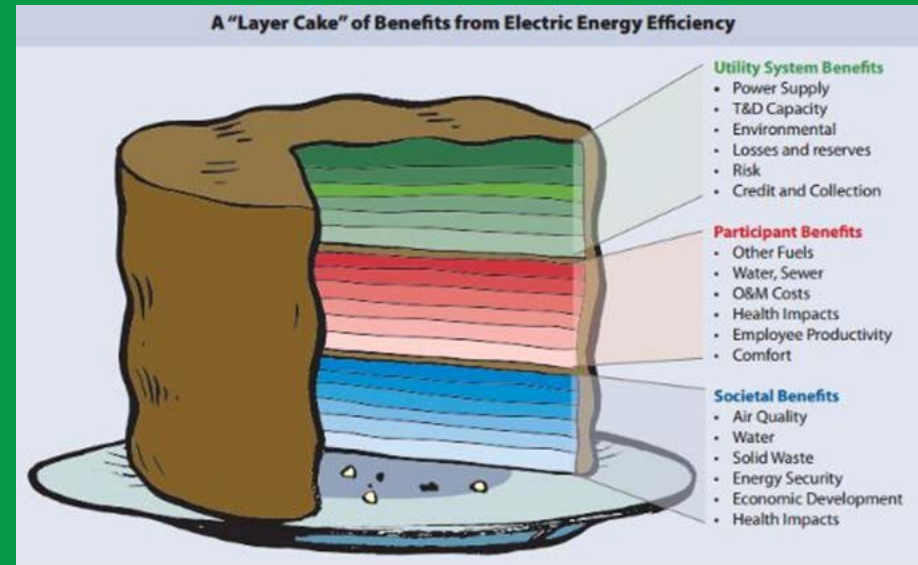


# Connecticut Benefit-Cost Testing

- Benefit Cost (B/C) Testing Overview
- CT B/C Evolution
- CT B/C Tests Detail
- Non-Energy Impacts
- Questions

Joe Swift, Eversource



Source: Raponline.org

# Benefit Cost Screening Overview

- Typically there are five types of tests that are used (often in combination)
  - Participant Cost Test (PCT).
  - Program Administrator Cost (Utility Cost) Test (PACT, or UCT)
  - Ratepayer Impact Test (RIM)
  - Total Resource Cost Test (TRC)
  - Societal Cost Test (SCT)
- These tests vary in terms of which benefits are included and which costs.

Component	PCT	PAC	RIM	TRC	SCT
Energy and capacity related avoided costs.	-	Benefit	Benefit	Benefit	Benefit
Additional resource savings	-	-	-	Benefit	Benefit
Non-monetized benefits	-	-	-	-	Benefit
Incremental equipment and install costs	Cost	-	-	Cost	Cost
Program overhead costs	-	Cost	Cost	Cost	Cost
Incentive payments	Benefit	Cost	Cost	-	-
Bill Savings	Benefit		Cost	-	-

[http://aceee.org/files/pdf/conferences/mt/2009/E2\\_Price.pdf](http://aceee.org/files/pdf/conferences/mt/2009/E2_Price.pdf)

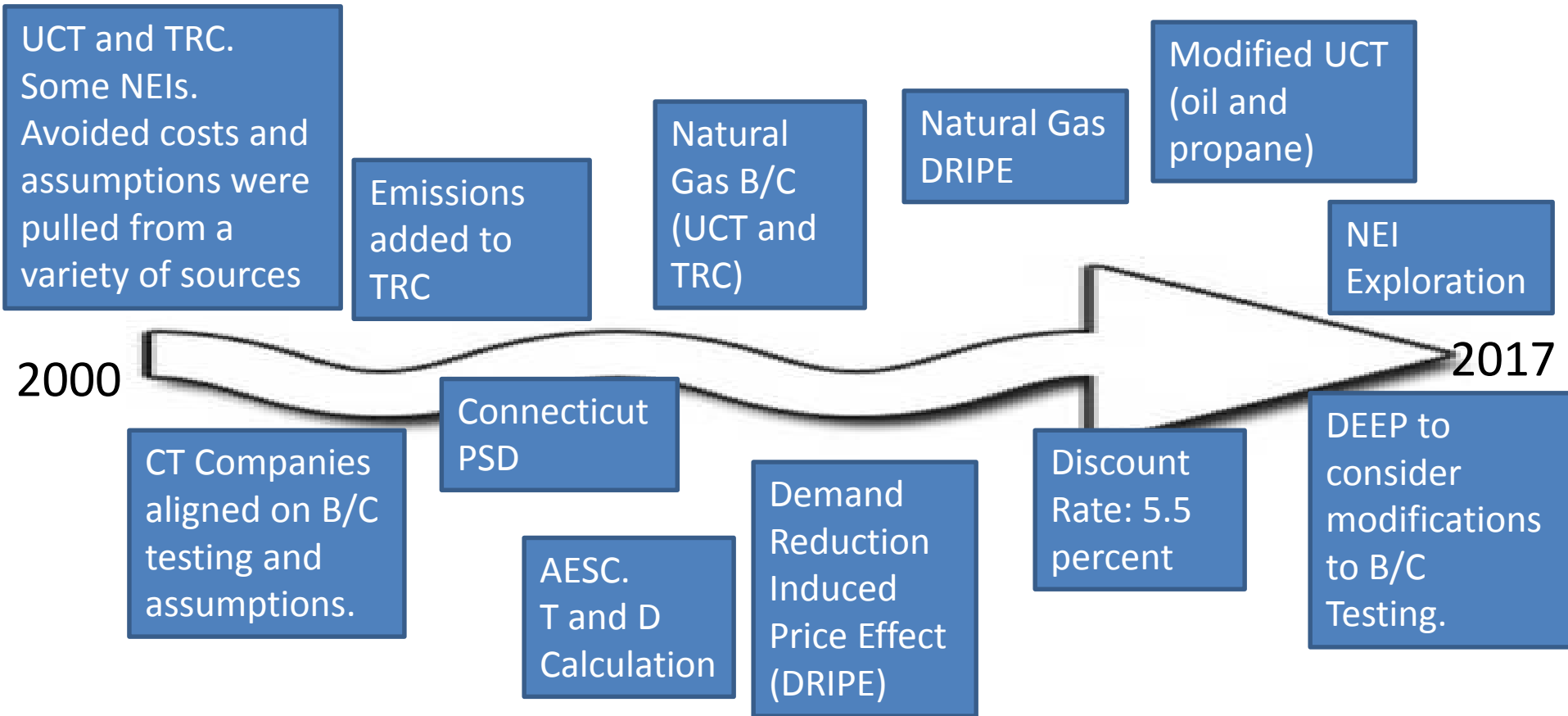
# PUBLIC ACT NO. 98-28 AN ACT CONCERNING ELECTRIC RESTRUCTURING

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- *“Programs included in the plan shall be screened through cost-effectiveness testing which compares the value and payback period of program benefits to program costs to ensure that programs are designed to obtain energy savings whose value is greater than the costs of the programs.”*
- *Updated language in PA 16-245m(d) is similar*



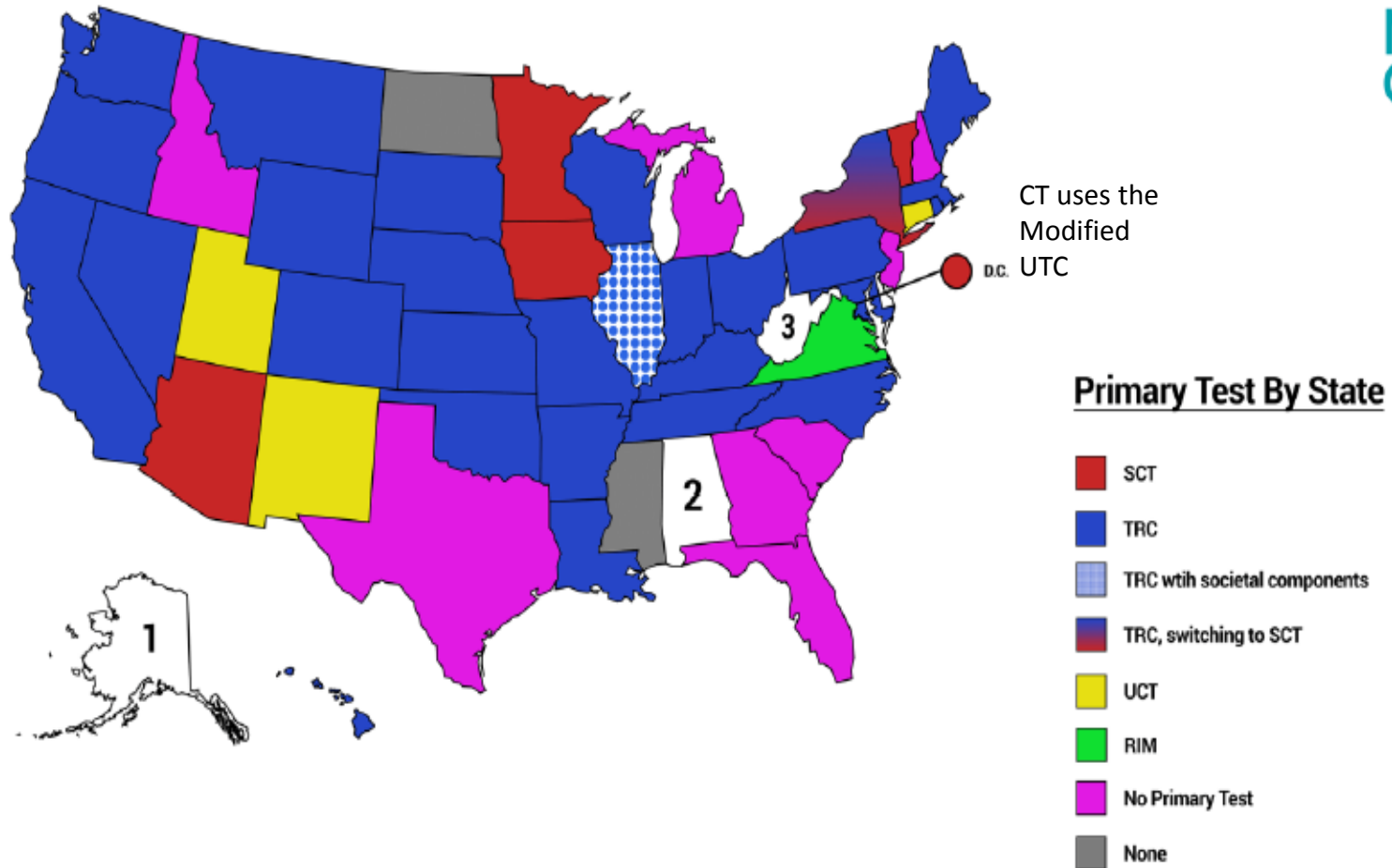
# Evolution of BC Testing in CT



# National Survey

- States (including CT) have adopted variations of these tests. Many states (including CT) use multiple tests.

Primary Cost Test Used by Different States					
PCT	UCT/PAC	RIM	TRC	SCT	Unspecified
	CT UT, TX	FL	CA, MA, MO, NH, NM,	AZ, ME, MN, VT, WI	AR, CO, DC, DE, GA, HI, IA, ID, IL, IN, Ks, KY, MD, MT, NC, ND, NJ, NV, OK, OR, PA, RI, SC, VA WA WY
Secondary Cost Test Used by Different States					
PCT	UCT/PAC	RIM	TRC	SCT	
AR, FL, GA, HI, IA, IN, MN, VA	AT, CA, CT, HI, IA, IN, MN, NO, NV, OR, UT, VA, TX	AR, DC, FL, GA, HI, IA, IN, KS, MN, NH, VA	AR, CA, CO, CT, DE, FL, GA, HI, IL, IN, KS, MA, ME, MN, MO, MT, NH, NM, NY, UT, VA	AZ, CO, GA, HI, IA, IN, MW, MN, MT, NV, OR, VA, VT, WI	



- 1 - No formally approved ratepayer-funded energy efficiency programs
- 2 - The Commission permits rate recovery for energy efficiency programs that are cost-effective for all retail customers.
- 3 - Appalachian Power is required to have a 3rd party program evaluator.

# Connecticut B/C Testing

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Currently, the Connecticut uses three types of B/C tests:

- **The Utility Cost Test (UCT)** includes the value of utility specific benefits and program costs associated with those benefits. For example, the Utility Cost Test includes energy avoided costs from electric/gas conservation measures/programs; and all program costs associated with acquiring those benefits. The Utility Cost Test does not include customer out of pocket costs or cost or benefits associated with oil or propane savings. Nor does the Utility Cost Test include indirect or societal benefits, such as reductions in emissions or non-energy benefits (e.g. water).
- **The Modified Utility Cost Test (MUCT)** includes all benefits and costs as the Utility Cost Test. **In addition, the Modified Utility Cost Test includes oil and propane avoided costs, and the program costs associated with acquiring oil and propane savings.** Note that the Modified Utility Cost Test currently applies only to residential programs that save oil or propane. This test is a blended (UCT/TRC) test and is unique to Connecticut.
- **The Total Resource Cost Test (TRC)** includes all energy and non-energy benefits, such as water savings, emissions, and non-resource savings. In addition, the Total Resource Cost Test includes all costs associated with acquiring savings. This includes program costs and customer out-of-pocket costs.





# Connecticut B/C Detail

Benefit Type (numerator)	Units	Utility Cost Test (Gas/Electric)	Modified Utility Cost Test	Total Resource Cost Test	Source
<b>Electric Program Benefits</b>					
Energy	\$/kWh	X	X	X	AESC
Capacity	\$/kW	X	X	X	AESC
Transmission (Note 1)	\$/kW	X	X	X	EDSs
Distribution (Note 1)	\$/kW	X	X	X	EDCs
DRIPE CT	\$/kWh	X	X	X	AESC
DRIPE ROP	\$/kWh	X	X	X	AESC
Capacity DRIPE (Note 2)	\$/kW	X	X	X	AESC
Cross Fuel DRIPE (CT)	\$/kWh	X	X	X	AESC
Non Embedded Emissions	\$/kWh			X	AESC
<b>Natural Gas Program Benefits</b>					
Gas	\$/MMBtu	X	X	X	AESC
DRIPE	\$/MMBtu	X	X	X	AESC
DRIPE ROP	\$/MMBtu	X	X	X	AESC
Cross Fuel DRIPE (CT)	\$/MMBtu	X	X	X	AESC
Cross Fuel DRIPE (ROP)	\$/MMBtu	X	X	X	AESC
<b>Other Benefits - Electric and Natural Gas</b>					
Oil (Note 3)	\$/MMBtu		X	X	AESC
Propane (Note 3)	\$/MMBtu		X	X	AESC
Water (non-gas water home)	\$/Gallons			X	CT rates (Note 4)
Non-Resource	\$ (varies)			X	Various (Note 5)
Fossil Emissions	\$/MMBtu			X (New)	AESC
<b>Cost (denominator)</b>		<b>Electric Cost (no oil/propane)</b>	<b>Program Cost (including oil, propane)</b>	<b>Total Cost (program + customer)</b>	

**Note 1:** Transmission and Distribution benefits are based on Electric Distribution Companies' (EDC) responses to Order 9 Final Decision Docket 08-10-03.

**Note 2:** Capacity DRIPE is zero based in the 2015 AESC. It is included in this table since it was a non-zero benefit in 2014.

**Note 3:** Oil and Propane benefits are assigned to electric programs. However, natural gas programs may include oil and propane benefits if oil and propane funding in electric programs is exhausted.

**Note 4:** Water benefits based on Tighe and Bond Water Survey for Connecticut. 2016 value calculated to be \$0.012.

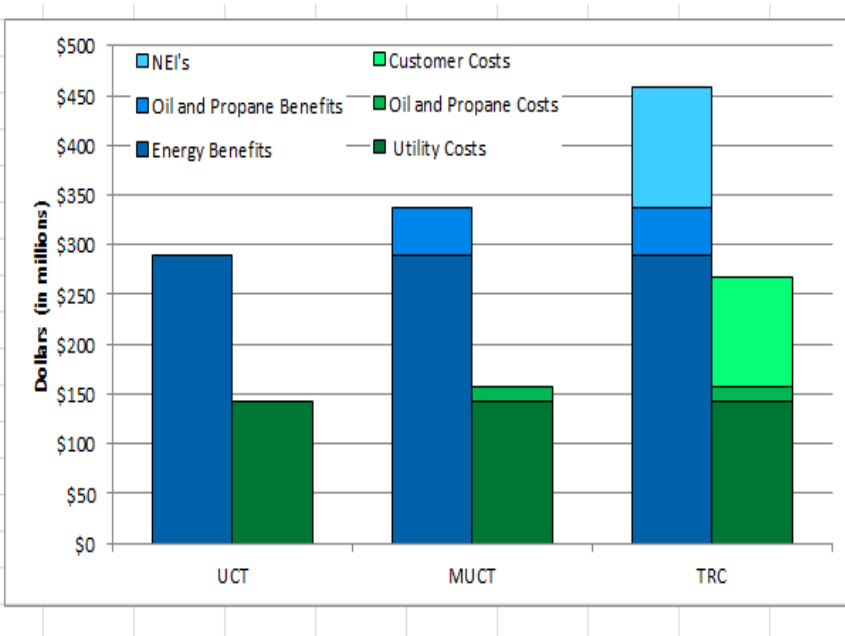
<http://rates.tighebond.com/index.aspx>

**Note 5:** Non-Resource benefit assumptions are included in the Program Savings Documentation (PSD).

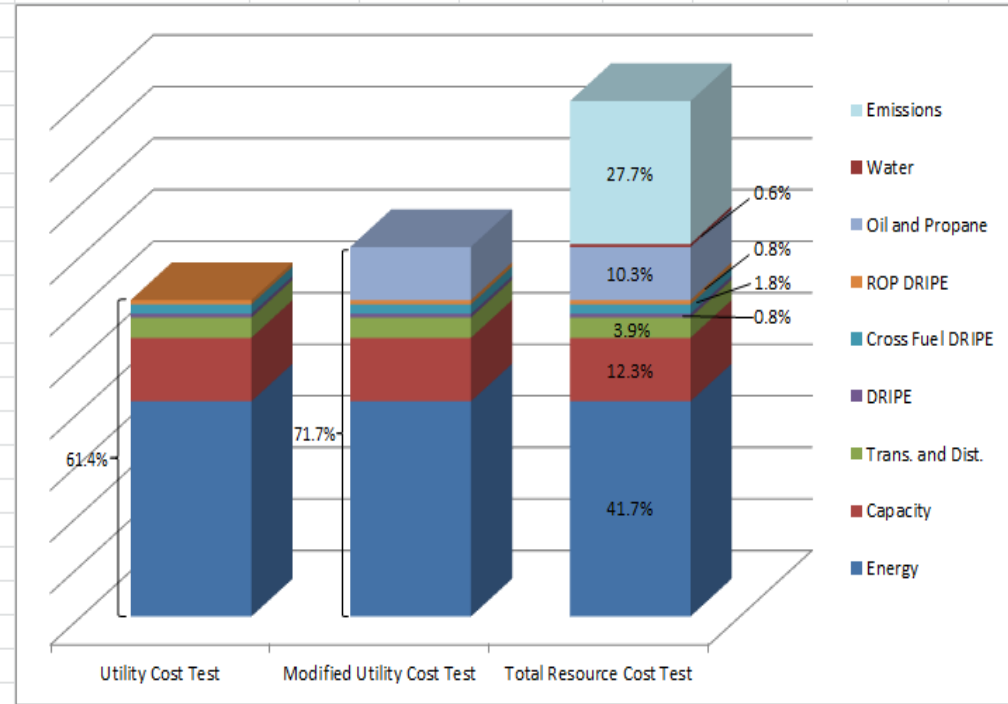


# 2017 Connecticut Electric Program

## Benefits and Costs



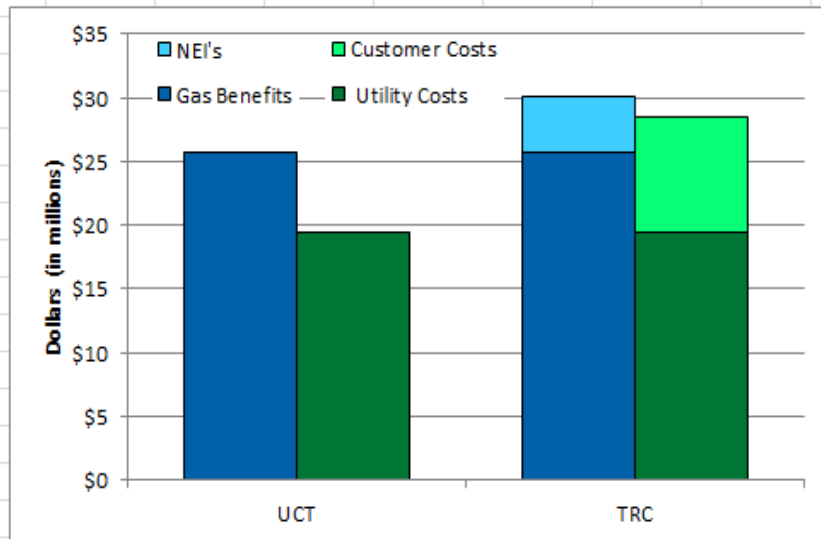
## Benefit Detail



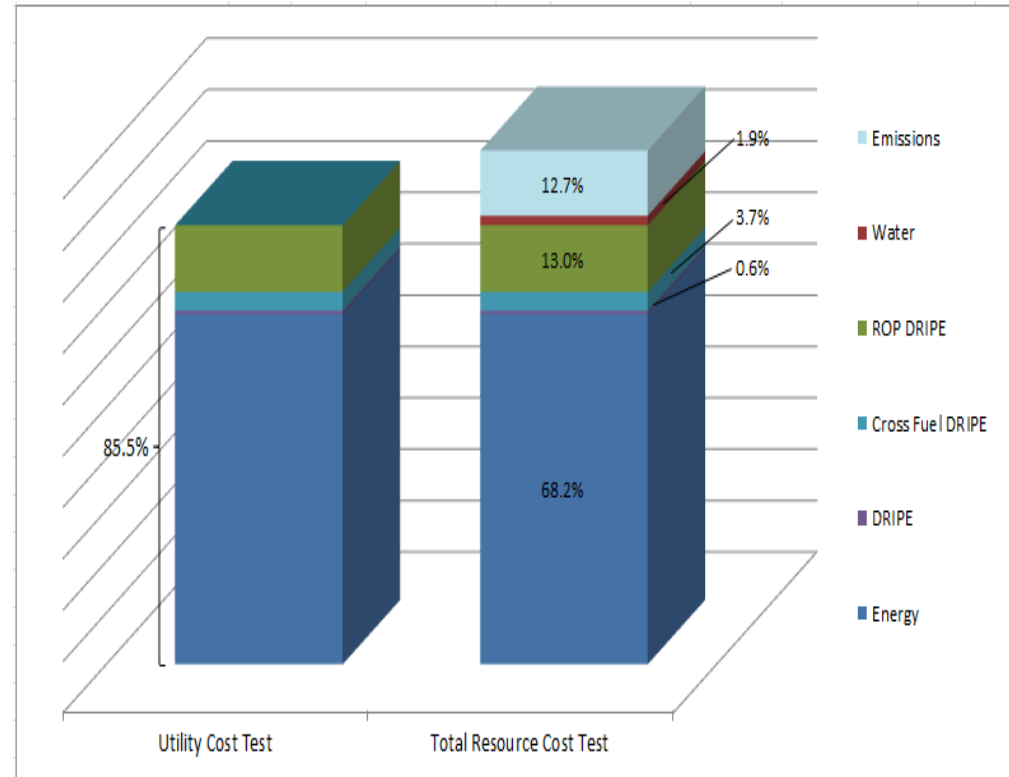
Note: Percentages are based on 2017 CT Plan Update (Eversource) total benefits associated with the Total Resource Cost Test

# 2017 Connecticut Gas Program

## Benefits and Costs



## Benefit Detail



Note: Percentages are based on 2017 CT Plan Update (Eversource) total benefits associated with the Total Resource Cost Test.

# Discount Rates

- Discount Rates are used in calculate future benefits (Net Present Value)
- Choice of discount rate makes a significant difference in the benefits (NPV) calculation.

Discount Rate	0.00%	2.00%	5.50%	10.00%
NPV for \$1 for 10 years	\$10.00	\$8.98	\$7.54	\$6.14

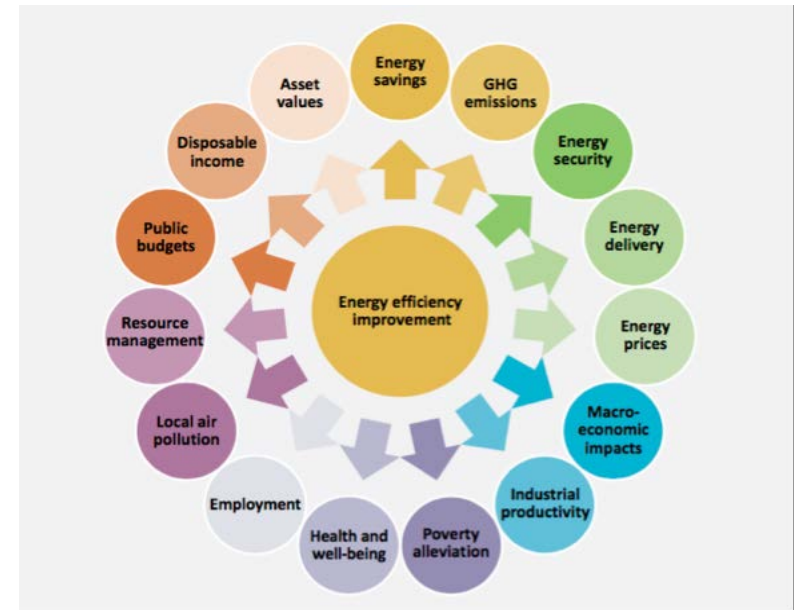
- It is challenging to select a single appropriate discount rate to screen programs because programs serve different classes of customers and benefits may flow directly to customers or be more societal (e.g. emissions)
- Choice of discount rate varies and different rationale are used to justify the choice of a discount rate\*. Typically, discount rates are aligned with the customers economic status. For Example:
  - For a household, it may be appropriate to use a typical lending rate.
  - C&I Customers often seek short payback measures implying a higher discount rate.
  - Utility Cost Tests often use the utility cost of capital
  - Societal benefits are often evaluating using lower discount rates.

\* Source: Understanding Cost-Effectiveness of Energy Efficiency Programs:  
Best Practices, Technical Methods, and Emerging Issues for Policy-Makers  
A RESOURCE OF THE NATIONAL ACTION PLAN FOR ENERGY EFFICIENCY  
NOVEMBER 2008



# Non-Energy Impacts

- Positive and negative non-energy benefits can result from various energy efficiency program activities, which together are referred to as non-energy impacts (NEIs)
- Types of NEIs
  - ✓ Participant-specific : Water, Comfort, Health, Durability, Maintenance
  - ✓ Utility-specific: Reduced spending on debt collection
  - ✓ Other: Economic Development, National Security, Environmental



Source: International Energy Agency

# Connecticut Non-Energy Benefits (NEIs)

- A recent evaluation identified and quantified some NEI “multipliers” associated with the residential weatherization and HVAC programs.

NEI	HES	HES-IE	HVAC	Multi-Family
Comfort	\$0.25	\$0.17	\$0.31	-
Outside Noise	\$0.04	\$0.05	\$0.06	-
Appliance Noise	\$0.05	\$0.06	\$0.15	-
Maintenance	\$0.07	\$0.08	\$0.18	\$0.15
Home Value	\$0.12	\$0.07	\$0.24	\$0.09
Home Appearance	\$0.03	\$0.06	\$0.04	-
Home Safety	\$0.05	\$0.07	\$0.05	\$0.21
Lighting Quality	\$0.08	\$0.14	-	\$0.14
Compliants	-	-	-	\$0.08
Total	\$0.69	\$0.70	\$1.03	\$0.67

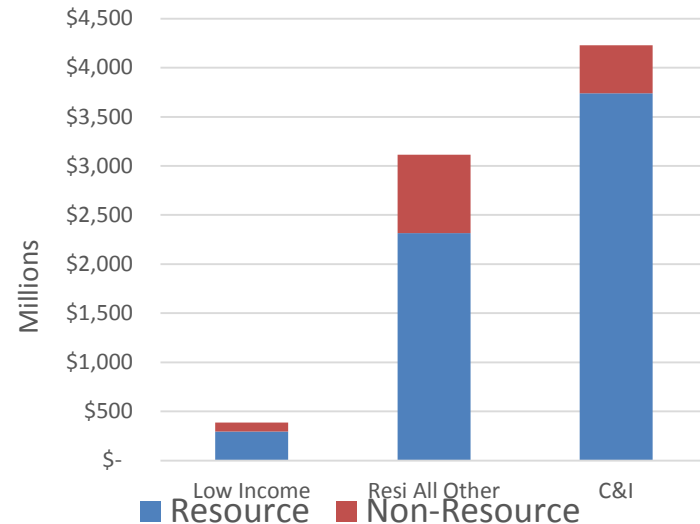
- Currently, the above NEIs are not included in the 2017 Plan Update.
- Connecticut currently includes emissions, water, O&M.
- An NEI study is currently included in the CT Evaluation Plan.
- DEEP is currently exploring modifications to the Connecticut benefit-cost testing.

Source: NMR Group, Inc. Submitted to Connecticut Energy Efficiency Fund Board, Eversource, and United Illuminating. Project R4 HES/HES-IE Process Evaluation and R31 Real-Time Research. April 13, 2016. Available at: <http://www.energizect.com>.

## Non-Energy Impacts – MA and NH

### Massachusetts

- MA policy is to fully quantify and capture the full suite of benefits from energy efficiency measures and programs
- Quantitative based on robust evaluations using widely accepted econometric tools
  - Annually per unit (i.e., a furnace or home)
  - Annually per kWh or therm saved
  - One time per unit
  - One time per kWh or therm saved
- Applied at the measure level within the Benefit/Cost model using values from the MA Technical Reference Manual



Mass Resource and non-Resource statewide benefits by sector (2013-2015 Term). Source: MassSaveData.com

### New Hampshire

- New Hampshire has included limited NEIs in the past (water)
- Utilities are proposing a 10 percent adder in the draft 2018-2020 plan.



# Questions??

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# Regional Survey

CT uses the “modified” PAC (UTC) as the primary test.

Cost-Effectiveness Metric		Connecticut	Delaware	District of Columbia	Massachusetts	New Hampshire	New York	Rhode Island	Vermont
Primary Policy Driver		Focus on electric system impacts only	Still under development	Energy efficiency programs must meet the Societal Cost test	All available cost-effective energy efficiency	Reduce market barriers to investments in cost-effective energy efficiency	Maximize cost-effectiveness given limited funding	All cost-effective energy efficiency	Least cost planning including environmental costs
Cost-Effectiveness Test(s) & Application	Primary Test	PAC	TRC	Societal	TRC	TRC	TRC	TRC	Societal
	Secondary Test	TRC	Societal; RIM						TRB; PAC
	Primary Screening Level	Program	Portfolio	Portfolio	Program	Program	Measure	Portfolio	Portfolio
	Additional Screening Level(s)		Program	Program, Project, Measure			Project, Program		Program, Project, Measure
	Discount rate used in Test	Utility WACC (currently 7.43%)	Societal Treasury Rate (rate TBD)	Societal 10Yr Treasury (currently 1.87%)	Low-Risk 10Yr Treasury (currently 0.55%)	Prime Rate (currently 2.46%)	Utility WACC (currently 5.5%)	Low-Risk 10Yr Treasury (currently 1.15%)	Societal (currently 3%)
	Study period over which Test is applied	Measure Life	Measure Life	Measure Life	Measure Life	Measure Life	Measure Life	Measure Life	Measure Life
Avoided Costs Included in Primary Cost-Effectiveness Test	Capacity Costs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Energy Costs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	T&D Costs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Environmental Compliance	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Price Suppression	Yes	Yes	Yes	Yes	No	No	Yes	No
	Line Loss Costs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Reduced Risk	No	Yes	Yes	No	No	No	No	Yes
OPIs/NEBs Included in Primary Cost-Effectiveness Test	Utility OPIs	No	No	No	Quantified	No	No	Quantified	Part of 15% Adder
	Participant OPIs								
	Resource	No	Yes - Calculation TBD	Quantified	Quantified	Quantified	Quantified	Quantified	Quantified
	Low-Income	Qualitative	No	Part of 10% Adder	Quantified	Qualitative	Qualitative	Quantified	Additional 15% Adder
	Equipment	No	No	O&M Quantified	Quantified	No	Qualitative	Quantified	O&M Quantified
	Comfort	No	No	Part of 10% Adder	Quantified	No	No	Quantified	Part of 15% Adder
	Health & Safety	No	No	Part of 10% Adder	Quantified	No	No	Quantified	Part of 15% Adder
	Property Value	No	No	Part of 10% Adder	Quantified	No	No	Quantified	Part of 15% Adder
	Utility Related	No	No	Part of 10% Adder	Quantified	No	No	Quantified	Part of 15% Adder
	Societal OPIs	No	No	Part of 10% Adder	No	No	No	Quantified	Part of 15% Adder

Source: Energy Efficiency Program Screening: Let's get Beyond the TRC Test.

Synapse Energy Economics, Inc.

Note: Current CT value is 5.5 percent (nominal)

# Benefit-Cost Testing Illustration\*

**Benefits = net savings \* avoided costs**

9.215 kW electricity

13,823 kWh electricity

0 mmbtu natural gas

0 mmbtu other fuel

0 gallons water

0 units non-resources

\$50 per kW electric capacity

\$0.08 per kWh electric energy

\$10 per mmbtu natural gas

\$13 per mmbtu other fuel

\$0.01 per gallon water

\$(variable) per units non-resources

$$\text{Year 1 benefits} = (9.215 * \$50) + (13,823 * \$0.08) + (\$10 * 0) + \dots = \$1,566.59$$

- The benefits are calculated for each year of the widget life and present valued using a discount rate to determine lifetime benefits

\* Source: 2015 AESC Regional Avoided Cost Study: Update. MA Energy Efficiency Council, March 31, 2015

# 2015 Avoided Cost Study (AESC)

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- Finalized March 27, 2015
- Use in the current CT three-year Plan, 2016-2018
- Avoided Energy Supply Component (AESC) Study Group;
  - 6 New England States
  - Program Administrators, State Government Representatives, EE Consultants
- 2013 AESC was the most recent prior study,
  - Used for the 2014-2015 programs
  - Study has been done every 2 years
  - Now will be 3 year cycle (matches CT, MA 3 yr. Plans)
- Based on updated market prices and forecasts
- New contractor (TCR), models, and assumptions for the 2015 AESC study
- Significant decline in avoided costs for both electric and natural gas due primarily to lower projected natural gas costs as well as pipeline expansion projections.