Federal Appliance and Equipment Standards

Conservation Resource Advisory Committee (CRAC) Meeting

June 4th, 2014

Savings from Standards in Residential, Commercial & Industrial Sectors

Table 1 and Table 2 summarize standards savings in the Residential, Commercial & Industrial sectors during and after the Sixth Power Plan time frame. These savings only include those savings above the Council’s Sixth Power Plan baseline.

Table 1. Residential Standards Savings (aMW), above Sixth Plan baseline, without Busbar

|  |  |  |
| --- | --- | --- |
| Product | Region | |
| **2010-2015** | **2016-2034** |
| Residential Dishwashers | 1.33 | 6.28 |
| Residential Refrigerators | 7.36 | 128.48 |
| Residential Freezers | 1.33 | 27.95 |
| External Power Supplies | 0.0 | 0.0 |
| Residential Clothes Washers | 0.0 | 0.0 |
| Residential Water Heaters | 14.21 | 182.01 |
| Ceiling Fan Lighting Kits | 3.44 | 4.24 |
| Torchieres | 2.67 | 1.11 |
| Residential Heat Pumps | 1.2 | 20.35 |
| Total Residential | 31.54 | 370.43 |

Table 2. Commercial/Industrial Standards Savings (aMW) , above Sixth Plan baseline, without Busbar

|  |  |  |
| --- | --- | --- |
| Product | Region | |
| **2010-2015** | **2016-2034** |
| Commercial Clothes Washers | 1.56 | 7.57 |
| Illuminated Exit Signs | 0.0 | 0.0 |
| Pre-Rinse Spray Valves | 0.0 | 0.0 |
| Commercial Refrigeration Equipment | 0.0 | 0.0 |
| Walk-In Coolers and Freezers | 2.0 | 8.77 |
| Electric Motors | 0.6 | 2.35 |
| Distribution Transformers | 41.2 | 292.37 |
| CAC Air-Cooled | 0.00 | 0.18 |
| CAC Water-Cooled | 0.01 | 0.06 |
| Packaged Terminal Air-Conditioning/Heat Pump | 0.11 | 0.33 |
| Total Commercial | 45.50 | 311.63 |

Lighting Standards-Driven Savings

Table 3 and Table 4 show lighting savings driven by lighting standards in multiple time frames, above the Sixth Plan baseline

Table 3. Regional Lighting Standards Energy Savings (2010-2015)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
| First-Year Savings (aMW) | 0 | 3.9 | 13.9 | 21.1 | 23.1 | 18.0 |

Table 4. Regional Lighting Standards Energy Savings by Year-bin

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 2010-2015 | 2016-2020 | 2021-2025 | 2026-2030 | 2031-2035 |
| First-Year Savings (aMW) | 80.0 | 48.1 | 10.1 | 5.9 | 6.7 |

Baseline Adjustments by Product

The one-time baseline adjustment account for the difference between the Sixth Power Plan’s assumed market shipments and baseline UEC in 2010 and those the team modeled in the standard analysis using best available data. Table 5 and Table 6 lay out the baseline adjustments by product.

Table 5. Residential Products’ one- time Baseline Adjustments

|  |  |  |
| --- | --- | --- |
| **Product** | **Regional Sixth Plan Baseline Adjustment (aMW)** | **BPA Sixth Plan Baseline Adjustment (aMW)** |
| Residential Dishwashers | 5.3 | 2.4 |
| Residential Refrigerators | -3.7 | -1.7 |
| Residential Freezers | 4.6 | 2.1 |
| External Power Supplies | 0 | 0 |
| Residential Clothes Washers | 6.5 | 3 |
| Residential Water Heaters | 21.2 | 9.7 |
| Ceiling Fan Lighting Kits | 0 | 0 |
| Torchiers | 0 | 0 |
| Residential Heat Pumps | 4.1 | 1.9 |
| **Total Residential Sector Adjustments** | **38** | **17.4** |

Table 6. Commercial Products’ one- time Baseline Adjustments

|  |  |  |
| --- | --- | --- |
| **Product** | **Regional Sixth Plan Baseline Adjustments (aMW)** | **BPA Sixth Plan Baseline Adjustments (aMW)** |
| Commercial Clothes Washers | 0.0 | 0.0 |
| Illuminated Exit Signs | 2.5 | 1.1 |
| Pre-Rinse Spray Valves | -0.1 | 0.0 |
| Commercial Refrigeration Equipments | 0.2 | 0.1 |
| Walk-In Coolers and Freezers | 0.0 | 0.0 |
| Electric Motors | 0.0 | 0.0 |
| Distribution Transformers | 0.0 | 0.0 |
| HVAC Equipments | 0.0 | 0.0 |
| **Total Commercial Sector Adjustments** | **2.6** | **1.2** |

Product Standards with Effective Date between 2005 and 2015

The following table lists product standards with effective dates between 2005 and 2015.

Table 7. Standard Effective Date by Product

| Product | Initial Federal Legislation | Last Standard Issued | Effective Date of Last Standard | Issued By |
| --- | --- | --- | --- | --- |
| **Residential** | | | | |
| Residential Refrigerators and Freezers | NAECA 1987 | 2011 | 2014 | DOE |
| Central Air Conditioners | EPACT 1992 |  | 2006 | DOE |
| External Power Supplies | EPACT 2005 | 2007 | 2008 | Congress |
| Heat Pumps | EPACT 1992 |  | 2006 | DOE |
| Dishwashers | NAECA 1987 | 2012 | 2013 | DOE |
| Residential Clothes Washers | NAECA 1987 | 2012 | 2015 | DOE |
| Dehumidifiers | EPACT 2005 | 2007 | 2012 | Congress |
| Boilers | NAECA 1987 | 2007 | 2012 | Congress |
| Residential Room Air Conditioners | NAECA 1987 | 2011 | 2014 | DOE |
| Direct Heating Equipment | NAECA 1987 | 2010 | 2013 | DOE |
| Cooking Ranges and Ovens | NAECA 1987 | 2009 | 2012 | DOE |
| Pool Heaters | NAECA 1987 | 2010 | 2013 | DOE |
| Compact Audio Equipment | None |  |  |  |
| DVD Players and Recorders | None |  |  |  |
| Pool Pumps | None |  |  |  |
| Portable Electric Spas | None |  |  |  |
| Residential Ceiling Fans | EPACT 2005 | 2005 | 2007 | Congress |
| **Commercial/Industrial** | | | | |
| Distribution Transformers: Liquid-Immersed and Medium-Voltage, Dry-Type | EPACT 1992 | 2007 | 2010 | DOE |
| Commercial CAC and HPs (Air-Cooled, Small) | EPACT 1992 | 2007 | 2008 | Congress |
| Commercial CAC and HPs (Air-Cooled, Large) | EPACT 1992 | 2005 | 2010 | Congress |
| Walk-In Coolers and Freezers | EISA 2007 | 2007 | 2009 | Congress |
| Commercial Refrigeration Equipment | EPACT 2005 | 2009 | 2012 | DOE |
| Commercial Pre-rinse Spray Valves | EPACT 2005 | 2005 | 2006 | Congress |
| Distribution Transformers: Low-Voltage Dry-Type | EPACT 2005 | 2005 | 2007 | Congress |
| Unit Heaters | EPACT 2005 | 2005 | 2008 | Congress |
| Commercial CAC and HPs (Air-Cooled, Very Large) | EPACT 1992 | 2005 | 2010 | Congress |
| Commercial Clothes Washers | EPACT 2005 | 2010 | 2013 | DOE |
| Refrigerated Beverage Vending Machines | EPACT 2005 | 2009 | 2012 | DOE |
| Automatic Commercial Ice Makers | EPACT 2005 | 2005 | 2010 | Congress |
| Electric Motors | EPACT 1992 | 2007 | 2010 | Congress |
| Commercial Packaged Boilers | EPACT 1992 | 2009 | 2012 | DOE |
| Packaged Terminal AC and HP | EPACT 1992 | 2008 | 2010 | DOE |
| Commercial CAC and HPs (Water- and Evaporatively Cooled) | EPACT 1992 | 2012 | 2013 | DOE |
| Hot Food Holding Cabinets | None |  |  |  |
| Water Dispensers | None |  |  |  |
| **Lighting** | | | | |
| General Service Incandescent Lamps | None | 2007 | 2012 | Congress |
| General Service Fluorescent Lamps | EPACT 1992 | 2009 | 2012 | DOE |
| Fluorescent Lamp Ballasts | NAECA 1988 | 2011 | 2014 | DOE |
| Metal Halide Lamp Fixtures | EISA 2007 | 2007 | 2009 | Congress |
| Ceiling Fan Light Kits | EPACT 2005 | 2005 | 2007 | Congress |
| Torchieres | EPACT 2005 | 2005 | 2006 | Congress |
| Incandescent Reflector Lamps | EPACT 1992 | 2009 | 2012 | DOE |
| Illuminated Exit Signs | EPACT 2005 | 2005 | 2006 | Congress |
| Traffic Signal Modules and Pedestrian Modules | EPACT 2005 | 2005 | 2006 | Congress |
| Candelabra & Intermediate Base Incandescent Lamps | None | 2007 | 2012 | Congress |
| Medium Base Compact Fluorescent Lamps | EPACT 2005 | 2005 | 2006 | Congress |
| Mercury Vapor Lamp Ballasts | EPACT 2005 | 2005 | 2008 | Congress |
| **Products Not in Effect from 2005-2015** | | | | |
| Battery Chargers | EPACT 2005 | None | None | N/A |
| Microwave Ovens | NAECA 1987 | None | None | DOE |
| Commercial Warm Air Furnaces | EPACT 1992 | 2004 |  |  |
| Commercial Water Heating Equipment | EPACT 1992 | 2001 | 2003 | DOE |
| High-Intensity Discharge Lamps | not till 2017 |  |  |  |
| Residential Clothes Dryers | NAECA 1987 | 2011 | 2015 | DOE |
| Residential Water Heaters | NAECA 1987 | 2010 | 2015 | DOE |
| Furnaces | NAECA 1987 | 2011 (revoked) | 2013 | DOE |

Sample Data Form

Input data of each standard analysis model are documented in data forms, the following is an example:

Table 8. Residential Dishwashers Input Data for Standard Model

|  | Input | Description | Regional Value Different from DOE NIA? | | Regional Value | DOE Value | Notes | | | Data Source |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Usage** | Cycles per Year | Average annual washing cycle | Yes, different from DOE | | 5P/6P: 215 cycles/yr (For all Res Housing Types);  RBSA (2012): 170 cycles/yr (Single Family) RBSA (2012): 116 cycles/yr (Manufactured Homes) | 215 | Update with RBSA values for Single Family and Manufactured Homes. | | | RBSA (2012), NW Council Supply Curve: EStarResDishwasherFY09v1\_0, DOE RES Dishwasher NIA |
| Water Heating Fuel Share | DHW heating market share by fuel type | Yes, different from DOE | | 64% electric (6P); 55%(SF) 89% electric (MH) (RBSA 2012) | 37% electric, 59% gas, 4% oil | Regional water heating fuel share is used | | | RBSA (2012) |
| 5P Baseline Device Efficiency | 5th Plan baseline device efficiency tiers | Yes, different from DOE | | Prior Federal Standard EF46 used as Baseline (Standard Configuration), 2005-2009 | 6 Efficiency Levels for Standard Configuration Dishwashers and 3 Efficiency Levels for Compact Configuration Dishwashers | DOE has more efficiency tiers and product classes | | | NW Council Supply Curve: EStarResDishwasherFY09v1\_0, DOE RES Dishwasher NIA |
| 6P Baseline Device Efficiency | Sixth Plan baseline device efficiency tiers | Yes, different from DOE | | Energy Star EF65 used as Baseline (Standard Configuration), 2010-2034 | NW Council Supply Curve: EStarResDishwasherFY09v1\_0, DOE RES Dishwasher NIA |
| 2010 Standard Device Efficiency | Device efficiency after standard took effect | Yes, different from DOE | | Prior Federal Standard EF46 (484 kWh/yr) | Standard Configuration - 2010 Federal Standard: EF 61 (355 kWh/yr) Compact Configuration - 2010 Federal Standard: EF 83 (260 kWh/yr) | Council's Sixth Plan baseline (Energy Star EF 65) is more efficient than the 2010 Federal Standard for Standard Configuration Dishwashers (EF 61). | | | NW Council Supply Curve: EStarResDishwasherFY09v1\_0, DOE RES Dishwasher NIA |
| 2013 Standard Device Efficiency | Device efficiency after standard took effect | Yes, different from DOE | | Energy Star EF65 (330 kWh/yr) | Standard Configuration - 2013 Federal Standard: EF 70 (307 kWh/yr) Compact Configuration - 2013 Federal Standard: EF 97 (222 kWh/yr) |
| **Market** | Pre-Case product class distribution | Number of product class(s) and distribution if standard did not exist | Yes, different from DOE | 1 product class (Standard Configuration) with the same EF | | 2 product classes with different EF's ; 99.8% Standard Configuration and 0.20% Compact Configuration | The council's baseline did not distinguish Standard vs. Compact configuration equipment. Suggest to analyze standard configuration only for simplicity | | | NW Council Supply Curve: EStarResDishwasherFY09v1\_0, DOE RES Dishwasher NIA |
| Post-Case case product class distribution | Number of product class(s) and distribution factoring in the effective standard | Yes, different from DOE | Not applicable since the 2013 standard was not included in 5P/6P. 6P baseline is above 2010 standard level. | | 2 product classes with different EF's ; 99.8% Standard Configuration and 0.20% Compact Configuration for 2010 standard and 2013 standard years | The council's baseline did not distinguish Standard vs. Compact configuration equipment. Suggest to analyze standard configuration only. Note that Council's Sixth Plan baseline (Energy Star EF 65) is more efficient than the 2010 Federal Standard for Standard Configuration Dishwashers (EF 61). | | | NW Council Supply Curve: EStarResDishwasherFY09v1\_0, DOE RES Dishwasher NIA |
| Pre-Case efficiency level distribution | Efficiency distribution of each product class if standard did not exist | Yes, different from DOE | 100% at EF 46 from 2005-2009; 100% at EF 65 from 2010-2034 | | 99.8% Standard Configuration and 0.20% Compact Configuration for both 2010 and 2013 standard years | Using frozen efficiency as the Pre-Case | | | NW Council Supply Curve: EStarResDishwasherFY09v1\_0, DOE RES Dishwasher NIA |
| Post-Case efficiency level distribution | Efficiency distribution of each product class factoring in the effective standard | Yes, different from DOE | Not applicable since the 2013 standard was not included in 5P/6P Baselines | | 100% at Pre-Case level until 2013, 100% at 2013 standard efficiency level after 2013. | 100% compliance after standard effective year in 2013. | | | Modeling assumption/DOE RES Dishwasher NIA |
| Appliance Saturation | Saturation rate of Res Dishwashers in the NW region | No, same as DOE | 5P/6P: 67%  RBSA 2012: 89% (SF); 77% (Manufactured) | | DOE 2011: 96.7% | Use RBSA 2012 value | | | RBSA 2012 |
| **Stock Model** | Historical Replacement Units Shipment in 2005 | Number of residential dishwashers shipped to region in 2005 | Not applicable | Data from supply curve | | Not applicable | | | Regional numbers | PNW Residential Sector Load Forecast Copied from PNWResSectorSupplyCurveUnits\_6th\_Fnl workbook |
| New Construction forecast | New construction forecast from 2005-2030 | Not applicable | Data from supply curve | | Not applicable | | | Regional numbers | PNW Residential Sector Load Forecast Copied from PNWResSectorSupplyCurveUnits\_6th\_Fnl workbook |
| Product Lifetime | Res Dishwasher Product Lifetime | Yes, different from DOE | | 5P/6P: 9 yrs RTF UES measure workbook: 15.43 | 15.43 | | ACEE commented that the residential dishwasher lifetime should be 11 years on average. DOE NIA uses a 15.43 years average lifetime value based on an analysis of residential dishwasher lifetimes in the field. RTF claims 9 years from assumption in "PNWResSectorSupplyCurveUnits\_6th\_Fnl" workbook. Using DOE value as it is more current and has been updated to 15.43 years in the TSD based on field research. | | [DOE source: https://www.federalregister.gov/articles/2012/10/01/2012-23953/energy-conservation-program-energy-conservation-standards-for-dishwashers](https://www.federalregister.gov/articles/2012/10/01/2012-23953/energy-conservation-program-energy-conservation-standards-for-dishwashers) |
| Turnover assumption | Product retirement rate | Yes, different from DOE | | 1/lifetime | Estimated using survey results from RECS and the U.S. Census American Housing Survey along with historic data on appliance shipments. Survival function (Variability characterized using Weibull probability distribution) | | The 1/lifetime assumption is consistent with the council's modeling practice. However, we can consider using survival functions. | | PNW Residential Sector Load Forecast Copied from PNWResSectorSupplyCurveUnits\_6th\_Fnl workbook http://www1.eere.energy.gov/buildings/appliance\_standards/pdfs/dw\_direct\_final\_rule\_5\_14\_2012.pdf |