STATEWIDE EVALUATION TEAM

TRM UPDATES – RESIDENTIAL MEASURES

Pennsylvania Public Utility Commission
Technical Working Group Meeting
8/7/2012

Nexant

GDS Associates, Inc.
Engineers and Consultants

MONDRE ENERGY, INC.

Key Updates

- Lighting Hours of Use (HOU)
- HVAC Equivalent Full Load Hours (EFLH)
- Daily Hot Water Usage
- Showerheads and Aerators
- New Construction
- Appliances

LIGHTING HOU

- 2012 TRM CFL Hours of Use = 3.0, based on the ENERGY STAR calculator
  - Per the DOE *2010 ENERGY STAR CFL Market Profile,* 3.0 hours was not based on metering or self-report studies.
  - 2.98 hours from 2011 Maryland study was used to support maintaining 3.0 from previous TRMs
  - HOU estimates from other sources are warranted.

LIGHTING HOU

Lighting Hours of Use Study Results							
	New England 2003	California 2005	Maine 2007	New England 2009	California 2010	Maryland 2011	North Carolina/ South Carolina 2011
Length of Study	2 months	17 months	1 month	10 months	18 months	3 months	1 month
Homes*	59	330	25	157	1,200	59	34
Loggers*	-	752	153	657	7,299	200	156
CFLs Monitored*	97**	983	203	1,154	-	-	-
HOU	2.6	2.34	3.2	2.8	1.8	2.98	2.54 (NC) 2.67 (SC)

*Quantity included in final analysis (as opposed to the initial sample)

**Subsequent to the short-term study an additional 32 CFLs were monitored for approximately 8 months- result of metered sample was 2.5 HOU

LIGHTING HOU

- DOE supports 1.9 hours per day, based on a 2010 metering study and 2002 Pacific Northwest study
- 2009 New England study surveyed more homes than all other regional studies combined

LIGHTING HOU

TRM Screw-Base CFL Hours of Use (HOU) Per Day			
State	**HOU**	**Date of TRM**	**Notes**
Connecticut	2.77	Sep-11	Also differentiates by room type and low-income versus non-low-income; Nexus Market Research (NMR), Residential Lighting Markdown Impact, January 20, 2009. Table 5-15, pg 51.
Illinois	2.57	Jun-12	Value represents "Residential and in-unit Multi Family" CFLs; Based on lighting logger study conducted as part of the PY3 ComEd Residential Lighting Program evaluation.
Maine	2.7	Feb-09	Program Assumption
Maryland, Delaware, Washington D.C. (Mid-Atlantic TRM)	2.98	Jul-11	Based on EmPOWER Maryland DRAFT 2010 Interim Evaluation Report
New Jersey	2.8	Jul-11	Proposed 2012 update did not revise this value; value based on RLW Analytics, New England Residential Lighting Markdown Impact Evaluation, January 20, 2009
New York	3.2	Oct-10	"Extended residential logging results" by Tom Ledyard, RLW Analytics Inc. and Lynn Heofgen, Nexus Market Research Inc., May 2, 2005, p.1.
Ohio	2.85	Aug-10	Based on weighted average daylength adjusted hours from Duke Energy, June 2010; "Ohio Residential Smart Saver CFL Program"
Average	**2.8**		

LIGHTING HOU

- Recommendation: 2.8 hours per day based on a review and analysis of several metering studies
  - Size of logged sample and geography considered most important considerations: New England study the most comprehensive study completed in the Northeast
  - The average HOU from all TRMs reviewed = 2.8

LIGHTING

- Adjust ENERGY STAR Indoor Fixtures, Outdoor Fixtures and Ceiling Fans to incorporate EISA 2007
- Update ENERGY STAR Ceiling Fans to include algorithms and match ENERGY STAR calculator assumptions

HVAC EFLH

- 2012 TRM EFLH based on ENERGY STAR calculator
  - Estimated using "ENERGY STAR HVAC Investor" which is no longer published
  - No further information on source
- Compared heating and cooling EFLH in 2012 TRM to EFLH values in TRMs from other states

HVAC EFLH - Cooling

Location	$EFLH_C$ TRM	$EFLH_C$ ENERGY STAR	TRM % Reduction from ENERGY STAR
Massachusetts			
Boston	360	729	50.6%
Worcester	360	453	20.5%
Mid-Atlantic			
Wilmington, DE	513	1,015	49.5%
Baltimore, MD	531	1,050	49.4%
Washington, DC	668	1,320	49.4%
New Jersey			
Atlantic City	600	832	27.9%
Newark	600	1,007	40.4%
New York			
Albany	322	515	37.5%
Binghamton	199	440	54.8%
Buffalo	334	571	41.5%
New York	670	1,089	38.5%
Syracuse	310	552	43.8%

Location	$EFLH_C$ TRM	$EFLH_C$ ENERGY STAR	TRM % Reduction from ENERGY STAR
Ohio			
Akron	476	714	33.3%
Cincinnati	664	996	33.3%
Cleveland	426	639	33.3%
Columbus	552	828	33.3%
Dayton	631	947	33.4%
Mansfield	474	711	33.3%
Toledo	433	649	33.3%
Youngstown	369	554	33.4%
Pennsylvania			
Allentown	784	784	0.0%
Erie	482	482	0.0%
Harrisburg	929	929	0.0%
Philadelphia	1,032	1,032	0.0%
Pittsburgh	737	737	0.0%
Scranton	621	621	0.0%
Williamsport	659	659	0.0%
Rhode Island			
Providence	360	656	45.1%
Wisconsin			
Green Bay	256	457	44.0%
La Crosse	430	713	39.7%
Madison	327	487	32.9%
Milwaukee	361	513	29.6%

HVAC EFLH - HEATING

Location	$EFLH_H$ TRM	$EFLH_H$ ENERGY STAR	TRM % Reduction from ENERGY STAR
Connecticut			
Bridgeport	1,307	2,358	44.6%
Hartford	1,307	2,555	48.8%
Massachusetts			
Boston	1,200	2,397	49.9%
Worcester	1,200	2,734	56.1%
Mid-Atlantic			
Wilmington, DE	1,291	2,346	45.0%
Baltimore, MD	1,195	2,061	42.1%
Washington, DC	1,134	2,172	47.8%
New Jersey			
Atlantic City	965	2,198	56.1%
Newark	965	2,340	58.8%
New York			
Albany	1,469	2,598	43.5%
Binghamton	1,531	2,754	44.4%
Buffalo	1,530	2,765	44.7%
New York	1,030	2,337	55.9%
Syracuse	1,466	2,586	43.3%

Location	$EFLH_H$ TRM	$EFLH_H$ ENERGY STAR	TRM % Reduction from ENERGY STAR
Ohio			
Akron	1,576	2,539	37.9%
Cincinnati	1,394	2,134	34.7%
Cleveland	1,567	2,471	36.6%
Columbus	1,272	2,274	44.1%
Dayton	1,438	2,238	35.7%
Mansfield	1,391	2,500	44.4%
Toledo	1,628	2,464	33.9%
Pennsylvania			
Allentown	2,492	2,492	0.0%
Erie	2,901	2,901	0.0%
Harrisburg	2,371	2,371	0.0%
Philadelphia	2,328	2,328	0.0%
Pittsburgh	2,380	2,380	0.0%
Scranton	2,532	2,532	0.0%
Williamsport	2,502	2,502	0.0%
Rhode Island			
Providence	1,200	2,532	52.6%

HVAC EFLH

- In process of completing REM/Rate modeling using Potential Study models
  - Based on Baseline Study results
- Expecting a 35-50% decrease in cooling EFLH and a slightly larger decrease in heating EFLH

Room Air Conditioners

- Inconsistency in the 2012 TRM between ENERGY STAR Room A/C and Room A/C Retirement sections
  - ENERGY STAR Room A/C used unadjusted EFLH whereas Room A/C Retirement used adjusted EFLH
- Corrected such that ENERGY STAR Room A/C section now uses adjusted EFLH

Daily Hot Water Usage

- 2012 TRM value from 1998 standards for water heater testing
- Various studies reveal value is too high
  - The DOE standards document itself states that a more realistic flow rate would be 50 gallons per day
- Recommendation: 50 gallons per day

Source	Value, gallons per day
PA 2012 TRM	64.3
Ontario Energy Board April 2009 Measures and Assumptions for Demand Side Planning	47
2001 Water Heaters Support Technical Document – Lawrence Berkeley Lab	45.3-49.9
1998 RECS Subgroup for Residential Hot Water Heaters	46.9
Natural Resource Canada – 2011 study on hot water use	49

Showerheads and Aerators

- 2013 TRM will have statewide, single family, and multifamily deemed savings values
- 2012 TRM incorrectly assumes recovery efficiency = energy factor of water heater
  - Recovery efficiency = 0.98, Energy Factor = 0.904
- Aerator flow rates and time of use assumptions being updated based on Illinois 2012 TRM
  - Flow rates decreased to account for throttling as opposed to the maximum rated flow rate
  - Time of use assumption increase based on multiple studies

Showerheads and Aerators

- 2012 TRM overstates savings by claiming savings for all flow through aerator
  - Savings can only be claimed for water that goes down the drain
  - Adding drain factor of 79.5% from Illinois 2012 TRM

New Construction

- Weather Sensitive Measures
  - Energy Savings = software output
  - Demand Savings = TRM algorithm
- Non-Weather Sensitive Measures
  - Energy and Demand Savings = TRM algorithms
- Removal of Ventilation Equipment section due to double-counting savings

APPLIANCES

- Add ENERGY STAR Most Efficient Refrigerators, Freezers, Dishwashers and Televisions
- Separate protocols for each appliance
  - Add algorithms to offer transparency and flexibility to calculate savings
- Update to account for changing ENERGY STAR (next 0-1 years) and federal standards (next 1-3 years) for most appliances

Methodology Used to Update Savings for Recycled Refrigerators and Freezers

- Calculated annual kWh savings for recycled refrigerators or freezers using the latest available Energy Star database
- Annual kWh savings are based on the size and model for each individual unit
- A single, state-wide number will be used for refrigerator savings and freezer savings
- Savings for units that are replaced are less than units not replaced

Appliance Recycling

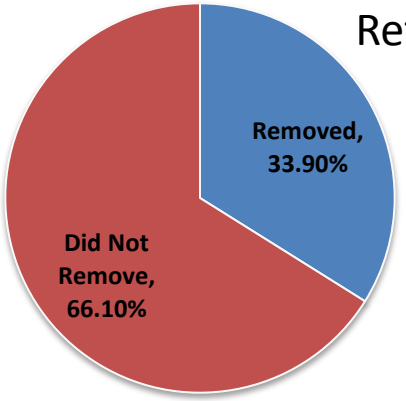
NUMBER OF UNITS COLLECTED		
EDC	**Refrigerators Retired**	**Freezers Retired**
PPL	11318	2829
PECO	7195	1097
WPP	2134	579
MET ED	6768	1742
DUQUESNE	791	137
PENN POWER	1706	496
PENELEC	6717	1645
Sum	**36629**	**8525**

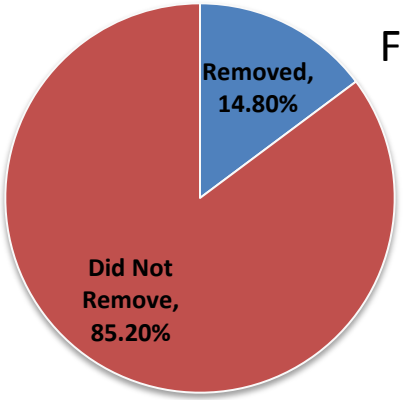
ANNUAL KWH SAVINGS PER UNIT RETIRED				
EDC	**Refrigerator - no replacement**	**Refrigerator - with replacement**	**Freezer - no replacement**	**Freezer - with replacement**
PPL	1581	921	1627	1062
PECO	1447	964	1594	1161
WPP	1582	954	1663	1138
MET ED	1555	952	1565	988
DUQUESNE	1541	879	1619	1090
PENN POWER	1664	994	1605	1133
PENELEC	1651	990	1668	1091
Wt. Average	**1559**	**960**	**1617**	**1092**

Appliance Recycling

What percentage of survey respondents removed a appliance?

EDC	Refrigerators	Freezers
Duquesne	30.0%	5.6%
FE (Met Ed)	42.9%	14.3%
FE (Penelec)	32.9%	14.6%
FE (Penn Power)	32.9%	23.8%
FE (WPP)	28.6%	17.4%
PPL	36.2%	13.2%
All	**33.90%**	**14.80%**

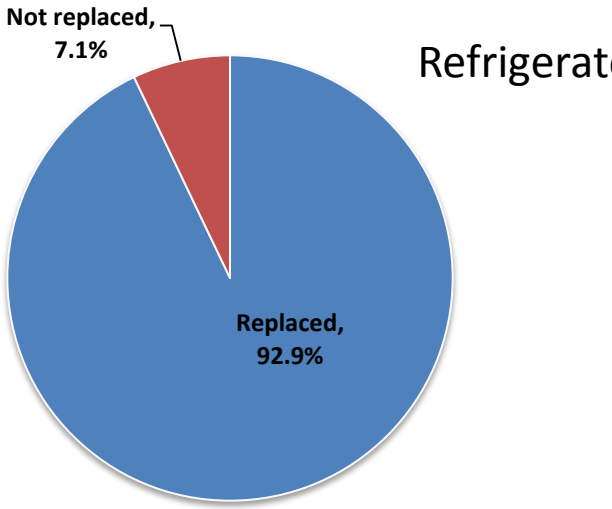


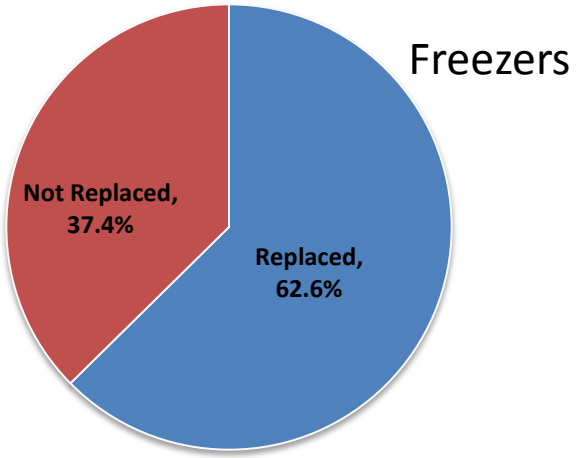


Appliance Recycling

What percentage of survey respondents replaced appliance after removal?

EDC	Refrigerators	Freezers
Duquesne	90.5%	0.0%
FE (Met Ed)	93.3%	80.0%
FE (Penelec)	91.3%	85.7%
FE (Penn Power)	95.7%	80.0%
FE (WPP)	95.0%	50.0%
PPL	91.7%	80.0%
All	**92.9%**	**62.6%**





Appliance Recycling

What did survey respondents do with appliance?

Refrigerators							
Action	Duquesne	FE (Met Ed)	FE (Penelec)	FE (Penn Power)	FE (WPP)	PPL	ALL
Donated	9.5%	3.3%	13.0%	26.1%	20.0%	8.0%	**13.3%**
I sold it	14.3%	6.7%	4.3%	4.3%	0.0%	8.0%	**6.3%**
Other	14.3%	13.3%	13.0%	17.4%	15.0%	24.0%	**16.2%**
Picked up by retailer	47.6%	43.3%	30.4%	26.1%	45.0%	32.0%	**37.4%**
Recycled by utility	4.8%	26.7%	21.7%	8.7%	10.0%	8.0%	**13.3%**
Trash	9.5%	6.7%	17.4%	17.4%	10.0%	16.0%	**12.8%**
Grand Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**100.0%**

Freezers							
Action	Duquesne	FE (Met Ed)	FE (Penelec)	FE (Penn Power)	FE (WPP)	PPL	All
Donated	0.0%	0.0%	14.3%	30.0%	37.5%	20.0%	**17.0%**
I sold it	100.0%	0.0%	0.0%	10.0%	12.5%	20.0%	**23.8%**
Other	0.0%	0.0%	0.0%	30.0%	12.5%	40.0%	**13.8%**
Picked up by retailer	0.0%	40.0%	42.9%	10.0%	12.5%	0.0%	**17.6%**
Recycled by utility	0.0%	40.0%	28.6%	20.0%	12.5%	20.0%	**20.2%**
Trash	0.0%	20.0%	14.3%	0.0%	12.5%	0.0%	**7.8%**
Grand Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	**100.0%**