

NAVIGANT



NORTHEAST ENERGY EFFICIENCY PARTNERSHIPS
FACILITATING PARTNERSHIPS TO ADVANCE ENERGY EFFICIENCY



A Regional Approach to Estimating Incremental Costs

DOE Energy Efficiency Measure
Cost Studies

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Regional EM&V Forum



EM&V Forum established in 2006

- » EM&V Forum goals also include increasing transparency and credibility of energy efficiency
- » Regional approach to pressing planning and evaluation issues in an expanding Energy Efficiency / Demand Side Management Environment
- » Consistent approaches tailored to Forum sponsors' evaluation and planning needs

Study Sponsors

- » BGE
- » Berkshire Gas
- » Columbia Gas
- » DC SEU
- » Efficiency VT
- » First Energy
- » National Grid
- » New England Gas
- » Northeast Utilities
- » NSTAR
- » NYPA
- » NYSERDA
- » PEPCO
- » SMECO
- » United Illuminating
- » Vermont Gas



Why This Study?



- » Increasing scrutiny to cost side of cost-effectiveness
 - › Increasing energy efficiency goals “All Cost-Effective Energy Efficiency” Mandates
 - › Increasing building codes and equipment standards
 - › EE as Resource in the Forward Capacity Markets
 - need to document *all* factors, including costs.
- » Setting incentive levels appropriate to the markets
- » Much existing cost information was extremely old. Much cost data based in 1990’s data.
- » Costs are dynamic: changes in baselines, technologies, market adoptions, often produce non-linear cost changes



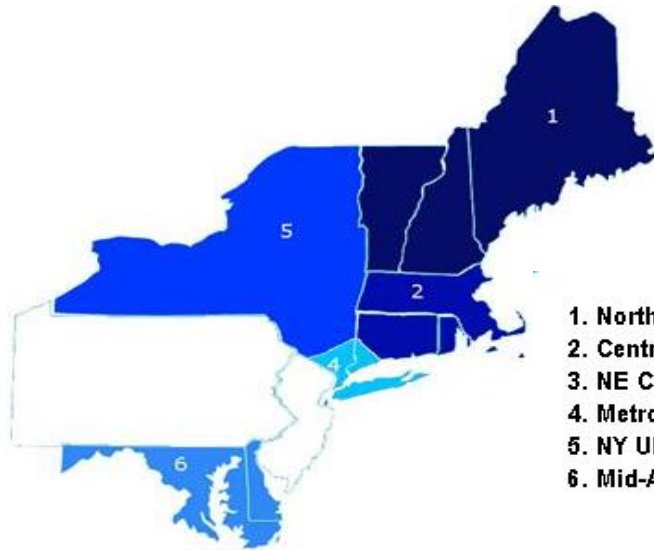
Why a Regional Approach?



- » Combining Forces - cost studies are expensive
 - › typically get low priority in planning or evaluation budgets
- » Many program administrators short on staff to manage multiple studies
- » Markets and suppliers don't fit neatly into Program Administrator (PA) service territories, but they are definable
- » Common interests - with respect to important measures
- » Priorities set from bottom up, interactively among PA's, NEEP, Navigant



Markets in ICS Region (Defined by R.S. Means)



Markets

1. Northern NE: ME, NH, VT
2. Central NE: MA, RI, most CT
3. NE City- Boston, Providence
4. Metro NY - NYC, LI, SW CT
5. NY UPstate
6. Mid-Atlantic



Market	Market Code	Market Territory	Cost Factor
Northern New England	1	ME, VT, NH	0.85
Central/Southern New England	2	MA , RI, most CT	1.06
New England City	3	Boston, Providence	1.13
Metro New York	4	NYC, metro suburbs Southwest CT	1.29
Upstate New York	5	Albany, Buffalo, Rochester, balance of the state	1
Mid-Atlantic	6	MD, DE, DC	0.95
Base Cost Factor (BCF)*	-	-	1

Key ICS Design Characteristics



- » Focus on prescriptive measures receiving incentives in current energy efficiency programs
- » Create cost curves (efficiencies/capacities)
- » Transparent calculation methodology
 - › Open workbook calculation
 - › User friendly, customizable
- » Close coordination with on the ground program implementation staff and measure experts



Budget and Timeline



- » Forum decisions about studies to be commissioned and budgets for each study determined annually
 - › Cost study initially planned for one year only, annual review authorized continuation for three more phases, budget varied according to sponsor resources available

» <u>Phases</u>	<u>Budget</u>
Phase 1: 2010	\$400,000
Phase 2 2011-12	\$370,000
Phase 3 2012-13	\$160,000
Phase 4 2014	<u>\$207,000</u>
Total	\$1,137,000



WITH LIMITED RESOURCES, MEASURE SELECTIONS ARE CRITICAL



In early phases, measure selections were based on EM&V sponsors needs/interest

Beginning in Phase 3, measures were scored and prioritized based on following criteria:

Cost Stability	Codes and Standards Stability
Incentives Currently Offered by PAs	
Contribution to Portfolio Savings	Level of Specificity



Characterization-Based Approach



Measure characterizations and baselines are carefully defined with respect to existing program offerings

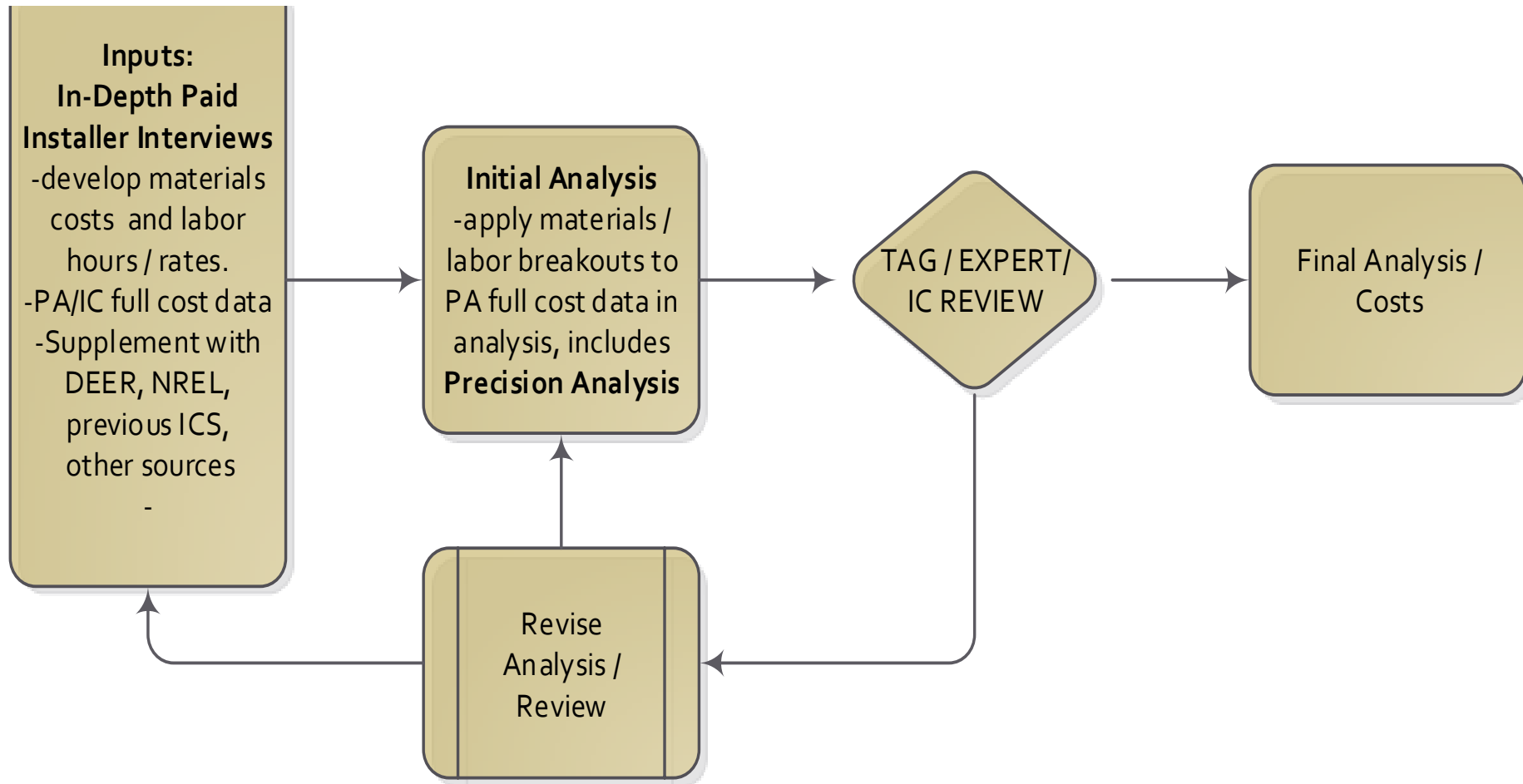
But these definitions are not equal across the region

» **Variances by State and by PA territory in:**

- › **Measure definitions**
- › **Rebated efficiency levels**
- › **Capacities/sizes of equipment supported**
- › **Baselines (e.g. gas furnaces in New England v. Mid-Atlantic states)**



Data Collection and Analysis



Data Collection Strategies



- » Program Administrator and expert input needed at multiple points
 - › Initial input on measure selection
 - › Characterization advice and review
 - › Nomination of installer interview candidates
 - › Primary equipment cost data from project database and invoice data (cost data often held by implementation contractors)
 - › Reviews of preliminary costs (sanity check)

- » Installer in-depth interviews for typical installations
 - › Baseline equipment and labor skills, hours, labor rates
 - › Boundaries of installations - what's included in costs, what's excluded.
 - › Is there any incremental labor cost?
 - › Typical incremental hours, rates, skills (differences from baseline)



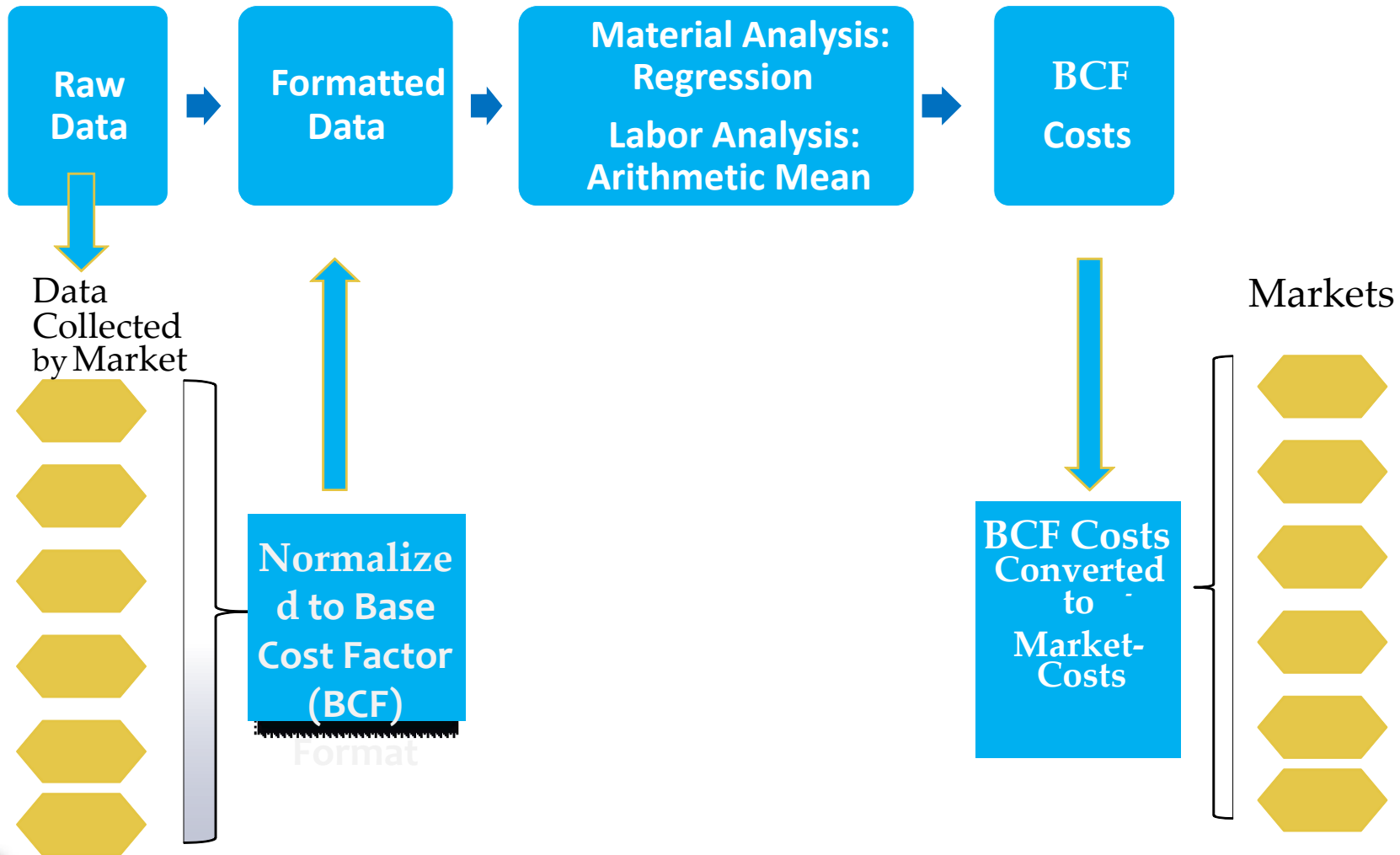
Challenge: Getting to the Right People and Data



- » Program Administrators
 - › Program implementation staff - often too busy
 - › Access to program implementation contractors and their data
 - Primary data often in invoices, paper and pdfs
- » Installers: Good responses from paid interviews but *always* too busy to pick up the phone
- » There is no silver bullet. Challenges are overcome by being strategic and persistent.



Analyzing Data From Multiple Markets



Characterization and Cost Example



Commercial Unitary Air-Conditioning (AC) Characterization

Measure Description	Commercial Unitary AC (packaged)
Baseline	Standard Efficient Unitary AC
Measure Scenario(s)	ROB, NC
Baseline Efficiency Levels	IECC 2009 and/or jurisdiction-specific. Baseline efficiency varies by size.
Measure Level Description	High-Efficiency Unitary Air-Conditioning Equipment
Measure Efficiency Levels	CEE Tier 1 & Tier 2 (see CEE Criteria Tab)
Sizes (1 ton = 12,000 Btu/h of cooling)	5.4-11.25 tons
	11.25-20 tons
	20 -63 tons
	>= 63 tons
Distinguishing Features	1) Heating type (none, gas, electric resistance) 2) Other features: (e.g., variable-speed fans and compressors associated with higher energy efficiency ratios [EERs])
Installation Scenarios	Single Package
Sources	NY TRM, Mid-Atlantic TRM, EVT TRM, Efficiency Maine TRM, MA TRM
Comments	Replace Unitary AC only There are no incremental labor costs for this measure.



Unitary AC costs



Base Costs are Determined and then for each market, multiplied by the appropriate equipment and labor factors

Base Cost Factors	Base Cost Factor (\$/Ton)	
Size Category (Tons)	CEE Tier 1	CEE Tier 2
5.4 to 11.25	\$63.42	\$126.84
11.25 to 20	\$63.42	\$126.84
20 to 63	\$18.92	\$37.83



Premium Pricing: Residential Air Conditioning



Consumer appliances and equipment often have features that increase cost without increasing energy savings

Navigant identified four premium features:

- » Durability and Appearance
- » Comfort and Noise Reduction
- » Improved Warranty
- » Improved Controls, Sensors, and Alarms

The Infinity 21 Series central air conditioner is engineered to be the best, with our highest SEER rating (up to 21). When combined with the advanced Infinity System, it is our most energy-efficient heating and cooling system, based on stringent ARI cost standards.

Key Features:	Please click below to download brochure.
† Up to 21 SEER	
† Tax Credit Eligible in 2, 3, and 4 tons † As low as 68 dB	
† Superior humidity control	
† Improved indoor air quality	
† Two-stage operation for ultimate comfort	
† Infinity® Control for maximum performance	
† Silencer System II™	
† WeatherArmor Ultra™ System	
† Enhanced diagnostics with Infinity control	
† Environmentally-sound Puron® refrigerant	
† 10-year Parts & Labor	
	



Residential AC Pricing



Navigant surveyed 4 major manufacturers, and examined features and pricing of various convenience features using pricing materials online data and dealer interviews

- » Overall conclusion: packaging of premium features is done in a generally opaque manner with respect to impacts on final cost to consumer. Premium features often offered only with high efficiency units.
- » Tear-down analysis may be best way to quantify isolating efficiency aspects from non-energy features



30 Measures Studied, in all



Measure	Sector	Fuel	Application	Cost Type	Source of Final Results	Measure Cost Shelf Life
Phase 1: Measures September 2011						
1 Air Sealing	Res	Gas/	RET	Full	Phase 1	
2 Air Source Heat Pumps	Res	Electric	RET	Incr	Phase 1	
3 Boilers (300-2,500 kBtu/h)	C&I	Gas	ROB	Incr	Phase 1	
4 Boilers (<300 kBtu/h)	Res	Gas	ROB	Incr	Phase 1	
5 Central Air Conditioning	Res	Electric	ROB	Incr	Phase 1	Medium
6 Combination Heat Hot Water	Res	Gas	ROB/NC	Incr	Phase 2	Frequent
7 Furnace Including ECMs (60-120 kBtu/h)	Res	Gas	ROB	Incr	Phase 1	
8 Indirect Water Heaters (30-65 Gal)	Res	Gas	ROB/NC		Phase 1	
9 Insulation, Attic, Cellulose	Res	Gas	RET	Incr	Phase 2	Stable
10 Lighting Controls	C&I	Electric	RET/NC	Full	Phase 1	
11 On Demand (Tankless) Water Heaters	Res	Gas	ROB	Incr	Phase 2	
12 On Demand (Tankless) Water Heaters (Condensing)	Res	Gas	ROB	Incr	Phase 2	Medium
13 Unitary Air Conditioning	C&I	Electric	ROB/NC		Phase 1	
Phase 2: Measures January 2013						
14 Dual Enthalpy Economizers	C&I	Electric	RET/NC	Incr, Full	Phase 2	Medium
15 Ductless Mini-Splits	Res	Electric	RET/NC	Incr, Full	Phase 2	Frequent
16 ENERGY STAR Ventilation Fans	Res	Electric	ROB/NC	Incr, Full	Phase 2	Medium
17 Prescriptive Chillers	C&I	Electric	ROB	Incr	Phase 2	Medium
18 Variable Frequency Drives	C&I	Electric	RET	Incr	Phase 2	Medium

Measures Studied (2)



Measure	Sector	Fuel	Application	Cost Type	Source of Final Results	Measure Cost Shelf Life
Phase 3: Measures June 2014						
Air Source Heat Pump	Com	Electric	ROB,NC	Inc	Phase 3	Stable
Heat Pump Water Heater	Res	Electric	ROB,NC	Inc	Phase 3	Stable
LED Refrigeration Case Lighting	Com	Electric	RET	Full*	Phase 3	Frequent
Steam traps	Com	Gas	ROB,NC	Full**	Phase 3	Stable
Unitary AC 65- 135kBh	Com	Electric	ROB,NC	Inc	Phase 3	Medium
Phase 4: Measures to be completed Spring 2015						
Air Compressors - multiple tiers and types	Com	electric				
Furnaces 225-500 kBh	Com	natural gas				
Infrared Heater	Com	gas				
Kitchen Equipment - Fryers	Com	gas				
Kitchen Equipment – Convection Ovens	Com	gas				
Refrigeration. Anti-sweat Heater Controls	Com	electric				
Variable Refrigerant Flow Multisplit AC Systems	Com	electric?				

How Data are Being Used



- » New England Gas Program Administrators used data to:
 - › Revise incentive levels for Combination Boilers / Domestic Hot Water units
 - In 2011 incentive was \$1,600
 - Non-qualifying models were removed from NEEP data set
 - Incremental cost was determined to be \$1,273.
Incentive was higher than incremental cost, so incentive lowered to below incremental cost - \$1,200
 - › Revise incentive levels for High Efficiency Gas Furnaces and Boilers
 - Used curve fits [incremental cost = f (efficiency, size)] from study to extrapolate to newer, more stringent efficiency levels than study covered.
- » Mid-Atlantic TRM (DE,MD, DC), includes incremental costs



How Data are Being Used



» NY DPS:

- › Used data for **Commercial Gas Hot Water Boilers** to develop Screening Tool for Pre-Qualified and Prescriptive Incentives
- › Used curve fit of incremental cost for 10 sizes and two efficiency levels

» NSTAR used cost data for **economizers**

- › To verify incentive levels
- › Recently as input to benchmarking programs



New York State Public Service Commission
Ensuring Safe, Reliable Service and Just, Reasonable Rates since 1907



» Efficiency Vermont used data for

- › Measure cost comparisons & research for preliminary analysis of custom projects
- › As supplemental info in measure cost database
- › Has/will be using ICS data for TRM Development activities (e.g. **Ductless Mini-Split** data)



Questions?



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Incremental Cost Study Team



Reports and ICS Reference Sheet can be found at:

<http://www.neep.org/initiatives/emv-forum/forum-products#EM&V>
Methods

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