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A BRIEF REVIEW OF BENEFIT-COST TESTING FOR ENERGY EFFICIENCY PROGRAMS:

CURRENT STATUS AND SOME KEY ISSUES

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The American Council for an Energy-Efficient Economy (ACEEE)

- Nonprofit 501(c)(3) dedicated to advancing energy efficiency through research, communications, and conferences. Founded in 1980.
- ~40 staff in Washington DC, + field offices in DE, MI, and WI.
- Focus on End-Use Efficiency in Industry, Buildings, Utilities, and Transportation; and State & National Policy
- Funding: Foundations (34%), Federal & State Grants (7%), Contract research work (21%) Conferences and Publications (34%), Contributions and Other (4%)

Martin Kushler, Ph.D. (Senior Fellow, ACEEE)

- 30 years conducting research in the utility industry, including:
- 10 years as Director of the ACEEE Utilities Program
- 10 years as Director of Evaluation at the Michigan PSC
- Have assisted over a dozen states with utility EE policies

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TOPICS

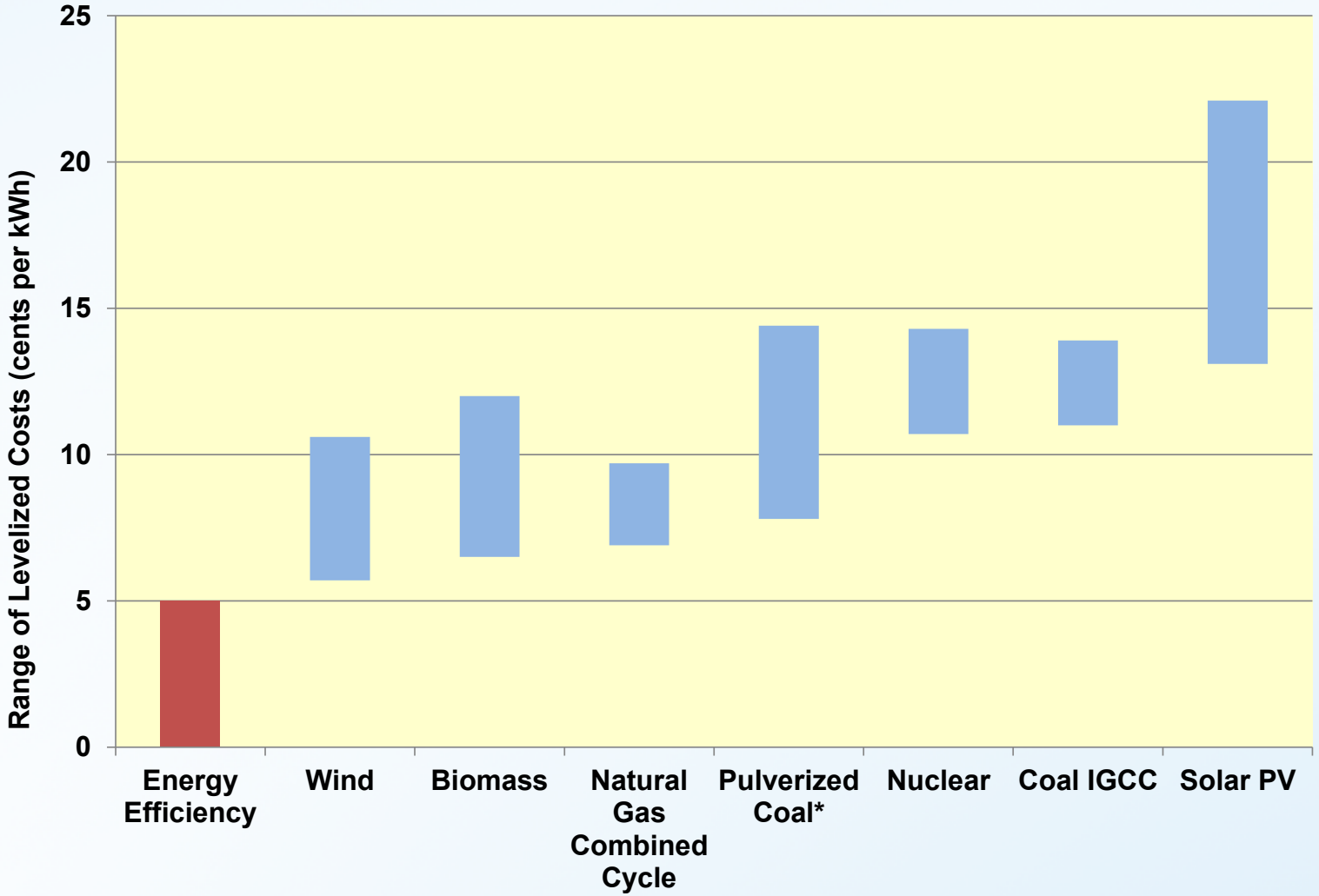
- Background and purposes of benefit-cost testing
- Overview of the 5 traditional cost-effectiveness tests
- Survey results on current state application of benefit-cost tests
- Some concerns about B/C testing, as currently applied
  - TRC imbalance
  - Under-valuing utility system benefits
- Conclusions
- Epilogue: some recent developments

WHY IS THIS ISSUE IMPORTANT?

- **Energy Efficiency is by far the cheapest source of new supply for utilities** (true for electricity and gas) [see graph]
- **If flawed or incorrect B/C tests are resulting in exclusion of EE programs that are actually cost-effective… then utility system costs (paid by ratepayers) will be higher than they need to be**
- From a broader state public policy perspective, if EE programs are excluded, **additional benefits will be lost as well**
  - Reduced environmental emissions
  - Local economic benefits ($ retained in-state, local employment, etc.)
  - Improved housing & building stock
  - More competitive businesses (reduced operating costs)
  - Inter-class and intra-class equity (residential customers, low-income)

Cost of New Electricity Resources

[Source: Lazard, Inc.]



Note: ACEEE's latest review of 20 states found **average cost of EE programs: 2.8 cents/kWh** http://www.aceee.org/research-report/u1402

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SOME HISTORY BEHIND B/C TESTING FOR EE

- Opposition to energy efficiency requirements by utilities and other powerful parties (e.g., industrial customers)
- High "burden of proof" placed on energy efficiency as a resource
- Scrutiny disproportionate to any other utility expenditure
- The legacy continues today

e.g., comparison of energy efficiency to other "alternative resources"

- ❖ 100% of states require benefit-cost testing for energy efficiency
- ❖ Only 67% of states require B/C testing for load management programs
- ❖ Only 28% of states require B/C testing for renewable energy programs

[NOTE: utilities are regulated at the state level. So each state establishes it's own benefit-cost test policy]

BIGGEST PROBLEMS WITH CURRENT BENEFIT-COST TESTING

- The TRC test, as generally applied, is fundamentally imbalanced by overstating costs/understating benefits
- States frequently do not adequately account for all of the benefits that energy efficiency provides to the utility system

Each of these problems systematically under-values energy efficiency programs

CAN WE "MEASURE" THE ENERGY EFFICIENCY RESOURCE?

- At the *individual device* level: easy (can even "meter" it)
- At the *program* level: must 'estimate' through EM&V
  - Can be 100's or 1000's of dispersed participants
  - For 'net' savings, must compare to a 'counterfactual' condition (i.e., "what would have happened in the absence of a program?")

Fortunately, we have abundant experience documenting energy efficiency savings through EM&V

- There is an entire profession, with 30 years of experience, dedicated to doing that EM&V [www.iepec.org]
- Routinely used in ESCO performance contracts [e.g.,IPMVP]
- Utility regulators routinely rely on that EM&V for EE to be a reliable resource (& "keep the lights on") [e.g., see the NE-ISO 'Forward Capacity Mkt.']

PURPOSES OF BENEFIT-COST TESTING FOR UTILITY ENERGY EFFICIENCY PROGRAMS

- To help ensure that ratepayer dollars are prudently spent (in this case, defined as the "benefits" being equal to or greater than the "costs"….. i.e., a B/C ratio of 1.0 or greater)
- To help prioritize amongst resource/program options (i.e., larger B/C ratios deliver more benefits per dollar)*

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* Of course, other factors also influence selection of programs (e.g., equity across customer groups)

THE 5 "CALIFORNIA" TESTS

- The *Participant* test [PART]
- The *Utility* or *Program Administrator* test [UCT or PACT]
- The *Total Resource Cost* test [TRC]
- The *Societal* cost test [SCT]
- The *Ratepayer Impact Measure* test [RIM]

COMPONENTS OF THE 5 TESTS

	Partic.	RIM	TRC	SCT	UCT/ PACT
Benefits					
Primary Fuel(s) Avoided Supply Costs		✓	✓	✓	✓
Secondary Fuel(s) Avoided Supply Costs			✓	✓	
Primary Fuel(s) Bill Savings (retail prices)	✓				
Secondary Fuel(s) Bill Savings (retail prices)	✓				
Other Resource Savings (e.g. water)	✓		~✓	✓	
Environmental Benefits				✓	
Other Non-Energy Benefits			Rarely	In Theory	
Costs					
Program Administration		✓	✓	✓	✓
Measure Costs					

CURRENT PRACTICE IN THE STATES REGARDING BENEFIT-COST TESTS
[Source: ACEEE National Survey (2012)]

- 44 states have ratepayer funded energy efficiency programs
- All 44 states surveyed indicated that they use some type of benefit-cost test. 41 have a "primary" test.

TESTS USED		PRIMARY TEST		
TRC	36 (84%)	29	(71%)	
UCT	28 (65%)	5	(12%)	
PCT	23 (53%)	0		
SCT	17 (40%)	6	(15%)	
RIM	22 (51%)	1	(2%)	[Now 0%]

LEVEL AT WHICH B/C TESTS ARE REQUIRED

70% Overall portfolio

70% Total program*

40% Customer project

30% Individual Measure**

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* Of these states, nearly half noted that they have some exceptions, such as low-income programs, pilot programs, etc.

** A majority of those states have some exceptions or flexibility in the application of B/C tests at the measure level, such as allowing 'bundling' of measures, or exceptions for certain types of programs (e.g., 'whole house' programs, low-income programs, etc.)

BENEFITS INCLUDED IN THE PRIMARY TEST

- **Avoided utility system costs: All States**
- Environmental: 14 (32%) [8 calculate, 6 use general 'adder']
  [10 states include CO2 as part of rationale]
- Other fuels and water 7 (17%)
- **Customer non-energy benefits: 2 (5%)**
  - Reduced maintenance: 2 (5%)
  - Health: 0 Comfort: 0 Improved productivity: 0

[Only 1 out of 29 states using the TRC as a primary test included a specific customer NEB as a quantified benefit.]

COSTS INCLUDED IN THE PRIMARY TEST

- **Utility Program costs: All States**
- **Customer costs**: 36 (88%) (including all the TRC states)

The core problem:

As currently implemented, the TRC test is* ***fundamentally imbalanced…. it includes all customer costs for an energy efficiency project, but ignores all of the customer 'non-energy' benefits from the project****.*

** Note: a Societal Test can have the same imbalance, if not properly calculated*

CONCERNS ABOUT THE 'IMBALANCE' IN THE TRC

TRC= (utility costs + participant costs) vs. utility benefits only

- **Not conceptually logical** – customers invest their money in EE projects for a variety of benefits - - not solely to save energy. Why include all costs they incur but exclude many benefits in a B/C calculation?
- **Systematically biased against EE** – these extra 'customer' costs are not considered when selecting supply-side options (e.g., purchased power, distributed generation, customer-sited renewables, etc.)
- **Out-of-step with common practice in program design** and marketing (which often emphasizes NEBs)
- **Will result in 'screening out' programs** that would be cost-effective from a utility resource perspective

EXAMPLE: TRC AND HOME PERFORMANCE
Screening without NEBs (courtesy of Chris Neme)

Costs				
Measures (includes utility and participant costs)				$7,500
Administration				$1,500
Total				$9,000
Benefits				
	Therms	kWh	kW	
Energy Savings	300	750	0.6	
Savings Life -Yrs	20	10	10	
Avoided Cost/Unit	$1.35	$0.14	$115	
Value	$ 4,645	$ 1,020	$ 682	$ 6,347
Net Benefits				**$ (2,653)**
Benefit-Cost Ratio				**0.71**

REMEDIATION OPTIONS

TRC= (utility costs + participant costs) vs. utility benefits only

To address the "imbalance":

1. **Adjust participant cost to "energy portion only"**

TRC= (utility costs + participant energy portion of costs) vs. utility benefits only

2. **Add NEBs to "benefits"**

TRC= (utility costs + participant costs) vs. utility benefits + participant benefits

3. **Switch tests – to the UCT/PACT**

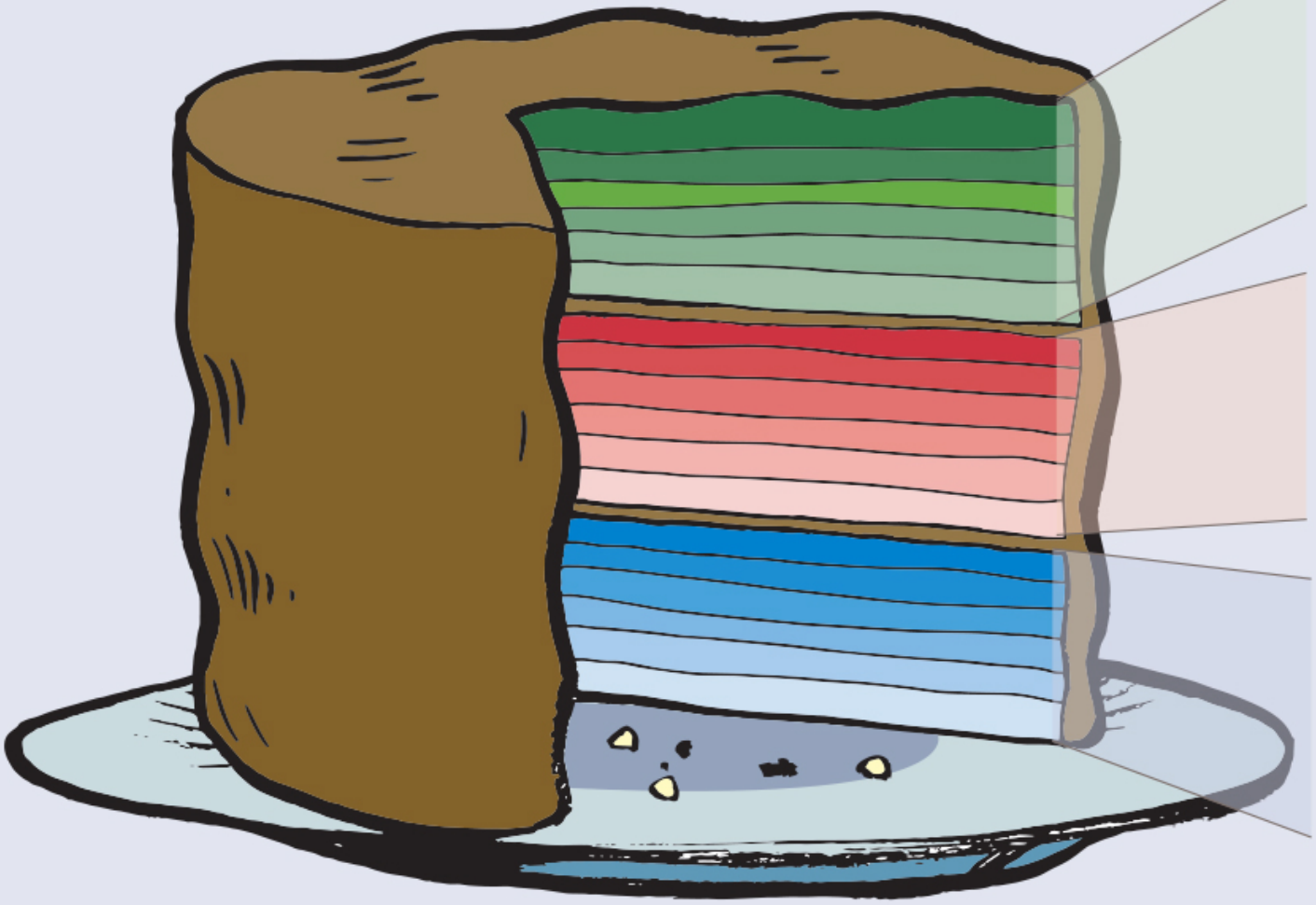
~~TRC~~ UCT= (utility costs ~~+ participant costs~~) vs. utility benefits only

Application of Fixes Home Performance Example

(courtesy C. Neme)

	Scenario		TRC Today	TRC Cost Adjusted	TRC w/NEBs	PACT
Costs						
Measure Costs		$7,500				
Rebate	33%	$2,500	$2,500	$2,500	$2,500	$2,500
Participant	67%	$5,000	$5,000	$5,000	$5,000	
Administration		$1,500	$1,500	$1,500	$1,500	$1,500
Customer Attribution of Costs						
Energy Reasons		50%				
Non-Energy Reasons		50%				
Cost Adjustment		$ (3,750)		-$3,750		
Total Costs			$9,000	$5,250	$9,000	$4,000
Benefits						
Energy - Avoided Costs		$ 6,000	$6,000	$6,000	$6,000	$6,000
Non-Energy		$ 6,000			$6,000	
Total Benefits			$6,000	$6,000	$12,000	$6,000
Net Benefits			-$3,000 **FAIL**	$750 **PASS**	$3,000 **PASS**	$2,000 **PASS**

A "Layer Cake" of Benefits from Electric Energy Efficiency



Utility System Benefits
- Power Supply
- T&D Capacity
- Environmental
- Losses and reserves
- Risk
- Credit and Collection

Participant Benefits
- Other Fuels
- Water, Sewer
- O&M Costs
- Health Impacts
- Employee Productivity
- Comfort

Societal Benefits
- Air Quality
- Water
- Solid Waste
- Energy Security
- Economic Development
- Health Impacts

Source: Regulatory Assistance Project

UTILITY SYSTEM BENEFITS OFTEN UNDER-VALUED

- All ***costs*** typically included (administration, rebates, eval., etc.)
- Energy and capacity benefits typically included
  (albeit inconsistently)
- **But many other benefits often not included or under-valued**
  - Avoided T&D costs often excluded or under-valued
  - Reserve margin benefits often omitted
  - Avoided environmental compliance costs often excluded
  - Wholesale price suppression effects not commonly captured
  - Risk mitigation benefits rarely included
  - Lower credit/collection costs rarely included
  - Line loss reductions commonly understated
    - Higher at peak than rest of year – only sometimes addressed
    - Should use marginal loss rates, but average losses used instead

Result: Efficiency under-valued in all screening tests.

LOW-INCOME PROGRAMS ARE A SPECIAL CATEGORY

- Benefits included in a typical comprehensive low-income weatherization program:
  - Energy use reduction
  - Home repair
  - increased comfort
  - Indoor air quality (mold, allergens, radon, CO, etc)
  - Poisons (house cleaners, lead, etc)
  - Safety (furnace, housing structure, living conditions, etc)

  The value of these "non-energy" benefits typically exceeds the value of the "energy" benefits

➢ Nearly all states have special provisions for low-income energy efficiency programs

CONCLUSIONS

- Benefit-cost testing can be informative, and useful for decision-making….if properly done
- Use of benefit-cost tests for assessing ratepayer-funded energy efficiency programs is essentially universal in the states
- Reliance upon TRC for cost-effectiveness screening is very widespread (much due to legacy and entrenched practice)
- The TRC test (as commonly applied) has serious shortcomings that are likely to impede the full acquisition of cost-effective energy efficiency as a utility resource.
- Utility system benefits are often under-valued in **all** of the B/C tests
- These concerns about benefit-cost testing are leading to a re-examination of this issue in the industry and the regulatory community

KEY RECOMMENDATIONS

- Fix the "imbalance" problem with the currently dominant test (TRC), or switch B/C tests
- Some combination of a Utility Cost Test and Societal Cost Test is likely a more practical approach
- Be sure to fully account for all utility system benefits
- Apply B/C screen at the program and portfolio level, not at the individual measure level
- Don't use RIM test as a screen

EPILOGUE: RECENT DEVELOPMENTS

- In the fall of 2013 the National Home Performance Council and Conservation Services Group convened a working group of national experts in energy efficiency program evaluation, to review current B/C testing practices and recommend improvements
- This group has developed a proposed new

  "**Resource Value Framework**"….

  and has formed an "Energy Efficiency Screening Coalition" to advocate for an improved B/C testing protocol

- Still a work-in-progress
  - The Energy Efficiency Screening Coalition is currently soliciting input from EE experts to refine the framework.
  - See http://www.nhpci.org/projects/costbenefittesting.html for more information.

OVERVIEW OF THE 'RESOURCE VALUE FRAMEWORK'

Essential elements of the framework:

1. Clarifies the objective of efficiency screening: **to identify resources that are in the public interest.**
2. Allows flexibility for each state to determine an efficiency screening test that **accounts for the energy policy goals of that state.**
3. Builds off of the existing screening tests, especially the Utility Cost and the Societal Cost tests.
4. Ensures a **symmetrical approach to incorporating costs and benefits**
5. Allows for **consideration of relevant hard-to-quantify benefits**.
6. Provides an **explicit, transparent process** to identify the appropriate screening test for each state.

Resource Value Framework

	Program Name:		Date:	
	1. Key Assumptions, Parameters and Summary of Results			
	Analysis Level	□ Program		
		□ Portfolio		
	Measure Life		Discount Rate	
	Projected Annual Savings		Projected Lifetime Utility Savings	
Required for Utility Perspective	**2. Monetized Utility Costs**		**Monetized Utility Benefits**	
	Program Administration		Avoided Energy Costs	
	Incentives Paid to Participants		Avoided Capacity Costs	
	Shareholder Incentive		Avoided T&D Costs	
	Other Utility Costs		Wholesale Market Price Suppression	
			Avoided Environmental Compliance Costs	
			Other Utility System Benefits	
	NPV Total Utility Cost		NPV Total Utility Benefits	
Required for Societal Perspective	**3. Monetized Participant Costs**		**Monetized Participant Benefits**	
	Participant Contribution		Participants' Savings of Other Fuels	
	Participant's Increased O&M Costs		Participant Non-Energy Benefits:	
	Other Participant Costs		Participants' Water and Sewer Savings	
			Participants' Reduced O&M Costs	
			Participants' Health Impacts	
			Participant Employee Productivity	
			Participant Comfort	
			Additional Low-Income Participant Benefits	
			Other Participant Non-Energy Benefits	
	NPV Total Participant Cost		NPV Total Participant Benefits	
Depends Upon Policy Goals	**4. Monetized Public Costs**		**Monetized Public Benefits**	
	Public Costs		Public Benefits of Low Income Programs	
			Reduced Environmental Impacts (if monetized)	
			Public Fuel and Water Savings	
			Reduced Public Health Care Costs	
			Other Public Benefits	
	NPV Total Public Costs		NPV Total Public Benefits	

	Total Monetized Costs and Benefits			
	Total Costs		**Total Benefits**	
	Benefit- Cost Ratio		**Net Benefits**	
Depends Upon Policy Goals	**5. Non-Monetized Public Costs and Benefits**			
	Non-Monetized Benefits		Comments	
	Promotion of Customer Equity			
	Promotion of Market Transformation			
	Reduced Environmental Impacts (if not monetized)			
	Increased Jobs and Economic Development			
	6. Determination:			
	□ Program is in the public interest		□ Program is not in the Public Interest	

SOME REFERENCES

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