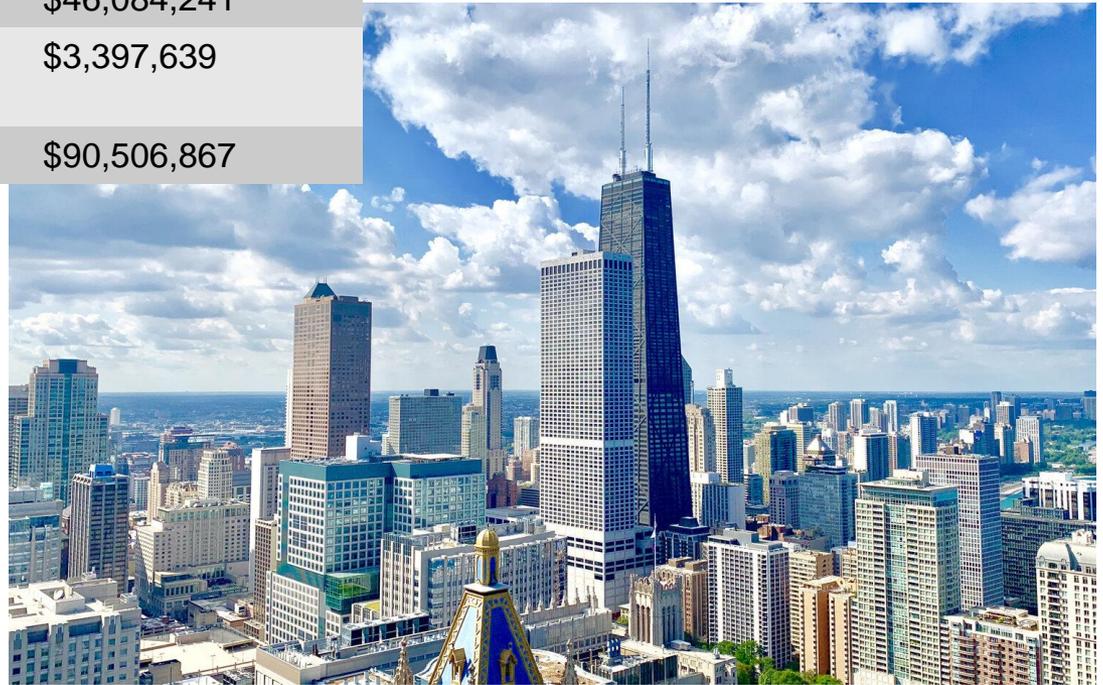
- COBRA estimates ~**\$1.5 million** in total health benefits for low sensitivity, discounted at 3% rate, due to emissions reduced by voltage optimization in 2018.
- The low estimates for health components contributing to the total mortality and health benefits by program are shown below.

		COBRA Health Benefits (Low Estimates)			
ComEd Other Programs	Total Benefits	Reduced Mortality	Reduced Asthma Exacerbation & Emergency Room Visits	Reduced Work Loss & Minor Restricted Activity Days	Reduced Other Health Impacts (bronchitis, other resp, heart attacks, etc.)
Voltage Opimization	\$1,502,235	\$ 1,482,927	\$ 307	\$ 12,096	\$ 6,905

PRELIMINARY RESULTS: TOTAL PORTFOLIO

- COBRA estimates **\$40 million (low) to \$90.5 million (high)** in total health benefits, discounted at 3% rate, from air emission reductions associated with ComEd programs in 2018.

ComEd Sector	Total Health and Mortality Benefits (low estimate)	Total Health and Mortality Benefits (low estimate)
Income Eligible	\$2,417,059	\$5,466,717
Residential	\$15,721,765	\$35,558,270
Business	\$20,375,727	\$46,084,241
Voltage Optimization	\$1,502,235	\$3,397,639
Total	\$40,016,786	\$90,506,867



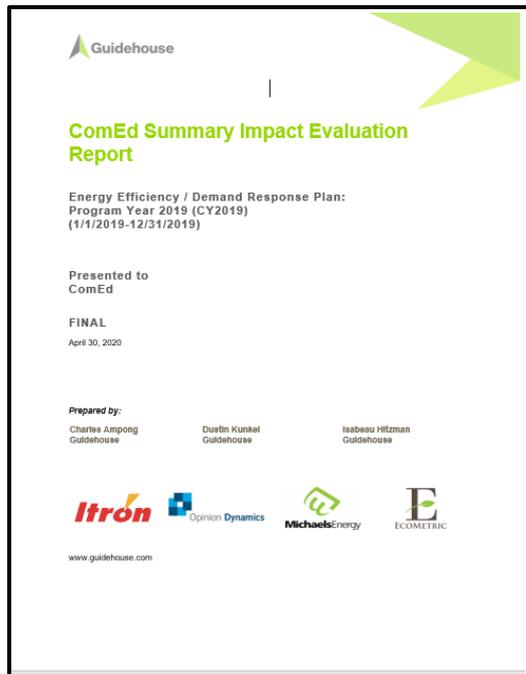
NEXT STEPS

July 2020

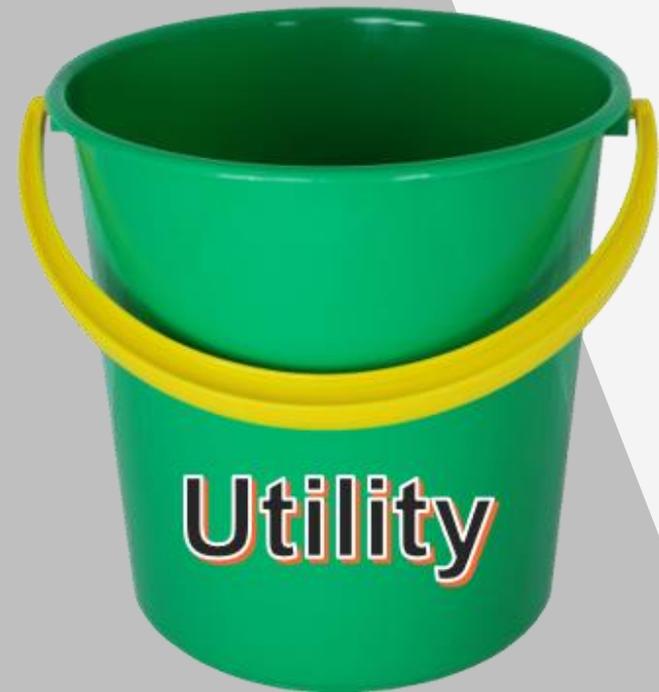
- EPA expects to finish updates to the Great Lakes / Mid-Atlantic region of the AVERT model

August 2020

Incorporate SAG feedback regarding Societal NEIs and
Update COBRA analysis using latest version of AVERT and CY2019 portfolio energy savings data for ComEd to use in 2022 – 2025 Plan



COMED'S PRELIMINARY UTILITY NEI RESULTS



Utility NEI Pathway

Reduced energy bills for participants

- Participants in weatherization programs have lower bills and are more resilient to extreme weather



Participants are better able to pay their bills

- With lower bills, income eligible participants are in a better position to pay each bill in full



Monetizable benefits accrue to utility, participant, or both

- If participants pay their bills on time, utilities will have fewer disconnections, reduce carrying costs on unpaid bills, and/or avoid charging late fees that may go unpaid

Preliminary ComEd Utility NEI Results

NEIs associated with Single-Family – Retrofits and Multifamily Retrofits*

Methodology

- Treatment Group – CY2018 participants in SF-R
- Pre-program group – CY2017 customer debits and credits dataset
- Post-program group – CY2019 customer debits and credits dataset
- Non-participant group – CY2018 ComEd CARE participants
- Data included: late payments, pre-program arrearages, disconnection notices, monthly bill amounts, alternative payment plans

The difference-in-difference technique analyzes:

1. The difference between the pre-program and post-program periods within each group (i.e., CY2019 minus CY2017), and
2. The difference of those differences (i.e., participant group minus non-participant group)

Guidehouse assessed statistical significance by evaluating the standard error between the difference of the difference and confirming the confidence interval at the 90% level – to assert that the program's impact occurred with 90% confidence.

*Guidehouse received data from ComEd associated with both Single-Family – Retrofits and Multifamily –Retrofits program participants. However, debit and credit data was only available for the Single-Family Retrofit program participants due to lack of customer account numbers in Multifamily - Retrofits program implementation's dataset.

Preliminary ComEd Utility NEIs Results

Smaller increase in annual bills and reduced late payments

- While the average annual bill increased for all customers in the analysis' time period, participants in both components of the SF-R program experienced a smaller increase than non-participants.**
- The incidence of late payments is small, but the percentage of customers with a late payment decreases after program participation.

Metric	SF-R Component	Difference (Participant – Non-Participant)
Average Annual Bill 2019 to 2017	CBA	-\$59*
Average Annual Bill 2019 to 2017	IHWAP	-\$149*
Percentage of Households with Late Payments (%)	CBA	-2.0%
Percentage of Households with Late Payments (%)	IHWAP	-3.3%

* Significance at the 90% confidence level.

** Most customers' annual bills increased in CY2019 metric increases likely due to rate changes and weather, including the Polar Vortex in January 2019

Preliminary ComEd Utility NEIs Results

Reduced arrearages translate to carrying cost savings

- The \$280 value represents the conditional case of dollars *per households with arrearages*; to establish the non-conditional case, values were scaled by a factor of ~6.5% (representing the percent of customers with arrearage).
- Application of the scaling factor yields \$18 *per household*: [280 * 0.065 = 18]
- **Applying ComEd's discount rate, the savings for the carrying cost of capital is \$0.43 per household.**

Metric	SF-R Component	Difference (Participant – Non-Participant)
Pre-Program Arrearage Reduction	CBA	-\$53
Pre-Program Arrearage Reduction	IHWAP	-\$280*
Pre-Program Arrearage Reduction	CBA	9.1%*
Pre-Program Arrearage Reduction	IHWAP	1.4%

* Significance at the 90% confidence level.

Preliminary ComEd Utility NEI Results

Some analyses did not reach statistical significance.

- Reduced number of households receiving payment arrangements
 - via LIHEAP (for CBA channel),
 - and reduced portion of bill paid by arrangements with LIHEAP (for CBA and IHWAP channel)
- Reduced number of disconnections and reconnections
- Reduced number of billing and disconnection notices

Preliminary ComEd Utility NEI Results

Next Steps

- Incorporate SAG feedback regarding utility NEIs.
- Monetize additional utility NEIs if additional ComEd data and information are available:

Financial and Accounting

Reduced income eligible participation in alternative payment programs

Disconnections/reconnections

Billing notices

Customer calls/collections

UPDATE ON PARTICIPANT NEI RESEARCH



Participant NEI Research Update: Ameren Illinois

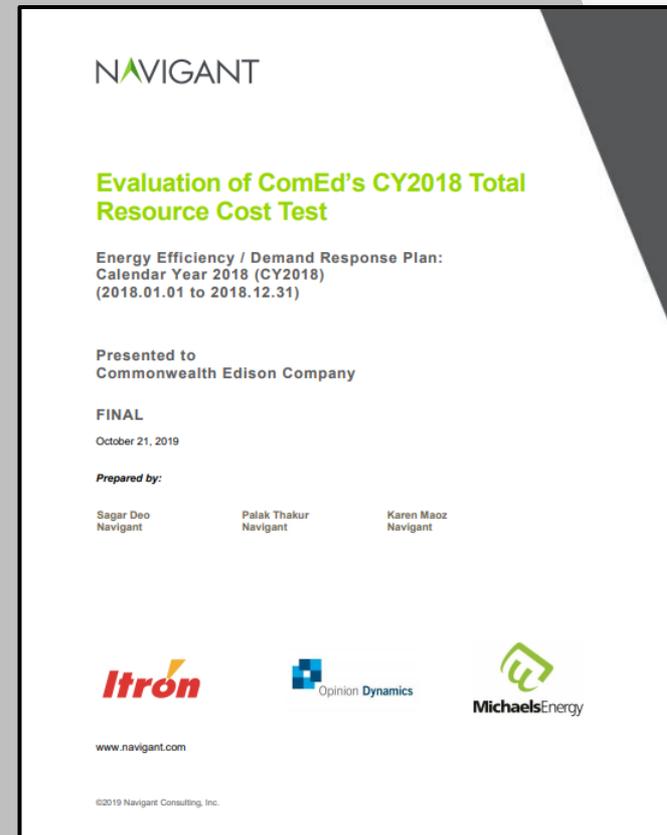
- Discussed AIC perspectives on survey objectives and goals
- AIC is modifying program delivery due to Covid-19
 - Sample design called for surveying a large number of participants as or just after received weatherization
 - Given the hold on in-person program delivery, we will revisit timelines once program activity in customer homes resumes

Participant NEI Research Update – ComEd

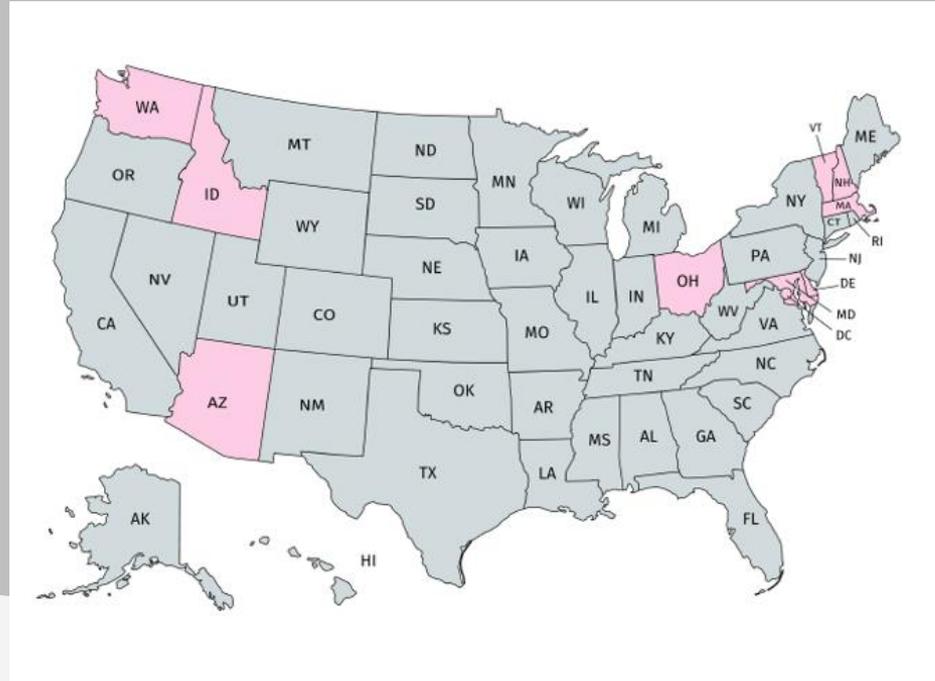
NEIs associated with two comprehensive income eligible programs: MF-R and SF-R

- ComEd approved survey and survey invitation cards
- ComEd also revised on-site program implementation due to Covid-19
 - Sample design called for surveying a large number of on-site participants as or just after they are receiving weatherization in 2020
 - We will revisit timelines when ComEd resumes implementation activities.

POTENTIALLY INCORPORATING NEI RESEARCH RESULTS IN IL UTILITIES' EE PORTFOLIO COST- EFFECTIVENESS TESTS



NEIS IN OTHER STATES' COST-EFFECTIVENESS TESTS AND PLANNING ACTIVITIES



Guidehouse Analysis and Memo:

“Review of States’ Methodologies to include Monetized Non-Energy Impacts in Cost-Effectiveness Tests”

- In addition to Illinois, eleven states use monetized NEIs in their cost-effectiveness tests: Arizona, Delaware, District of Columbia, Maryland, Massachusetts, Minnesota, New York, Rhode Island, Vermont, Washington, and Wisconsin.
- Guidehouse examined the NEI values from six states that use region-specific or state-specific research to quantify and monetize NEIs to use in cost-effectiveness (C/E) tests or program plans.

States	Societal NEIs Included in:	Utility NEIs Included in:	Participant NEIs included in:
Wisconsin	C/E Tests		
Idaho	EE Program Planning		
Washington	EE Program Planning		
Maryland		C/E Tests	C/E Tests
Massachusetts		C/E Tests	C/E Tests
Rhode Island		C/E Tests	C/E Tests



Societal NEIs: Wisconsin

Since 2016, Wisconsin utilities have used the societal NEI results from AVERT in their cost-effectiveness tests by including the monetized emissions reductions in the TRC tests.

Monetized Societal NEIs from AVERT used in WI Utilities' Cost-effectiveness Tests

Program Year	Residential Programs' Societal NEIs	Non-Residential Programs' Societal NEIs	Total:
CY2016 Emissions Benefits	\$33,448,073	\$70,655,200	\$104,103,273
CY2017 Emissions Benefits	\$27,784,615	\$72,107,782	\$99,892,397

Source: Focus on Energy CY2016 Program Evaluation Appendix from portfolio-level modeling within AVERT; and Focus on Energy CY2017 Program Evaluation

Societal NEIs: Idaho and Washington

Avista Utilities in Idaho and Washington used COBRA in their energy efficiency program planning.

Monetized Societal NEIs from COBRA used in ID and WA Utilities' Plans

Societal NEI	Idaho and Washington	Preliminary ComEd
Low Sensitivity Estimate	\$0.02/kWh	TBD
High Sensitivity Estimate	\$0.24/kWh	

Sources: Abt Associates 2018, *Human Health Benefits of Reducing Residential Wood Smoke Emissions in Avista Corporation's Service Territory – Final Report.* and DeYoung 2017, *ACEEE Energy Efficiency*

In November 2017, these values were included in Avista Utilities' Biennial Conservation Plan and presented to the Washington Utilities and Transportation Commission.



Utility NEIs: Maryland, Massachusetts and Rhode Island

As of 2019, three states quantified and monetized utility NEIs and used these values in their cost-effectiveness tests.

Examples of Monetized Utility NEIs Used in Cost-Effectiveness Tests – Per Household

Utility NEI Type	Maryland	Massachusetts	Rhode Island	Average	Preliminary ComEd
Financial and Accounting	\$2.55-\$25.00	2.61-\$39.90	\$2.62-\$3.74	\$13.00	TBD
Carrying Costs on Arrearages		\$1.50-\$4.00		\$2.50	\$0.43
Reduced income eligible participation in alternative payment programs		\$3.00-\$25.00		\$13.00	TBD
Disconnections/reconnections		\$0.10-\$3.65		\$0.65	TBD
Notices		\$0.05-\$1.50		\$0.60	TBD
Customer calls/collections		\$0.40-\$1.50		\$0.90	TBD
Total				\$30.65	\$0.43

Sources: Malone et al, 2019; NEEP 2017



Participant NEIs: Maryland, Massachusetts and Rhode Island

- The DOE WAP Evaluation Study calculated several significant participant NEIs including: reduced medical costs associated with asthma and thermal stress, and reduced missed days of work.
- Maryland, Massachusetts and Rhode Island used the same methodology to conduct state-specific participant NEI studies which quantified and monetized values used in cost-effectiveness tests .

Participant NEI type	Maryland	Massachusetts	Rhode Island	Average	ComEd
Comfort	\$26.00-\$105.00	\$31.00-\$125.00	\$1.42-\$125.00	\$69.00	TBD
Health & Safety	\$3.02-\$100.50	\$4.00-\$45.00	\$0.13-\$45.00	\$33.00	TBD
Reduced missed days of work		\$149.45		\$149.45	TBD
Total				\$251.45	TBD

Sources: Three³ Malone et al 206; Malone et all 2019; NEEP 2016.

ILLUSTRATIVE EXAMPLE: NEI INFLUENCE ON COMED'S EE PROGRAMS' TRCs



Equation 2. IL TRC Benefits

$$B_{ILTRC} = \sum_{t=1}^N \frac{UAEP_t + UATD_t + UAA_t + EB_t + RC}{(1+d)^{t-1}} + \sum_{t=1}^N \frac{UAC_{at} + PAC_{at}}{(1+d)^{t-1}}$$

Equation 3. IL TRC Costs

$$C_{ILTRC} = \sum_{t=1}^N \frac{PNIC_t + IMCN_t + UIC_t}{(1+d)^{t-1}}$$

ILLUSTRATIVE EXAMPLE: NEI INFLUENCE ON TWO COMED INCOME ELIGIBLE PROGRAMS' CY2018 TRCs

CY2018 ComEd Programs	# of Participants	TRC Without NEIs	TRC with Societal NEIs (Low Estimate)	TRC with Societal NEIs (High Estimate)	With Utility – NEIs (Actual of \$0.43/household/year)	With Participant NEIs (From literature review \$251.45/household/year)	With all NEI categories (Low)	With all NEI categories (High)
MF-R Elevate	4,094	0.76	0.89	1.05	N/A	2.10	2.23	2.37
MF-IHWAP	79	0.26	0.34	0.44	N/A	0.36	0.44	0.54
SF-CBA	1,563	0.71	0.80	0.91	0.71	1.37	1.46	1.57
SF-IHWAP	365	0.39	0.45	0.53	0.39	0.62	0.68	0.75

ILLUSTRATIVE EXAMPLE: NEI INFLUENCE ON COMED RESIDENTIAL AND BUSINESS PROGRAM'S CY2018 TRCs

CY2018 ComEd Programs	TRC Without NEIs	TRC with Societal NEIs (Low Estimate)	TRC with Societal NEIs (High Estimate)
Residential: Multifamily Energy Savings	1.54	2.15	2.91
Business: Small Business - Private	1.11	1.46	1.89

RECOMMENDATIONS FROM 4-30-2020 MEMO

Based on our review of the current practices that other states use to include monetized NEIs in cost-effectiveness tests, Guidehouse submits the following recommendations for ComEd's and SAG's consideration:

Recommendation #1: Include monetized Societal NEIs results from a COBRA analysis in ComEd portfolio programs' TRC tests.

Recommendation #2: When final, include monetized Utility NEIs associated with ComEd's Income Eligible programs in their TRC tests.

Recommendation #3: When availability and if statistically significant, include the monetized Participant NEIs associated with ComEd's Income Eligible Multifamily – Retrofit program and Single-Family – Retrofit program in these programs' TRC tests.

Please note feedback on the memo is due within 15 business days (by Friday, May 22nd). Feedback on this presentation is due by May 27. Please send feedback to Patricia Plympton, Guidehouse (Patricia.Plympton@guidehouse.com) and (Celia@CeliaJohnsonConsulting.com).

Feedback will be discussed during the June 1 NEI Working Group meeting.

APPENDIX

ILLINOIS CY2018 TOTAL RESOURCE COST TEST

- NEIs included in the TRC tests
- Although CO2 emissions and water benefits are currently accounted for in the Illinois TRC, we ran a test to see how these additional NEIs affect CY2018 TRC ratios for select few ComEd programs.
- Guidehouse uses the following equations when calculating TRC values

Equation 2. IL TRC Benefits

$$B_{ILTRC} = \sum_{t=1}^N \frac{UAEP_t + UATD_t + UAA_t + EB_t + RC}{(1+d)^{t-1}} + \sum_{t=1}^N \frac{UAC_{at} + PAC_{at}}{(1+d)^{t-1}}$$

Equation 3. IL TRC Costs

$$C_{ILTRC} = \sum_{t=1}^N \frac{PNIC_t + IMCN_t + UIC_t}{(1+d)^{t-1}}$$

Where benefits are defined as:

UAEPt	= Utility avoided electric and capacity production costs in year t
UATDt	= Utility avoided transmission and distribution costs in year t
UAAt	= Utility avoided ancillary costs in year t
EBt	= Environmental Benefits in year t
UACat	= Utility avoided supply costs for the alternate fuel in year t
PACat	= Participant avoided costs in year t for alternate fuel devices
RC	= NPV of replacement costs of incandescent equivalents

And costs are defined as:

PNICt	= Program Non-Incentive costs in year t
IMCNt	= Net Incremental costs in year t
UICt	= Utility increased supply costs in year t

And:
d = Societal discount rate

PRELIMINARY RESULTS: HEALTH BENEFITS

- Guidehouse generated the preliminary list of health benefits using COBRA for a variety of human health aspects

Exhibit 8. Description of Health Effects and their Economic Values

Health Effect	Description
Mortality (low estimate)	Low estimate of the number of deaths, based on Krewski et al. (2009)
\$ Mortality (low estimate)	Low estimate of the economic value of the number of deaths, using Krewski et al. (2009) and a discount rate of 3% or 7%
Mortality (high estimate)	High estimate of the number of deaths, based on Lepeule et al. (2012)
\$ Mortality (high estimate)	High estimate of the economic value of the number of deaths, using Lepeule et al. (2012) and a discount rate of 3% or 7%
Infant Mortality	Number of infant deaths
\$ Infant Mortality	Economic value of the number of infant deaths
Nonfatal Heart Attacks (low estimate)	Low estimate of the number of non-fatal heart attacks, based on four acute myocardial infarction (AMI) studies
\$ Nonfatal Heart Attacks (low estimate)	Low estimate of the economic value of non-fatal heart attacks, based on four AMI studies and a discount rate of 3% or 7%
Nonfatal Heart Attacks (high estimate)	High estimate of the number of non-fatal heart attacks, based on Peter et al. (2001)
\$ Nonfatal Heart Attacks (high estimate)	High estimate of the economic value of non-fatal heart attacks, using Peter et al. (2001) and a discount rate of 3% or 7%
Hospital Admits, All Respiratory	Number of respiratory-related hospitalizations
Hospital Admits, Asthma	Number of asthma-related hospitalizations
Hospital Admits, Chronic Lung Disease	Number of hospitalizations related to chronic lung disease
\$ Hospital Admits, All Respiratory	Economic value of respiratory-related hospitalizations (total across respiratory-related, asthma-related, and chronic lung disease hospitalizations)
Hospital Admits, Cardiovascular (except heart attacks)	Number of cardiovascular-related hospitalizations (ICD codes 390-409, 411-429); ICD code 410 (nonfatal heart attacks) is counted only in 'Non-fatal Heart Attacks'
\$ Hospital Admits, Cardiovascular	Economic value of cardiovascular-related hospitalizations

Health Effect	Description
Acute Bronchitis	Cases of acute bronchitis
\$ Acute Bronchitis	Economic value of acute bronchitis cases
Upper Respiratory Symptoms	Episodes of upper respiratory symptoms (runny or stuffy nose; wet cough; and burning, aching, or red eyes)
\$ Upper Respiratory Symptoms	Economic value of episodes of upper respiratory symptoms
Lower Respiratory Symptoms	Episodes of lower respiratory symptoms: cough, chest pain, phlegm, or wheeze
\$ Lower Respiratory Symptoms	Economic value of episodes of lower respiratory symptoms
Emergency Room Visits, Asthma	Number of asthma-related emergency room visits
\$ Emergency Room Visits, Asthma	Economic value of asthma-related emergency room visits
Minor Restricted Activity Days	Number of minor restricted activity days (days on which activity is reduced, but not severely restricted – e.g., missing work or being confined to bed is too severe to be MRAD).
\$ Minor Restricted Activity Days	Economic value of minor restricted activity days
Work Loss Days	Number of work days lost due to illness
\$ Work Loss Days	Economic value of work days lost due to illness

Notes: * For adult mortality and nonfatal heart attacks, COBRA contains multiple health impact functions that relate PM_{2.5} and each health effect. Therefore, there are high and low estimates of the cases avoided and their economic values for each of these health effects. More details on the underlying health impact functions are available in Appendix C of the user manual. In addition, future costs are calculated using a discount rate (3% or 7%) that you selected before running the scenario.