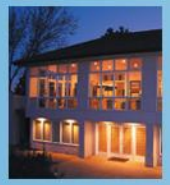





GDS Associates

Estimating the Potential for Energy Efficiency Resources

Efficiency Maine Symposium:
In Pursuit of Maine's Least-Cost Energy

September 7, 2011

Project Background

- **In 2007, GDS Associates was engaged by Central Maine Power to develop an estimate of the Maximum Achievable Cost Effective (MACE) Potential for Energy Efficiency and Demand Response in five sub-areas of the CMP Service Territory, 2008-2017**
- **In 2009, GDS updated these estimates for the following sub-areas, 2009-2018:**
  - *Northern Maine*
  - *Winslow-Skowhegan*
  - *Midcoast*
  - *Western Maine*
  - *Lewiston Loop*
  - *Southern Maine*
  - *South Portland Loop*

Overview of Methodology for Energy Efficiency

1. **Identify energy efficiency measures to be included**
   - *Extensive GDS measure database plus review of other studies and programs*
   - *Determine characteristics of each measure*
   - *Incremental cost, energy savings, saturation, measure life*
2. **Determine baseline & forecasted electric end-use characteristics**
   - *Saturation levels & consumption, by market segment and end use*
3. **Conduct cost-effectiveness screening & sorting of measures**
   - *Rank measures: least to highest levelized cost/kWh saved*
4. **Calculate technical & maximum achievable potential**
5. **Identify measures that pass the Maine Modified Societal Test**
6. **Calculate maximum achievable cost-effective (MACE) potential**

Maine Modified Societal Test

Programs that are reasonably likely to satisfy the Modified Societal Test are cost effective. The Modified Societal Test is satisfied when the program benefits exceed the program costs. Costs and benefits shall be considered in the Modified Societal Test regardless of whether they are paid or experienced by the participant, the Conservation Program Fund, or any other individual, business, or government agency.

Program benefits:

1. **Avoided electric generation costs** including energy and capacity costs,
2. **Avoided transmission and distribution costs**,
3. **Avoided fossil fuel costs**,
4. **Other resource benefits**, such as reduced water and sewer costs,
5. **Non-resource benefits**, including customer benefits such as reduced operation and maintenance costs, deferred replacement costs, productivity improvements, economic development benefits and environmental benefits, to the extent such benefits can be reasonably quantified and valued.

Program costs:

1. **Direct program costs**,
2. **Measure costs**,
3. **Ongoing customer costs**.

Basic Residential Sector Technical Potential Equation

For Each Measure:

Residential Technical Potential = **Number of Households** x **Saturation of Applicable End-Use** x **Percent Inefficient** x **Convertible Factor** x **Savings Factor**

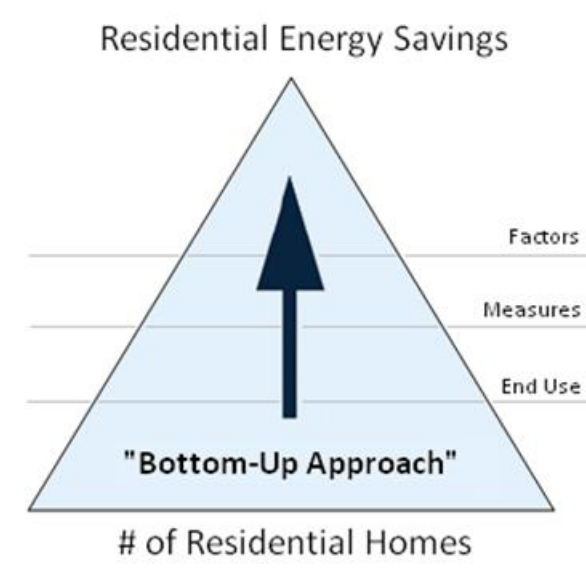
Where:

- **Saturation** = Percent of Households that have the applicable end-use
- **Percent Inefficient** = Percent of the end-use (lighting, appliance, etc.) that is not efficient (e.g., not Energy Star labeled)
- **Convertible Factor** = Fraction of existing end-use that are feasible to replace (e.g., it is not possible to replace all lighting with CFLs – fluorescent tubes, LED, no bulb, other bulbs)
- **Savings Factor** = Annual kWh saved per measure

Typical Residential Measures Considered

End Use Type	End-Use Description	Measures/Programs Includes
Appliances	General Home Appliances	* Dehumidifiers * Refrigerators * Freezers * Refrigerator/Freezer Turn-In
Appliances/WH	Kitchen/Laundry	* Clothes Washers, Dishwashers * Heat Pump Dryers
Electronics	Home Electronics	* Controlled Power Strips * Laptops, Computer Monitors * Televisions (LED, LCD, Plasma) * Set Top Boxes * Misc. Consumer Electronics
HVAC (Envelope)	Building Envelope Upgrades	* Insulation * Air Sealing * Duct Sealing * Energy Star Windows
HVAC (Equipment)	Heating/Cooling /Ventilation Equipment	* Efficient Central AC * Room AC * Efficient Furnaces * Efficient Boilers * Dual-Fuel Systems * Bathroom Exhaust Fans
Lighting	Indoor/Outdoor Lighting	* Incandescent to CFL/LED * CFL to LED
Other	Miscellaneous Efficiency Measures	* Pool Pump Motor * Direct Feedback Devices (In Home Display Units) * Indirect Energy Consumption Feedback
Water Heating	Domestic Hot Water	* Efficient Storage Tank WH * Tankless Water Heater (Gas) * Heat Pump WH * Solar WH (w/ Electric Back Up) * Tank Wrap, Pipe Wrap * Low Flow Showerheads, Faucet Aerators

Example: Developing Technical Potential Estimates



Tech. Potential Example:

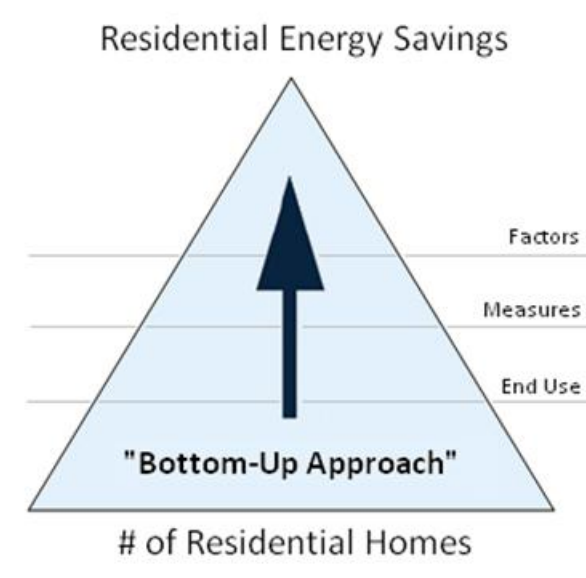
- **100,000 homes**
- **75% have dishwashers**
- **25% of all dishwashers are energy efficient *(Remaining potential is 75%)***
- **70 kWh annual savings**

100,000 * 75% = 75,000 homes

75,000 * 75% (*100%-25%)= 56,250 homes

56,250 * 70kWh = 3,937,500 kWh

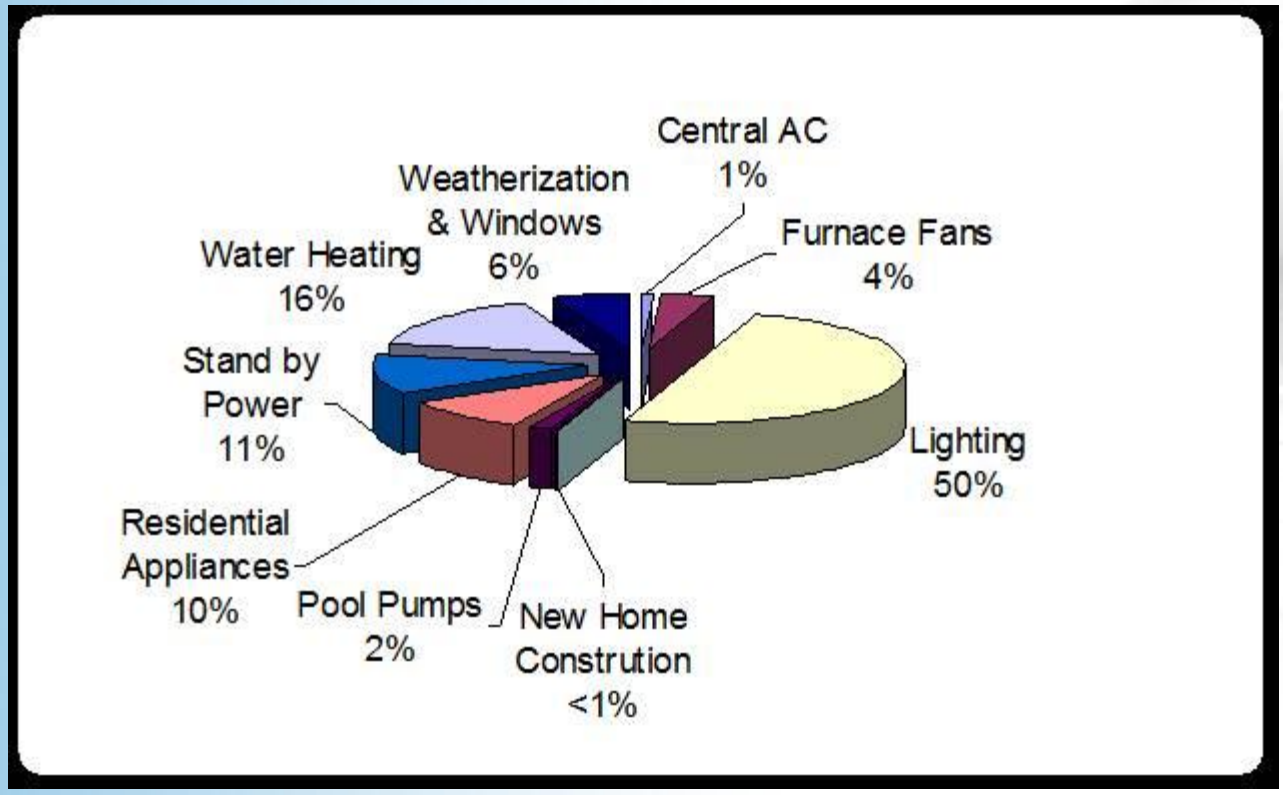
Example: Savings from a CFL



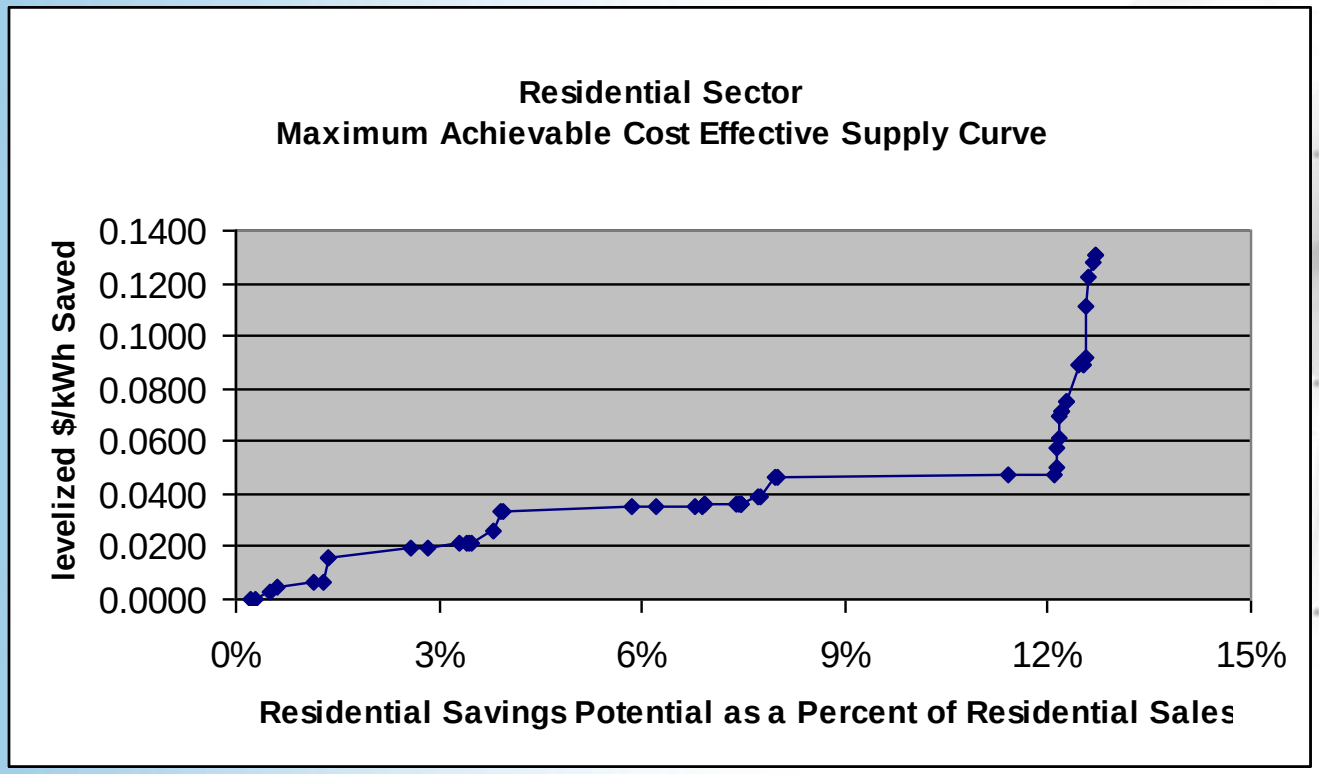
<u>CFL replacing an Incandescent</u>:

- **17 Watts vs. 60 Watts**
- **43 Watts Saved * Hours of Use (986) = 42 kWh/year**
- **Lifetime savings = 42 kWh * Useful Life (6.8 years) = 288 kWh**
- **Peak Savings**
  - **Summer** = 43 Watts * 8.2% = 3.5 Watts (i.e., one million CFLs = 3.5 MW)
  - **Winter** = 43 Watts * 33.6% = 14.4 Watts (i.e., one million CFLs = 14.4 MW)

Residential MACE Energy Savings by End-Use



Residential Energy Efficiency Supply Curve



Basic Commercial/Industrial Technical Potential Equation

For Each Measure:

Commercial/Industrial Technical Potential = **Total End-Use Energy Sales** x **Base Case Factor** x **Remaining Factor** x **Conversion Factor** x **Savings Factor**

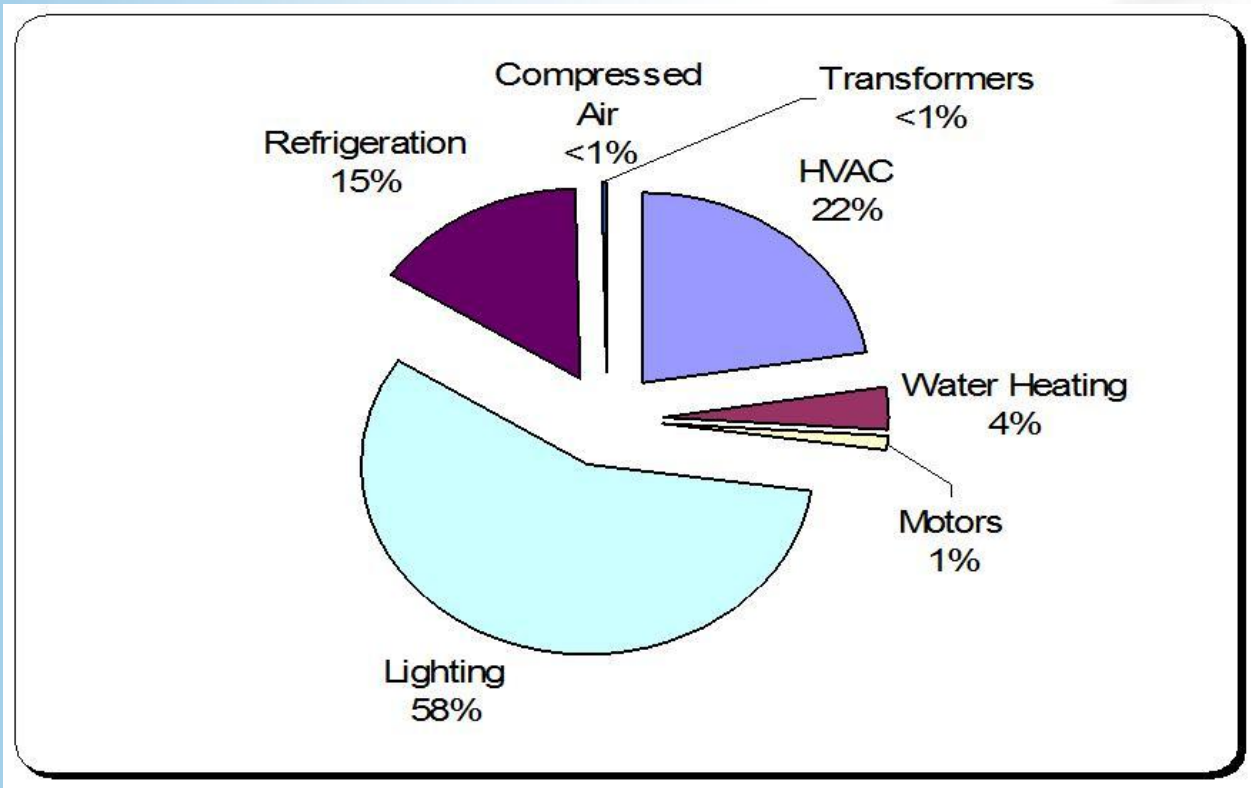
Where:

- **Base Case Factor** = Fraction of the end-use electric energy that is applicable for the measure
- **Remaining Factor** =Fraction of applicable kWh sales that are associated with equipment that has not yet been converted to the measure
- **Conversion Factor** = Fraction of the equipment that is technically feasible for conversion
- **Savings Factor** = Percentage reduction in electricity use resulting from application of the measure

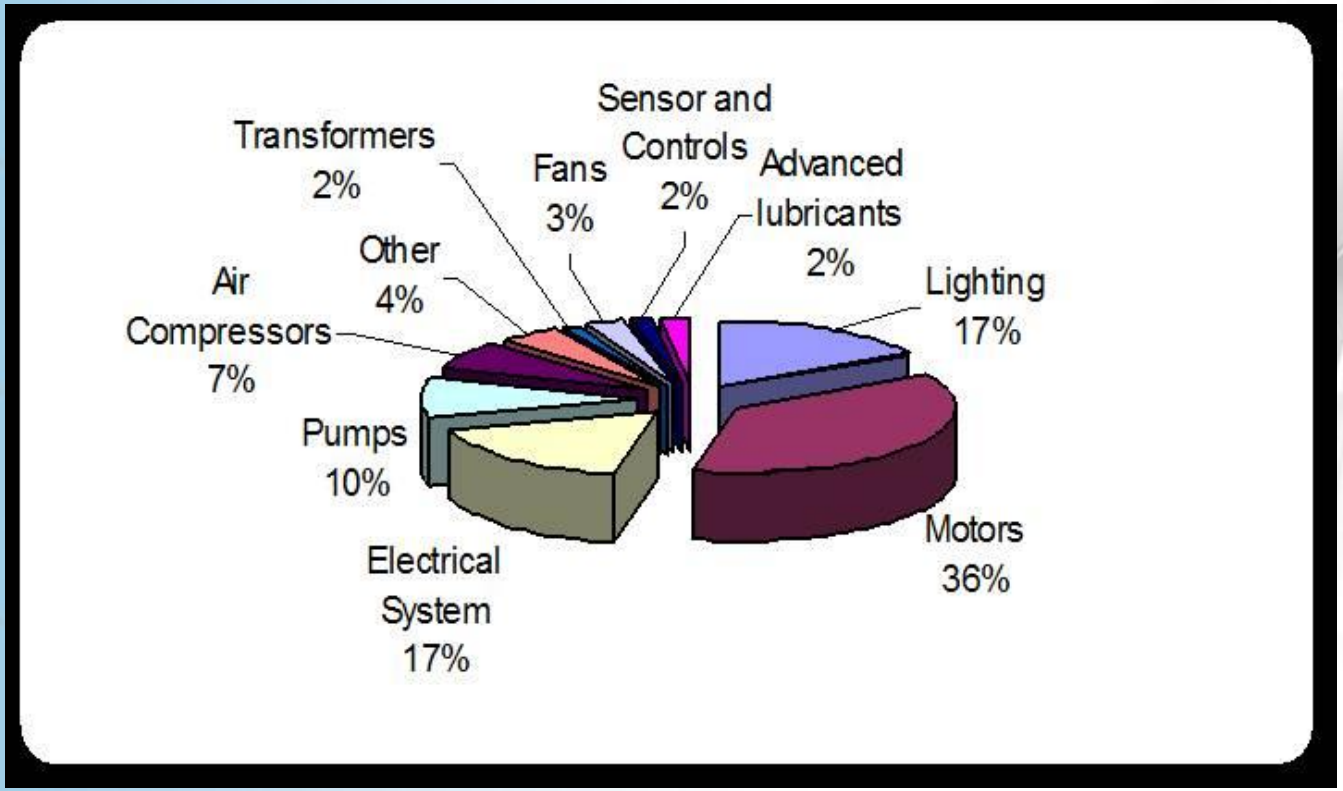
Typical Commercial Measures Considered

End-Use Type	Typical Measures		
Office Equip.	• Energy Star Refrigerator	• Energy Star Office Equipment	• PC Power Management
Water Heating	• Heat Pump Water Heater • Solar Water Heating • Booster Water Heater •Greywater Heat Exchanger	• Point of Use Water Heater • Efficient Electric /Gas Water Heater • High Efficiency Dishwasher •Low Flow Nozzles, Aerators, Showerheads	•High Efficiency Clothes Washer • Ozone Laundry System •Indirect Fired Water heater •Condensing Water Heater
Pools	• Efficient Pump w/Controls	• Heat Pump & Solar Pool Heating	• Pools Covers
Envelope	• Energy Efficient Windows	• Insulation	• Air Sealing
HVAC	• High Eff. Chiller & HVAC • Adv. Tune-up/Diagnostics • Retro commissioning •High Efficiency Furnaces/Boilers	• Programmable Thermostats • Energy Management Systems •Occupancy Control System •Improved Weatherization/Insulation	• Ductless (mini split) •Ground Source Heat Pump •Combination WH/Furnace •Combination WH/Boiler
Cooking	• High Eff. Steamer, Fryer	•High Eff. Holding Cabinet, Oven	•Kitchen Hood Controls
Refrigeration	• Vending Miser • Case Covers • Economizer • High Eff. Cooler & Freezer	• High Efficiency Ice-makers • Evaporator Fan Motor Controls • H.E. Evaporative Fan Motors • Zero-Energy Doors	•Door Heater Controls •Discus and Scroll Compressors •Floating Head Pressure Control •LED Lighting in Refrigeration
Lighting	• High Performance T8s • High Efficiency Fixtures • T5s	• High Intensity Fixture • LED Exit Signs • LED Traffic Signals	• CFL Fixture & Screw-in • LED Fixture & Screw In

Commercial MACE Energy Savings by End-Use



Industrial MACE Energy Savings by End-Use



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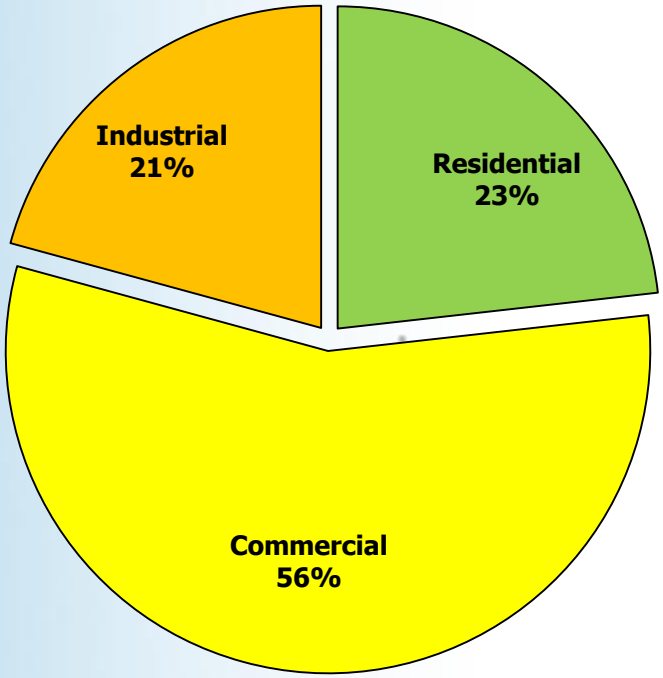
Percent of 2018 Gross MACE by Customer Class (MW)



Scope of the Update

- **GDS reviewed and updated all major study inputs and assumptions using the latest available data sources including:**
  - CMP's January 2009 Forecast Update (2009-2018)
    - Service Center Sales by Customer Class
    - Summer Peak Load = 1,867 MW in 2018
      - *assuming Efficiency Maine savings of ≈160 MW*
  - Updated Residential, Commercial and Industrial Energy Efficiency Measure Data
  - Results of ISO-NE FCA #2 for Demand Response
  - Avoided Costs (Synapse Energy – August 2007)

Scope of the Update for Demand Response

- **CMP Household Forecast**
- **Residential Appliance Saturations**
- **CMP Commercial Customer Forecast**
- **ISO-NE's FCA #2 Results for Demand Response**
  - Used to define the amount of demand response that can be obtained.
  - Demand Resource = Resources identified as being located within CMP Service Centers + 80% of resources not identified with any particular utility's service territory (≈166 MW)
- **Data Sources:**
  - CMP's January 2009 Forecast Update
  - CMP's 2008 Home Energy Survey
  - ISO-New England

Updated Estimates for CMP

GDS Update Based CMP's January 2009 Load Forecast Gross MACE & DR Potential by 2018								
	Northern Maine	Winslow - Skowhegan	Midcoast	Western Maine	Lew. Loop	Southern Maine	South Portland Loop	Total CMP
Gross MACE								
Energy Savings (GWH)	908.9	138.8	69.9	258.7	92.5	628.1	153.5	1,536.9
Peak Savings (MW)	225.1	34.6	16.9	64.4	23.2	157.7	39.6	382.8
Cumulative Program Budget (000s)	$223,568	$35,424	$16,975	$64,069	$22,565	$154,421	$37,011	$377,989
Demand Response Potential								
Peak Savings (MW)	168.4	33.6	9.7	68.5	13.5	83.6	18.8	252.0
Cumulative Program Budget (000s)	$83,569	$15,778	$6,190	$31,055	$19,273	$45,049	$10,596	$128,618

Source: CMP Response to ODR-13-12, MPRP Proceeding, February 2010.

Balancing Cost and Risk

- **Integrated resource planning** (IRP) is a formal process by which utilities/states analyze the costs, benefits, and risks of *all* resources available to them
  - Central Maine Power was doing this back in 1989-1991
  - But, things have changed since then
- The goal of IRP is to **identify a portfolio of resources that meets future needs at lowest cost and/or risk**
  - Energy efficiency & demand response (EE & DR) are an important part of the portfolio
  - EE & DR are the lowest cost resources