Input Variables

Table 75: Input Values for Economizer Repair Savings Calculations

Component	Type	Value	Unit	Source(s)
Tons	Variable	See customer application.	tons	Customer application
SF	Variable	See Table 49.	-	Mid-Atlantic TRM 2016, p. 433

Table 76. Economizer Energy Savings Factors (kWh/ton) for Virginia and North Carolina[229]

Savings Factors (kWh/ton)	Baltimore, MD	Richmond, VA	Charlotte, NC
Education[230]	39	35	32
Education – College and University			
Education – High School			
Education – Elementary and Middle School			
Food Sales[231]	89	81	72
Food Sales – Convenience Store			
Food Sales – Gas Station Convenience Store			
Service (Beauty, Auto Repair Workshop)			
Food Service[232]			
Food Service - Full Service	29	26	24
Food Service - Fast Food[233]	37	34	30
Food Sales - Grocery[234]	143	130	116

[229] Richmond VA and Charlotte NC values are calculated from Baltimore SF and degree days (DD-65°F = HDD + CDD) using TMY3 data for weather stations at Baltimore BLT-Washington International AP (Weather station number 724060; CDD = 1,233, HDD = 4,600), Richmond International AP (Weather station number 724010; CDD = 1,448, HDD = 3,849), and Charlotte Douglas International Airport (Weather station number 723140; CDD = 1,598, HDD = 3,140). Weather station data and IDs found from https://www.google.com/fusiontables/DataSource?docid=1EsB07O-9SiqyJDlzl69GO8jTHsomsNIpkA1SLL8#rows:id=1, accessed Jan 8, 2015. Example calculation for Richmond SF Education = 39 x (5,297 / 5,833) = 23. See Appendix A for CDD and HDD.

[230] All education building types in the STEP Manual were mapped to savings factors for the "Primary School" building type listed in the Mid-Atlantic TRM 2016, p. 433.

[231] All food sales, service (beauty, auto repair workshop) and mercantile (mall) building types in the STEP Manual were mapped to savings factors for the "Small Retail" building type listed in the Mid-Atlantic TRM 2016, p. 433.

[232] All general food service and food service-full service building types in the STEP Manual were mapped to savings factors for the "Full Service Restaurant" building type listed in the Mid-Atlantic TRM 2016, p. 433.

[233] Food service – fast food building types in the STEP Manual were mapped to savings factors for the "Fast Food" building type in the Mid-Atlantic TRM 2016, p. 433.

[234] Food-sales-grocery and mercantile (retail, not mall) building types in the STEP Manual were mapped to the "Big Box Retail" building type listed in the Mid-Atlantic TRM 2016, p. 433.

Savings Factors (kWh/ton)	Baltimore, MD	Richmond, VA	Charlotte, NC
Mercantile (Retail, not mall)			
Mercantile (mall)	89	81	72
Office – Small (<40,000 sq ft)[235]	175	159	142
Office – Large (>= 40,000 sq ft)			
Public Assembly	25	23	20
Religious Worship	6	5	5
Warehouse and Storage	2	2	2
Other[236]	57	52	46
Lodging – (Hotel, Motel and Dormitory)			
Health Care - outpatient			
Health Care - inpatient			
Public Order and Safety (Police and Fire Station)			

Default Savings

If the proper values are not supplied, a default savings may be applied using conservative input values. Default hours of use will be taken from the above chart if the building type is available.

The default gross coincident demand reductions will be assigned as follows:

$$\Delta kW = 0$$

Source(s)

The primary source for this deemed savings approach is the Mid-Atlantic TRM 2016, p. 431-433.

[235] Office – small (< 40,000 sq ft) and office – large (>= 40,000 sq ft) building types in the STEP Manual were mapped to savings factors for the "Small Office" building types in the Mid-Atlantic TRM 2013, p. 283.

[236] Other, lodging – (hotel, motel and dormitory), health care-outpatient, healthcare-inpatient, public order and safety (police and fire station) building types in the STEP Manual were mapped to the "Other" building type in the Mid-Atlantic TRM 2013, p. 283.

12 NON-RESIDENTIAL DUCT TESTING AND SEALING PROGRAM

From 2012 to early 2017, Dominion's Non-residential Duct Testing and Sealing program provided building owners incentives to use Dominion approved duct-sealing contractors to reduce conditioned air leakage to unconditioned spaces by the following steps: 1) test non-residential duct systems for air leakage, 2) seal the ducts using an aerosol based product, and then 3) confirm that sealing the ducts reduced the rate of air leakage with final duct testing.

The duct testing and sealing measure is also delivered through the Non-Residential Small Business Improvement program, described in detail in Section 15.2.1, and the Non-Residential Prescriptive Program, described in Section 16.

Measure Description

This measure realizes energy savings by identifying and sealing leaky duct work using an aerosol-based product. Eligible ductwork is connected to a unitary HVAC system or a heat pump and occurs within an unconditioned plenum space, between an insulated, finished ceiling and a roof surface.

Note: The following energy savings and demand reduction approaches are appropriate for all eligible systems to include unitary systems and large chiller systems as of 2015. Based on DNV GL judgment, this measure is applicable to ductwork served by unitary and chiller systems.

Savings Estimation Approach

All methodologies used to estimate gross annual electric energy savings and gross coincident demand reductions are calculated as described in Section 15.2.1 with one exception: full-load cooling hours ($FLH_{cooling}$) is drawn from Table 137 (rather than Table 138, used by the Small Business Improvement Program and the Non-Residential Prescriptive Program).

13 NON-RESIDENTIAL WINDOW FILM

The Non-Residential Window Film Program provides incentives to non-residential customers to install reflective window film on existing windows in order to reduce the solar heat gain through the affected windows. The program is offered in Virginia beginning August 1, 2014, and in North Carolina beginning January 1, 2015.

Measure eligibility is as follows:

The final Solar Heat Gain Coefficient (SHGC) of the window after application of window film must be equal to or less than 0.4[237]

Measure Description

This measure applies to window film installed on the exterior side of existing non-residential single pane or double pane windows. Savings are calculated per square foot of north, south, east, and west facing windows.

Savings Estimation Approach

The window film installation measure savings calculations utilize savings factors developed using DOE-2.2 energy modelling software simulations of prototypical building eQUEST models. Building models are based on the Database for Energy Efficient Resources (DEER) building data, modified for Richmond, VA and Elizabeth City, NC weather using typical meteorological year 3 (TMY3) data and modification of a few key window parameters. The assumed values for key parameters affected by addition of window film to single and double pane windows are provided in Table 77.

Table 77: Key Building Energy Modelling Parameters.

Window Variable	Window Type	Baseline Value	Source(s)	Post-Retrofit Value	Source(s)
U-Factor	Single Pane	1.23	DEER (1978-2001)	1.23	DEER (1978-2001)
	Double Pane	0.77	DEER (2001)	0.77	DEER 2001
SHGC	Single Pane	0.82	DEER (1978-2001)	0.4	CSWF Program Requirement
	Double Pane	0.61	DEER (2001)	0.4	FRWF Program Requirement

The savings factors are listed per square foot of reflective window film area for each building type and window orientation in Table 79 and

Table 80. Savings factors differ based on the number of panes of affected windows (single or double) and the heating fuel type of the building (electric or non-electric). Similarly, gross coincident peak demand reduction factors are provided in Table 81 and Table 82.

[237] Non-Residential Window Film Program website. Dominion. https://dom-vendor.com/non-residential-window-film. Accessed 6/19/2017

Gross annual electric energy savings are calculated according to the following equation:

$$\Delta kWh = SQFT_{window\ orientation} \times ESF$$

Gross coincident demand reductions are calculated according to the following equation:

$$\Delta kW = SQFT_{window\ orientation} \times DRF$$

Where:

ΔkWh/year = gross annual electric energy savings
ΔkW = gross coincident demand reductions. The summer electric peak hours are defined as an average of all hours between June 1 through September 30, 11am through 10pm, Monday through Friday. The demand reductions is the difference between the average baseline and the average measure total building load modeled during those hours.
$SQFT_{window\ orientation}$ = square feet of window area for each window orientation of a retrofitted building
ESF = annual energy savings factor (ESF)
DRF = annual demand reduction factor (DRF)

Input Variables

Table 78: Input Values for Solar Window Film

Component	Type	Value	Unit	Source(s)
$SQFT_{window\ orientation}$	Variable	See customer application	$Feet^2$	Customer application
$ESF_{window\ orientation}$	Fixed	See Table 79 and Table 80	kWh/ year ·$feet^2$	DOE 2.2 model
$DRF_{window\ orientation}$	Fixed	See Table 81 and Table 82	$kW/feet^2$	DOE 2.2 energy modelling software

Table 79: Annual Energy Savings Factors per Square Foot of Reflective Window Film per Building Type and Window Orientation for Richmond, VA

Building Type[238]	Window Type	Heating System Type[239]	ESF_{North} (kWh/ year·ft²)	ESF_{East} (kWh/ year·ft²)	ESF_{South}[240] (kWh/ year·ft)	ESF_{West} (kWh/ year·ft²)
Education – Elementary and Middle School	Single Pane	Electric	4.34	8.20	6.66	10.02
		Non-electric	4.20	9.07	9.51	9.31
	Double Pane	Electric	2.24	4.25	3.40	5.04
		Non-electric	2.09	4.58	4.56	4.70
Education – High School	Single Pane	Electric	3.39	7.37	13.00	5.14
		Non-electric	4.36	13.10	44.20	13.71
	Double Pane	Electric	1.74	3.70	2.76	3.92
		Non-electric	2.01	6.66	6.98	8.45
Education – College and University	Single Pane	Electric	1.67	11.99	16.83	13.29
		Non-electric	5.64	18.64	25.04	18.60
	Double Pane	Electric	1.62	7.99	12.97	8.84
		Non-electric	3.01	9.79	15.96	9.67
Food Sales - Grocery	Single Pane	Electric	3.06	5.20	-2.32	7.40
		Gas	3.82	7.00	3.88	8.72
	Double Pane	Electric	1.63	2.79	-3.57	3.84
		Gas	1.84	3.55	-0.09	4.43
Food Sales – Convenience Store	Single Pane	Electric	1.50	4.24	-2.42	6.58
		Non-electric	3.23	6.44	4.33	8.20
	Double Pane	Electric	0.78	2.29	-2.76	3.41
		Non-electric	1.85	3.31	0.96	4.16
Food Sales – Gas Station Convenience Store	Single Pane	Electric	1.50	4.24	-2.42	6.58
		Non-electric	3.23	6.44	4.33	8.20
	Double Pane	Electric	0.78	2.29	-2.76	3.41
		Non-electric	1.85	3.31	0.96	4.16
Food Service - Full Service	Single Pane	Electric	5.03	9.59	6.29	9.57
		Non-electric	4.57	10.18	9.44	9.89
	Double Pane	Electric	2.45	4.94	3.24	4.70
		Non-electric	2.42	5.14	4.81	4.96
Food Service - Fast Food	Single Pane	Electric	3.48	8.64	5.72	7.09
		Non-electric	3.68	9.23	9.79	7.34
	Double Pane	Electric	1.78	4.18	4.49	3.60
		Non-electric	1.95	4.58	5.36	3.88
Health Care-inpatient	Single Pane	Electric	3.73	17.87	-59.89	3.88
		Non-electric	4.84	23.16	-18.37	20.19
	Double Pane	Electric	1.98	8.61	4.96	1.99
		Non-electric	3.13	11.92	6.47	10.16
Health Care-outpatient	Single Pane	Electric	1.70	4.85	-3.63	4.62
		Non-electric	2.63	7.18	1.63	6.86
		Electric	1.06	2.54	-4.91	2.40

Building Type[238]	Window Type	Heating System Type[239]	ESF_{North} (kWh/ year·ft^2)	ESF_{East} (kWh/ year·ft^2)	ESF_{South}[240] (kWh/ year·ft)	ESF_{West} (kWh/ year·ft^2)
	Double Pane	Non-electric	1.50	3.60	-1.89	3.43

[238] Warehouse and storage building type DEER models do not have windows. Tracking data with this building type will be flagged for on-site verification.

[239] Non-electric heating systems were represented by gas heating in building energy models.

[240] Negative demand reductions are observed in some building types for south window orientation, implying that installation of window film on the south side of the these buildings leads to increased energy use due to increase heating load in the winter season.

Building Type[238]	Window Type	Heating System Type[239]	ESF_{North} (kWh/ year·ft²)	ESF_{East} (kWh/ year·ft²)	ESF_{South}[240] (kWh/ year·ft)	ESF_{West} (kWh/ year·ft²)
Lodging – (Hotel, Motel, and Dormitory)	Single Pane	Electric	2.81	5.57	-0.02	6.11
		Non-electric	5.04	11.31	9.21	9.28
	Double Pane	Electric	1.42	2.86	-1.27	2.78
		Non-electric	2.58	5.89	3.02	4.24
Mercantile (mall)	Single Pane	Electric	2.97	5.11	1.17	6.06
		Non-electric	6.16	13.43	16.27	12.09
	Double Pane	Electric	1.85	3.24	2.11	3.96
		Non-electric	2.95	6.95	7.45	5.67
Mercantile (Retail, not mall)	Single Pane	Electric	3.26	8.75	11.28	11.55
		Non-electric	3.78	9.30	12.07	7.27
	Double Pane	Electric	1.34	4.10	5.18	5.55
		Non-electric	1.85	4.32	5.66	4.40
Office – Small (<40,000 sq ft)	Single Pane	Electric	0.52	6.05	3.22	5.52
		Non-electric	3.09	8.36	7.43	7.82
	Double Pane	Electric	0.36	3.25	2.86	2.99
		Non-electric	1.57	4.24	4.46	3.93
Office – Large (>= 40,000 sq ft)	Single Pane	Electric	5.93	30.29	41.28	29.71
		Non-electric	12.77	44.15	55.42	40.59
	Double Pane	Electric	3.45	16.38	22.04	15.91
		Non-electric	6.74	22.89	28.77	21.18
Other[241]	Single Pane	Electric	1.50	4.24	-2.42	6.58
		Gas	3.23	6.44	4.33	8.20
	Double Pane	Electric	0.78	2.29	-2.76	3.41
		Gas	1.85	3.31	0.96	4.16
Public Assembly	Single Pane	Electric	3.02	5.52	3.05	15.47
		Non-electric	4.33	8.60	8.90	18.58
	Double Pane	Electric	1.52	2.97	1.73	12.01
		Non-electric	2.21	4.44	4.64	13.93
Public Order and Safety (Police and Fire Station)	Single Pane	Electric	1.04	7.64	-0.84	4.15
		Non-electric	2.17	11.12	6.85	8.75
	Double Pane	Electric	0.55	3.79	2.74	-0.07
		Non-electric	1.12	5.60	5.60	2.95
Religious Worship	Single Pane	Electric	10.98	31.39	15.40	32.80
		Non-electric	9.08	22.89	10.84	23.59
	Double Pane	Electric	6.84	17.56	8.29	17.97
		Non-electric	5.35	12.68	5.87	12.76
	Single Pane	Electric	5.26	1.78	0.00	1.65
		Non-electric	1.90	5.37	3.29	3.80
		Electric	0.20	0.79	0.42	0.99

Building Type[238]	Window Type	Heating System Type[239]	ESF_{North} (kWh/ year·ft²)	ESF_{East} (kWh/ year·ft²)	ESF_{South}[240] (kWh/ year·ft)	ESF_{West} (kWh/ year·ft²)
Service (Beauty, Auto Repair Workshop)	Double Pane	Non-electric	0.95	1.87	1.64	1.91

Table 80: Annual Energy Savings Factors per Square Foot of Reflective Window Film per Building Type and Window Orientation for Elizabeth City, NC

Building Type[242]	Window Type	Heating System Type[243]	ESF_{North} (kWh/ year·ft²)	ESF_{East} (kWh/ year·ft²)	ESF_{South}[244] (kWh/ year·ft²)	ESF_{West} (kWh/ year·ft²)
Education – Elementary and Middle School	Single Pane	Electric	5.39	10.33	10.29	12.53
		Non-electric	2.36	5.23	5.60	5.30
	Double Pane	Electric	2.74	5.33	5.41	6.32
		Non-electric	2.36	5.23	5.60	5.30
Education – High School	Single Pane	Electric	4.30	9.47	9.12	10.83
		Non-electric	4.30	9.47	9.12	10.83
	Double Pane	Electric	2.17	4.76	4.62	5.44
		Non-electric	2.17	4.76	4.62	5.44
Education – College and University	Single Pane	Electric	2.61	25.42	27.91	16.32
		Non-electric	6.15	32.13	25.64	22.13
	Double Pane	Electric	1.55	8.25	9.95	-1.49
		Non-electric	2.75	10.04	11.97	-0.06
Food Sales - Grocery	Single Pane	Electric	4.14	7.39	-1.54	9.94
		Gas	4.11	7.88	2.79	10.10
	Double Pane	Electric	2.14	3.78	-3.75	5.09
		Gas	2.01	3.99	-1.34	5.08
Food Sales – Convenience Store	Single Pane	Electric	2.40	6.05	-1.68	8.75
		Non-electric	3.75	7.08	3.52	9.27
	Double Pane	Electric	1.22	3.04	-3.30	4.42
		Non-electric	1.89	3.58	-0.19	4.67
Food Sales – Gas Station	Single Pane	Electric	2.40	6.05	-1.68	8.75
		Non-electric	3.75	7.08	3.52	9.27
		Electric	1.22	3.04	-3.30	4.42

[241] ESF for the "Other" building type is taken from the Convenience store building energy model because it represents a conservative savings estimate and common building characteristics.

Building Type[242]	Window Type	Heating System Type[243]	ESF_{North} (kWh/ year·ft²)	ESF_{East} (kWh/ year·ft²)	ESF_{South}[244] (kWh/ year·ft²)	ESF_{West} (kWh/ year·ft²)
Convenience Store	Double Pane	Non-electric	1.89	3.58	-0.19	4.67
Food Service - Full Service	Single Pane	Electric	5.28	12.08	11.10	14.03
		Non-electric	4.93	11.26	11.75	12.72
	Double Pane	Electric	2.80	6.01	5.76	6.72
		Non-electric	2.59	5.75	6.01	6.16
Food Service - Fast Food	Single Pane	Electric	3.66	11.12	9.62	8.79
		Non-electric	3.62	10.63	10.22	8.37
	Double Pane	Electric	1.95	5.97	5.90	4.53
		Non-electric	1.89	5.68	5.93	4.30
Health Care-inpatient	Single Pane	Electric	4.54	21.98	14.75	-23.53
		Non-electric	6.29	26.17	15.16	24.57
	Double Pane	Electric	-12.17	11.23	7.49	-18.79
		Non-electric	6.29	26.17	15.16	24.57
Health Care-outpatient	Single Pane	Electric	2.77	6.02	3.33	2.04
		Non-electric	3.38	7.91	6.50	4.03
	Double Pane	Electric	1.39	3.07	2.69	3.16
		Non-electric	1.73	4.03	4.28	4.06
Lodging – (Hotel, Motel, and Dormitory)	Single Pane	Electric	3.77	10.11	3.68	8.87
		Non-electric	4.91	13.76	10.06	10.85
	Double Pane	Electric	1.85	5.02	-0.76	4.41
		Non-electric	2.50	7.10	2.00	5.48
Mercantile (mall)	Single Pane	Electric	4.11	8.85	7.00	9.50
		Non-electric	6.68	18.30	23.16	21.06
	Double Pane	Electric	2.04	3.95	3.18	4.43
		Non-electric	2.98	9.41	11.37	10.25
Mercantile (Retail, not mall)	Single Pane	Electric	3.38	9.45	13.99	14.03
		Non-electric	3.51	8.96	13.00	8.29
	Double Pane	Electric	1.83	4.81	6.47	6.91
		Non-electric	1.78	4.35	6.05	3.93
Office – Small (<40,000 sq ft)	Single Pane	Electric	1.40	7.28	8.01	7.82
		Non-electric	3.15	8.58	9.81	8.87
	Double Pane	Electric	0.97	3.62	4.05	3.97
		Non-electric	1.57	4.26	4.90	4.43
Office – Large (>= 40,000 sq ft)	Single Pane	Electric	7.86	35.45	46.89	33.70
		Non-electric	13.23	44.49	56.89	41.44
	Double Pane	Electric	4.50	18.99	24.48	17.94
		Non-electric	6.77	22.83	29.08	21.31
Other[245]		Electric	2.40	6.05	-1.68	8.75

Building Type[242]	Window Type	Heating System Type[243]	ESF_{North} (kWh/ year·ft²)	ESF_{East} (kWh/ year·ft²)	ESF_{South}[244] (kWh/ year·ft²)	ESF_{West} (kWh/ year·ft²)
	Single Pane	Gas	3.75	7.08	3.52	9.27
	Double Pane	Electric	1.22	3.04	-3.30	4.42
		Gas	1.89	3.58	-0.19	4.67
Public Assembly	Single Pane	Electric	3.71	7.46	5.46	12.53
		Non-electric	4.56	9.58	9.94	14.91
	Double Pane	Electric	1.88	3.85	2.91	7.77
		Non-electric	2.28	4.86	5.08	9.17
Public Order and Safety (Police and Fire Station)	Single Pane	Electric	3.59	9.59	9.65	8.83
		Non-electric	4.60	12.59	14.30	12.20
	Double Pane	Electric	3.59	9.59	9.65	8.83
		Non-electric	4.60	12.59	14.30	12.20
Religious Worship	Single Pane	Electric	19.30	44.39	20.46	43.22
		Non-electric	11.83	27.15	12.11	26.47
	Double Pane	Electric	10.46	20.33	12.52	22.13
		Non-electric	6.37	12.90	7.24	26.47
Service (Beauty, Auto Repair Workshop)	Single Pane	Electric	4.52	2.56	7.29	3.00
		Non-electric	2.04	4.25	7.57	4.35
	Double Pane	Electric	0.58	1.30	4.58	1.54
		Non-electric	1.02	2.10	4.51	1.42

Table 81: Annual Demand Reduction Factors per Square Foot of Reflective Window Film per Building Type and Window Orientation for Richmond, VA

Building Type[246]	Window Type	Heating System Type[247]	DRF_{North} (kW/ft²)	DRF_{East} (kW/ft²)	DRF_{South}[248] (kW/ft²)	DRF_{West} (kW/ft²)
Education – Elementary and Middle School	Single Pane	Electric	1.74E-03	2.52E-03	3.02E-03	3.83E-03
		Non-electric	1.72E-03	2.62E-03	2.90E-03	3.54E-03
	Double Pane	Electric	9.60E-04	1.33E-03	1.62E-03	2.01E-03
		Non-electric	8.47E-04	1.47E-03	1.41E-03	1.89E-03
Education – High School	Single Pane	Electric	1.18E-03	2.03E-03	4.89E-03	1.97E-03
		Non-electric	1.24E-03	2.42E-03	7.87E-03	3.10E-03
		Electric	6.16E-04	1.03E-03	1.18E-03	1.29E-03

[246] Warehouse and storage building type DEER models do not have windows. Tracking data with this building type will be flagged for on-site verification.

[247] Non-electric heating systems were represented by gas heating in building energy models.

[248] Negative demand reductions are observed in some building types for south window orientation, implying that installation of window film on the south side of the these buildings leads to increased energy use due to increase heating load in the winter season.

Building Type[246]	Window Type	Heating System Type[247]	DRF_{North} (kW/ft^2)	DRF_{East} (kW/ft^2)	DRF_{South}[248] (kW/ft^2)	DRF_{West} (kW/ft^2)
	Double Pane	Non-electric	6.99E-04	1.22E-03	1.42E-03	1.88E-03
Education – College and University	Single Pane	Electric	1.20E-03	2.67E-03	3.18E-03	3.21E-03
		Non-electric	1.26E-03	2.79E-03	3.24E-03	3.21E-03
	Double Pane	Electric	6.32E-04	1.30E-03	1.85E-03	1.58E-03
		Non-electric	6.61E-04	1.36E-03	1.95E-03	1.56E-03
Food Sales - Grocery	Single Pane	Electric	1.08E-03	1.68E-03	2.26E-04	2.57E-03
		Gas	1.03E-03	1.47E-03	-2.55E-04	2.30E-03
	Double Pane	Electric	5.45E-04	8.76E-04	-8.30E-04	1.33E-03
		Gas	4.73E-04	7.23E-04	-1.20E-03	1.14E-03
Food Sales – Convenience Store	Single Pane	Electric	8.76E-04	1.56E-03	7.02E-04	2.43E-03
		Non-electric	8.34E-04	1.33E-03	2.23E-04	2.12E-03
	Double Pane	Electric	4.25E-04	8.15E-04	-2.46E-04	1.25E-03
		Non-electric	4.80E-04	6.75E-04	-6.07E-04	1.08E-03
Food Sales – Gas Station Convenience Store	Single Pane	Electric	8.76E-04	1.56E-03	7.02E-04	2.43E-03
		Non-electric	8.34E-04	1.33E-03	2.23E-04	2.12E-03
	Double Pane	Electric	4.25E-04	8.15E-04	-2.46E-04	1.25E-03
		Non-electric	4.80E-04	6.75E-04	-6.07E-04	1.08E-03
Food Service - Full Service	Single Pane	Electric	1.16E-03	2.16E-03	2.18E-03	2.86E-03
		Non-electric	1.05E-03	1.91E-03	1.93E-03	2.55E-03
	Double Pane	Electric	5.84E-04	1.07E-03	1.09E-03	1.43E-03
		Non-electric	5.27E-04	9.64E-04	9.69E-04	1.27E-03
Food Service - Fast Food	Single Pane	Electric	1.01E-03	2.04E-03	1.29E-03	2.04E-03
		Non-electric	8.82E-04	1.80E-03	1.83E-03	1.79E-03
	Double Pane	Electric	5.29E-04	9.72E-04	1.13E-03	1.05E-03
		Non-electric	4.58E-04	8.46E-04	9.74E-04	9.19E-04
Health Care-inpatient	Single Pane	Electric	8.09E-04	3.14E-03	-9.03E-03	1.28E-03
		Non-electric	7.17E-04	2.76E-03	-2.81E-03	3.22E-03
	Double Pane	Electric	4.25E-04	1.18E-03	7.57E-04	6.41E-04
		Non-electric	5.55E-04	1.61E-03	9.14E-04	1.78E-03
		Electric	8.09E-04	1.68E-03	-3.34E-05	1.81E-03

Building Type[246]	Window Type	Heating System Type[247]	DRF_{North} (kW/ft^2)	DRF_{East} (kW/ft^2)	DRF_{South}[248] (kW/ft^2)	DRF_{West} (kW/ft^2)
Health Care-outpatient	Single Pane	Non-electric	8.06E-04	1.75E-03	-4.43E-07	1.87E-03
	Double Pane	Electric	4.33E-04	8.48E-04	-8.85E-04	9.14E-04
		Non-electric	4.38E-04	8.81E-04	-8.91E-04	9.45E-04
Lodging – (Hotel, Motel, and Dormitory)	Single Pane	Electric	1.08E-03	1.60E-03	1.61E-03	2.31E-03
		Non-electric	1.25E-03	2.14E-03	1.95E-03	2.57E-03
	Double Pane	Electric	5.56E-04	8.37E-04	6.35E-04	1.15E-03
		Non-electric	6.40E-04	1.11E-03	6.73E-04	1.28E-03
Mercantile (mall)	Single Pane	Electric	1.45E-03	2.49E-03	2.47E-03	3.01E-03
		Non-electric	1.27E-03	2.05E-03	2.12E-03	2.45E-03
	Double Pane	Electric	7.52E-04	1.21E-03	1.26E-03	1.52E-03
		Non-electric	6.33E-04	1.02E-03	1.06E-03	1.22E-03
Mercantile (Retail, not mall)	Single Pane	Electric	1.03E-03	1.96E-03	2.35E-03	2.79E-03
		Non-electric	1.01E-03	1.85E-03	2.01E-03	2.26E-03
	Double Pane	Electric	5.04E-04	9.78E-04	1.10E-03	1.64E-03
		Non-electric	4.93E-04	8.39E-04	9.26E-04	1.34E-03
Office – Small (<40,000 sq ft)	Single Pane	Electric	6.43E-04	1.75E-03	1.59E-03	2.35E-03
		Non-electric	8.41E-04	1.74E-03	1.47E-03	2.24E-03
	Double Pane	Electric	3.28E-04	9.10E-04	9.75E-04	1.18E-03
		Non-electric	4.31E-04	8.79E-04	9.45E-04	1.12E-03
Office – Large (>= 40,000 sq ft)	Single Pane	Electric	3.10E-03	8.52E-03	9.84E-03	9.20E-03
		Non-electric	3.11E-03	8.62E-03	9.95E-03	9.28E-03
	Double Pane	Electric	1.58E-03	4.33E-03	5.04E-03	4.74E-03
		Non-electric	1.61E-03	4.42E-03	5.11E-03	4.79E-03
Other[249]	Single Pane	Electric	8.76E-04	1.56E-03	7.02E-04	2.43E-03
		Gas	8.34E-04	1.33E-03	2.23E-04	2.12E-03
	Double Pane	Electric	4.25E-04	8.15E-04	-2.46E-04	1.25E-03
		Gas	4.80E-04	6.75E-04	-6.07E-04	1.08E-03
Public Assembly		Electric	1.10E-03	1.82E-03	1.92E-03	5.63E-03

[249] DRF for the "Other" building type is taken from the Convenience store building energy model because it represents a conservative savings estimate and common building characteristics.

Building Type[246]	Window Type	Heating System Type[247]	DRF$_{North}$ (kW/ft^2)	DRF$_{East}$ (kW/ft^2)	DRF$_{South}$[248] (kW/ft^2)	DRF$_{West}$ (kW/ft^2)
	Single Pane	Non-electric	1.21E-03	1.99E-03	2.07E-03	7.11E-03
	Double Pane	Electric	5.68E-04	9.40E-04	9.83E-04	4.42E-03
		Non-electric	6.17E-04	1.02E-03	1.05E-03	5.83E-03
Public Order and Safety (Police and Fire Station)	Single Pane	Electric	8.03E-04	1.95E-03	7.56E-04	1.64E-03
		Non-electric	7.68E-04	2.10E-03	8.88E-04	1.75E-03
	Double Pane	Electric	3.97E-04	9.84E-04	1.07E-03	3.42E-04
		Non-electric	3.91E-04	1.06E-03	1.14E-03	4.04E-04
Religious Worship	Single Pane	Electric	5.10E-03	1.20E-02	5.86E-03	1.26E-02
		Non-electric	2.80E-03	6.93E-03	3.27E-03	7.09E-03
	Double Pane	Electric	2.91E-03	6.49E-03	3.11E-03	6.73E-03
		Non-electric	1.63E-03	3.81E-03	1.77E-03	3.84E-03
Service (Beauty, Auto Repair Workshop)	Single Pane	Electric	9.90E-04	1.02E-03	0.00E+00	1.37E-03
		Non-electric	6.19E-04	1.49E-03	1.07E-03	1.43E-03
	Double Pane	Electric	2.94E-04	4.34E-04	5.10E-04	6.89E-04
		Non-electric	3.08E-04	4.76E-04	5.34E-04	7.13E-04

Table 82: Annual Demand Reduction Factors per Square Foot of Reflective Window Film per Building Type and Window Orientation for Elizabeth City, NC

Building Type[250]	Window Type	Heating System Type[251]	DRF$_{North}$ (kW/ft^2)	DRF$_{East}$ (kW/ft^2)	DRF$_{South}$[252] (kW/ft^2)	DRF$_{West}$ (kW/ft^2)
Education – Elementary and Middle School	Single Pane	Electric	1.84E-03	2.55E-03	3.09E-03	4.07E-03
		Non-electric	9.54E-04	1.41E-03	1.52E-03	2.02E-03
	Double Pane	Electric	9.97E-04	1.32E-03	1.58E-03	2.12E-03
		Non-electric	9.54E-04	1.41E-03	1.52E-03	2.02E-03
		Electric	1.26E-03	2.09E-03	2.37E-03	3.30E-03

[250] Warehouse and storage building type DEER models do not have windows. Tracking data with this building type will be flagged for on-site verification.

Building Type[250]	Window Type	Heating System Type[251]	DRF_{North} (kW/ft²)	DRF_{East} (kW/ft²)	DRF_{South}[252] (kW/ft²)	DRF_{West} (kW/ft²)
Education – High School	Single Pane	Non-electric	1.26E-03	2.09E-03	2.37E-03	3.30E-03
	Double Pane	Electric	6.25E-04	1.04E-03	1.19E-03	1.62E-03
		Non-electric	6.25E-04	1.04E-03	1.19E-03	1.62E-03
Education – College and University	Single Pane	Electric	1.26E-03	4.43E-03	4.51E-03	3.99E-03
		Non-electric	1.49E-03	4.79E-03	3.42E-03	4.22E-03
	Double Pane	Electric	6.72E-04	1.46E-03	1.53E-03	5.12E-04
		Non-electric	6.39E-04	1.42E-03	1.48E-03	4.61E-04
Food Sales - Grocery	Single Pane	Electric	1.02E-03	1.65E-03	-6.42E-04	2.84E-03
		Gas	8.59E-04	1.38E-03	-1.12E-03	2.46E-03
	Double Pane	Electric	5.38E-04	8.52E-04	-1.48E-03	1.44E-03
		Gas	4.43E-04	7.00E-04	-1.86E-03	1.25E-03
Food Sales – Convenience Store	Single Pane	Electric	9.15E-04	1.54E-03	-5.66E-05	2.69E-03
		Non-electric	9.24E-04	1.29E-03	-4.56E-04	2.33E-03
	Double Pane	Electric	4.63E-04	8.00E-04	-8.48E-04	1.37E-03
		Non-electric	4.74E-04	6.64E-04	-1.15E-03	1.18E-03
Food Sales – Gas Station Convenience Store	Single Pane	Electric	9.15E-04	1.54E-03	-5.66E-05	2.69E-03
		Non-electric	9.24E-04	1.29E-03	-4.56E-04	2.33E-03
	Double Pane	Electric	4.63E-04	8.00E-04	-8.48E-04	1.37E-03
		Non-electric	4.74E-04	6.64E-04	-1.15E-03	1.18E-03
Food Service - Full Service	Single Pane	Electric	1.18E-03	2.01E-03	2.19E-03	3.32E-03
		Non-electric	1.02E-03	1.76E-03	1.94E-03	2.94E-03
	Double Pane	Electric	5.93E-04	9.96E-04	1.10E-03	1.64E-03
		Non-electric	5.04E-04	8.88E-04	9.83E-04	1.45E-03
Food Service - Fast Food	Single Pane	Electric	9.86E-04	2.06E-03	1.83E-03	2.35E-03
		Non-electric	8.58E-04	1.80E-03	1.52E-03	2.07E-03
	Double Pane	Electric	5.13E-04	1.09E-03	1.11E-03	1.21E-03
		Non-electric	4.45E-04	9.56E-04	9.55E-04	1.06E-03
Health Care-inpatient	Single Pane	Electric	8.69E-04	3.44E-03	2.37E-03	-3.25E-03
		Non-electric	1.07E-03	3.52E-03	2.03E-03	4.36E-03
	Double Pane	Electric	-2.02E-03	1.83E-03	1.22E-03	-2.91E-03

Building Type[250]	Window Type	Heating System Type[251]	DRF_{North} (kW/ft^2)	DRF_{East} (kW/ft^2)	DRF_{South}[252] (kW/ft^2)	DRF_{West} (kW/ft^2)
		Non-electric	1.07E-03	3.52E-03	2.03E-03	4.36E-03
Health Care-outpatient	Single Pane	Electric	9.19E-04	1.75E-03	1.28E-03	9.88E-04
		Non-electric	9.37E-04	1.82E-03	1.36E-03	1.02E-03
	Double Pane	Electric	4.70E-04	8.82E-04	8.92E-04	1.01E-03
		Non-electric	4.79E-04	9.16E-04	9.39E-04	1.05E-03
Lodging – (Hotel, Motel, and Dormitory)	Single Pane	Electric	1.05E-03	1.75E-03	1.17E-03	2.62E-03
		Non-electric	1.20E-03	2.40E-03	1.67E-03	2.97E-03
	Double Pane	Electric	5.33E-04	8.90E-04	9.50E-05	1.34E-03
		Non-electric	6.12E-04	1.25E-03	1.70E-04	1.50E-03
Mercantile (mall)	Single Pane	Electric	1.55E-03	2.69E-03	2.53E-03	3.49E-03
		Non-electric	1.32E-03	2.93E-03	2.97E-03	4.13E-03
	Double Pane	Electric	7.74E-04	1.34E-03	1.27E-03	1.74E-03
		Non-electric	6.51E-04	1.44E-03	1.46E-03	2.04E-03
Mercantile (Retail, not mall)	Single Pane	Electric	1.12E-03	1.96E-03	2.41E-03	3.76E-03
		Non-electric	9.24E-04	1.60E-03	2.05E-03	2.58E-03
	Double Pane	Electric	6.28E-04	1.02E-03	1.15E-03	1.85E-03
		Non-electric	4.85E-04	8.46E-04	9.94E-04	1.27E-03
Office – Small (<40,000 sq ft)	Single Pane	Electric	6.82E-04	1.77E-03	1.90E-03	2.83E-03
		Non-electric	8.47E-04	1.71E-03	1.87E-03	2.64E-03
	Double Pane	Electric	3.70E-04	8.73E-04	9.07E-04	1.42E-03
		Non-electric	4.14E-04	8.43E-04	9.04E-04	1.33E-03
Office – Large (>= 40,000 sq ft)	Single Pane	Electric	3.21E-03	8.24E-03	9.91E-03	9.71E-03
		Non-electric	3.20E-03	8.35E-03	1.00E-02	9.79E-03
	Double Pane	Electric	1.62E-03	4.20E-03	5.01E-03	4.99E-03
		Non-electric	1.62E-03	4.22E-03	5.05E-03	4.98E-03
Other[253]	Single Pane	Electric	9.15E-04	1.54E-03	-5.66E-05	2.69E-03
		Gas	9.24E-04	1.29E-03	-4.56E-04	2.33E-03
		Electric	4.63E-04	8.00E-04	-8.48E-04	1.37E-03

Building Type[250]	Window Type	Heating System Type[251]	DRF_{North} (kW/ft^2)	DRF_{East} (kW/ft^2)	DRF_{South}[252] (kW/ft^2)	DRF_{West} (kW/ft^2)
	Double Pane	Gas	4.74E-04	6.64E-04	-1.15E-03	1.18E-03
Public Assembly	Single Pane	Electric	1.10E-03	1.84E-03	1.83E-03	3.88E-03
		Non-electric	1.21E-03	2.04E-03	1.97E-03	4.69E-03
	Double Pane	Electric	5.61E-04	9.44E-04	9.38E-04	2.48E-03
		Non-electric	6.10E-04	1.04E-03	1.01E-03	3.19E-03
Public Order and Safety (Police and Fire Station)	Single Pane	Electric	1.04E-03	2.03E-03	2.34E-03	2.36E-03
		Non-electric	1.07E-03	2.19E-03	2.54E-03	2.53E-03
	Double Pane	Electric	1.04E-03	2.03E-03	2.34E-03	2.36E-03
		Non-electric	1.07E-03	2.19E-03	2.54E-03	2.53E-03
Religious Worship	Single Pane	Electric	5.90E-03	1.32E-02	5.95E-03	1.32E-02
		Non-electric	3.38E-03	7.84E-03	3.33E-03	7.55E-03
	Double Pane	Electric	3.13E-03	6.11E-03	3.55E-03	6.75E-03
		Non-electric	1.81E-03	3.45E-03	2.14E-03	7.55E-03
Service (Beauty, Auto Repair Workshop)	Single Pane	Electric	9.37E-04	9.53E-04	1.88E-03	1.70E-03
		Non-electric	6.39E-04	1.07E-03	1.96E-03	1.69E-03
	Double Pane	Electric	2.99E-04	4.94E-04	1.10E-03	8.64E-04
		Non-electric	3.19E-04	1.15E-03	1.15E-03	5.78E-04

Default Savings

No default savings will be awarded for this measure if the proper values are not provided in the customer application.

Source

The primary source for this deemed savings approach is prototypical building energy models defined by the 2008 Database for Energy Efficient Resources (DEER)[254], modified to represent Richmond, VA and Elizabeth City, NC weather and window characteristics.

[254] http://www.energy.ca.gov/deer/

14 NON-RESIDENTIAL DISTRIBUTED GENERATION PROGRAM

The Non-Residential Distributed Generation (NRDG) Program is designed to reduce peak demand for the Company. In exchange for incentives, qualifying and participating customers commit to curtail load by operating backup generation when called upon by the Company. The program terms place restrictions on the number of hours per year that an event can be called and operates 12 months per year.

The program is implemented by a third party contractor who installs the controls that enable dispatch, remote operations and monitoring of the customer's backup generation resource during an event under the direction of the Company. The implementation contractor and participant are provided notice of each event at least 30 minutes in advance of an event either by e-mail or telephone. Total average event kW curtailment, calculated on a monthy basis, must be at least 95% of enrolled and committed kW for the participating customer to be considered compliant.

Measure Description

The primary output of the (DG) program is the amount of kW demand reduction achieved by the backup generation resource at each customer site. The most important indicator of performance is the realization rate. The realization rate is calculated as an overall aggregate of all sites for each month of the program, and at the site level by event day. The methology for calculating the realization rate is presented in further detail in the following section.

Savings Estimation Approach

The first step in estimating savings is aggregation of the kW resource commited, dispatched, and measured across participant sites for each event interval. The start and end time of each event can vary by event, as can the number of dispatched sites.

The primary measure of program performance is the realization rate. For an individual site and interval, the ex-post impact is an estimate of the kW resource generated. This ex-post value is divided by the dispatched (expected) kW resource at the site and interval level.

In the equation below, the realization rate for the total Program in an event interval is the total measured generation (ex post value) divided by the total dispatched generation. For participants indexed by i, and for an event interval j,

$$Realization\ Rate_j = \frac{\sum_i Measured\ Generation\ (kW)}{\sum_i Dispatched\ Generation\ (kW)}$$

The aggregated ex-post and amount of dispatched generation across the Program is tabulated by event interval and day for performance tracking. Event day plots facilitate the analysis of realization rate patterns for the entire program.

Input Variables

Table 83: Input Values for Non-Residential Distributed Generation Savings Calculations

Component	Type	Value	Unit	Source(s)
Measured Generation	Variable	Metered site data	kW	Supplied by Dominion Metering Data
Dispatched Generation	Variable	Metered site data	kW	Supplied by Dominion Metering Data
Enrolled Amount	Variable	Fixed per generation site	kW	Supplied by Dominion Enrollment Data

Default Savings

No default savings will be awarded for an NRDG resource if actual measured values of the resource are not available.

Source(s)

DNV GL developed the methodology used to generate savings for this program according to standard EM&V protocols.

15 NON-RESIDENTIAL SMALL BUSINESS IMPROVEMENT PROGRAM

Dominion's Non-Residential Small Business Improvement Program provides small business owners incentives to use Dominion approved contractors to provide many of the measures already provided through existing legacy programs that typically target building owners: Non-Residential Energy Audit Program, Non-Residential Heating and Cooling Efficiency program, Non-residential Lighting Systems and Controls program, and Non-Residential Duct Testing and Sealing program. In addition, four HVAC-retrocommissioning measures are provided. Program measures are summarized in Table 84.

According to the program terms and conditions, as of June 2017, to be eligible to participate in this program, Dominion Energy Virginia non-residential customers must be of a privately-owned business with five or fewer locations that has not exceeded monthly demand of 100 kW three or more times in the past 12 months, has not opted out of participation, is responsible for the electric bill and is the owner of the facility or reasonably able to secure permission to complete measures. Once a customer participates in the program and receive a rebate, they cannot opt out for three years following the year of participation.

Furthermore, as of June 1, 2017 the Small Business Improvement Program will no longer deliver refrigeration measures to Virginia customers.

Table 84: Small Business Improvement Program Measure List

End-Use	Measure	Legacy Program	Manual Section
HVAC	Duct Testing & Sealing	N/A	Section 15.2.1
	Unitary/Split AC, HP, and Chiller Tune-up		Section 15.2.2
	Refrigerant Charge Correction		Section 15.2.3
	Unitary/Split AC & HP Upgrade	Non-Res. Heating & Cooling Efficiency	Section 10.1.1
	Mini-split Heat Pump		Section 10.1.2
	Dual Enthalpy Air-side Economizer		Section 0
	Variable Frequency Drive		Section 10.1.4
	Programmable Thermostat	N/A	Section 1.1.1
Lighting	Lighting, Fixtures, Lamps, and Delamping	Non-Res. Lighting Systems & Controls	Section 9.1.1
	Sensors & Controls		Section 9.1.2
	LED Exit Signs	N/A	Section 1.1.1
Refrigeration [255]	Door Gasket	Non-residential Prescriptive	Section 16.4.2
	Door Closer		Section 16.4.1
	Strip Curtain		Section 1.1.1
	Night Cover		Section 16.4.8
Other	Compressed Air Leak Repair	N/A	Section 15.5.1

[255] Due to SCC ruling, refrigeration measures were discontinued in this program in mid-2017.

15.2 Heating Ventilation and Air Conditioning (HVAC) End Use

15.2.1 Duct Testing and Sealing

Measure Description

This measures provides building owners incentives to use Dominion-approved, duct-sealing contractors to reduce conditioned-air leakage to unconditioned spaces by the following steps: 1) test non-residential duct systems for air leakage, 2) seal the ducts using an aerosol based product, and then 3) test the sealed duct systems for air leakage to confirm that sealing the ducts reduced the air-leakage rate.

Eligible ductwork is connected to a unitary HVAC system or a heat pump and occurs within an unconditioned plenum space or between an insulated, finished ceiling and a roof surface. Based on DNV GL's judgment, this measure is applicable to ductwork at unitary and chiller-cooled systems.

Savings Estimation Approach

Unitary Systems, Air Source Heat Pumps, and AC Units Annual Savings

Gross annual electric energy savings are calculated according to the following equations.

Unitary systems, for air-source heat pumps and AC units <65,000 Btu/h:

$$\Delta kWh/year = tons \times \frac{12\ kBtuh/ton}{SEER} \times FLH_{cool} \times \left(1 - \frac{\bar{n}_{dist,base}}{\bar{n}_{dist,ee}}\right)_{cool}$$

$$+kBtuh \times \frac{FLH_{heat}}{HSPF} \times \left(1 - \frac{\bar{n}_{dist,base}}{\bar{n}_{dist,ee}}\right)_{heat}$$

Unitary systems, for air-source heat pumps and AC units ≥65,000 Btu/h:

$$\Delta kWh/year = tons \times \frac{12\ kBtuh/ton}{IEER} \times FLH_{cool} \times \left(1 - \frac{\bar{n}_{dist,base}}{\bar{n}_{dist,ee}}\right)_{cool}$$

$$+kBtuh \times \frac{FLH_{heat}}{COP} \times \left(1 - \frac{\bar{n}_{dist,base}}{\bar{n}_{dist,ee}}\right)_{heat}$$

Chiller System Annual Savings

$$\Delta kWh/year = \Delta kWh/year_{cool} + \Delta kWh/year_{heat}$$

Water-cooled chiller systems, cooling savings:

$$\Delta kWh/year_{water-cooled\ chiller,cool} = tons \times \frac{kW}{ton_{IPLV}} \times FLH_{cool} \times \left(1 - \frac{\bar{n}_{dist,base}}{\bar{n}_{dist,ee}}\right)_{cool}$$

Air-cooled chiller systems, cooling savings:

$$\Delta kWh/year_{air-cooled\ chiller,cool} = tons \times \frac{12\ kBtuh/ton}{EER_{IPLV}} \times FLH_{cool} \times \left(1 - \frac{\bar{n}_{dist,base}}{\bar{n}_{dist,ee}}\right)_{cool}$$

Chiller system heating savings <65,000 Btu/h:

$$\Delta kWh/year_{heat,<65kBtuh} = kBtuh_{out} \times \frac{FLH_{heat}}{HSPF} \times \left(1 - \frac{\bar{n}_{dist,base}}{\bar{n}_{dist,ee}}\right)_{heat}$$

Chiller system heating savings ≥65,000 Btu/h:

$$\Delta kWh/year_{heat,\geq 65kBtuh} = kBtuh_{heat,\geq 65kBtuh} \times \frac{FLH_{heat}}{COP} \times \left(1 - \frac{\bar{n}_{dist,base}}{\bar{n}_{dist,ee}}\right)_{heat}$$

Heating systems with non-electric primary heat will receive zero heating savings.

Peak Demand Savings

Gross coincident demand reductions are calculated according to the following equations.

Unitary systems:

$$\Delta kW = tons \times \frac{12\ kBtuh/ton}{EER} \times \left(1 - \frac{n_{dist,pk,base}}{n_{dist,pk,ee}}\right) \times CF$$

Water-cooled chiller systems:

$$\Delta kW = tons \times \frac{kW}{ton_{full\ load}} \times \left(1 - \frac{\bar{n}_{dist,pk,base}}{\bar{n}_{dist,pk,ee}}\right) \times CF$$

Air-cooled chiller systems:

$$\Delta kW = tons \times \frac{12\ kBtuh/ton}{EER_{full\ load}} \times \left(1 - \frac{\bar{n}_{dist,pk,base}}{\bar{n}_{dist,pk,ee}}\right) \times CF$$

Where:

ΔkWh/year	=	gross annual electric energy savings
ΔkW	=	gross coincident demand reductions
tons	=	system cooling capacity in tons, based on nameplate data
kBtuh	=	nominal rating of the unitary systems (heat pumps or AC units)
SEER	=	seasonal energy efficiency ratio in Btu/watt-hour

EER = energy efficiency ratio in Btu/watt-hour. See Equation 6: Energy Efficiencies - COP to EER, in Appendix E to convert SEER to EER, if EER is not provided.

HSPF = heating seasonal performance factor in Btu/watt-hour. See Equation 5, in Appendix E, to convert COP to HSPF, if HSPF is not provided.

$\bar{n}_{dist,base,cool}$ = duct system average seasonal efficiency of baseline (pre-sealing) cooling system

$\bar{n}_{dist,base,heat}$ = duct system average seasonal efficiency of baseline (pre-sealing) heating system

$\bar{n}_{dist,ee,cool}$ = duct system average seasonal efficiency of efficient (post-sealing) cooling system

$\bar{n}_{dist,ee,heat}$ = duct system average seasonal efficiency of efficient (post-sealing) heating system

$n_{dist,pk,base}$ = duct system efficiency of baseline system, under peak conditions (equal to $\bar{n}_{dis,base,cool}$)

$n_{dist,pk,ee}$ = duct system efficiency of efficient system, under peak conditions (equal to $\bar{n}_{dis,base,cool}$)

$\frac{kW}{ton_{IPLV}}$ = chiller system efficiency at integrated part load value (IPLV) in kW/ton

$\frac{kW}{ton_{full\ load}}$ = chiller system efficiency at full load in kW/ton

FLH_{cool} = annual cooling equivalent full load hours (FLH). It is the ratio of the annual building cooling energy to nameplate capacity

$$FLH_{cool} = \frac{Annual\ kWh_{cooling}}{kW_{peak,cooling}}$$

FLH_{heat} = annual heating equivalent FLH. It is the ratio of the annual building heating energy to the nameplate capacity.

$$FLH_{heat} = \frac{Annual\ Heating\ Energy\ (Btu)}{Nameplate\ capacity\ (Btu/h)}$$

CF = peak coincidence factor

Input Variables

Table 85: Input Values for Duct Sealing Savings Calculations

Component	Type	Value	Unit	Source(s)
tons	Variable	See customer application.	tons/unit	Customer application
kBtuh	Variable	See customer application.	kBtu/h-unit	Customer application
SEER	Variable	See customer application.	kBtu/kW-hr	Customer application
		Default: see Table 37 and Table 38.		ASHRAE 90.1-2010
IEER	Variable	See customer application	kBtu/kW-hr	Customer application
		Default: see Table 37 and Table 38.		ASHRAE 90.1-2010
EER	Variable	See customer application	kBtu/kW-hr	Customer application
		Default: see Table 37 and Table 38.		ASHRAE 90.1-2010
HSPF	Variable	See customer application	-	Customer application
		Default: see Table 38.		ASHRAE 90.1-2010
$kW/ton_{full\ load}$	Variable	See customer application.[256]	kW/ton	Customer application
		Default: see Table 43.		ASHRAE 90.1-2010
kW/ton_{IPLV}	Variable	See customer application.	kW/ton	Customer application
		Default: see Table 43.		ASHRAE 90.1-2010
$EER_{full\ load}$	Variable	See customer application.[257]	kBtu/kW-h	Customer application
		Default: see Table 43		ASHRAE 90.1-2010
EER_{IPLV}	Variable	See customer application.	kBtu/kW-h	Customer application
		Default: see Table 43		ASHRAE 90.1-2010
$\overline{n}_{dist,base,cool}$	Variable	See customer application**Error! Reference source not found.**	%	Customer application
		Default: No insulation, 30% leakage.		New York TRM 2016, p. 199
$\overline{n}_{dist,base,heat}$	Variable	See customer application Table 86 and Table 87	%	Customer application
		Default: No insulation, 30% leakage		New York TRM 2016, p. 199
$\overline{n}_{dist,ee,cool}$	Variable	See customer application Table 86 and Table 87	%	Customer application
		Default: No insulation, 15% leakage		New York TRM 2016, p. 199
$\overline{n}_{dist,ee,heat}$	Variable	See customer application Table 86 and Table 87	%	Customer application

[256] When missing either the IPLV or the full load value, use the following efficiency relationship to replace the missing value: kW/tonIPLV = C x kW/ton full load, where C=0.80 for water-cooled chillers <200 ton and C=0.95 for water-cooled chillers ⩾200 ton.

[257] When missing either the IPLV or the full load value, use the following efficiency relationship to replace the missing value: EER_{IPLV} = C x $EER_{full\ load}$, where C=0.76 for air-cooled chillers.

Component	Type	Value	Unit	Source(s)
		Default: No insulation, 15% leakage		New York TRM 2016, p. 199
$n_{dist,pk,base}$	Variable	See customer application Table 86 and Table 87	%	Customer application
		Default: No insulation, 30% leakage		New York TRM 2016, p. 199
$n_{dist,pk,ee}$	Variable	See customer application Table 86 and Table 87	%	Customer application
		Default: No insulation, 15% leakage		New York TRM 2016, p. 199
FLH_{heat}	Fixed	See Table 139.	hours/year	Mid-Atlantic TRM 2017 p. 351-353
FLH_{cool}	Fixed	For the Non-residential Small Business Improvement Program and Non-residential Prescriptive Program, see Table 138; for CDUC Program, see ; for chiller systems, see Table 42.	hours/year	Mid-Atlantic TRM 2017 p. 351-353
CF	Fixed	0.68	-	Calculated CF from Dominion's DSM Phase I program. April 1, 2012 EM&V Report, Appendix C-1, p. F-1[258]

The New York TRM (2016) provides values for duct system efficiency for uninsulated ducts and ducts with R-6 insulation for four building types: assembly building, fast food restaurant, full service restaurant, and small retail. The average column in **Error! Reference source not found.** is a simple average of the four building types. The values for R-2, R-4 and R-8 insulation have been calculated by scaling the results using an engineering relationship of the effectiveness of increasing R-values (non-linear).

The manual provides efficiencies for only five leakage-rate bins: 8%, 15%, 20%, 25%, and 30%. In preparation for receiving duct leakage percentages that do not match these specific values, DNV GL used a linear regression to model duct system efficiency as a function of leakage percent. The coefficients from this model were used to compute duct system efficiency for any leakage value between 0% and 50%.

[258] Appendix C-1, Commercial HVAC Program: Load Shape and Net Savings Analysis Evaluation Report; Evaluation, Measurement and Verification Report for Dominion Virginia Power, Case PUE-2010-00084, Apr. 1, 2012, p. F-1.

Table 86: Duct System Efficiency[259]

Duct Total Leakage (%)	Duct System R-Value (Supply and Return)	Assembly Building		Fast Food Restaurant		Full Service Restaurant		Small Retail		Average	
		Heating	Cooling	Heating	Cooling	Heating	Cooling	Heating	Cooling	Heating	Cooling
8	Uninsulated	0.857	0.922	0.766	0.866	0.797	0.854	0.614	0.838	0.759	0.870
15	Uninsulated	0.829	0.908	0.734	0.853	0.765	0.845	0.581	0.827	0.727	0.858
20	Uninsulated	0.810	0.897	0.714	0.844	0.743	0.837	0.559	0.818	0.707	0.849
25	Uninsulated	0.793	0.886	0.693	0.834	0.721	0.829	0.538	0.809	0.686	0.840
30	Uninsulated	0.776	0.873	0.675	0.823	0.701	0.820	0.520	0.799	0.668	0.829
8	R-2	0.877	0.954	0.821	0.906	0.845	0.904	0.691	0.885	0.808	0.912
15	R-2	0.846	0.938	0.780	0.889	0.807	0.893	0.648	0.871	0.770	0.898
20	R-2	0.826	0.926	0.754	0.878	0.781	0.884	0.619	0.861	0.745	0.887
25	R-2	0.807	0.913	0.729	0.865	0.755	0.874	0.593	0.850	0.721	0.875
30	R-2	0.789	0.899	0.707	0.852	0.732	0.864	0.570	0.839	0.699	0.863
8	R-4	0.886	0.970	0.848	0.925	0.869	0.929	0.729	0.908	0.833	0.933
15	R-4	0.855	0.952	0.802	0.907	0.827	0.917	0.681	0.893	0.791	0.917
20	R-4	0.833	0.940	0.774	0.894	0.799	0.908	0.649	0.883	0.764	0.906
25	R-4	0.814	0.926	0.747	0.881	0.772	0.897	0.621	0.871	0.738	0.893
30	R-4	0.795	0.911	0.723	0.867	0.748	0.885	0.594	0.859	0.715	0.881
8	R-6	0.896	0.986	0.875	0.945	0.893	0.954	0.767	0.931	0.858	0.954
15	R-6	0.863	0.967	0.825	0.925	0.848	0.941	0.714	0.915	0.813	0.937
20	R-6	0.841	0.954	0.794	0.911	0.818	0.931	0.679	0.904	0.783	0.925
25	R-6	0.821	0.939	0.765	0.896	0.789	0.919	0.648	0.891	0.756	0.911
30	R-6	0.801	0.924	0.739	0.881	0.763	0.907	0.619	0.879	0.731	0.898
8	R-8	0.901	0.994	0.889	0.955	0.905	0.967	0.786	0.943	0.870	0.965
15	R-8	0.867	0.974	0.836	0.934	0.858	0.953	0.731	0.926	0.823	0.947
20	R-8	0.845	0.961	0.804	0.919	0.827	0.943	0.694	0.915	0.793	0.935
25	R-8	0.825	0.946	0.774	0.904	0.798	0.930	0.662	0.901	0.764	0.920
30	R-8	0.804	0.930	0.747	0.888	0.771	0.918	0.631	0.889	0.738	0.906

[259] NY TRM 2016, Appendix H. Distribution Efficiencies, p. 448 – 451. New York City values are used for heating and cooling efficiencies for different building types. This table represent more R-Values and total duct leakage (%) than the reference table and for those cases, regression analysis was performed to obtain the respective heating and cooling duct system efficiencies.

Table 87: Duct System Efficiency Mapping to Building Type[260]

Building Type	Associated Duct System Efficiency Building Type
Education Education – College and University Education – High School Education – Elementary and Middle School Health Care – inpatient Health Care – outpatient Lodging – (Hotel, Motel, and Dormitory) Office – Small (< 40,000 sq ft) Office – Large (≥ 40,000 sq ft) Other Warehouse and Storage	Average
Food Sales Food Sales – Gas Station Convenience Store Food Sales – Convenience Store Food Sales – Grocery Mercantile (Retail, not Mall) Mercantile (Mall) Service (Beauty, Auto Repair Workshop)	Small Retail
Food Service Food Service – Fast Food Food Service – Other	Fast Food Restaurant
Food Service – Restaurant Food Service – Full Service	Full Service Restaurant
Public Assembly Public Order and Safety (Police and Fire Station) Religious Worship	Assembly Building

Default Savings

If the proper values are not supplied, a default savings may be applied using conservative input values. Default hours of use will be taken from the above chart if the building type is available.

Source(s)

The primary sources for this deemed savings approach is the New York TRM 2016, p. 198-201, Mid-Atlantic TRM 2017, and ASHRAE 90.1-2010.

[260] Where "Building Type" does not clearly map to "Associated Duct System Efficiency Building Type," "Associated Duct System Efficiency Building Type is assigned to most conservative type." Full building type list was consolidated to map directly to 2003 U.S. DOE CBECS building types. Full building type list from Mid-Atlantic TRM. Original sources: Connecticut Program Savings Document for 2012 Program Year (September, 2011), p. 219-220. http://www.ctenergyinfo.com/2012%20CT%20Program%20Savings%20Documentation%20FINAL.pdf. 2003 US DOE CBECS building type definitions. http://www.eia.gov/emeu/cbecs/building_types.html.

15.2.2 Unitary/Split Air Conditioning, Heat Pump, and Chiller Tune-up

Measure Description

This measure involves tuning up packaged air conditioning units, heat pump units (both air and ground source), and air-cooled chillers at small commercial and industrial sites. All HVAC applications other than space cooling and heating—such as process cooling—are ineligible for this measure.

Savings Estimation

Gross annual electric energy savings are calculated by combining the cooling and heating energy savings according to the following equation:

$$\Delta kWh/year = \Delta kWh/year_{cool} + \Delta kWh/year_{heat}$$

Cooling Energy Savings

For air-source heat pumps and AC units <65,000 kBtuh:

$$\Delta kWh/year_{cool,<5\ tons} = Tons_{cool} \times \frac{12}{SEER} \times FLH_{cool} \times TUF$$

For air-source heat pumps and AC units >=65,000 kBtuh, and all ground-source heat pumps:

$$\Delta kWh/year_{cool,\geq 5\ tons} = Tons_{cool} \times \frac{12}{IEER} \times FLH_{cool} \times TUF$$

For air-cooled chillers:

$$\Delta kWh/year = Tons_{cool} \times IPLV \times FLH_{cool} \times TUF$$

Heating Energy Savings

For air-source heat pumps <65,000 kBtuh:

$$\Delta kWh/year_{heat,<5\ tons} = kBtu/h_{heat} \times \frac{1}{HSPF} \times FLH_{heat} \times TUF$$

For air-source heat pumps >=65,000 kBtuh, and all ground-source heat pumps:

$$\Delta kWh/year_{heat,\geq 5\ tons} = kBtu/h_{heat} \times \frac{1}{COP} \times FLH_{heat} \times TUF$$

For AC units and air-cooled chillers:

$$\Delta kWh/year_{heat} = 0$$

Gross coincident demand reductions are calculated according to the following equation:

$$\Delta kW = Tons_{cool} \times \frac{12}{EER} \times CF \times TUF$$

Where:

$\Delta kWh/year$ = gross annual electric energy savings

ΔkW = gross coincident demand reductions

$\Delta kWh/year_{cool,<5\ tons}$ = gross annual electric cooling energy savings for systems that are less than 5 tons

$\Delta kWh/year_{cool,\geq 5\ tons}$ = gross annual electric cooling energy savings for systems that are greater than or equal to 5 tons

$\Delta kWh/year_{heat,<5\ tons}$ = gross annual electric heating energy savings for systems that are less than 5 tons

$\Delta kWh/year_{heat,\geq 5\ tons}$ = gross annual electric heating energy savings for systems that are greater than or equal to 5 tons

$Tons_{cool}$ = tons of cooling capacity of equipment

$kBtu/h_{heat}$ = heating capacity of equipment in kBtu/h, if applicable. (For heat pumps, $kBtu/h_{heat} = 12 \times Tons_{cool}$.)

SEER = seasonal energy efficiency ratio (SEER) of the existing air conditioning equipment. SEER is used when calculating savings for heat pumps and AC units that are up to 5 tons in size.

FLH_{cool} = annual full load cooling hours

FLH_{heat} = annual full load heating hours

IPLV = integrated part load value of air-cooled chiller

TUF = rate of energy efficiency improvement due to tune-up

EER = energy efficiency ratio (EER) of existing air conditioning equipment. EER is used to analyze performance of air source heat pumps and AC units that are ≥ 5 tons in size. Ground source heat pumps use EER to determine cooling.

HSPF = heating seasonal performance factor (HSPF) of existing heat pump. HSPF is used in heating savings for air-source heat pumps.

COP = coefficient of performance (COP) of existing heating equipment. Ground source heat pumps use COP to determine heating savings.

CF = summer peak coincidence factor

Input Variables

Table 88: Input Variables for AC/HP/Chiller Tune-up Measure

Component	Type	Value	Units	Source(s)
$Tons_{cool}$	Variable	Application	Tons of refrigeration	Customer application
$kBtu/h_{heat}$	Variable	Application	kBtu/h	Customer application
FLH_{heat}	Fixed	See Table 139.	hours/year	Mid-Atlantic TRM 2017 p. 351-353
FLH_{cool}	Fixed	For AC/HP, see Table 138. For chillers, see Table 42.	hours/year	Mid-Atlantic TRM 2017 p. 351-353
HSPF/SEER/ EER/COP	Variable	See Table 37 and Table 38.	k/kW-hour (except COP is dimensionless)	ASHRAE 90.1-2010 Table 6.8.1A and Table 6.8.1B
IPLV	Variable	Application	kW/ton	Customer application
TUF	Fixed	For AC units: 0.023 For HP units: 0.027 For chillers: 0.050	-	Mid-Atlantic TRM 2016 p. 398, California 2013-14 Evaluation Report[261], and Wisconsin Focus on Energy TRM, p. 154.
CF	Fixed	Use system capacity to assign CF: < 11.5 tons = 0.588 ≥ 11.5 tons = 0.874	-	Mid-Atlantic TRM 2017 p. 396

Source

The primary sources for this deemed savings approach include the Mid-Atlantic TRM 2017, p. 394-397, the California 2013-14 Impact Evaluation Report, and the Wisconsin Focus on Energy TRM.

[261] California Public Utilities Commission (2016). Impact Evaluation of 2013-14 Commercial Quality Maintenance Programs (HVAC3): www.calmac.org/publications/HVAC3ImpactReport_0401ES.pdf.

15.2.3 Refrigerant Charge Adjustment

Measure Description

This measure involves adjusting the amount of refrigerant charge at air conditioners and heat pumps for packaged and split systems at small commercial and industrial sites. All HVAC applications other than space cooling and heating—such as process cooling—are ineligible for this measure.

Savings Estimation

AC Units

The following equations are used for energy and demand savings.

$$kWh_{savings} = Tons_{cool} \times \frac{12}{SEER} \times FLH_{cool} \times RCF$$

$$kW_{peak\ savings} = Tons_{cool} \times \frac{12}{EER} \times RCF \times CF$$

Since this measure includes both SEER or HSPF (<5 tons) and EER or COP (>5 tons) rated units, the program may require converting SEER into EER and HSPF to COP (see Appendix E: General Equations).

Heat Pumps

The following equations are used to calculate energy and demand savings.

$$kWh_{Savings} = \Delta kWh_{cool} + \Delta kWh_{heat}$$

$$\Delta kWh_{cool} = Tons_{cool} \times \frac{12}{IEER} \times FLH_{cool} \times RCF$$

$$\Delta kWh_{heat} = Tons_{cool} \times \frac{12}{HSPF} \times FLH_{heat} \times RCF$$

$$kW_{peak\ savings} = CF \times Tons_{cool} \times \frac{12}{EER} \times RCF$$

Where,

$Tons_{cool}$ = Unit capacity for cooling, in tons
EER = Energy Efficiency Ratio
$SEER$ = Seasonal Energy Efficiency Ratio
$HSPF$ = Heating Seasonal Performance Factor
FLH_{cool} = Full load hours for cooling
FLH_{heat} = Full load hours for heating
RCF = Refrigerant Charge Factor
CF = Demand Coincidence Factor

Input Variables

Table 89: Input Variables for Refrigerant Charge Adjustment

Component	Type	Value	Units	Source(s)
$Tons_{cool}$	Variable	See customer application.	Tons of cooling capacity	Customer application
FLH_{heat}	Fixed	See Table 139	hours/year	Mid-Atlantic TRM 2017 p. 351-353
FLH_{cool}	Fixed	See Table 138	hours/year	Mid-Atlantic TRM 2017 p. 351-353
EER/SEER	Variable	See customer application. Default = see Table 37.	kBtu/kWh	Customer application ASHRAE 90.1-2010 Table 6.8.1A and Table 6.8.1B
HSPF/COP	Variable	See customer application; otherwise, see Table 38	kBtu/kWh (COP is dimension-less)	Customer application/STEP
RCF	Fixed	AC units: 0.027 HP units: 0.022	dimensionless	Mid-Atlantic TRM and California 2013-2014 Evaluation Report[262]
CF	Fixed	Use system capacity to assign CF as follows: < 11.5 tons = 0.588 ≥ 11.5 tons = 0.874	dimensionless	Mid-Atlantic TRM 2017 p. 396

Source

The primary sources for this deemed savings approach include the Mid-Atlantic TRM 2017, p.394-397 and the California 2013-14 Impact Evaluation Report, p. BB-2 to BB-3.

[262] California Public Utilities Commission (2016). Impact Evaluation of 2013-14 Commercial Quality Maintenance Programs (HVAC3). www.calmac.org/publications/HVAC3ImpactReport_0401ES.pdf

15.2.4 Unitary/Split AC & HP Upgrade

This measure is also offered through the Non-Residential Heating and Cooling Efficiency program. The savings approach is described in Section 10.1.1.

15.2.5 Mini-split Heat Pump

This measure is also offered through the Non-Residential Heating and Cooling Efficiency program. The savings approach is described in Section 10.1.2.

15.2.6 Dual Enthalpy Air-side Economizer

This measure is also offered through the Non-Residential Heating and Cooling Efficiency program. The savings approach is described in Section 0.

15.2.7 Variable Frequency Drive

This measure is also offered through the Non-Residential Heating and Cooling Efficiency program. The savings approach is described in Section 10.1.4.

15.2.8 Programmable Thermostats

Measure Description

This measure involves the installation of programmable thermostats[263] for cooling and/or heating systems in spaces with no existing setback control. The programmable thermostat shall setaback the temperature setpoint during unoccupied period. The savings will be realized from turning off the system and fans during unoccupied times. The baseline operation of the HVAC units are assumed to be on continuous ON mode during the unoccupied period with fans cycling to maintain the occupied period temperature setpoints.

Savings Estimation

Annual Savings

Gross annual electric energy savings are calculated according to the following equations.

$$kWh_{savings} = \left[Tons \times \left(\frac{12}{EER}\right) \times FLH_{cool} \times ESF_{cool}\right] + \left[kBtu/h_{out} \times FLH_{heat} \times \left(\frac{1}{COP}\right) \times ESF_{heat}\right]$$

$$kW_{savings} = 0$$

[263] Non-communicating thermostats are not eligible for the demand response programs.

Input Variables

Table 90: Input Parameters for Programmable Thermostat Measure

Component	Type	Value	Units	Source(s)
Tons	Variable	See customer application.	tons	Customer application
kBTU/h_{out}	Variable	See customer application.	kBtu/h	Customer application
FLH_{heat}	Fixed	See Table 139.	hours/year	Mid-Atlantic TRM 2017 p. 351-353
FLH_{cool}	Fixed	See Table 138.	hours/year	Mid-Atlantic TRM 2017 p. 351-353
SEER/EER	Variable	See customer application. Otherwise, see Table 37.	kBtu/kW-hour	Customer application/STEP
HSPF/COP	Variable	See customer application. Otherwise, see Table 38.	kBtu/kW-hour (except COP is dimensionless)	Customer application/STEP
ESF_{cool}	Fixed	0.09	dimensionless	NY TRM 2017, pg. 251
ESF_{heat}	Fixed	0.068	dimensionless	NY TRM 2017, pg. 251

Source

The primary source for this deemed savings approach is the New York TRM 2017, p. 251.

15.3 Lighting End Use

15.3.1 Lighting, Fixtures, Lamps, and Delamping

This measure is also offered through the Non-Residential Lighting Systems and Controls program. The savings approach is described in Section 9.1.1.

15.3.2 Sensors and Controls

This measure is also offered through the Non-Residential Lighting Systems and Controls program. The savings approach is described in Section 9.1.2.

15.3.3 LED Exit Signs

Measure Description

This measure realizes energy savings by installing an exit sign that is illuminated with light emitting diodes (LED). This measure should be limited to retrofit installations.

Savings Estimation Approach

Gross annual electric energy savings are calculated according to the following equation:

$$\Delta kWh/\,year = \frac{((quantity \times watts)_{baseline} - (quantity \times watts)_{installed})}{1{,}000\,W/kW} \times HOU \times WHF_e \times ISR$$

Gross coincident demand reductions are calculated according to the following equation:

$$\Delta kW = \frac{((quantity \times watts)_{baseline} - (quantity \times watts)_{installed})}{1{,}000\,W/kW} \times WHF_d \times CF \times ISR$$

Where:

ΔkWh/year = gross annual electric energy savings
ΔkW = gross coincident demand reductions
$quantity_{baseline}$ = number of existing exit signs
$quantity_{installed}$ = number of LED exit sign replacements. It is assumed that the $Quantity_{baseline}$ equals $Quantity_{installed}$
$watts_{baseline}$ = connected load of the existing exit sign, measured in watts
$watts_{installed}$ = connected load of the LED exit sign, measured in watts
HOU = average hours of use per year
WHFe = waste heat factor for energy to account for cooling savings from efficient lighting
WHFd = waste heat factor for demand to account for cooling savings from efficient lighting
CF = summer peak coincidence factor
ISR = in-service rate is the percentage of rebated measures actually installed

Input Variables

Table 91: Input Values for LED Exit Sign Calculations

Component	Type	Value	Unit	Source(s)
$quantity_{baseline}$	Variable	See customer application.	-	Customer application
$quantity_{installed}$	Variable	Equal to $Quantity_{baseline}$	-	Customer application
$watts_{base}$	Variable	See customer application Default: 16 W CFL.	watts	ENERGY STAR®[264]
$watts_{ee}$	Variable	See customer application Default: 5 W LED.	watts	ENERGY STAR®
HOU	Fixed	8,760	hours/ year	Mid-Atlantic TRM 2016 p. 314
WHFe	Variable	See Table 135.	-	Mid-Atlantic TRM 2016 p. 314
WHFd	Variable	See Table 135.	-	Mid-Atlantic TRM 2016 p. 315
CF	Fixed	1	-	Mid-Atlantic TRM 2016 p. 315
ISR	Fixed	1.0	-	Mid-Atlantic TRM 2016 p. 314

Note that the coincidence factor (CF) is 1 for this measure since exit signs are on continuously on, including during the entirety of the peak period.

Default Savings

No default savings will be awarded for this measure if the proper values are not provided in the customer application.

Source(s)

The primary source for this deemed savings approach is the Mid-Atlantic TRM 2016, p. 314-317.

[264] LED exit sign default values come from an ENERGY STAR® report: Save Energy, Money and Prevent Pollution with Light-Emitting Diode (LED) Exit Signs:http://www.energystar.gov/ia/business/small_business/led_exitsigns_techsheet.pdf (accessed 9/15/2016).

15.4 Refrigeration End Use

15.4.1 Door Gasket (Cooler and Freezer)

This measure is also offered through the Non-Residential Energy Audit program and the Non-Residential Prescriptive program. The savings approach is described in Section 16.4.2.

15.4.2 Door Closer (Cooler and Freezer)

This measure is also offered through the Non-Residential Energy Audit program and the Non-Residential Prescriptive program. The savings approach is described in Section 16.4.1.

15.4.3 Strip Curtain (Cooler and Freezer)

This measure is also offered through the Non-Residential Energy Audit program and the Non-Residential Prescriptive program. The savings approach is described in Section 1.1.1.

15.4.4 Refrigeration Night Cover

This measure is also offered through the Non-Residential Energy Audit program and the Non-Residential Prescriptive program. The savings approach is described in Section 16.4.8.

15.5 Other End Use

15.5.1 Air Compressor Leak Repair

Measure Description

This measure involves improving the performance of an existing air compressor by repairing air leaks.

Savings Estimation

The following equations are used for energy and demand savings.

$$kWh_{savings} = hp_{compr} \times LF_{compr} \times CFM/hp \times (Leak_{baseline} - Leak_{ee}) \times kW/CFM \times Hours_{annual}$$

$$kW_{peak\ savings} = hp_{compr} \times LF_{compr} \times CFM/hp \times (Leak_{baseline} - Leak_{ee}) \times kW/CFM \times CF_{compr}$$

Where:

hp_{compr} = rated horsepower, hp
LF_{compr} = load factor of air compressor, percent
CFM/hp = compressed air flow rate per air compressor motor horsepower, CFM/hp
$Leak_{baseline}$ = baseline air leakage rate, percent
$Leak_{ee}$ = post-retrofit air leakage rate, percent
kW/CFM = energy consumed for each cfm of compressed air, kW/CFM
$Hours_{annual}$ = annual hours of operation, hours/year
CF_{compr} = coincidence factor of air compressor, percent

Input Variables

Table 92: Input Variables for Air Compressor Leak Repair Measure

Component	Type	Value	Units	Source(s)
hp_{compr}	Variable	See customer application.	hp	Customer application
LF_{compr}	Variable	See customer application.	percent	Customer application
CFM/hp	Variable	See customer application.	CFM/hp	Customer application
$Leak_{baseline}$	Variable	See customer application.	percent	Customer application
$Leak_{post}$	Variable	See customer application.	percent	Customer application
kW/CFM	Fixed	0.20	kW/CFM	Michigan Energy Measure Database[265]
$Hours_{annual}$	Fixed	6,270	hours	Michigan Energy Measure Database[266]
CF	Fixed	0.865	dimensionless	Michigan Energy Measure Database[267]

Source

The primary source for this deemed savings approach is the Michigan Energy Measure Database 2016, at http://www.michigan.gov/mpsc/0,4639,7-159-52495_55129---,00.html, Document "FES-I20 Compressed Air Leak Survey and Repair Michigan 100512.doc," October 2012.

[265] Michigan Energy Measure Database 2017, at http://www.michigan.gov/mpsc/0,4639,7-159-52495_55129---,00.html, document "FES-I20 Compressed Air Leak Survey and Repair Michigan 100512.doc", October 2012, pg. 1.
[266] Ibid.
[267] Ibid.

16 NON-RESIDENTIAL PRESCRIPTIVE PROGRAM

Dominion's Non-Residential Prescriptive Program provides qualifying business owners incentives to use pursue one or more of the qualified energy efficiency measures through a local, participating contractor in Dominion's contractor network. To qualify for this program, the customer must be responsible for the electric bill and must be the owner of the facility or reasonably able to secure permission to complete the measures. All program measures are summarized in Table 93.

Table 93: Non-residential Prescriptive Program Measure List

End-Use	Measure	Legacy Program	Manual Section
Cooking	Commercial Convection Oven	N/A	Section 16.1.1
	Commercial Electric Combination Oven		Section 16.1.2
	Commercial Electric Fryer		Section 16.1.3
	Commercial Griddle		Section 1.1.1
	Commercial Hot Food Holding Cabinet		Section 1.1.1
	Commercial Steam Cooker		Section 1.1.1
HVAC	Duct Testing & Sealing	Small Business Improvement Program	Section 15.2.1
	Unitary/Split AC & HP Tune-up		Section 15.2.2
	Variable Speed Drives on Kitchen Fan	N/A	Section 16.2.3
Plug Load	Smart Strip	N/A	16.3.1
Refrigeration	Door Closer	N/A	Section 16.4.1
	Door Gasket		Section 16.4.2
	Evaporator Fan Control		Section 16.4.4
	Floating Head Pressure Control		Section 1.1.1
	Refrigeration Night Cover		Section 16.4.8
	Refrigeration Coil Cleaning		Section 16.4.9
	Suction Pipe Insulation		Section 1.1.1
	Strip Curtain		Section 1.1.1
	Vending Maching Miser		Section 1.1.1
	Commercial Freezers and Refrigerators – Solid Door	N/A	Section 16.4.3
	Ice Maker		Section 16.4.6
	Low/No-Sweat Door Film		Section 16.4.7

16.1 Cooking End Use

16.1.1 Commercial Convection Oven

Measure Description

This measure involves the installation of an ENERGY STAR® qualified commercial convection oven. Commercial convection ovens that are ENERGY STAR® certified have higher heavy load cooking efficiencies and lower idle energy rates making them more efficient than standard models.

Baseline Description

The baseline equipment is assumed to be a standard efficiency convection oven with a heavy-load efficiency of 65% for full-size electric ovens (i.e., a convection oven this can accommodate full-size sheet pans measuring 18 x 26 x 1-inch) and 68% for half-size electric ovens (i.e., a convection oven that can accommodate half-size sheet pans measuring 18 x 13 x 1-inch).

Savings Estimation

Gross annual electric energy savings are calculated according to the following equations:

$$kWh_{base} = (kWh\ Cooking_{base} + kWh\ Idle_{base}) * Days$$

$$kWh\ Cooking_{base} = lb * \frac{E_{food}}{Eff_{base}}$$

$$kWh\ Idle_{base} = Idle_{base} * \left(Hours_{day} - \frac{lb}{PC_{base}}\right)$$

Therefore,

$$kWh_{base} = \left(lb * \frac{E_{food}}{Eff_{base}} + Idle_{base} * \left(Hours_{day} - \frac{lb}{PC_{base}}\right)\right) * Days$$

$$kWh_{eff} = (kWh\ Cooking_{eff} + kWh\ Idle_{eff}) * Days$$

$$kWh\ Cooking_{eff} = lb * \frac{E_{food}}{Eff_{eff}}$$

$$kWh\ Idle_{eff} = Idle_{eff} * \left(Hours_{day} - \frac{lb}{PC_{eff}}\right)$$

Therefore,

$$kWh_{eff} = \left(lb * \frac{E_{food}}{Eff_{eff}} + Idle_{eff} * \left(Hours_{day} - \frac{lb}{PC_{eff}}\right)\right) * Days$$

$$\Delta kWh = kWh_{base} - kWh_{ee}$$

Where:

ΔkWh = gross annual electric energy savings, kWh
kWh_{base} = the annual energy usage of the baseline equipment

kWh_{ee} = the annual energy usage of the efficient equipment
kWh $Cooking_{base}$ = Baseline daily cooking energy consumption (kWh)
kWh $Idle_{base}$ = Baseline daily idle energy consumption (kWh)
$Hours_{day}$ = Average daily operating hours
E_{food} = ASTM Energy to Food (kWh/lb); the amount of energy absorbed by the food during cooking, per pound of food
lb = Pounds of food cooked per day (lb/day)
Days = Annual days of operation
Eff_{base} = Baseline equipment cooking energy efficiency (%)
Eff_{eff} = Efficienct equipment cooking energy efficiency (%)
$Idle_{base}$ = Baseline equipment idle energy rate (kW)
$Idle_{ee}$ = Efficient equipment idle energy rate (kW)
PC_{base} = Baseline equipment production capacity (lb/hr)
PC_{eff} = Efficient equipment production capacity (lb/hr)

Gross coincident demand reductions are calculated according to the following equation:

$$\Delta kW = \frac{\Delta kWh}{Hours_{day} * Days}$$

Where:

ΔkWh = gross annual electric energy savings
ΔkW = gross coincident demand reductions
Days = annual days of operation
Hoursday = Average daily operating hours.

Input Variables

Table 94: Input Parameters for Convection Oven

Component	Type	Value	Units	Source(s)
Hours/day	Variable	See customer application; Default: 12	hours/day	Mid-Atlantic TRM 2017, p. 448
Days	Variable	See customer application; Default: 365	day/year	Mid-Atlantic TRM 2017, p. 448
lb	Variable	See customer application; Default: 100	lb/day	Mid-Atlantic TRM 2017, p. 444
E_{food}	Fixed	0.0732	kWh/lb	Mid-Atlantic TRM 2017, p. 449
PC_{base}	Fixed	Half Size: 45 Full Size: 90	lb/hr/ft^2	Mid-Atlantic TRM 2017, p. 449
Eff_{base}	Fixed	Half Size: 0.68 Full Size: 0.65	Dimensionless	Mid-Atlantic TRM 2017, p. 449
$Idle_{base}$	Fixed	Half Size:1.03 Full Size: 2.0	kW/ft^2	Mid-Atlantic TRM 2017, p. 449
$Idle_{ee}$	Fixed	Half Size: 1.0 Full Size: 1.6	kW/ft^2	Mid-Atlantic TRM 2017,p. 449
PC_{ee}	Fixed	Half Size: 50 Full Size: 90	lb/hr/ft^2	Mid-Atlantic TRM 2017, p. 449

Component	Type	Value	Units	Source(s)
Hours/day	Variable	See customer application; Default: 12	hours/day	Mid-Atlantic TRM 2017, p. 448
Days	Variable	See customer application; Default: 365	day/year	Mid-Atlantic TRM 2017, p. 448
Eff_{ee}	Fixed	Half Size: 0.71 Full Size: 0.71	Dimensionless	Mid-Atlantic TRM 2017, p. 449

Source

The primary sources for this deemed savings approach is the Mid-Atlantic TRM 2017, p. 447-450.