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# The Total Resource Cost Test in Rhode Island

$$Z = \frac{1}{\chi_1 + \chi_2}\left[\begin{array}{l}\lambda(\chi_1+\chi_2)S_\lambda + (Z_A+Z_B)C_\lambda \\ + \dfrac{Z_A Z_B S_\lambda}{\lambda(\chi_1+\chi_2)}\end{array}\right]^{-1}$$

$$\times\left\{\begin{array}{l} L\lambda\chi_1\chi_2(\chi_1+\chi_2)S_\lambda + \chi_1[\lambda\chi_1 S_\lambda + L\chi_2 C_\lambda]Z_A \\ + \chi_2[\lambda\chi_2 S_\lambda + L\chi_1 C_\lambda]Z_B \\ + \left[2\chi_1\chi_2 + (\chi_1^2+\chi_2^2)C_\lambda + \dfrac{L}{\lambda}\chi_1\chi_2 S_\lambda\right]\dfrac{Z_A Z_B}{\chi_1+\chi_2}\end{array}\right\}$$

Presentation to Rhode Island Public Utilities Commission

May 8, 2014

# Agenda

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- PART 1. Current application of the TRC Test in RI
  - Background
  - Why RI uses the TRC
  - Components of TRC
  - Examples
  - Special Cases
- Part 2. Current perspectives on TRC Test
  - Overview of National Effort
  - How Rhode Island looks through this lens
  - Rates, bills, participants, equity and cross-subsidization
- Part 3. Does the RI TRC Test need tweaking?
  - Preview of modifications recommended in revised standards
  - State Energy Plan recommendations may provide further guidance

# Background

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- **General reason for cost effectiveness testing**
  - use of consumer funds
- **RIGL cost effectiveness requirement**
  - **§ 39-1-27.7 System reliability and least-cost procurement** simply states "The commission shall issue an order approving all energy efficiency measures that are cost effective and lower cost than acquisition of additional supply"
  - Does not specify test or components for energy efficiency in general
  - Does specify components for combined heat and power

# Cost Effectiveness Tests

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**Table 1: Components of the Energy Efficiency Cost-Effectiveness Tests**

| | PAC Test | TRC Test | Societal Cost Test |
|---|---|---|---|
| **Energy Efficiency Program Benefits:** | | | |
| Avoided Energy Costs | Yes | Yes | Yes |
| Avoided Capacity Costs | Yes | Yes | Yes |
| Avoided Transmission and Distribution Costs | Yes | Yes | Yes |
| Wholesale Market Price Suppression Effects | Yes | Yes | Yes |
| Avoided Cost of Environmental Compliance | Yes | Yes | Yes |
| Reduced Risk | Yes | Yes | Yes |
| Other Program Impacts (utility-perspective) | Yes | Yes | Yes |
| Other Program Impacts (participant-perspective) | --- | Yes | Yes |
| Other Program Impacts (societal-perspective) | --- | --- | Yes |
| **Energy Efficiency Program Costs:** | | | |
| Program Administrator Costs | Yes | Yes | Yes |
| EE Measure Cost: Program Financial Incentive | Yes | Yes | Yes |
| EE Measure Cost: Participant Contribution | --- | Yes | Yes |
| Other Program Impacts (participant costs) | --- | Yes | Yes |

Source: NEEP

# Why RI Uses the TRC

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- Transitioned from RI Test to TRC test in 2009 Plan
  - 2009 Plan was first year of first three year plan under LCP
- Stated purposes of the "Comprehensive Energy Conservation, Efficiency and Affordability Act of 2006" had a strong focus on consumer benefits
  - RI Test was essentially a PAC test
  - TRC test does a better job of counting participant costs and benefits than RI Test
- TRC test also captures that efficiency costs less than supply
- TRC was also area of political/industry consensus at the time

# TRC Framework

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- Calculate present value over life of measure, project, or program using avoided costs of resource and non-resource benefits
- Compare present value to incremental cost (rebate and customer cost)
- Total Resource Cost (TRC) Ratio = Benefits/Costs
- Benefit/Cost (B/C) ratio must be greater than 1 after inclusion of other costs
  - At program level include costs of administration, marketing, and evaluation and aggregate across all measures
  - At portfolio level include non-program costs, such as pilots, regulatory costs, and shareholder incentive
- *What follows is largely documented in Appendix C of Company's 2009-11 Least Cost Procurement Plan in Docket 3931*

# How Does the TRC Test Determine Cost Effectiveness?

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- TRC test is applied by dividing the total lifetime **benefits** of a program by the total **costs** of the program, to create a Benefit Cost Ratio (BCR):

$$BCR = \frac{\text{Total benefits (\$)}}{\text{Total costs (\$)}}$$

| If the BCR is | it is considered | because |
|---|---|---|
| ≥ 1.0 | cost effective | benefits exceed costs |
| < 1.0 | not cost effective | costs exceed benefits |

# TRC Test: Benefits

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- **Benefits** = $ value of avoided supply costs and non-energy impacts resulting from a program over the lifetime of the measure
- Benefits accrue from:
  - Avoided energy, valued at different times (summer/winter and on/off peak)
  - Avoided capacity, based on its value during peaking periods
  - Avoided transmission
  - Avoided distribution
  - Avoided fuel (natural gas, oil, or other delivered fuels) use
  - Effects on energy market prices, or DRIPE (electric and cross fuel), included in energy and capacity avoided costs
  - Non-Energy Impacts Reductions in all costs associated with reduced customer arrearages, service terminations, and reconnections

# TRC Test: Benefits continued

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- **Benefits** are calculated using net savings of:
  - Electric energy (kWh)
  - Electric capacity (kW)
  - Natural gas (MMBtu)
  - Fuel, water, and sewer resources (MMBtu oil, kerosene, etc.; gallons of water; etc.)
  - Non-resources (include LI benefits, O&M savings, etc.)
  - Environmental benefits associated with RGGI are included in energy avoided costs.

# TRC Benefits

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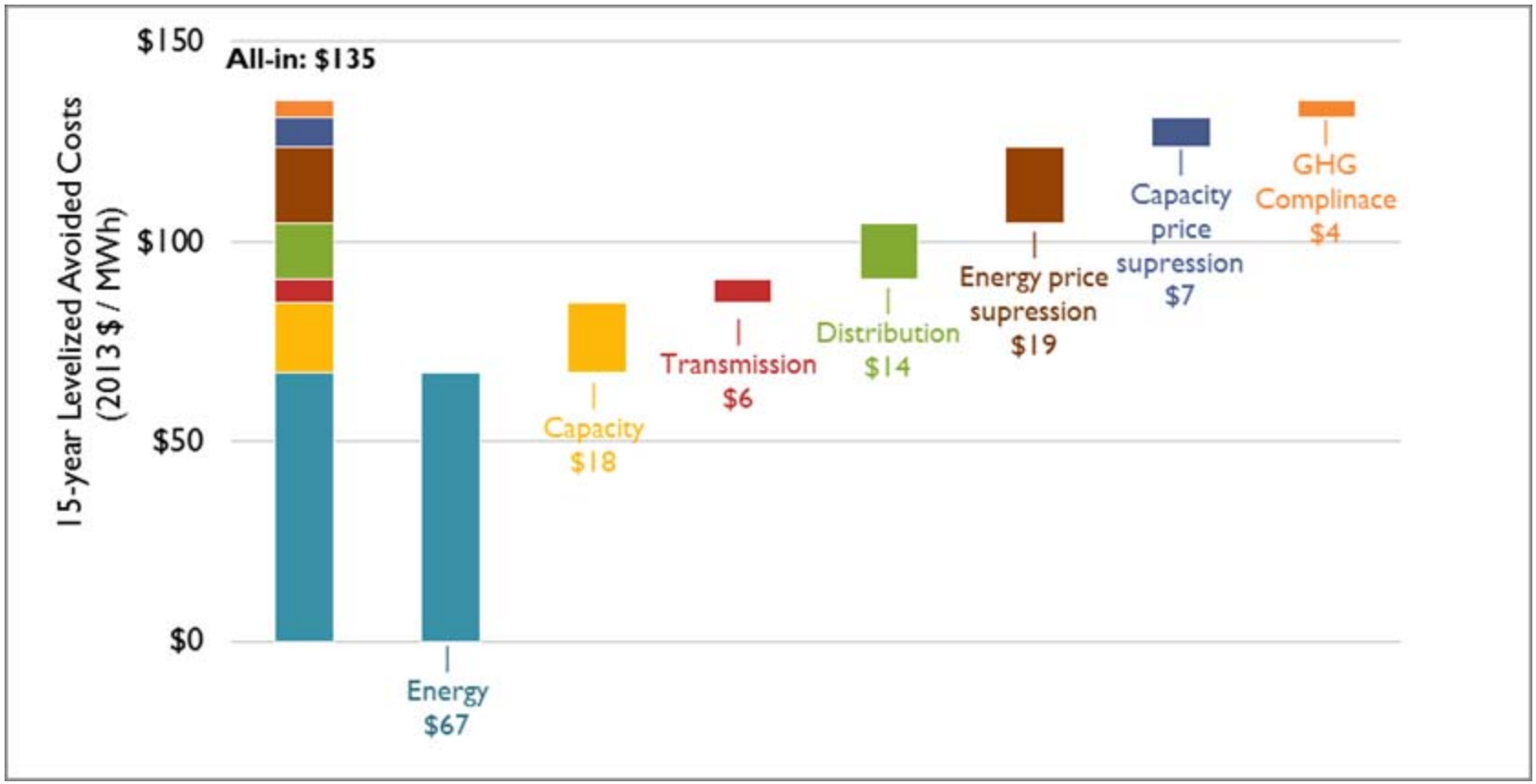


Source: Synapse

# TRC test: Costs

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- Costs = $ value of all costs
  - Program implementation costs include:
    - Program planning and administration
    - Marketing and advertising
    - Program participant incentives (rebates)
    - Sales, technical assistance and training
    - Evaluation, measurement, and verification
  - Program participant costs; these are the measure costs minus program participant incentives (i.e. total customer costs for the measures installed)
  - Shareholder incentive cost (sector and portfolio level)
  - Measure costs can be total costs or incremental costs depending on the program

# Participant Costs

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- Participant cost = measure cost - participant incentive

- Measure cost is equal to:
  - Incremental cost of the energy efficient alternative over the standard efficiency product/service for new construction or time of replacement programs, because customer would have paid for the standard efficiency alternative anyway

  OR

  - Total cost of the efficiency product/service for retrofit programs

Standard efficiency widget = $500

Energy efficient widget = $625

**Measure cost (incremental) = $125**

No new widget = $0

Energy efficient widget = $625

**Measure cost (total) = $625**

Assume incremental cost of widget is $125 and participant incentive is $50:

Participant Cost = $125 - $50 = $75

# Program Cost Effectiveness

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- Program BCRs include:
  - All lifetime benefits and all costs associated with all program measures
    - Plans must include sufficient information to determine measure cost-effectiveness
    - In aggregate, measures must accrue sufficient benefits for the overall program to be cost-effective
  - Other costs associated with the program

# Program BCR example

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| | Lifetime Benefits | Costs | $\frac{\text{Lifetime Benefits}}{\text{Costs}}$ | BCR |
|---|---|---|---|---|
| Measure A | $125 | $75 | $\frac{125}{75}$ | 1.67 |
| Measure B | $200 | $200 | $\frac{200}{200}$ | 1.00 |
| Measure C | $150 | $100 | $\frac{150}{100}$ | 1.50 |
| PP&A, marketing, etc. | | $50 | | |
| **Total Program** | **$475** | **$425** | $\frac{\mathbf{475}}{\mathbf{425}}$ | **1.12** |

# Portfolio Cost Effectiveness

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- Portfolio must be cost effective
  - Counts all benefits and all costs associated with all programs
  - Also counts other costs associated with pilot programs, hard to measure efforts, regulatory allocations, and general administration expenses
    - Such efforts might not have immediate energy savings or whose energy savings may be difficult to quantify and therefore cannot be included in program benefits calculations and themselves should not be expected to be cost effective
  - In aggregate, programs must have sufficient benefits for the overall portfolio to be cost-effective

# Benefits

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- Benefits = Gross Savings * Impacts Factors * Value Components
  - **Gross savings** are from engineering analysis, manufacturer's specs, etc. linked to **TRM** (except site specific calculations)
  - **Impact factors** are spillover, free-ridership, coincidence, in-service rates, persistence and realization rates from evaluations to determine the savings actually attributable to program efforts
    - Gross Savings * Impact Factors = Net Savings
  - **Value components** are avoided cost factors and non energy impacts per unit
  - Benefits are in Net Present Value (NPV) dollars over the lifetime of the measure or program
    - Discount rate reflects risks in cost and benefits of energy efficiency

# Gross Savings

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- Gross savings = savings resulting from a technology represented by:
  - kW and kWh of electricity
  - MMBtu of natural gas
  - MMBtu of other fuel resources
  - gallons of water and/or sewage
  - units of non-resources

# Technical Reference Manual (TRM) nationalgrid

- Documents how we count energy savings and provides transparency for each measure or measure category
  - Contains savings and impact factors
- Sources are evaluation studies, engineering calculations, or agreed to ("deemed") values
- Provides consistent format and transparency
- Edited annually
  - New evaluations, engineering analyses, baselines from codes and standards
- TRM links to Company's tracking system and benefit/cost model assumptions; all contain same values for 2014

# Value Components

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- Avoided costs of supply are all costs associated with decrease in energy use resulting from the energy efficiency measure or program. They are represented by cost factors of $ value per unit savings from regional avoided cost study :
    - $ value per kW of generation capacity
    - $ value per kWh of electricity
    - $ value per MMBtu of natural gas
    - $ value per MMBtu of fuel resources or gallons of water
    - $ value of price suppression benefit per kWh, kW, or MMBtu
- Avoided transmission and distribution capacity in $/kW are annualized costs of avoidable investments from a spreadsheet model developed by an avoided cost study contractor
- Avoided water and sewer values in $/gallon are from a survey of water districts.
- Non-energy impacts (previously called NEBs) are other benefits, such as O&M reductions, low-income service benefits, etc.
    - $ value per unit or participant

# Electric Benefits Example

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- **CFL saves 0.043 gross kW and runs 1,022 hours a year.**
  - Simplified net savings equations from the TRM:
    - Net kW savings = Gross kW * Realization Rate * Net to Gross Ratio
    - Net kWh savings = Gross kW * hours of use * Realization Rate * Net to Gross Ratio
    - Assume net to gross ratio of 43% (from evaluation) and realization rate of 100% (from evaluation)

Net kW savings = 0.043 kW * 1.0 * 0.43 = 0.018 kW

Net kWh savings = 0.043 kW * 1,022 hrs * 1.0 * 0.43 = 18.9 kWh

# Example Calculation of Benefits

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Benefits = net savings * avoided costs over the life of CFL

| | |
|---|---|
| 0.018 kW electricity | $173.1 per kW electric capacity |
| 18.9 kWh electricity | $0.33 per kWh electric energy |
| 0 MMBtu natural gas | $0 per MMBtu natural gas |
| 0 MMBtu other fuel | $0 per MMBtu other fuel |
| 0 gallons water | $0 per gallon water |
| 0 units non-resource | $1.23 one-time per unit non-resource |

Benefits = (0.018 * $173.1) + (18.9 * $0.33) + ($1.23) = $10.50

Costs = Incentive ($1.40) + Customer Cost ($1.60) = $3.00

**TRC = Benefits ($10.50) ÷ Costs ($3.00) = 3.5**

# Gas Benefits Example

- **A 95% AFUE Boiler saves 27.8 gross MMBtu a year.**
  - Simplified net savings equations from the TRM:
    - Net MMBtu savings = Gross MMBtu * Realization Rate * Net to Gross Ratio
    - Assume net to gross ratio of 62.6% (from evaluation) and realization rate of 100% (from evaluation)

Net MMBtu savings = 27.8 MMBtu * .626 * 1.0 = 17.4 MMBtu

# Example Calculation of Benefits

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Benefits = net savings * avoided costs over the life of PRSV

| | |
|---|---|
| 0 kW electricity | $0 per kW electric capacity |
| 0 kWh electricity | $0 per kWh electric energy |
| 17.4 MMBtu natural gas | $220.27 per MMBtu natural gas |
| 0 MMBtu other fuel | $0 per MMBtu other fuel |
| 0 gallons water | $0 per gallon water |
| 0 units non-resource | $0 one-time per unit non-resource |

Benefits = (17.4 * $220.27) = $ 3,833

Costs = Incentive ($1,500) + Customer Cost ($1,979) = $3,479

**TRC = Benefits ($3,833) ÷ Costs ($3,479) = 1.1**

# Special Cases: Home Energy Reports

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- Savings are calculated by comparing energy usage of treatment group to control group through a billing analysis, the difference is attributable to program
  - Savings are statistically significant
  - Methods adhere to best practices recommended by DOE & EPA's SEE Action
    - Vendor conducts billing analysis regularly to report savings
    - Evaluation contractor determines accuracy of billing analysis and cross-program participation, creating a realization rate
- Once savings are identified, the calculation of the TRC BCR is the same as any other program

# Special Case: CHP

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- R.I. Gen. Laws §39-1-27.7(c)(6)(iii), identifies specific benefits to be valued for CHP (1) direct and indirect job creation and retention; (2) energy and cost savings for customers; (3) energy supply costs; (4) greenhouse gas emission standards and air quality benefits; and (5) system reliability benefits
  - The Toray docket, #4397 identifies how each one of these benefits were quantified
  - See response to Commission 1-5 and Division 1-1 in that docket
- CHP is only element of LCP to have assigned to it economic benefits and greenhouse gas reduction benefits
- These benefits can accrue to CHP because the Legislature specifically assigned these benefits to CHP under Least Cost Procurement
  - The TRC test is flexible enough to look at different measures differently, if doing so is consistent with state policy

# Other Special Cases Under EE

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- Pilots
  - Not necessarily expected to be cost effective
  - Are part of portfolio cost effectiveness
- Demand rich measures/Demand Response
  - May have opportunity costs for participants in addition to measure costs
  - May have ancillary benefits depending on type of resource

# Questions?

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