



Evaluating Impact Do it Right or Not At All

NEUAC Conference 2016

Jackie Berger

David Carroll

June 6, 2016

APPRISE



- Nonprofit research institute
- Mission: Analyze data and information to assess and improve public programs
- Research areas: Energy efficiency and energy affordability
- Clients
 - Federal government (DOE, HHS)
 - State governments
 - Utility companies
 - Nonprofits

Session Outline

- Why Evaluate?
- Impact Evaluation
 - Program Data Analysis
 - Usage Impact Analysis
 - Payment Impact Analysis
 - Economic Impacts
 - Cost Benefit Analysis
- DOE WAP Study vs. E2E WAP Study
- Recommendations

Why Evaluate?

“Measurement is the first step that leads to control and eventually to improvement. If you can’t measure something, you can’t understand it. If you can’t understand it, you can’t control it. If you can’t control it, you can’t improve it.”

— [H. James Harrington](#)

Measure Program Impacts

- Energy usage
- Energy bill affordability
- Economic impacts
- Environmental impacts
- Health, safety, and comfort
- Cost benefit analysis

Assess Potential Program Improvements

- Goals
 - Is the program meeting its goals?
- Efficiency
 - Same impacts at a lower cost?
- Effectiveness
 - Increased impacts?

Assess Potential Program Improvements

- Equity
 - Geographic, renters/owners
- Targeting
 - High users, vulnerable groups, other
- Client satisfaction

Meet Regulatory Requirements

- State
- Public Utility Commission
- Other regulatory

Impact Evaluation

Impact Evaluation Activities

Program Data Analysis	★	
Usage Impact Analysis	★	
Payment Impact Analysis	★	
Economic Impact Analysis	★	
Environmental Impact Analysis		
Health and Safety Impact Analysis		
Participant Survey		
Cost-Benefit Analysis	★	



Indicates that the research activity is focused on in this presentation.

Program Data Analysis

Program Data Analysis Description

- Collect and analyze program data.
- Availability and quality of data vary.

Disaggregated data in paper files at local providers



Databases at local providers



One central database

Program Data Analysis Purpose

- Provides a characterization of:
 - Participants
 - Homes
 - Measures
 - Testing results

Program Data Analysis

Finding: The Program is serving many vulnerable households.

Vulnerable Status	Treatment Group	
	#	%
Child <18	2,843	44%
Elderly >62	1,881	29%
Disabled	346	5%
Any Vulnerable	4,624	72%

Program Data Analysis

Finding: Contractors serve renters at different rates.

Occupancy Type	Contractor				
	1	2	3	4	5
Obs.	4,082	985	812	527	31
Own	72%	54%	74%	51%	74%
Rent	27%	46%	26%	48%	26%
Other	0%	<1%	<1%	<1%	0%
Missing	2%	<1%	<1%	<1%	0%
Total	100%	100%	100%	100%	100%

Program Data Analysis

Utility Low Income Usage Evaluation – Measures

Measure	% With Measure	Measure Cost		Measure	% With Measure	Measure Cost	
		Mean	Median			Mean	Median
Air Sealing	93%	\$425	\$301	Water Heater Repair	13%	\$386	\$450
Attic Insulation	46%	\$707	\$706	Thermostat	10%	\$87	\$80
Wall Insulation	5%	\$456	\$408	AC Replacement	0%	--	--
Floor Insulation	16%	\$755	\$756	AC Repair	<1%	\$850	\$850
Kneewall Insulation	1%	\$224	\$168	Window Repair	56%	\$628	\$515
Basement Insulation	6%	\$193	\$135	Door Repair	64%	\$525	\$474
Duct Sealing and Insulation	1%	\$292	\$95	Other Repairs	69%	\$137	\$86
Furnace Replacement	34%	\$1677	\$1367	CFLs	7%	\$23	\$15
Furnace Repair	16%	\$274	\$248	Health and Safety Measures	82%	\$163	\$135
Furnace Cleaning	36%	\$94	\$83	Other Major Measures	6%	\$287	\$160

Program Data Analysis

Measure Groups Installed

Protocol Savings Category	Treatment Group Year 1		Comparison Group Year 2	
	#	%	#	%
CFL	5,100	79%	6,760	69%
Air Sealing	4,201	65%	5,202	53%
Hot Water	3,926	61%	5,214	53%
HVAC	2,991	46%	4,260	44%
Refrigerator	2,797	43%	3,622	37%
Thermostat	2,436	38%	3,140	32%
Duct Sealing	2,061	32%	3,080	31%
Insulation	2,029	32%	2,611	27%

Usage Impact Analysis

Usage Impact Analysis

Purpose

- Estimate the actual impact of the program on energy usage.
- Determine the impacts of different measures.
- Determine the effectiveness of different providers.
- Data to use in cost effectiveness analysis.

Usage Impact Analysis Description

- Obtain program measure data.
- Obtain electric usage data.
- Obtain weather data.
- Weather normalize the data.
- Compare change for treatment and comparison groups.

Usage Impact Analysis Description

- Usage Impact Methodology
 - Run regression to determine measure specific impacts

$$\begin{aligned} \text{Usage change} &= \alpha + \beta * \text{household characteristics} \\ &+ \gamma^1 * \text{measure}^1 + \gamma^2 * \text{measure}^2 + \gamma^3 * \text{measure}^3 \\ &+ \mu \end{aligned}$$

Usage Impact Analysis Options

- Comparison group
 - Later program participants
 - LIHEAP recipient households
- Weather normalization procedure
 - Prism – individual household analysis
 - Fixed effects regression – pooled analysis
 - Other method

Energy Savings

A

12 Months Pre-Wx
Energy Usage
Weather Normalize

Wx
Date

B

12 Months Post-Wx
Energy Usage
Weather Normalize

A-B

Gross
Energy
Savings

13-24 Months Pre-Wx
Energy Usage
Weather Normalize

C

1-12 Months Pre-Wx
Energy Usage
Weather Normalize

D

Comp.
Group
Wx
Date

C-D

Comp.
Group
Savings

Net
Savings

=

Gross Energy Savings

A-B

-

Comparison Group Savings

C-D

Energy Savings

Quasi-Experimental Design

	Pre	Post	Change	Measured
Treatment Group	Year Before Services	Year After Services	After - Before	Program Impact + Other Factors
Comparison Group	2 Years Before	1 Year Before	2 Years Before - 1 Year Before	Other Factors
Treatment - Comparison				Program Impact

Usage Impact Analysis



Utility Low-Income Weatherization Program Usage Impact Results

ELECTRIC USAGE IMPACTS							
	Treatment Group			Gross Savings		Net Savings	
	#	Pre-Use	Post-Use	kWh	% Savings	kWh	% Savings
Non Normalized	472	15,771	14,515	1,256*	8.0%	1,130*	7.2%
Degree Day Normalized	472	15,454	14,932	522*	3.4%	1,051*	6.8%
Degree Day Normalized With PRISM accounts	401	15,606	15,130	476*	3.1%	988*	6.3%
Prism Normalized	401	15,680	15,084	596*	3.8%	950*	6.1%

*Differences are statistically significant at the 90 percent confidence level.

Impact Analysis

Usage Impact

Billing Analysis – Energy Savings

Electric Baseload												
	Treatment Group					Comparison Group					Net Savings	
	Obs.	Usage		Savings		Obs.	Usage		Savings			
		Pre	Post	kWh	%		Pre	Post	kWh	%	kWh	%
All	5,097	7,193	6,718	475**	6.6%	6,919	7,384	7,381	2	<0.1%	473**	6.6%
Refrigerator	2,324	7,241	6,482	759**	10.5%	2,722	7,502	7,485	17	0.2%	742**	10.3%
No Refrigerator	2,748	7,155	6,914	241**	3.4%	3,979	7,261	7,267	-6	-0.1%	247**	3.5%

Electric Heating												
Model	Treatment Group					Comparison Group					Net Savings	
	Obs.	Usage		Savings		Obs.	Usage		Savings			
		Pre	Post	kWh	%		Pre	Post	kWh	%	kWh	%
All	499	13,137	12,136	1,001**	7.6%	385	13,444	13,514	-70	-0.5%	1,071**	8.2%
MM	214	14,760	12,927	1,833**	12.4%	145	15,295	15,328	-33	-0.2%	1,867**	12.6%
No MM	285	11,949	11,590	359**	3.0%	234	12,423	12,477	-55	-0.4%	414*	3.5%

Gas Heating												
Model	Treatment Group					Comparison Group					Net Savings	
	Obs.	Usage		Savings		Obs.	Usage		Savings			
		Pre	Post	ccf	%		Pre	Post	ccf	%	ccf	%
All	4,828	1,017	947	70**	6.9%	7,225	1,016	996	20**	2.0%	50**	4.9%
MM	2,285	1,097	985	112**	10.2%	2,848	1,079	1,048	31**	2.9%	80**	7.3%
No MM	2,539	947	917	30**	3.2%	4,309	972	960	12**	1.3%	18**	1.9%

Major Measure (MM): Defined as at least \$1,000 on air sealing, insulation, duct sealing, and HVAC combined.

Impact Analysis

Usage Impact

Savings by Pre-Treatment Usage

ELECTRIC BASELOAD SAVINGS BY PRE-TREATMENT USAGE

Pre Usage (kWh)	Treatment Group					Comparison Group					Net Savings	
	Obs.	Usage		Savings		Obs.	Usage		Savings			
		Pre	Post	kWh	%		Pre	Post	kWh	%	kWh	%
≤6,000	1,449	4,185	4,035	149**	3.6%	1,763	4,234	4,389	-155**	-3.7%	304**	7.3%
6001-10,000	1,115	7,778	7,443	335**	4.3%	1,667	7,819	7,932	-112**	-1.4%	447**	5.7%
>10,000	713	13,079	12,015	1,064**	8.1%	1,078	12,938	12,499	439**	3.4%	624**	4.8%

ELECTRIC HEATING BY PRE-TREATMENT USAGE

Pre Usage (kWh)	Treatment Group					Comparison Group					Net Savings	
	Obs.	Usage		Savings		Obs.	Usage		Savings			
		Pre	Post	kWh	%		Pre	Post	kWh	%	kWh	%
≤10,000	84	8,400	8,201	198	2.4%	50	8,303	8,458	-156	-1.9%	354	4.2%
10001-16,000	157	12,835	12,117	717**	5.6%	124	12,952	12,928	24	0.2%	693**	5.4%
>16,000	93	19,194	17,305	1,889**	9.8%	84	18,737	18,408	330	1.8%	1,559**	8.1%

GAS HEATING SAVINGS BY PRE-TREATMENT USAGE

Pre Usage (ccf)	Treatment Group					Comparison Group					Net Savings	
	Obs.	Usage		Savings		Obs.	Usage		Savings			
		Pre	Post	ccf	%		Pre	Post	ccf	%	ccf	%
≤800	1,044	627	621	6*	1.0%	1,550	632	635	-3	-0.6%	10*	1.5%
801-1,200	1,248	991	941	50**	5.0%	2,017	986	982	4	0.4%	46**	4.7%
>1,200	869	1,602	1,467	135**	8.4%	1,393	1,580	1,523	57**	3.6%	79**	4.9%

Impact Analysis

Usage Impact

Savings by Number of Major Measures Installed

ELECTRIC HEATING SAVINGS				
Number of Major Measures	Air Sealing, Attic Insulation, Other Insulation, HVAC Replace, Duct Sealing, Refrigerators			
	Obs.	%	Net Savings	
			kWh	%
None	102	20%	-29	-0.3%
1 Measure	121	24%	564*	4.5%
2 Measures	137	27%	1,223**	9.6%
3 Measures	97	19%	1,982**	13.2%
4-5 Measures	42	8%	2,934**	19.0%

GAS HEATING SAVINGS				
Number of Major Measures	Air Seal, Attic Insul, Floor Insul, Sidewall Insul, Wall/Perimeter Insul, HVAC Replace, Duct Seal			
	Obs.	%	Net Savings	
			ccf	%
None	1,365	28%	11	1.1%
1 Measure	1,066	22%	35**	3.9%
2 Measures	1,284	27%	34**	3.5%
3 Measures	792	16%	97**	8.8%
4 Measures	260	5%	150**	12.4%
5-6 Measures	57	1%	218**	15.9%

Payment Impact Analysis

Payment Impact Analysis Description

- Analysis of customer bills and payments.
- Analysis of assistance payments.
- Comparison between the year preceding and the year following service delivery.
- Use of a comparison group.

Payment Impact Analysis

- Average net reduction in charges following treatment:
 - Electric baseload: \$58
 - Electric heating: \$87
 - Combination: \$107

	Treatment Group			Comparison Group			Net Change
	Pre	Post	Change	Pre	Post	Change	
Electric Baseload	\$1,456	\$1,260	-\$196**	\$1,568	\$1,430	-\$137**	-\$58**
Electric Heating	\$2,349	\$2,021	-\$328**	\$2,517	\$2,276	-\$241**	-\$87**
Gas Heating	\$1,322	\$1,078	-\$243**	\$1,363	\$1,107	-\$256**	\$13
Combination	\$2,788	\$2,354	-\$434**	\$2,847	\$2,519	-\$327**	-\$107**

**Denotes significance at the 99 percent level.

Payment Impact Analysis

	Usage		Savings		
	Pre	Post	Gross	Net	Net %
Total Bill	\$1,214	\$1,194	-\$21	-\$118	-10%
Total Payments	\$1,124	\$1,179	\$54	-\$58	-5%
Bill Coverage Rate	93%	100%	8%	12%	13%

There were 1,873 customers in the treatment group and 1,228 customers in the comparison group.

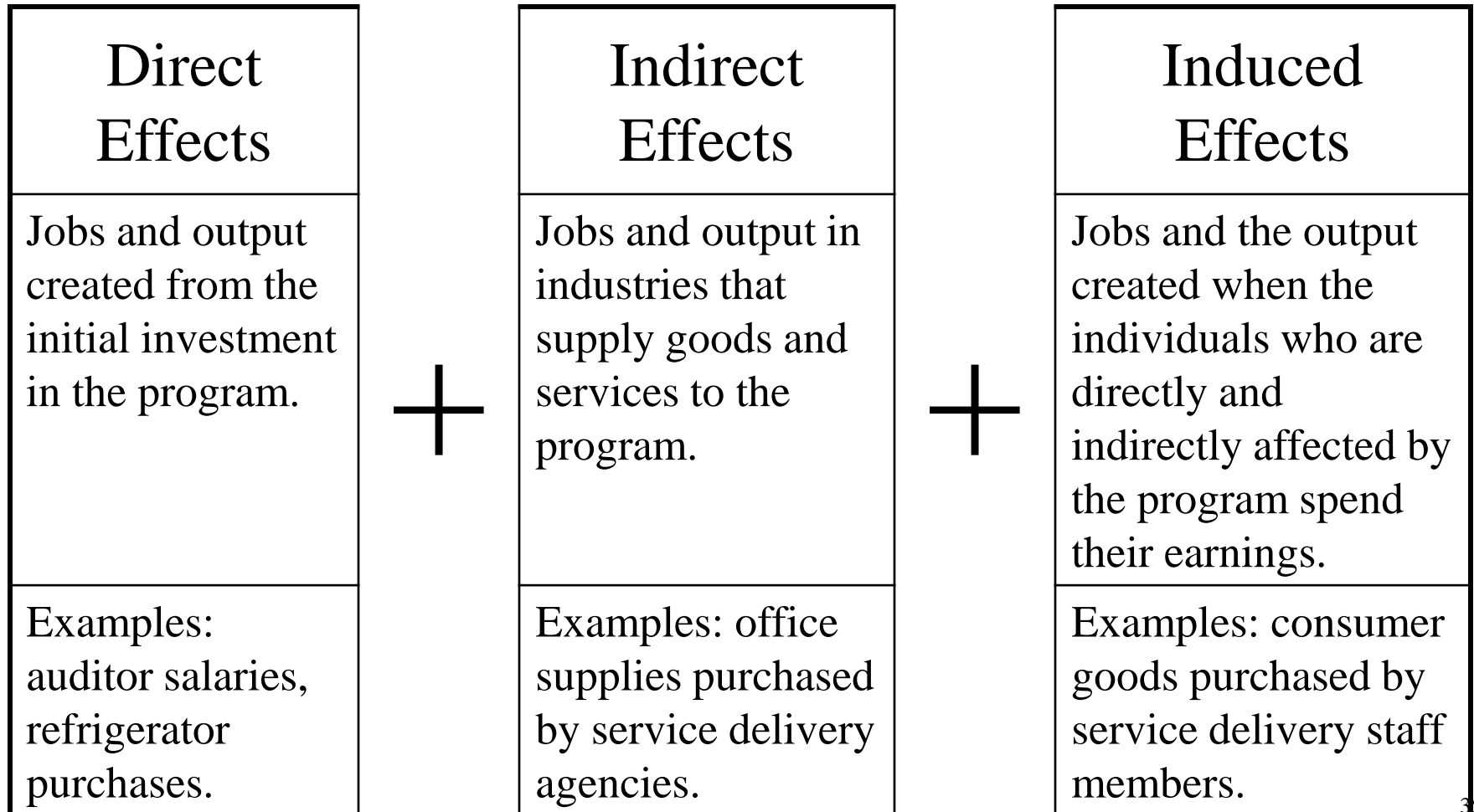
Economic Impacts

Economic Impacts

Purpose

- Determine program impact on economic activity.
- Determine program impact on job creation.

Economic Impacts Description



Economic Impacts Description

$$\text{multiplier} = \frac{\text{direct effects} + \text{indirect effects} + \text{induced effects}}{\text{direct effects}}$$

Example:

- Program expenditures (direct effects): \$10 million
- Indirect effects: \$500,000
- Induced effects: \$1 million
- Multiplier = 1.15

Economic Impacts

Description

- Ohio Electric Partnership Program example – impact of expenditure of state funds.
- If Ohio was not spending State funds on the EPP, these funds would be used to subsidize electric bills.
- Expenditures on energy conservation have a greater impact on the economy than expenditures on electricity.
 - A larger fraction of expenditures on energy conservation are spent inside the state.
 - Energy conservation work is more labor intensive than electricity production.

Economic Impacts Description

Economic benefit from EPP expenditures

$$\begin{aligned} &= \\ &\left(\begin{array}{c} \text{conservation} \\ \text{multiplier} \end{array} - \begin{array}{c} \text{electric} \\ \text{multiplier} \end{array} \right) * \begin{array}{c} \text{EPP} \\ \text{expenditures} \\ \text{in Ohio} \end{array} \\ &- \\ &\begin{array}{c} \text{electric} \\ \text{multiplier} \end{array} * \begin{array}{c} \text{EPP} \\ \text{expenditures} \\ \text{outside Ohio} \end{array} \end{aligned}$$

Economic Impacts Description

- Ohio Electric Partnership Program example – reduction of ratepayer subsidy
 - If the program has a benefit/cost ratio of > 1 , there will be an additional reduction in the amount spent on electricity.
 - This reduction goes to the Ohio ratepayers who had subsidized the electric use of PIPP participants.
 - Ohio ratepayers have more disposable income to spend on consumer goods that have higher multipliers for the Ohio economy than electricity multipliers.

Economic Impacts Description

Economic benefit from EPP net benefits

$$\left(\begin{array}{c} \text{consumer} \\ \text{goods} \\ \text{multiplier} \end{array} - \begin{array}{c} \text{electric} \\ \text{multiplier} \end{array} \right) * \begin{array}{c} \text{net benefits} \\ \text{spent} \end{array} - \begin{array}{c} \text{electric} \\ \text{multiplier} \end{array} * \begin{array}{c} \text{net benefits} \\ \text{saved} \end{array}$$

Economic Impacts Description

Source of Impact	Positive Economic Benefits			Negative Economic Benefits	
	Multiplier		Base	Multiplier	Base
	Without EPP	With EPP			
EPP Expenditures	Electricity	Construction, consumer goods, government, technology services	EPP expenditures in Ohio	Electricity	EPP expenditures outside of Ohio.
EPP Net Benefits	Electricity	Consumer goods	Part of the net present value of benefits that is spent.	Electricity	Part of the net present value of benefits that is saved.

Economic Impacts

	Output Multiplier	Employment Multiplier
	Dollars of output per \$1 spent	Jobs created per \$1 million spent
Electricity	1.43	6.9
Construction	1.85	18.2
Consumer Goods	1.74	42.2
Government	1.85	27.9
Technology	1.71	N/A
Services	1.94	27.7

Economic Impacts

Impacts from EPP Expenditures

	\$ Spent in Ohio	Multiplier		Output Increase
		Electric	EPP	
Software	\$0	1.43	--	\$0
Programming	\$958,760	1.43	1.94	\$488,967
Computers	\$117,253	1.43	1.71	\$32,831
OEE Staff	\$331,098	1.43	1.85	\$139,061
Evaluation	\$27,255	1.43	1.74	\$8,449
Consultants	\$17,772	1.43	1.74	\$5,509
Other	\$142,169	1.43	1.74	\$44,072
Training	\$244,667	1.43	1.94	\$124,780
Measures	\$4,398,142	1.43	1.74	\$1,363,424
Admin	\$2,012,381	1.43	1.94	\$1,026,314
Total	\$8,249,497			\$3,233,407

Economic Impacts

Impacts from EPP Expenditures

	Electric Multiplier	\$ Spent Outside Ohio	Output Decrease
Software	1.43	\$254,000	-\$363,220
Programming	1.43	\$0	\$0
Computers	1.43	\$664,433	-\$950,139
OEE Staff	1.43	\$0	\$0
Evaluation	1.43	\$245,300	-\$350,779
Consultants	1.43	\$159,947	-\$228,724
Other	1.43	\$15,796	-\$22,588
Training	1.43	\$27,185	-\$38,875
Measures	1.43	\$488,682	-\$698,815
Admin	1.43	\$0	\$0
Total		\$1,855,343	-\$2,653,140

Economic Impacts

Impacts from EPP Expenditures

	Output Increase	Output Decrease	Net Output Change
Software	\$0	-\$363,220	-\$363,220
Programming	\$488,967	\$0	\$488,967
Computers	\$32,831	-\$950,139	-\$917,308
OEE Staff	\$139,061	\$0	\$139,061
Evaluation	\$8,449	-\$350,779	-\$342,330
Consultants	\$5,509	-\$228,724	-\$223,215
Other	\$44,072	-\$22,588	\$21,484
Training	\$124,780	-\$38,875	\$85,905
Measures	\$1,363,424	-\$698,815	\$664,609
Admin	\$1,026,314	\$0	\$1,026,314
Total	\$3,233,407	-\$2,653,140	\$580,267

Economic Impacts

EPP Net Energy Savings

	Net Lifetime Benefit (Per Home)	Number of Homes	Total Benefit
High Use	\$453	5,561	\$2,519,133
Moderate Use	\$661	519	\$343,059
Total		6,080	\$2,862,192

Economic Impacts

Impact on Output from EPP Net Benefit

	Amount Spent	Multiplier		Output Increase	Amount Saved	Output Decrease	Net Output Change
		Electric	EPP				
High Use	\$2,267,220	1.43	1.74	\$702,839	\$251,913	-\$360,236	\$342,602
Mod Use	\$308,753	1.43	1.74	\$95,713	\$34,306	-\$49,058	\$46,655
Total	\$2,575,973			\$798,552	\$286,219	-\$409,293	\$389,259

Economic Impacts

Summary of EPP Economic Benefits

Source of Impact	Output Increase	Employment Increase
EPP Expenditures	\$580,267	227
EPP Net Benefits	\$389,259	89
TOTAL	\$969,526	316

Cost Benefit Analysis

Cost Benefit Analysis

Purpose

- Determine whether program is cost-effective.
- Determine whether specific measures are cost-effective.

Cost Benefit Analysis

Description

- Comparison of program benefits and program costs.
- Use of discount rate to determine total benefits over lifetime of the measures.

Cost Benefit Analysis Options

- Type of cost-benefit tests
 - Costs to include
 - Program costs
 - Participant costs
 - Ratepayer costs
 - Benefits to include
 - Utility avoided supply costs
 - Participant savings
 - Non-energy benefits

Cost Benefit Analysis Outputs

LIURP Evaluation

	#	Average Savings	Average Total Cost	Cost Per Unit Saved	Measure Life (years)		
					5	10	15
Electric Baseload							
Electric (kWh)	4,198	887	\$444	\$0.50	\$0.12	\$0.06	\$0.05
Electric Heat							
Electric (kWh)	162	1,129	\$1,969	\$1.74	\$0.40	\$0.23	\$0.17
Gas Heat							
Electric (kWh)	841	550	\$203	\$0.37	\$0.09	\$0.05	\$0.04
Gas (ccf)	854	89	\$1,936	\$21.76	\$5.02	\$2.82	\$2.10

DOE WAP Evaluation and E2e
WAP Evaluation: What do they
tell us and what can we do with
that information?

Controversy

- E2e Headline – “Costs of *Residential* Energy Efficiency Investments are Twice Their Benefits: Implications for Policy”
 - This “may help explain why energy efficiency has low take up rates.”
 - Claims “weatherization upgrades were found to be expensive ways to cut carbon.”
- http://e2e.haas.berkeley.edu/pdf/briefs/weatherization_assistance_policy_summary.pdf

Controversy

- DOE Headline – “Getting it Right: Weatherization and Energy Efficiency are Good Investments”
 - WAP Evaluation shows that “WAP is indeed a good investment with energy savings exceeding costs by a factor of 1.4” and “With health and safety benefits and costs included, the benefit cost ratio rises to 4.”
- <http://energy.gov/eere/articles/getting-it-right-weatherization-and-energy-efficiency-are-good-investments>

Controversy

- ACEEE – “The E2e weatherization study: Generating more heat than light”
 - Study ... ”looks at one program in one state and inappropriately seeks to apply the results to all residential energy efficiency programs.”
 - Study ... “ignores that fact that low-income weatherization is not only designed to save energy, but also has other objectives”
- <http://aceee.org/blog/2015/07/e2e-weatherization-study-generating>

Controversy

- APPRISE Assessment – The controversy is a barrier to development of good policy related to investments in low-income energy assistance and energy efficiency.
 - The study E2e conducted does not support their findings. And, they do not clearly communicate the strengths and limitations.
 - DOE’s response was to defend WAP, rather than take the opportunity to clearly demonstrate what the evaluation found in terms of both the accomplishments of the program AND the opportunities for improvement.

Evaluation

- Ask the right question
- Use the right research method(s)
- Pay attention to the results

E2e Evaluation

- Study Objective – Assess whether there is an “information gap” causing households to “under-invest” in energy efficiency.
 - Not ... What is the performance of the WAP program?
- Study Methodology – RCT using “Encouragement Design” method. Targeted in one geographic area and to one set of WAP service providers.
 - Not ... A comprehensive study of the WAP program.

E2e Evaluation

- Study Results – Study had a number of reasonable findings ...
 - It is difficult to effectively communicate the benefits of energy efficiency services to low-income households.
 - If you encourage households who don't need weatherization (i.e., have comfortable, safe, and affordable homes) to apply for services, you will be over-investing in energy efficiency.
 - The NEAT audit does not furnish very good results if you don't have actual energy usage data.

E2e Evaluation

- Study Results – Study “inappropriately seeks to apply the results to all residential energy efficiency programs.”
 - The treated households had relatively low energy bills compared to WAP program participants in other areas.
 - Other evaluations find substantial variation in performance between states and between agencies within states; no discussion of whether the study agencies were representative of overall WAP performance.
 - Ignored all other benefits of the WAP program and ignored that fact that the WAP program also has responsibilities related to fiscal integrity and verification of health and safety.

E2e Evaluation

- DID NOT ask the right question
- DID NOT use the right research method(s)
- DID NOT pay attention to the results

DOE WAP Evaluation(s)

- Planned in 2006, conducted from 2010 through 2014
- 2008 Evaluation (Retrospective Study)
- 2010 Evaluation (ARRA Funding Period)

DOE WAP Evaluation(s)

- Study Objectives
 - How is the program implemented?
 - How much funding was used?
 - Who does it serve?
 - Who does it not serve?
 - What services are delivered?
 - How well are those services delivered?
 - What do those services costs?

DOE WAP Evaluation(s)

- Ask the right question(s) – continued...
 - What are the impacts on energy usage?
 - What are the impacts on energy bills?
 - What are impacts on indoor air quality?
 - What are the other impacts on clients?
 - What are the other societal impacts?
 - Environmental / Macroeconomic /Taxpayer and Ratepayer

DOE WAP Evaluation(s)

- Ask the right question(s) – continued...
 - Is this a good investment of public funds?
 - Compared to Energy Assistance
 - Compared to other Public Investments
 - Compared to private taxpayer use of funds

DOE WAP Evaluation(s)

- Study Methodology (2008 Energy Impacts)
 - Included all 51 states
 - Sampled 400 of over 1,000 agencies
 - Collected detailed household, housing unit, and service delivery data
 - Used a quasi-experimental design that has been validated multiple times in multiple ways.
 - Included an RCT procedure for homes heated with fuel oil.

DOE WAP Evaluation(s)

- Study Methodology ... continued
 - Collected 60 months of usage data from more than 1,000 utilities
 - Developed detailed information on energy costs and energy cost projections from EIA
 - Used multiple analytic procedures to examine the consistency of findings
 - Used multiple methods for assessment of energy savings cost-effectiveness

DOE WAP Evaluation(s)

- Study Methodology (Other Impacts)
 - Pre/Post Survey with Treatment/Comparison Clients
 - Pre/Post Surveys with Weatherization Staff
 - On-Site Observation of Service Delivery
 - On-Site Measurement of Indoor Air Quality
 - In-Depth Study of Client Deferrals
 - Used of National Research Council methods for measuring emissions impacts

DOE WAP Evaluation(s)

- Study Findings
 - Good performance in terms of energy savings
 - But, clearly a lot of room to increase savings through policy initiatives and quality improvement
 - Clearly delivers non-energy benefits to clients
 - But, analysis procedure used opens DOE to unnecessary criticism
 - Clearly delivers emissions benefits to society
 - But, DOE failure to publicize limits public awareness of those benefits

DOE WAP Evaluation - 2008
WAP Energy Impacts for Single Family Site-Built Homes
Net Gas Savings for Natural Gas Main Heat by Pre-Weatherization
Gas Usage (therms/year)

Pre-WAP Gas Use (therms/yr)	# of Major Measures	# Homes	Gas Use Pre-WAP	Net Savings	% of Pre
All Clients	1.7	3,498	1,020	181 (±13)	17.8% (±1.2%)
<750 th/yr.	1.4	858	571	67 (±9)	11.8% (±1.5%)
750-1000	1.7	963	875	133 (±10)	15.2% (±1.2%)
1000-1250	1.9	726	1,120	206 (±12)	18.4% (±1.1%)
1250-1500	2.1	472	1,367	271 (±27)	19.8% (±2.0%)
>=1500 th/yr.	2.0	479	1,879	414 (±49)	22.1% (±2.6%)

State #2

PY 2010 Gas Impact Results by Agency for Gas Heated Single Family Site-Built Homes (therms/year)

Agency ID	Gas Use Pre-WAP	Net Savings	% of Pre	# of Measures
A	1,268	281 (±65)	22.2% (±5.1%)	2.2
B	1,025	250 (±43)	24.4% (±4.2%)	2.3
C	1,037	240 (±53)	23.1% (±5.1%)	2.3
D	1,130	216 (±55)	19.1% (±4.9%)	2.4
E	911	211 (±41)	23.2% (±4.5%)	2.0
F	997	204 (±58)	20.5% (±5.9%)	1.4
G	1,190	195 (±17)	16.3% (±1.4%)	1.9
H	993	180 (±16)	18.1% (±1.6%)	1.9
I	938	160 (±18)	17.1% (±1.9%)	2.2
J	1,035	158 (±12)	15.3% (±1.2%)	2.0
K	1,012	150 (±23)	14.8% (±2.2%)	1.9
L	1,252	150 (±41)	12.0% (±3.2%)	1.4
M	1,023	141 (±33)	13.8% (±3.3%)	1.7
N	1,039	137 (±12)	13.2% (±1.2%)	1.9
O	921	130 (±32)	14.2% (±3.4%)	1.8
P	893	129 (±29)	14.5% (±3.2%)	1.4
Q	988	111 (±16)	11.3% (±1.6%)	1.3
R	962	109 (±29)	11.3% (±3.1%)	1.8
S	1,104	95 (±76)	8.6% (±6.9%)	1.8
Total	1,043	163 (±8)	15.7% (±0.7%)	1.9

*Agencies with less than 30 homes with energy savings results are not shown. but are included in the total savings figures.

Sample Results – Housing Unit Conditions

	Pre-Treatment	Post-Treatment	Gross Change	Comparison Group Change	Net Change
Observed Standing Water in Home	33%	27%	-6%	0%	-6%
Frequent Mildew Odor or Musty Smell	31%	22%	-9%	+1%	-10%
Home Somewhat or Very Infested with Insects	24%	14%	-10%	+3%	-13%
Findings	<p><i>Client self-reports of housing unit status suggest that WX resulted in a reduction in potential asthma triggers. [Note: N is about 400 for Treatment Group and for Comparison Group. Differences are statistically significant at the 95% level.]</i></p>				

Sample Results – Status of Household Members

	Pre-Treatment	Post-Treatment	Gross Change	Comparison Group Change	Net Change
Asthma Symptoms in the Last Year	74%	74%	0%	+3%	-3%
Overnight Stay in Past 12 Months	15%	11%	-4%	-1%	-3%
Emergency Room Visit in Past 12 Months	11%	6%	-5%	-1%	-4%
Findings	<p><i>Client self-reports of health status suggest that there were net impacts on asthma symptoms and need for medical attention.</i> [Note: N is about 70 for Treatment Group and for Comparison Group. Differences are not statistically significant at the 90% level.]</p>				

Emissions Non-Energy Benefits

	Housing Units (2008 Program)	Aggregate Tons*	Tons per Unit (All Fuels)	Aggregate Value (millions of 2013 Dollars)	Value per Housing Unit
CO₂ Equivalents	85,931	2,246,174	26.14	\$85.4m	\$994
SO₂		3,275	0.0381	\$139.1m	\$1,619
NO_x		1,825	0.0212	\$19.1m	\$223
PM 2.5		106	0.001234	\$7.6m	\$88
VOCs		65	0.000756	\$0.6m	\$8
TOTAL		N/A	N/A	\$251.9m	\$2,932

*In short tons, except for CO₂ equivalents which are in metric tons.

DOE Study

- DID ask the right questions
- DID use the right research method(s)
- DID NOT pay attention to ALL of the results

Recommendations

Recommendations

- Prioritize goals for the evaluation.
- Determine available/appropriate evaluation budget.
- Choose research activities that are most likely to provide information needed.
- Combination of process and impact data is usually important.
- Use of all findings – Accomplishments AND Areas for Improvements

Contact Information



Jackie Berger

President

[jackie-berger@
appraiseinc.org](mailto:jackie-berger@appraiseinc.org)

609-252-8009



David Carroll

Managing
Director

[david-carroll@
appraiseinc.org](mailto:david-carroll@appraiseinc.org)

609-252-8010



APPRISE

32 Nassau Street

Suite 200

Princeton, NJ

08542