Illinois Statewide Technical Reference Manual for Energy Efficiency

Version 5.0

Volume 1: Overview and User Guide

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1 Purpose of the TRM

The purpose of the Illinois Statewide Technical Reference Manual (TRM) is to provide a transparent and consistent basis for calculating energy (electric kilowatt-hours (kWh) and natural gas therms) and capacity (electric kilowatts (kW)) savings generated by the State of Illinois' energy efficiency programs[1] which are administered by the Department of Commerce and Economic Opportunity (DCEO) and the state's largest electric and gas Utilities[2] (collectively, Program Administrators).

The TRM is a technical document that is filed with the Illinois Commerce Commission (Commission or ICC) and is intended to fulfill a series of objectives, including:

- "Serve as a common reference document for all… stakeholders, [Program Administrators], and the Commission, so as to provide transparency to all parties regarding savings assumptions and calculations and the underlying sources of those assumptions and calculations.
- Support the calculation of the Illinois Total Resource Cost test[3] ("TRC"), as well as other cost-benefit tests in support of program design, evaluation and regulatory compliance. Actual cost-benefit calculations and the calculation of avoided costs will not be part of this TRM.
- Identify gaps in robust, primary data for Illinois, that can be addressed via evaluation efforts and/or other targeted end-use studies.
- [Provide] a process for periodically updating and maintaining records, and preserve a clear record of what deemed parameters are/were in effect at what times to facilitate evaluation and data accuracy reviews.
- …[S]upport coincident peak capacity (for electric) savings estimates and calculations for electric utilities in a manner consistent with the methodologies employed by the utility's Regional Transmission Organization ("RTO"), as well as those necessary for statewide Illinois tracking of coincident peak capacity impacts."[4]

[1] 220 ILCS 5/8-103, 220 ILCS 5/16-111.5B and 220 ILCS 5/8-104.
[2] In addition to DCEO, the Program Administrators include: Ameren Illinois, ComEd, Peoples Gas, North Shore Gas, and Nicor Gas (collectively, the Utilities).
[3] The Illinois TRC test is defined in 220 ILCS 5/8-104(b) and 20 ILCS 3855/1-10.
[4] Illinois Statewide Technical Reference Manual Request for Proposals, August 22, 2011, pages 3-4, http://ilsag.org/yahoo_site_admin/assets/docs/TRM_RFP_Final_part_1.230214520.pdf

1.1 Acknowledgements

This document was created through collaboration amongst the members of the Illinois Energy Efficiency Stakeholder Advisory Group (SAG). The SAG is an open forum where interested parties may participate in the evolution of Illinois' energy efficiency programs. Parties wishing to participate in the SAG process may do so by visiting http://www.ilsag.info/questions.html and contacting the Independent Facilitator at Annette.Beitel@FutEE.biz. Parties wishing to participate in the Technical Advisory Committee (TAC), a subcommittee of the SAG, may do so by contacting the TRM Administrator at iltrmadministrator@veic.org.

SAG Stakeholders[5]
Ameren Illinois Company (Ameren)
Citizen's Utility Board (CUB)
City of Chicago
Commonwealth Edison Company (ComEd)
Elevate Energy
Energy Resources Center at the University of Illinois, Chicago (ERC)
Environment IL
Environmental Law and Policy Center (ELPC)
Future Energy Enterprises LLC
Illinois Attorney General's Office (AG)
Illinois Commerce Commission Staff (ICC Staff)
Illinois Department of Commerce and Economic Opportunity (DCEO)
Independent Evaluators (ADM, Cadmus, Itron, Navigant)
Metropolitan Mayor's Caucus (MMC)
Midwest Energy Efficiency Association (MEEA)
Natural Resources Defense Council (NRDC)
Nicor Gas
Peoples Gas and North Shore Gas

[5] Being an open forum, this list of SAG stakeholders and participants may change at any time.

Table 1.1: Document Revision History

Document Title	Applicable to PY Beginning
Illinois_Statewide_TRM_Effective_060112_Version_1.0_091412_Clean.doc	6/1/12
Illinois_Statewide_TRM_Effective_060113_Version_2.0_060713_Clean.docx	6/1/13
Illinois_Statewide_TRM_Effective_060114_Version_3.0_022414_Clean.docx	6/1/14
Illinois_Statewide_TRM_Effective_060115_Final_022415_Clean.docx	6/1/15
IL-TRM_Effective_060116_v5.0_Vol_1_Overview_021116_Final IL-TRM_Effective_060116_v5.0_Vol_2_C_and_I_021116_Final IL-TRM_Effective_060116_v5.0_Vol_3_Res_021116_Final IL-TRM_Effective_060116_v5.0_Vol_4_X-Cutting_Measures_and_Attach._021116_Final	6/1/16

1.2 Summary of Measure Revisions

The following tables summarize the evolution of measures that are new, revised or errata. This version of the TRM contains 97 measure-level changes as described in the following table.

Table 1.2: Summary of Measure Level Changes

Change Type	# Changes
Errata	13
Revision	73
New Measure	11
Total Changes	97

The 'Change Type' column indicates what kind of change each measure has gone through. Specifically, when a measure error was identified and the TAC process resulted in a consensus, the measure is identified here as an 'Errata'. In these instances the measure code indicates that a new version of the measure has been published, and that the effective date of the measure dates back to June 1st, 2015. Measures that are identified as 'Revised' were included in the fourth edition of the TRM, and have been updated for this edition of the TRM. Both 'Revised' and 'New Measure(s)' have an effective date of June 1st, 2016.

The following table provides an overview of the 97 measure-level changes that are included in this version of the TRM.

Table 1.3: Summary of Measure Revisions

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
Overview	Section 1-3			Revision	Hotel and Motel and Low-use Small Business Definitions. Proposed new section 3.8 Measure Incremental Cost Definition. Updates to dates, references, "Summary of Measure Revisions" and Early Replacement section. Replacement of light/heavy industry with manufacturing building type definition. Addition of Childcare/Pre School. Addition of text in regard to applying inflation rates to future costs.	n/a

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
					Updating the real discount rate for O&M NPV calculations.	
C&I	Food Service Equipment	4.2.1 Combination Oven	CI-FSE-CBOV-V02-160601	Revision	Re-write using algorithms rather than deemed savings. Standard updates. Added electric combination ovens.	Unknown
C&I	Food Service Equipment	4.2.3 Commercial Steam Cooker	CI-FSE-STMC-V04-160601	Revision	Formatting edits to algorithm for clarity and improved reference.	None
C&I	Food Service Equipment	4.2.6 ENERGY STAR Dishwasher	CI-FSE-ESDW-V02-160601	Revision	ENERGY STAR standard update. Reworked measure to more accurately reflect calculation. Improved reference.	Unknown
C&I	Food Service Equipment	4.2.8 ENERGY STAR Griddle	CI-FSE-ESGR-V02-160601	Revision	Fixed error in Daily Idle Energy Calculation. Improved reference.	None
C&I	Food Service Equipment	4.2.9 ENERGY STAR Hot Food Holding Cabinets	CI-FSE-ESHH-V02-160601	Revision	Improved reference.	None
C&I	Food Service Equipment	4.2.11 High Efficiency Pre-Rinse Spray Valve	CI-FSE-SPRY-V03-160601	Revision	Added reference to IECC 2015	None
C&I	Hot Water	4.3.1 Storage Water Heater	CI-HW_-STWH-V02-160601	Revision	Changed methodology from deemed approach to algorithm.	Unknown
C&I	Hot Water	4.3.2 Low Flow Faucet Aerators	CI-HWE-LFFA-V06-160601	Revision	Fixed EPG factor dependent on water temperature. Fixed error in example result	Dependent on application
C&I	Hot Water	4.3.5 Tankless Water Heater	CI-HW_-TKWH-V03-160601	Revision	Added reference to IECC 2015	None
C&I	Hot Water	4.3.7 Multifamily Central Domestic Hot Water Plants	CI-HW_-MDHW-V02-160601	Revision	Updated DeOreo reference.	None
C&I	Hot Water	4.3.9 Heat Recovery Grease Trap Filter	CI-HW_-GRTF-V01-160601	New	New Measure	N/A
C&I	HVAC	4.4.1 Air Conditioner Tune up	CI-HVC-ACTU-V03-160601	Revision	Removed SEER test for <65kBtu - now EER test for all. Added explanation of test methodology.	None
C&I	HVAC	4.4.2 Space Heating Boiler Tune Up	CI-HVC-BLRT-V06-160601	Revision	Added clarifying language on	None

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
					appropriate firing rates for combustion efficiency testing.	
C&I	HVAC	4.4.3 Process Boiler Tune Up	CI-HVC-PBTU-V05-160601	Revision	Added clarifying language on appropriate firing rates for combustion efficiency testing.	None
C&I	HVAC	4.4.6 Electric Chiller	CI-HVC-CHIL-V04-160601	Revision	Added specifications for IECC 2015 Updated cost assumptions	None
C&I	HVAC	4.4.9 Heat Pump Systems	CI-HVC-HPSY-V04-160601	Revision	Added specifications for IECC 2015	None
C&I	HVAC	4.4.11 High Efficiency Furnace	CI-HVC-FRNC-V05-150601	Errata	Future deferred baseline replacement cost increased in line with inflation	None
			CI-HVC-FRNC-V06-160601	Revision	Update of Heating Fan hour assumptions Added building specific coincidence factors. Clarification of Early Replacement determination	Dependent on application
C&I	HVAC	4.4.13 PTAC and PTHP	CI-HVC-PTAC-V06-150601	Errata	Future deferred baseline replacement cost increased in line with inflation	None
			CI-HVC-PTAC-V07-160601	Revision	Added specifications for IECC 2015. Updated SEER to EER conversion	None
C&I	HVAC	4.4.14 Pipe Insulation	CI-HVC-PINS-V04-160601	Revision	Allow for custom 3E Plus derived entry. Added ability to use actual boiler efficiency	Unknown
C&I	HVAC	4.4.15 Single-Package and Split System Unitary AC	CI-HVC-SPUA-V04-160601	Revision	Added specifications for IECC 2015. Updated SEER to EER conversion Clarified baseline applicable dates and Time of Sale baseline.	None
C&I	HVAC	4.4.16 Steam Trap Replacement or Repair	CI-HVC-STRE-V04-160601	Revision	Providing clarifying edits and secondary equations to calculate maximum steam loss. Allowing actual steam pressure and HOU	Increase

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
					entry. Update values for deemed average pressure and operating hours based on program data.	
C&I	HVAC	4.4.17 Variable Speed Drives for HVAC Pumps and Cooling Tower Fans	CI-HVC-VSDHP-V03-160601	Revision	Added reference to IECC 2015 Updated Heating and Cooling HOU assumptions	Dependent on application
C&I	HVAC	4.4.19 Demand Control Ventilation	CI-HVC-DCV-V03-160601	Revision	Added heating savings for electrically heated buildings (resistance and heat pump).	None
C&I	HVAC	4.4.21 Linkageless Boiler Controls for Space Heating	CI-HVC-LBC-V05-160601	Revision	Clarity on VSD measure referred to for electric savings	None
C&I	HVAC	4.4.24 Small Pipe Insulation	CI-HVC-SPIN-V02-160601	Revision	Allow for custom 3E Plus derived entry.	Unknown
C&I	HVAC	4.4.26 Variable Speed Drives for Supply and Return Fans	CI-HVC-VSDF-V02-160601	Revision	Added reference to IECC 2015 Updated Heating, Cooling and Ventilation HOU assumptions	Dependent on application
C&I	HVAC	4.4.27 Energy Recovery Ventilator	CI-HVC-ERVE-V02-160601	Revision	Removed reference to previously deleted table of building characteristics and replaced with table showing occupied hours. Added reference to IECC 2015	None
C&I	HVAC	4.4.30 Notched V Belts for HVAC Systems	CI-HVC-NVBE-V02-160601	Revision	Updated Heating, Cooling and Ventilation HOU assumptions	Dependent on application
C&I	HVAC	4.4.31 Small Business Furnace Tune-Up	CI-HVC-FTUN-V02-160601	Revision	Added clarifying language on appropriate firing rates for combustion efficiency testing.	None
C&I	HVAC	4.4.33 Industrial Air Curtains	CI-MSC-AIRC-V01-160601	New	New Measure	N/A
C&I	HVAC	4.4.34 Destratification Fans	CI-HVC-DSFN-V01-160601	New	New Measure	N/A
C&I	HVAC	4.4.35 Economizer Repair and Optimization	CI-HVC-ECRP-V01-160601	New	New Measure	N/A

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
C&I	HVAC	4.4.36 Multi-Family Space Heating Steam Boiler Averaging Controls	CI-HVC-SBAC-V01-160601	New	New Measure	N/A
C&I	HVAC	4.4.37 Unitary HVAC Condensing Furnace	CI-HVC-DSFN-V01-160601	New	New Measure	N/A
C&I	Lighting	4.5 Lighting End Use		Revision	Updated HOU and CF assumptions for select building types based on IL evaluation. Updated hours of use for remaining building types based on eQuest modeling. Provide updated "Unknown" assumptions based on weighted averages. Added Childcare/Pre-School Updated lighting waste heat factors (fixing autosizing issues). Updated remaining building type CFs based on eQuest models.	Dependent on application
C&I	Lighting	4.5.1 Commercial ENERGY STAR Compact Fluorescent Lamp	CI-LTG-CCFL-V06-160601	Revision	Adjustment of Real Discount Rate and O&M values. Clarification that O&M costs should be multiplied by ISR.	None
C&I	Lighting	4.5.3 High Performance and Reduced Wattage T8 Fixtures and Lamps	CI-LTG-T8FX-V05-160601	Revision	Adjustment of T12 baseline until June 1, 2018. Table review – providing nominal and ballast factor assumptions. Adding significant digits to show difference in values.	None
C&I	Lighting	4.5.4 LED Bulbs and Fixtures	CI-LTG-LEDB-V05-160601	Revision	Adjusted language for PAR, MR, and MRX Lamps to use manufacturer recommended incandescent equivalent wattage instead of lumen based approach in the event	Increase

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
					inputs are unknown. Adding incremental cost to reference tables. Updating O&M for Standard Omnidirectional lamps. Updating and consolidating reference tables. Adjustment of Real Discount Rate and O&M values. Clarification that O&M costs should be multiplied by ISR.	
C&I	Lighting	4.5.7 Lighting Power Density	CI-LTG-LPDE-V03-160601	Revision	Added specifications for IECC 2015	None
C&I	Lighting	4.5.9 Multi-Level Lighting Switch	CI-LTG-MLLC-V03-160601	Revision	Added reference to IECC 2015	None
C&I	Lighting	4.5.10 Occupancy Sensor Lighting Controls	CI-LTG-OSLC-V04-160601	Revision	Update to costs, kW connected and % savings.	Reduction
C&I	Lighting	4.5.12 T5 Fixtures and Lamps	CI-LTG-T5FX-V04-160601	Revision	Adjustment of T12 baseline until June 1, 2018.	None
C&I	Lighting	4.5.13 Occupancy Controlled Bi-Level Lighting Fixtures	CI-LTG-OCBL-V02-160601	Revision	Added reference to IECC 2015	None
C&I	Lighting	4.5.14 Commercial ENERGY STAR Specialty Compact Fluorescent Lamp	CI-LTG-SCFL-V02-160601	Revision	Adjusted language for PAR, MR, and MRX Lamps to use manufacturer recommended incandescent equivalent wattage instead of lumen based approach in the event inputs are unknown.. Clarification that O&M costs should be multiplied by ISR.	Unknown
C&I	Compressed Air	4.7.5 Cycling Compressed Air Dryer	CI-CPA-CADR-V01-160601	New	New Measure	N/A
C&I	Miscellaneous	4.7.6 Roof Insulation for C&I Facilities	CI-MSC-RINS-V02-160601	Revision	Changed measure number to 4.8.2. Added specifications for IECC 2015	None

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
C&I	Miscellaneous	4.8.4 Modulating Commercial Gas Clothes Dryer	CI-MSC-MODD-V01-160601	New	New Measure	N/A
Res	Appliances	5.1.1 ENERGY STAR Air Purifier	RS-APL-ESAP-V02-160601	Revision	Updated using more recent ENERGY STAR calculator.	Unknown
Res	Appliances	5.1.2 ENERGY STAR and CEE Tier 2 and 3 Clothes Washers	RS-APL-ESCL-V04-160601	Revision	Added unknown DHW/ known Dryer and known DHW/unknown Dryer to tables. Updated % gas v electric dryer assumptions. Added decimal place to % of combustion table to bring calculated and algorithm derived values closer. Fixed parentheses issue.	None
Res	Appliances	5.1.3 ENERGY STAR Dehumidifier	RS-APL-ESDH-V03-160601	Revision	Removed old ENERGY STAR spec values. Fixed hour assumption listing - calculated deemed values correct. Clarifying text on use of actual capacity.	None
Res	Appliances	5.1.4 ENERGY STAR Dishwasher	RS-APL-ESDI-V03-160601	Revision	Update to ENERGY STAR specification – now for Standard, Standard with Connected Functionality and Compact.	Increases
Res	Appliances	5.1.6 ENERGY STAR and CEE Tier 2 Refrigerator	RS-APL-ESRE-V03-150601	Errata	Future deferred baseline replacement cost increased in line with inflation	None
			RS-APL-ESRE-V04-160601	Revision	Fixed typo in algorithm table	None
Res	Appliances	5.1.7 ENERGY STAR Room AC	RS-APL-ESRA-V04-150601	Errata	Future deferred baseline replacement cost increased in line with inflation	None
			RS-APL-ESRA-V05-160601	Revision	Update of Federal Standard and ENERGY STAR specifications	Dependent on application
Res	Appliances	5.1.8 Refrigerator and Freezer Recycling	RS-APL-RFRC-V06-160601	Revision	Added customers value on lost amenity to measure cost.	None

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
					Deleted redundant variable	
Res	Consumer Electronics	5.2.1 Advanced Power Strip Tier 1	RS-CEL-SSTR-V02-160601	Revision	Changed name of existing measure (Smart Strip) as proprietary name by single manufacturer.	None
Res	Consumer Electronics	5.2.2 Tier 2 Advanced Power Strips (APS) – Residential Audio Visual	RS-CEL-APS2-V01-160601	New	New Measure	N/A
Res	HVAC	5.3.1 Air Source Heat Pump	RS-HVC-ASHP-V05-150601	Errata	Future deferred baseline replacement cost increased in line with inflation	None
			RS-HVC-ASHP-V06-160601	Revision	Clarification of Early Replacement determination. Update to CF and EFLH for multifamily homes.	Reduction for MF weatherized
Res	HVAC	5.3.2 Boiler Pipe Insulation	RS-HVC-PINS-V02-160601	Revision	Clarification in pipe circumference with insulation calculation	None
Res	HVAC	5.3.3 Central AC	RS-HVC-CAC1-V05-150601	Errata	Future deferred baseline replacement cost increased in line with inflation	None
			RS-HVC-CAC1-V06-160601	Revision	Clarification of Early Replacement determination.	None
Res	HVAC	5.3.4 Duct Insulation and Sealing	RS-HVC-DINS-V06-160601	Revision	Added semi-conditioned space savings by use of Thermal Regain Factor.	None
Res	HVAC	5.3.6 Gas High Efficiency Boiler	RS-HVC-GHEB-V04-150601	Errata	Future deferred baseline replacement cost increased in line with inflation. Addition of HF in algorithm and variable list	None
			RS-HVC-GHEB-V05-160601	Revision	Clarification of Early Replacement determination	Reduction for MF
Res	HVAC	5.3.7 Gas High Efficiency Furnace	RS-HVC-GHEF-V05-150601	Errata	Future deferred baseline replacement cost increased in line with inflation. Addition of HF in	None

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
					algorithm	
			RS-HVC-GHEF-V06-160601	Revision	Clarification of Early Replacement determination	None
Res	HVAC	5.3.8 Ground Source Heat Pump	RS-HVC-GSHP-V05-150601	Errata	Future deferred baseline replacement cost increased in line with inflation.	None
			RS-HVC-GSHP-V06-160601	Revision	Updated DeOreo reference. Clarification of Early Replacement determination.	None
Res	HVAC	5.3.10 HVAC Tune Up	RS-HVC-TUNE-V03-160601	Revision	Fix typo of variable name. Adding CF_{PJM} for Heat Pumps	None
Res	HVAC	5.3.12 Ductless Heat Pumps	RS-HVC-DHP-V03-150601	Errata	Removed /1000 from kW calculation since capacity is already in kBtu.	Increased kW
Res	HVAC	5.3.12 Ductless Heat Pumps	RS-HVC-DHP-V04-160601	Revision	Change of algorithm to be based on Capacity and EFLH as opposed to %displaced and annual load. Update to CF and EFLH. Fixing existing efficiency assumptions.	Unknown
Res	HVAC	5.3.13 Residential Furnace Tune-Up	RS-HVC-FTUN-V02-160601	Revision	Added clarifying language on appropriate firing rates for combustion efficiency testing.	None
Res	HVAC	5.3.16 Advanced Thermostats	RS-HVC-ADTH-V01-160601	New	New Measure	N/A
Res	Hot Water	5.4.2 Gas Water Heater	RS-HWE-GWHT-V05-150601	Errata	Future deferred baseline replacement cost increased in line with inflation.	None
			RS-HWE-GWHT-V06-160601	Revision	Updated DeOreo reference.	None
Res	Hot Water	5.4.3 Heat Pump Water Heater	RS-HWE-HPWH-V05-160601	Revision	Updated DeOreo reference.	None
Res	Hot Water	5.4.4 Low Flow Faucet Aerators	RS-HWE-LFFA-V05-160601	Revision	Updated DeOreo reference. Adding ISR assumptions for Efficiency Kits	Dependent on application

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
Res	Hot Water	5.4.5 Low Flow Showerheads	RS-HWE-LFSH-V04-160601	Revision	Adding ISR assumptions for Efficiency Kits	Dependent on application
Res	Hot Water	5.4.8 Thermostatic Restrictor Shower Valve	RS-HWE-TRVA-V02-160601	Revision	Add EPG_electric factor in to equation	Reduced
Res	Lighting	5.5.1 ENERGY STAR Compact Fluorescent Lamp	RS-LTG-ESCF-V05-160601	Revision	Adjustment of Real Discount Rate and O&M values. Clarification that O&M costs should be multiplied by ISR. Clarification on Leakage Rates	None
Res	Lighting	5.5.2 ENERGY STAR Specialty CFL	RS-LTG-ESCC-V04-160601	Revision	Adjusted language for PAR, MR, and MRX Lamps to use manufacturer recommended incandescent equivalent wattage instead of lumen based approach in the event inputs are unknown. Clarification that O&M costs should be multiplied by ISR. Clarification on Leakage Rates	Unknown
Res	Lighting	5.5.3 ENERGY STAR Torchiere	RS-LTG-ESTO-V03-160601	Revision	Clarification that O&M costs should be multiplied by ISR. Clarification on Leakage Rates	None
Res	Lighting	5.5.4 Exterior Hardwired Compact Fluorescent Fixture	RS-LRG-EFOX-V05-160601	Revision	Adjustment of Real Discount Rate and O&M values. Clarification that O&M costs should be multiplied by ISR. Clarification on Leakage Rates	None
Res	Lighting	5.5.5 Interior Hardwired Compact Fluorescent Fixture	RS-LTG-IFIX-V05-160601	Revision	Adjustment of Real Discount Rate and O&M values. Clarification that O&M costs should be multiplied by ISR. Clarification on Leakage Rates	None

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
Res	Lighting	5.5.6 LED Specialty Lamps	RS-LTG-LEDD-V05-150601	Errata	Changed name of existing measure (LED Downlight) to LED Specialty Lamps. Made consistent with CFL Specialty assumptions. Removed default efficient wattages as actuals always used. Adjusted language for PAR, MR, and MRX Lamps to use manufacturer recommended incandescent equivalent wattage instead of lumen based approach in the event inputs are unknown.	Dependent on application
			RS-LTG-LEDD-V06-160601	Revision	Clarification that O&M costs should be multiplied by ISR. Clarification on Leakage Rates	None
Res	Lighting	5.5.8 LED Screw Based Omnidirectional Bulbs	RS-LTG-LEDA-V04-160601	Revision	Adjustment of Real Discount Rate and O&M values. Clarification that O&M costs should be multiplied by ISR. Clarification on Leakage Rates	None
Res	Shell	5.6.1 Air Sealing	RS-SHL-AIRS-V04-150601	Errata	Changing Latent Multiplier assumption to be based on calculation of hours sensible and total loads.	Reduction
Res	Shell	5.6.1 Air Sealing	RS-SHL-AIRS-V05-160601	Revision	Change cooling and heating n-factor values based on applying LBNL infiltration model. Revert HDD assumption back to base temperature 60F. Adjusting default gas efficiency to 72%. Adding prescriptive air	Reduction

Volume	End Use	Measure Name	Measure Code	Change Type	Explanation	Impact on Savings
					sealing savings for when blower door testing is not possible.	
Res	Shell	5.6.2 Basement Sidewall Insulation	RS-SHL-BINS-V07-160601	Revision	Applying 80% adjustment factor to cooling savings and 60% adjustment factor to heating savings. Adjusting default gas efficiency to 72%.	Reduction
Res	Shell	5.6.3 Floor Insulation above Crawlspace	RS-SHL-FINS-V07-160601	Revision	Applying 80% adjustment factor to cooling savings and 60% adjustment factor to heating savings. Adjusting default gas efficiency to 72%.	Reduction
Res	Shell	5.6.4 Wall and Ceiling Insulation	RS-SHL-AINS-V06-160601	Revision	Applying 80% adjustment factor to cooling savings and 60% adjustment factor to heating savings. Adjusting default gas efficiency to 72%.	Reduction
Cross-Cutting Measures and Attachments	Behavior	6.1.1 Adjustments to Behavior Savings to Account for Persistence	CC-BEH-BEHP-V01-170601	New	New measure	N/A

Table 1.4: Summary of Attachment A: IL-NTG Methods Revisions

IL-TRM Volume	Sectors	Protocol Name	Change Type	Explanation
Vol. 4	Sections 1-2		Revision	Clarifying edits made to Diverging from the IL-NTG Methods section Expanded spillover definition and added new Spillover-Specific Issues section with a subsection covering incremental Measure Costs issues related to spillover
Vol. 4	Commercial, Industrial, and Public Sectors	Small Business C&I New Construction Study-Based Training and Technical Assistance	New	Added protocols to cover additional non-residential program types: Small Business New Construction Study-Based Training and Technical Assistance

IL-TRM Volume	Sectors	Protocol Name	Change Type	Explanation
Vol. 4	Commercial, Industrial, and Public Sectors	Changed section name from Standard/Prescriptive and Custom Programs to Core Non-Residential Protocol Free Ridership Participant Spillover	Revision	Changed name of Standard/Prescriptive and Custom Programs to Core Non-Residential Protocol and revised section to make it applicable to a number of non-residential programs Added Core Free Ridership Algorithm Spillover section expanded to include protocol for Participant Spillover which is generally applicable to most non-residential program types
Vol. 4	Residential and Low Income Sectors	Prescriptive Rebate (With No Audit) Single-Family Home Energy Audit Multifamily Energy Savings Kits and Elementary Education Residential New Construction Residential Cross-Cutting Approaches: Participant Spillover Nonparticipant Spillover Measured through Trade Allies Nonparticipant Spillover Measured from Customers	New	Added protocols to cover additional residential program types: Prescriptive Rebate Programs (With No Audit) Single-Family Home Energy Audit Multifamily Energy Savings Kits and Elementary Education Residential New Construction Added Residential Cross-Cutting Approaches section containing general protocols for measuring: Participant Spillover Nonparticipant Spillover Measured through Trade Allies Nonparticipant Spillover Measured from Customers
Vol. 4	Residential and Low Income Sectors	Appliance Recycling Residential Upstream Lighting	Revision	Appliance Recycling protocol changed to allow for spillover Algorithm flow chart added to Residential Upstream Lighting protocol
Vol. 4	Cross-Sector	Behavioral Code Compliance	New	Added protocols to cover cross-sector program types: Behavioral Code Compliance

1.3 Enabling ICC Policy

This Illinois Statewide Technical Reference Manual (TRM) was developed to comply with the Illinois Commerce Commission (ICC or Commission) Final Orders from the electric and gas Utilities'[6] Energy Efficiency Plan dockets. In the Final Orders, the ICC required the utilities to work with DCEO and the Illinois Energy Efficiency Stakeholder Advisory Group (SAG) to develop a statewide TRM. *See, e.g.,* ComEd's Final Order *(Docket No. 10-0570, Final Order[7] at 59-60, December 21, 2010);* Ameren's Final Order *(Docket No. 10-0568, Order on Rehearing[8] at 19, May 24, 2011);* Peoples Gas/North Shore Gas' Final Order *(Docket No. 10-0564, Final Order[9]at 76, May 24, 2011),* and Nicor's Final Order *(Docket No. 10-0562, Final Order[10] at 30, May 24, 2011).*

As directed in the Utilities' Efficiency Plan Orders, the SAG had the opportunity to, and also participated in, every aspect of the development of the TRM. Interested members of the SAG participated in weekly teleconferences to review, comment, and participate in the development of the TRM. The active participants in the TRM were designated as the "Technical Advisory Committee" (TAC). The TAC participants include representatives from the following organizations:

- the Utilities (ComEd, Ameren IL, Nicor Gas, Peoples Gas/North Shore Gas),
- DCEO, Implementation contractors (Applied Proactive Technologies (APT), CLEAResult, Conservation Services Group, Elevate Energy, Franklin Energy, GDS Associates, PECI, 360 Energy Group),
- Illinois Department of Commerce and Economic Opportunity (DCEO),
- the independent evaluators (ADM Associates, The Cadmus Group, Itron, Navigant Consulting, Michael's Engineering, Opinion Dynamics Corporation),
- ICC Staff,
- the Illinois Attorney General's Office (AG),
- Natural Resources Defense Council (NRDC),
- the Environmental Law and Policy Center (ELPC),
- the Citizen's Utility Board (CUB),
- The University of Illinois at Chicago,
- Future Energy Enterprises,
- Selective participants including; Geothermal Alliance of Illinois, the Geothermal Exchange Organization, Embertec and TrickleStar.
-

1.4 Development Process

The first edition of the IL-TRM was approved by the Commission in ICC Docket No. 12-0528[11]. The second edition of the IL-TRM was approved by the Commission in ICC Docket No. 13-0437[12]. The policies surrounding the applicability and use of the IL-TRM in planning, implementation, and evaluation were established by the

[6] The Illinois Utilities subject to this TRM include: Ameren Illinois Company d/b/a Ameren Illinois (Ameren), Commonwealth Edison Company (ComEd), The Peoples Gas Light and Coke Company and North Shore Gas Company, and Northern Illinois Gas Company d/b/a Nicor Gas.
[7] http://www.icc.illinois.gov/docket/files.aspx?no=10-0570&docId=159809
[8] http://www.icc.illinois.gov/docket/files.aspx?no=10-0568&docId=167031
[9] http://www.icc.illinois.gov/docket/files.aspx?no=10-0564&docId=167023
[10] http://www.icc.illinois.gov/docket/files.aspx?no=10-0562&docId=167027
[11] http://www.icc.illinois.gov/docket/files.aspx?no=12-0528&docId=187554
[12] http://www.icc.illinois.gov/docket/files.aspx?no=13-0437&docId=200492

Commission in ICC Docket No. 13-0077[13]. The Commission extended these policies, including the applicability of the IL-TRM, to the Section 16-111.5B energy efficiency programs in ICC Docket No. 14-0588[14] and most recently in ICC Docket No. 15-0541[15], in order to increase certainty for all parties. The third edition of the IL-TRM was approved by the Commission in ICC Docket No. 14-0189[16]. The fourth edition of the IL-TRM was approved by the Commission in ICC Docket No. 15-0187[17]. This document represents the fifth edition of the IL-TRM. It contains a series of new measures, as well as a series of errata items[18] and updates to existing measures that were already present in the first four editions. Like the previous editions, it is a result of an ongoing review process involving the Illinois Commerce Commission (ICC) Staff (Staff or ICC Staff), the Utilities, DCEO, the Evaluators, the SAG TAC, and the SAG. VEIC meets with the SAG and/or the TRM TAC at least once each month to create a high level of transparency and vetting in the development of this TRM.

Measure requests that are submitted by interested parties are ranked based on the following criteria to determine the approximate priority level for order of inclusion in the TRM:

1. High Priority
   - For those existing measures that make up a significant portion of a utilities' portfolio and/or where the impact of the requested change is high
   - For new measures where plans are in place to implement in the next program year
2. Medium Priority
   - For existing measures that are a less significant percent of a utilities' portfolio and value change will not have a significant impact
   - For new measures where a savings value is estimated but implementation plans not yet developed
3. Low Priority
   - For existing measures that represent a very small percent of a utilities' portfolio
   - For new measures that are just beginning to be explored and will not be implemented in the next program year

These rankings are used to align budget and schedule constraints with desired updates from the TRM.

As measure requests are finalized leading up to the next update of the TRM, weekly TAC meetings are often scheduled to maximize the level of collaboration and visibility into the measure characterization process. Where

[13] http://www.icc.illinois.gov/docket/files.aspx?no=13-0077&docId=203903; http://www.icc.illinois.gov/docket/files.aspx?no=13-0077&docId=195913; http://www.icc.illinois.gov/downloads/public/edocket/339744.pdf

[14] ICC Docket No. 14-0588, Final Order at 227, December 17, 2014.
The adopted consensus language concerning the IL-TRM and its applicability to future Section 16-111.5B energy efficiency programs can be accessed from the following link:
http://www.icc.illinois.gov/downloads/public/June%2018%202014%20Consensus%20Language%20for%20Section%2016-111.5B%20Oversight%20and%20Evaluation%20Responsibility%20Energy%20Efficiency%20Issues.pdf

[15] ICC Docket No. 15-0541, Final Order at 36, 82-83, December 16, 2015.

[16] http://www.icc.illinois.gov/docket/files.aspx?no=14-0189&docId=210478
http://www.icc.illinois.gov/downloads/public/Illinois_Statewide_TRM_Effective_060114_Version_3.0_022414_Clean.pdf

[17] http://www.icc.illinois.gov/docket/files.aspx?no=15-0187&docId=226161
http://www.icc.illinois.gov/downloads/public/Illinois_Statewide_TRM_Effective_060115_Final_022415_Clean.pdf

[18] Errata as well as links to the official IL-TRM documents, dockets, and policy documents are available on the following ICC webpage: http://www.icc.illinois.gov/Electricity/programs/TRM.aspx

consensus does not emerge on specific measures or issues, those items are identified in a memo, and are not included in the TRM. As a result, this TRM represents a broad consensus amongst the SAG and TAC participants. In keeping with the goal of transparency, all of the comments and their status to-date are available through the TAC SharePoint web site, https://portal.veic.org.

For each measure characterization, this TRM includes engineering algorithm(s) and a value(s) for each parameter in the equation(s). These parameters have values that fall into one of three categories: a single deemed value, a lookup table of deemed values or an actual value such as the capacity of the equipment. The TRM makes extensive use of lookup tables because they allow for an appropriate level of measure streamlining and customization within the context of an otherwise prescriptive measure.

Accuracy is the overarching principle that governs what value to use for each parameter. When it is explicitly allowed within the text of the measure characterization, the preferred value is the actual or on-site value for the individual measure being implemented. The *deemed values*[19] in the lookup tables are the next most accurate choice, and in the absence of either an actual value or an appropriate value in a lookup table, the single, *deemed value* should be used. As a result, this single, *deemed value* can be thought of as a default value for that particular input to the algorithm.

A single *deemed savings estimate* is produced by any given combination of an algorithm and the allowable input values for each of its parameters. In cases where lookup tables are provided, there is a range of deemed savings estimates that are possible, depending on site-specific factors such as equipment capacity, location and building type.

Algorithms and their parameter values are included for calculating estimated:

- Gross annual electric energy savings (kWh)
- Gross annual natural gas energy savings (therms)
- Gross electric summer coincident peak demand savings (kW)

To support cost-effectiveness calculations, parameter values are also included for:

- Incremental costs ($)
- Measure life (years)
- Operation and maintenance costs ($)
- Water (gal) and other resource savings where appropriate.

[19] Emphasis has been added to denote the difference between a “deemed value” and a “deemed savings estimate”. A deemed value refers to a single input value to an algorithm, while a deemed savings estimate is the result of calculating the end result of all of the values in the savings algorithm.

2 Organizational Structure

The organization of this document follows a three-level format. These levels are designed to define and clarify what the measure is and where it is applied.

1. **Market Sectors Volumes**[20]

   - This level of organization specifies the type of customer the measures apply to, either Commercial and Industrial (provided in Volume 2), Residential (provided in Volume 3) or cross-cutting measures, such as Behavior Persistence (provided in Volume 4, together with Attachments including the documentation of Illinois Statewide Net-to-Gross methodologies).

   - Answers the question, "What category best describes the customer?"

2. **End-use Category**

   - This level of organization represents most of the major end-use categories for which an efficient alternative exists. The following table lists all of the end-use categories in this version of the TRM.

   - Answers the question, "To what end-use category does the measure apply?"

Table 2.1: End-Use Categories in the TRM[21]

Volume 1: Residential Market Sector	Volume 2: Commercial and Industrial Market Sector	Volume 3: Cross-Cutting Measures and Attachments
Appliances	Agricultural Equipment	Behavior
Consumer Electronics	Food Service Equipment	
Hot Water	Hot Water	
HVAC	HVAC	
Lighting	Lighting	
Shell	Refrigeration	
	Compressed Air	
	Miscellaneous	

3. **Measure & Technology**

   - This level of organization represents individual efficient measures such as CFL lighting and LED lighting, both of which are individual technologies within the Lighting end-use category.

   - Answers the question, "What technology defines the measure?"

This organizational structure is silent on which fuel the measure is designed to save; electricity or natural gas. By

[20] Note that the Public sector buildings and low income measures that DCEO administers are not listed as a separate Market Sector. The Public building type is one of a series of building types that are included in the appropriate measures in the Commercial and Industrial Sector.

[21] Please note that this is not an exhaustive list of end-uses and that others may be included in future versions of the TRM.

organizing the TRM this way, measures that save on both fuels do not need to be repeated. As a result, the TRM will be easier to use and to maintain.

2.1 Measure Code Specification

In order to uniquely identify each measure in the TRM, abbreviations for the major organizational elements of the TRM have been established. When these abbreviations are combined and delimited by a dash ('-') a unique, 18-character alphanumeric code is formed that can be used for tracking the measures and their associated savings estimates. Measure codes appear at the end of each measure and are structured using five parts.

Code Structure = Market + End-use Category + Measure + Version # + Effective Date

For example, the commercial boiler measure is coded: "CI-HVC-BLR_-V01-120601"

Table 2.2: Measure Code Specification Key

Market (@@)	End-use (@@@)	Measure (@@@@)	Version (V##)	Effective Date
CI (C&I)	AGE (Agricultural Equipment)	BLR_	V01	YYMMDD
RS (Residential)	APL (Appliances)	T5FX	V02	YYMMDD
CC (Cross-Cutting)	BEH (Behavior)	T8FX	V03	YYMMDD
	CEL (Consumer Electronics)	…	…	…
	CPA (Compressed Air)			
	FSE (Food Service Equipment)			
	HVC (HVAC)			
	HW_ (Hot Water)			
	LTG (Lighting)			
	MSC (Miscellaneous)			
	RFG (Refrigeration)			
	SHL (Shell)			

2.2 Components of TRM Measure Characterizations

Each measure characterization uses a standardized format that includes at least the following components. Measures that have a higher level of complexity may have additional components, but also follow the same format, flow and function.

DESCRIPTION

Brief description of measure stating how it saves energy, the markets it serves and any limitations to its applicability.

DEFINITION OF EFFICIENT EQUIPMENT

Clear definition of the criteria for the efficient equipment used to determine delta savings. Including any standards or ratings if appropriate.

DEFINITION OF BASELINE EQUIPMENT

Clear definition of the efficiency level of the baseline equipment used to determine delta savings including any standards or ratings if appropriate. If a Time of Sale measure the baseline will be new base level equipment (to replace existing equipment at the end of its useful life or for a new building). For Early Replacement or Early Retirement measures the baseline is the existing working piece of equipment that is being removed.

DEEMED LIFETIME OF EFFICIENT EQUIPMENT

The expected duration in years (or hours) of the savings. If an early replacement measure, the assumed life of the existing unit is also provided.

DEEMED MEASURE COST

For time of sale measures, incremental cost from baseline to efficient is provided. Installation costs should only be included if there is a difference between each efficiency level. For Early Replacement the full equipment and install cost of the efficient installation is provided in addition to the full deferred hypothetical baseline replacement cost.

LOADSHAPE

The appropriate loadshape to apply to electric savings is provided.

COINCIDENCE FACTOR

The summer coincidence factor is provided to estimate the impact of the measure on the utility's system peak – defined as 1PM to hour ending 5PM on non-holiday weekdays, June through August.

Algorithm

CALCULATION OF ENERGY SAVINGS

Algorithms are provided followed by list of assumptions with their definition.

If there are no Input Variables, there will be a finite number of Output values. These will be identified and listed in a table. Where there are custom inputs, an example calculation is often provided to illustrate the algorithm and provide context.

ELECTRIC ENERGY SAVINGS

SUMMER COINCIDENT PEAK DEMAND SAVINGS

NATURAL GAS SAVINGS

WATER IMPACT DESCRIPTIONS AND CALCULATION

DEEMED O&M COST ADJUSTMENT CALCULATION

Only required if the operation and maintenance cost for the efficient case is different to the baseline.

MEASURE CODE

2.3 Variable Input Tables

Many of the measures in this TRM require the user to select the appropriate input value from a list of inputs for a given parameter in the savings algorithm. Where the TRM asks the user to select the input, look-up tables of allowable values are provided. For example, a set of input parameters may depend on building type; while a range

of values may be given for each parameter, only one value is appropriate for any specific building type. If no table of alternative inputs is provided for a particular parameter, then the single deemed value will be used, unless the measure has a custom allowable input.

2.3.1 C&I Custom Value Use in Measure Implementation

This section defines the requirements for capturing Custom variables that can be used in place of defaults for select assumptions within the prescriptive measures defined in this statewide TRM. This approach is to be used when a variable in a measure formula can be replaced by a verifiable and documented value that is not presented in the TRM. This approach assumes that the algorithms presented in the measure are used as stated and only allows changes to certain variable values and is not a replacement algorithm for the measure. A custom variable is when customer input is provided to define the number or the value is measured at the site. Custom values can also be supplied from product data of the measure installed. In certain cases the custom data can be provided from a documented study or report that is applicable to the measure. Custom variables and potential sources are clearly defined in the specific measures where "Actual" or "Custom" is noted.

In exceptional cases where the participant, program administrator, and independent evaluator all agree that the TRM algorithm for a particular energy efficiency measure does not accurately characterize the energy efficiency measure within a project due to the complexity in the design and configuration of the particular energy efficiency project, a more comprehensive custom engineering and financial analysis may be used that more accurately incorporates the attributes of the measure in the complex energy efficiency project. In such cases and consistent with Commission policy adopted in ICC Docket No. 13-0077, Program Administrators are subject to retrospective evaluation risk (retroactive adjustments to savings based on ex post evaluation findings) for such projects utilizing customized savings calculations.

2.4 Program Delivery & Baseline Definitions

The measure characterizations in this TRM are not grouped by program delivery type. As a result, the measure characterizations provided include information and assumptions to support savings calculations for the range of program delivery options commonly used for the measure. The organizational significance of this approach is that multiple baselines, incremental costs, O&M costs, measure lives and in-service rates are included in the measure characterization(s) that are delivered under two or more different program designs. Values appropriate for each given program delivery type are clearly specified in the algorithms or in look-up tables within the characterization.

Care has been taken to clearly define in the measure's description the types of program delivery that the measure characterization is designed to support. However, there are no universally accepted definitions for a particular program type, and the description of the program type(s) may differ by measure. Nevertheless, program delivery types can be generally defined according to the following table. These are the definitions used in the measure descriptions, and, when necessary, individual measure descriptions may further refine and clarify these definitions of program delivery type.

Table 2.3: Program Delivery Types

Program	Attributes
Time of Sale (TOS)	Definition: A program in which the customer is incented to purchase or install higher efficiency equipment than if the program had not existed. This may include retail rebate (coupon) programs, upstream buydown programs, online store programs or contractor based programs as examples. Baseline = New equipment. Efficient Case = New, premium efficiency equipment above federal and state codes and

Program	Attributes
	standard industry practice. Example: CFL rebate
New Construction (NC)	Definition: A program that intervenes during building design to support the use of more-efficient equipment and construction practices. Baseline = Building code or federal standards. Efficient Case = The program's level of building specification Example: Building shell and mechanical measures
Retrofit (RF)	Definition: A program that upgrades existing equipment before the end of its useful life. Baseline = Existing equipment or the existing condition of the building or equipment. A single baseline applies over the measure's life. Efficient Case = New, premium efficiency equipment above federal and state codes and standard industry practice. Example: Air sealing and insulation
Early Replacement (EREP)	Definition: A program that replaces existing equipment before the end of its expected life. Baseline = Dual; it begins as the existing equipment and shifts to new baseline equipment after the expected life of the existing equipment is over. Efficient Case = New, premium efficiency equipment above federal and state codes and standard industry practice. Example: Refrigerators, freezers
Early Retirement (ERET)	Definition: A program that retires duplicative equipment before its expected life is over. Baseline = The existing equipment, which is retired and not replaced. Efficient Case = Zero because the unit is retired. Example: Appliance recycling
Direct Install (DI)	Definition: A program where measures are installed during a site visit. Baseline = Existing equipment. Efficient Case = New, premium efficiency equipment above federal and state codes and standard industry practice. Example: Lighting and low-flow hot water measures
Efficiency Kits (KITS)	Definition: A program where measures are provided free of charge to a customer in an Efficiency Kit. Baseline = Existing equipment. Efficient Case = New, premium efficiency equipment above federal and state codes and standard industry practice. Example: Lighting and low-flow hot water measures

The concept and definition of the baseline is a key element of every measure characterization and is directly related to the program delivery type. Without a clear definition of the baseline, the savings algorithms cannot be adequately specified and subsequent evaluation efforts would be hampered. As a result, each measure has a detailed description (and in many cases, specification) of the specific baseline that should be used to calculate savings. Baselines in this TRM fall into one of the following four categories, and are organized within each measure characterization by the program delivery type to which it applies.

1. **Building Code:** As defined by the minimum specifications required under state energy code or applicable federal standards.

2. **Existing Equipment**: As determined by the most representative (or average) example of equipment that is in the existing stock. Existing equipment baselines apply over the equipment's remaining useful life.

3. **New Equipment:** As determined by the equipment that represents standard practice in the current market environment. New equipment baselines apply over the effective useful life of the measure.

4. **Dual Baseline:** A baseline that begins as the existing equipment and shifts to new equipment after the expected life of the existing equipment is over

3 Assumptions

The information contained in this TRM contains VEIC's recommendations for the content of the Illinois TRM. Sources that are cited within the TRM have been chosen based on two priorities, geography and age. Whenever possible and appropriate, VEIC has incorporated Illinois-specific information into each measure characterization. The Business TRM documents from Ameren and ComEd were reviewed, as well as program and measure specific data from evaluations, efficiency plans, and working documents.

The assumptions for these characterizations rest on our understanding of the information available. In each case, the available Illinois and Midwest-specific information was reviewed, including evaluations and support material provided by the Illinois Utilities.

When Illinois or region-specific evaluations or data were not available, best practice research and data from other jurisdictions was used, often from west and east-coast states that have allocated large amounts of funding to evaluation work and to refining their measure characterization parameters. As a result, much of the most-defensible information originates from these regions. In every case, VEIC used the most recent, well-designed, and best-supported studies and only if it was appropriate to generalize their conclusions to the Illinois programs.

3.1 Footnotes & Documentation of Sources

Each new and updated measure characterization is supported by a work paper, which is posted to the SharePoint web site (https://portal.veic.org).[22] Both the work paper and the measure characterizations themselves use footnotes to document the references that have been used to characterize the technology. The reference documents are too numerous to include in an Appendix and have instead been posted to the TRM's Sharepoint website. These files can be found in the 'Sources and Reference Documents' folder in the main directory, and are also posted to the SAG's public web site (http://www.ilsag.info/technical-reference-manual.html).

3.2 General Savings Assumptions

The TRM savings estimates are expected to serve as average, representative values, or ways to calculate savings based on program-specific information. All information is presented on a per-measure basis. In using the measure-specific information in the TRM, it is helpful to keep the following notes in mind.

- All estimates of energy (kWh or therms) and peak (kW) savings are for first-year savings, not lifetime savings.
- Unless otherwise noted, measure life is defined to be the life of an energy consuming measure, including its equipment life and measure persistence.
- Where deemed values for savings are provided, they represent the average energy (kWh or therms) or peak (kW) savings that could be expected from the average of all measures that might be installed in Illinois in the program year.
- In general, the baselines included in the TRM are intended to represent average conditions in Illinois. Some are based on data from the state, such as household consumption characteristics provided by the Energy Information Administration. Some are extrapolated from other areas, when Illinois data are not available.

[22] To gain access to the SharePoint web site, please contact the TRM Administrator at iltrmadministrator@veic.org.

3.3 Shifting Baseline Assumptions

The TRM anticipates the effects of changes in efficiency codes and standards on affected measures. When these changes take effect, a shift in the baseline is usually required. This complicates the measure savings estimation somewhat, and will be handled in future versions of the TRM by describing the choice of and reasoning behind a shifting baseline assumption. In this version of the TRM, this applies to CFLs and T5/T8 Linear Fluorescents, Furnaces and Early Replacement Measures.

3.3.1 CFL and T5/T8 Linear Fluorescents Baseline Assumptions

Specific reductions in savings have been incorporated for CFL measures that relate to the shift in appropriate baseline due to changes in Federal Standards for lighting products. Federal legislation (stemming from the Energy Independence and Security Act of 2007) mandates a phase-in process beginning in 2012 for all general-purpose light bulbs between 40W and 100W to be approximately 30% more energy efficient than current incandescent bulbs, in essence beginning the phase-out of the current style, or "standard", incandescent bulbs. In 2012, standard 100W incandescent bulbs will no longer be manufactured, followed by restrictions on standard 75W bulbs in 2013 and 60W and 40W bulbs in 2014. The baseline for the CFL measure in the corresponding program years starting June 1 each year will therefore become bulbs (improved or "efficient" incandescent, or halogen) that meet the new standard and have the same lumen equivalency. Those products can take several different forms we can envision now and perhaps others we do not yet know about. Halogens are one of those possibilities and have been chosen to represent a baseline at that time. To account for this shifting baseline, annual savings are reduced within the lifetime of the measure. Other lighting measures will also have baseline shifts (for example screw based LED and CFL fixtures) that will result in significant impacts to annual estimated savings in later years.

In July 14, 2012, Federal Standards were enacted that were expected to eliminate T-12s as an option for linear fluorescent fixtures. Through v3.0 of the TRM, it was assumed that the T-12 would no longer be baseline for retrofits from 1/1/2016. However, due to significant loopholes in the legislation, T-12 compliant product is still freely available and in Illinois T-12s continue to hold a significant share of the existing and replacement lamp market. Therefore the timing of the sunsetting of T-12s as a viable baseline was pushed back in v4.0 until 6/1/2016, and again in v5.0 until 6/1/2018, and will be revisited in future update sessions.

3.3.2 Early Replacement Baseline Assumptions

A series of measures have an option to choose an Early Replacement Baseline if the following conditions are met:

Early Replacement determination will be based on meeting the following conditions:

- The existing unit is operational when replaced, or
- The existing unit requires minor repairs (see table below) [23].

Existing System	Maximum repair cost
Air Source Heat Pump	$918
Central Air Conditioner	$734
Boiler	$709
Furnace	$528

[23] The Technical Advisory Committee agreed that if the cost of repair is less than 20% of the new baseline replacement cost it can be considered early replacement.

Existing System	Maximum repair cost
Ground Source Heat Pump	<$249 per ton

- All other conditions will be considered Time of Sale.

The Baseline efficiency of the existing unit replaced:

- If the efficiency of the existing unit is less than the maximum shown below, the Baseline efficiency is the actual efficiency value of the unit replaced. If the efficiency is greater than the maximum, the Baseline efficiency is shown in the "New Baseline" column below:

Existing System	Maximum efficiency for Actual	New Baseline
Air Source Heat Pump	10 SEER	14 SEER
Central Air Conditioner	10 SEER	13 SEER
Boiler	75% AFUE	82% AFUE
Furnace	75% AFUE	80% AFUE
Ground Source Heat Pump	10 SEER	13 SEER

- If the operational status, repair cost or efficiency of the existing unit is unknown, the Baseline efficiency is the "New Baseline" column above.

3.3.3 Furnace Baseline

The prior national standard for residential oil and gas furnaces was 78% AFUE. DOE raised the standard in 2007 to 80% AFUE, effective 2015. However, virtually all furnaces on the market have an AFUE of 80% or better, which prompted states and environmental and consumer groups to sue DOE over its 2007 decision. In April 2009, DOE accepted a "voluntary remand" in that litigation. In October 2009, manufacturers and efficiency advocates negotiated an agreement that, for the first time, included different standard levels in three climate regions: the North, South, and Southwest. DOE issued a direct final rule (DFR) in June 2011 reflecting the standard levels in the consensus agreement. The DFR became effective on October 25, 2011 establishing new standards: In the North, most furnaces will be required to have an AFUE of 90%.The 80% AFUE standard for the South and Southwest will remain unchanged at 80%. Oil furnaces will be required to have an AFUE of 83% in all three regions. The amended standards will become effective in May 2013 for non-weatherized furnaces and in January 2015 for weatherized furnaces. DOE estimates that the standards will save about 3.3 quads (quadrillion Btu) of energy over 30 years and yield a net present value of about $14 billion at a 3 percent discount rate.

Update*:* On January 14th 2013, the U.S. Department of Energy (DOE) proposed to settle a lawsuit brought by the American Public Gas Association (APGA) that seeks to roll back gas furnace efficiency standards. As a result, the new standards, completed in 2011 and slated to take effect in May 2013, would be eliminated in favor of yet

another round of DOE hearings and studies. Even if DOE completes a new rulemaking in two years, it's unlikely to take effect before 2020."[24]

As a result, each of the furnace measures contains the following language describing the baseline assumption:

"Although the current Federal Standard for gas furnaces is an AFUE rating of 78%, based upon review of available product in the AHRI database, the baseline efficiency for this characterization is assumed to be 80%. The baseline will be adjusted when the Federal Standard is updated."

3.4 Glossary

Baseline Efficiency: The assumed standard efficiency of equipment, absent an efficiency program.

Building Types[25]:

Building Type	Definition
Assisted Living MultiFamily	Applies to residential buildings of three of more units with staff to assist the occupants. Gross Floor Area should include all fully-enclosed space within the exterior walls of the building(s) including individual rooms or units, wellness centers, exam rooms, community rooms, small shops or service areas for residents and visitors (e.g. hair salons, convenience stores), staff offices, lobbies, atriums, cafeterias, kitchens, storage areas, hallways, basements, stairways, corridors between buildings, and elevator shafts.
Auditorium/Assembly	Applies to any performance space such as a theater, arena, or hall. Gross Floor Area should include all space within the building(s), including seating, stage and backstage areas, food service areas, retail areas, rehearsal studios, administrative/office space, mechanical rooms, storage areas, elevator shafts, and stairwells.
Childcare/Pre-school	Applies to any building providing childcare to pre-kindergarten age children.
College/University	Applies to facility space used for higher education. Relevant buildings include administrative headquarters, residence halls, athletic and recreation facilities, laboratories, etc. The total gross floor area should include all supporting functions such as kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Convenience Store	Applies to facility space used for the retail sale of a limited selection of food and beverage products. The total gross floor area should include all supporting functions such as kitchens and break rooms used by staff, storage areas (refrigerated and non-refrigerated), and administrative areas.
Elementary School	Applies to a school serving children In any grades from Kindergarten through sixth grade. The total gross floor area should include all supporting functions such as administrative space, conference rooms, kitchens used by staff, lobbies, cafeterias, gymnasiums, auditoria, laboratory classrooms, portable classrooms, greenhouses, stairways, atria, elevator shafts, small landscaping sheds, storage areas, etc.
Exterior	Applies to unconditioned spaces that are outside of the building envelope.
Garage	Applies to unconditioned spaces either attached or detached from the primary building envelope that are not used for living space.
Grocery	Applies to facility space used for the retail sale of food and beverage products. It should not be used by restaurants. The total gross floor area should include all supporting functions such as kitchens and break rooms used by staff, storage areas (refrigerated

[24] Appliance Standards Awareness Project, http://www.appliance-standards.org/product/furnaces

[25] Source: US EPA, www.energystar.gov, Space Type Definitions, or definitions as developed through the Technical Advisory Committee.

Building Type	Definition
	and non-refrigerated), administrative areas, stairwells, atria, lobbies, etc.
Healthcare Clinic	Applies to a facility space used to provide diagnosis and treatment for medical, dental, or psychiatric outpatient care. Gross Floor Area should include all space within the building(s) including offices, exam rooms, laboratories, lobbies, atriums, conference rooms and auditoriums, employee break rooms and kitchens, rest rooms, elevator shafts, stairways, mechanical rooms, and storage areas.
High School/Middle School	Applies to facility space used as a school building for 7th through 12th grade students. This does not include college or university classroom facilities and laboratories, vocational, technical, or trade schools. The total gross floor area should include all supporting functions such as administrative space, conference rooms, kitchens used by staff, lobbies, cafeterias, gymnasiums, auditoria, laboratory classrooms, portable classrooms, greenhouses, stairways, atria, elevator shafts, small landscaping sheds, storage areas, etc.
Hospital	Applies to a general medical and surgical hospital (including critical access hospitals and children's hospitals) that is either a stand-alone building or a campus of buildings. Spaces more accurately characterized as a Healthcare Clinic should use that definition. The definition of Hospital accounts for all space types that are located within the Hospital building/campus, such as medical offices, administrative offices, and skilled nursing. The total floor area should include the aggregate floor area of all buildings on the campus as well as all supporting functions such as: stairways, connecting corridors between buildings, medical offices, exam rooms, laboratories, lobbies, atria, cafeterias, storage areas, elevator shafts, and any space affiliated with emergency medical care, or diagnostic care.
Hotel/Motel Combined (All Spaces)	Applies to buildings that rent overnight accommodations on a room/suite basis, typically including a bath/shower and other facilities in guest rooms. The total gross floor area should include all interior space, including guestrooms, halls, lobbies, atria, food preparation and restaurant space, conference and banquet space, health clubs/spas, indoor pool areas, and laundry facilities, as well as all space used for supporting functions such as elevator shafts, stairways, mechanical rooms, storage areas, employee break rooms, back-of-house offices, etc. Hotel does not apply to fractional ownership properties such as condominiums or vacation timeshares. Hotel properties should be owned by a single entity and have rooms available on a nightly basis. Where distinction between Hotel and Motel is necessary: Hotel: Room entrances and Corridors are located in the *interior* of the building. Corridors are conditioned spaces. Building can be significantly larger in size/height. Motel: Room entrances and Corridors are located on the *exterior* of the building. Corridors are not conditioned spaces. Buildings tend to be two to three stories in height.
Hotel/Motel Common Areas	All the common areas open to guests of the hotel such as the lobby, corridors and stairways, and other spaces that may have continuous or large lighting and HVAC hours.
Hotel/Motel Guest Room	Applies to the guest rooms of the hotel or motel. These spaces are occupied intermittantly.
Low-use Small Business	Any business type with low (<3000) operating hours (provided as option in lighting measures).
Manufacturing	Applies to buildings that are dedicated to manufacturing activities. Includes light industry buildings characterized by consumer product and component manufacturing and heavy industry buildings typically characterized by a plant that includes a main production area that has high-ceilings and contains heavy equipment used for assembly line production. These building types may be distinguished by categorizing NAICS (SIC)

Building Type	Definition
	codes according to the needs of the Program Administrator.
Miscellaneous	Applies to spaces that do not fit clearly within any available categories should be designated as "miscellaneous".
Multifamily-Mid Rise	Applies to residential buildings with up to four floors, including all public and multiuse spaces within the building envelope. Small Multifamily buildings best described as a house should use the residential measure characterizations.
Multifamily-High Rise Combined (All Spaces)	Applies to residential buildings with five or more floors, including all public and multiuse spaces within the building envelope. Gross Floor Area should include all fully-enclosed space within the exterior walls of the building(s) including living space in each unit (including occupied and unoccupied units), interior common areas (e.g. lobbies, offices, community rooms, common kitchens, fitness rooms, indoor pools), hallways, stairwells, elevator shafts, connecting corridors between buildings, storage areas, and mechanical space such as a boiler room. Open air stairwells, breezeways, and other similar areas that are not fully-enclosed should not be included in the Gross Floor Area.
Multifamily-High Rise Common Areas	All the common areas open to occupants of the building such as the lobby, corridors and stairways, and other spaces that may have continuous or high lighting and HVAC hours.
Multifamily-High Rise Residential Units	Applies to the residential units in the building only.
Movie Theater	Applies to buildings used for public or private film screenings. Gross Floor Area should include all space within the building(s), including seating areas, lobbies, concession stands, bathrooms, administrative/office space, mechanical rooms, storage areas, elevator shafts, and stairwells.
Office-Low Rise	Applies to facility spaces in buildings with four floors or fewer used for general office, professional, and administrative purposes. The total gross floor area should include all supporting functions such as kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Office-Mid Rise	Applies to facility spaces in buildings with ffive to nine floors used for general office, professional, and administrative purposes. The total gross floor area should include all supporting functions such as kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Office-High Rise	Applies to facility spaces in buildings with ten floors or more used for general office, professional, and administrative purposes. The total gross floor area should include all supporting functions such as kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Religious Worship/Church	Applies to buildings that are used as places of worship. This includes churches, temples, mosques, synagogues, meetinghouses, or any other buildings that primarily function as a place of religious worship. Gross Floor Area should include all areas inside the building that includes the primary worship area, including food preparation, community rooms, classrooms, and supporting areas such as restrooms, storage areas, hallways, and elevator shafts.
Restaurant	Applies to a subcategory of Retail/Service space that is used to provide commercial food services to individual customers, and includes kitchen, dining, and common areas.
Retail/Service-Department store	Applies to facility space used to conduct the retail sale of consumer product goods. Stores must be at least 30,000 square feet and have an exterior entrance to the public. The total gross floor area should include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, etc. Retail segments typically included under this definition are: Department Stores, Discount Stores, Supercenters, Warehouse Clubs, Drug Stores, Dollar Stores, Home Center/Hardware Stores, and Apparel/Hard Line Specialty Stores (e.g., books,

Building Type	Definition
	clothing, office products, toys, home goods, electronics). Retail segments excluded under this definition are: Grocery, Convenience Stores, Automobile Dealerships, and Restaurants.
Retail/Service- Strip Mall	Applies to facility space used to conduct the retail sale of consumer product goods. Stores must less than 30,000 square feet and have an exterior entrance to the public. The total gross floor area should include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, etc. Retail segments excluded under this definition are: Grocery, Convenience Stores, Automobile Dealerships, and Restaurants.
Warehouse	Applies to unrefrigerated or refrigerated buildings that are used to store goods, manufactured products, merchandise or raw materials. The total gross floor area of Refrigerated Warehouses should include all temperature controlled area designed to store perishable goods or merchandise under refrigeration at temperatures below 50 degrees Fahrenheit. The total gross floor area of Unrefrigerated Warehouses should include space designed to store non-perishable goods and merchandise. Unrefrigerated warehouses also include distribution centers. The total gross floor area of refrigerated and unrefrigerated warehouses should include all supporting functions such as offices, lobbies, stairways, rest rooms, equipment storage areas, elevator shafts, etc. Existing atriums or areas with high ceilings should only include the base floor area that they occupy. The total gross floor area of refrigerated or unrefrigerated warehouse should not include outside loading bays or docks. Self-storage facilities, or facilities that rent individual storage units, are not eligible for a rating using the warehouse model.

Coincidence Factor (CF): Coincidence factors represent the fraction of connected load expected to be coincident with a particular system peak period, on a diversified basis. Coincidence factors are provided for summer peak periods.

Commercial & Industrial: The market sector that includes measures that apply to any of the building types defined in this TRM, which includes multifamily common areas and public housing[26].

Connected Load: The maximum wattage of the equipment, under normal operating conditions.

Deemed Value: A value that has been assumed to be representative of the average condition of an input parameter.

Default Value: When a measure indicates that an input to a prescriptive saving algorithm may take on a range of values, an average value is also provided in many cases. This value is considered the default input to the algorithm, and should be used when the other alternatives listed in the measure are not applicable.

End-use Category: A general term used to describe the categories of equipment that provide a service to an individual or building. See Table 2.1.1 for a list of the end-use categories that are incorporated in this TRM.

Energy Efficiency: "Energy efficiency" means measures that reduce the amount of electricity or natural gas required to achieve a given end use. "Energy efficiency" also includes measures that reduce the total Btus of electricity and natural gas needed to meet the end use or uses (20 ILCS 3855/1-10). For purposes of this Section, "energy efficiency" means measures that reduce the amount of energy required to achieve a given end use. "Energy efficiency" also includes measures that reduce the total Btus of electricity and natural gas needed to meet

[26] Measures that apply to the multifamily and public housing building types describe how to handle tenant versus master metered buildings.

the end use or uses (220 ILCS 5/8-104(b)).

Equivalent Full Load Hours (EFLH): The equivalent hours that equipment would need to operate at its peak capacity in order to consume its estimated annual kWh consumption (annual kWh/connected kW) or therms.

High Efficiency: General term for technologies and processes that require less energy, water, or other inputs to operate.

Lifetime: The number of years (or hours) that the new high efficiency equipment is expected to function. These are generally based on engineering lives, but sometimes adjusted based on expectations about frequency of removal, remodeling or demolition. Two important distinctions fall under this definition; Effective Useful Life (EUL) and Remaining Useful Life (RUL).

> **EUL** – EUL is based on the manufacturers rating of the effective useful life; how long the equipment will last. For example, a CFL that operates x hours per year will typically have an EUL of y. A house boiler may have a lifetime of 20 years but the EUL is only 15 years since after that time it may be operating at a non-efficient point. An estimate of the median number of years that the measures installed under a program are still in place and operable.
>
> **RUL** – Applies to retrofit or replacement measures. For example, if an existing working refrigerator is replaced with a high efficiency unit, the RUL is an assumption of how many more years the existing unit would have lasted. As a general rule the RUL is usually assumed to be 1/3 of the EUL.

Load Factor (LF): The fraction of full load (wattage) for which the equipment is typically run.

Measure Cost: The incremental (for time of sale measures) or full cost (both capital and labor for retrofit measures) of implementing the High Efficiency equipment. See Section 3.8 Measure Incremental Cost Definition for full definition.

Measure Description: A detailed description of the technology and the criteria it must meet to be eligible as an energy efficient measure.

Measure: An efficient technology or procedure that results in energy savings as compared to the baseline efficiency.

Residential: The market sector that includes measures that apply only to detached, residential buildings or duplexes.

Operation and Maintenance (O&M) Cost Adjustments: The dollar impact resulting from differences between baseline and efficient case Operation and Maintenance costs.

Operating Hours (HOURS): The annual hours that equipment is expected to operate.

Program: The mode of delivering a particular measure or set of measures to customers. See Table 2.4 for a list of program descriptions that are presently operating in Illinois.

Rating Period Factor (RPF): Percentages for defined times of the year that describe when energy savings will be realized for a specific measure.

Stakeholder Advisory Group (SAG): The Illinois Energy Efficiency Stakeholder Advisory Group (SAG) was first defined in the electric utilities' first energy efficiency Plan Orders to include "… the Utility, DCEO, Staff, the Attorney General, BOMA and CUB and representation from a variety of interests, including residential consumers, business consumers, environmental and energy advocacy organizations, trades and local government... [and] a

representative from the ARES (alternative retail electric supplier) community should be included."[27] A group of stakeholders who have an interest in Illinois' energy efficiency programs and who meet regularly to share information and work toward consensus on various energy efficiency issues. The Utilities in Illinois have been directed by the ICC to work with the SAG on the development of a statewide TRM.

Table 3.2: Degree-Day Zones and Values by Market Sector

	Residential		C&I		
Zone	HDD	CDD	HDD	CDD	Weather Station / City
1	5,352	820	4,272	2,173	Rockford AP / Rockford
2	5,113	842	4,029	2,181	Chicago O'Hare AP / Chicago
3	4,379	1,108	3,406	2,666	Springfield #2 / Springfield
4	3,378	1,570	2,515	3,358	Belleville SIU RSCH / Belleville
5	3,438	1,370	2,546	3,090	Carbondale Southern IL AP / Marion
Average	4,860	947	3,812	2,362	Weighted by occupied housing units
Base Temp	60F	65F	55F	55F	Year climate normals, 1981-2010

3.5 Electrical Loadshapes (kWh)

Loadshapes are an integral part of the measure characterization and are used to divide energy savings into appropriate periods using Rating Period Factors (RPFs) such that each have variable avoided cost values allocated to them for the purpose of estimating cost effectiveness.

For the purposes of assigning energy savings (kWh) periods, the TRM TAC has agreed to use the industry standards for wholesale power market transactions as shown in the following table.

Table 3.3: On and Off Peak Energy Definitions

Period Category	Period Definition (Central Prevailing Time)
Winter On-Peak Energy	8AM - 11PM, weekdays, Oct – Apr, No NERC holidays
Winter Off-Peak Energy	All other hours
Summer On-Peak Energy	8AM - 11PM, weekdays, May – Sept, No NERC holidays
Summer Off-Peak Energy	All other hours

Loadshapes have been developed for each end-use by assigning Rating Period Factor percentages to each of the four periods above. Two methodologies were used:

1. Itron eShapes data for Missouri, reconciled to Illinois loads and provided by Ameren, were used to calculate the percentage of load in to the four categories above.

[27] ICC Docket No. 07-0540, Final Order at 32-33, February 6, 2008.
http://www.icc.illinois.gov/downloads/public/edocket/215193.pdf

2. Where the Itron eShapes data did not provide a particular end-use or specific measure load profile, loadshapes that have been developed over many years by Efficiency Vermont and that have been reviewed by the Vermont Department of Public Service, were adjusted to match Illinois period definitions. Note – no weather sensitive loadshapes were based on this method. Any of these load profiles that relate to High Impact Measures should be an area of future evaluation.

The following pages provide the loadshape values for most measures provided in the TRM[28]. To distinguish the source of the loadshape, they are color coded. Rows that are shaded in green are Efficiency Vermont loadshapes adjusted for Illinois periods. Rows that are unshaded and are left in white are Itron eShapes data provided by Ameren.

ComEd uses the DSMore™ (Integral Analytics DSMore™ Demand Side Management Option/Risk Evaluator) software to screen the efficiency measures for cost effectiveness. Since this tool requires a loadshape value for weekdays and weekends in each month (i.e., 24 inputs), the percentages for the four period categories above were calculated by weighting the proportion of weekdays/weekends in each month to the total within each period. The results of these calculations are also provided below.

[28] All loadshape information has been posted to the VEIC Sharepoint site, and is publically accessible through the Stakeholder Advisory Group's web site. http://www.ilsag.info/technical-reference-manual.html
http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Residential_Loadshapes_References.zip
http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Commercial_Loadshapes_References.zip
http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Version_3/Final_Draft/Sources%20and%20References%20-%20Loadshapes/TRM_Version_3_Loadshapes_2.24.zip

Table 3.4: Loadshapes by Season

		Winter Peak	Winter Off-peak	Summer Peak	Summer Off-peak
	Loadshape Reference Number	Oct-Apr, M-F, non-holiday, 8AM - 11PM	Oct-Apr, All other time	May-Sept, M-F, non-holiday, 8AM - 11PM	May- Sept, All other time
Residential Clothes Washer	R01	47.0%	11.1%	34.0%	8.0%
Residential Dish Washer	R02	49.3%	8.7%	35.7%	6.3%
Residential Electric DHW	R03	43.2%	20.6%	24.5%	11.7%
Residential Freezer	R04	38.9%	16.4%	31.5%	13.2%
Residential Refrigerator	R05	37.0%	18.1%	30.1%	14.7%
Residential Indoor Lighting	R06	48.1%	15.5%	26.0%	10.5%
Residential Outdoor Lighting	R07	18.0%	44.1%	9.4%	28.4%
Residential Cooling	R08	4.1%	0.7%	71.3%	23.9%
Residential Electric Space Heat	R09	57.8%	38.8%	1.7%	1.7%
Residential Electric Heating and Cooling	R10	35.2%	22.8%	31.0%	11.0%
Residential Ventilation	R11	25.8%	32.3%	18.9%	23.0%
Residential - Dehumidifier	R12	12.9%	16.2%	31.7%	39.2%
Residential Standby Losses - Entertainment Center	R13	26.0%	32.5%	18.9%	22.6%
Residential Standby Losses - Home Office	R14	23.9%	34.6%	17.0%	24.5%
Commercial Electric Cooking	C01	40.6%	18.2%	28.7%	12.6%
Commercial Electric DHW	C02	40.5%	18.2%	28.5%	12.8%
Commercial Cooling	C03	4.9%	0.8%	66.4%	27.9%
Commercial Electric Heating	C04	53.5%	43.2%	1.9%	1.4%

		Winter Peak	Winter Off-peak	Summer Peak	Summer Off-peak
	Loadshape Reference Number	Oct-Apr, M-F, non-holiday, 8AM - 11PM	Oct-Apr, All other time	May-Sept, M-F, non-holiday, 8AM - 11PM	May- Sept, All other time
Commercial Electric Heating and Cooling	C05	19.4%	13.5%	47.1%	19.9%
Commercial Indoor Lighting	C06	40.1%	18.6%	28.4%	12.9%
Grocery/Conv. Store Indoor Lighting	C07	31.4%	26.4%	22.8%	19.3%
Hospital Indoor Lighting	C08	29.1%	29.0%	21.0%	20.9%
Office Indoor Lighting	C09	42.1%	16.0%	30.4%	11.5%
Restaurant Indoor Lighting	C10	32.1%	25.7%	23.4%	18.8%
Retail Indoor Lighting	C11	35.5%	22.3%	25.8%	16.3%
Warehouse Indoor Lighting	C12	39.4%	18.5%	28.6%	13.5%
K-12 School Indoor Lighting	C13	45.8%	22.6%	20.2%	11.4%
Indust. 1-shift (8/5) (e.g., comp. air, lights)	C14	50.5%	7.2%	37.0%	5.3%
Indust. 2-shift (16/5) (e.g., comp. air, lights)	C15	47.5%	10.2%	34.8%	7.4%
Indust. 3-shift (24/5) (e.g., comp. air, lights)	C16	34.8%	23.2%	25.5%	16.6%
Indust. 4-shift (24/7) (e.g., comp. air, lights)	C17	25.8%	32.3%	18.9%	23.0%
Industrial Indoor Lighting	C18	44.3%	13.6%	32.4%	9.8%
Industrial Outdoor Lighting	C19	18.0%	44.1%	9.4%	28.4%
Commercial Outdoor Lighting	C20	23.4%	35.3%	13.0%	28.3%
Commercial Office Equipment	C21	37.7%	20.9%	26.7%	14.7%
Commercial Refrigeration	C22	38.5%	20.6%	26.7%	14.2%
Commercial Ventilation	C23	38.1%	20.6%	29.7%	11.6%
Traffic Signal - Red Balls, always changing or flashing	C24	25.8%	32.3%	18.9%	23.0%

		Winter Peak	Winter Off-peak	Summer Peak	Summer Off-peak
	Loadshape Reference Number	Oct-Apr, M-F, non-holiday, 8AM - 11PM	Oct-Apr, All other time	May-Sept, M-F, non-holiday, 8AM - 11PM	May- Sept, All other time
Traffic Signal - Red Balls, changing day, off night	C25	37.0%	20.9%	27.1%	14.9%
Traffic Signal - Green Balls, always changing	C26	25.8%	32.3%	18.9%	23.0%
Traffic Signal - Green Balls, changing day, off night	C27	37.0%	20.9%	27.1%	14.9%
Traffic Signal - Red Arrows	C28	25.8%	32.3%	18.9%	23.0%
Traffic Signal - Green Arrows	C29	25.8%	32.3%	18.9%	23.0%
Traffic Signal - Flashing Yellows	C30	25.8%	32.3%	18.9%	23.0%
Traffic Signal - “Hand” Don’t Walk Signal	C31	25.8%	32.3%	18.9%	23.0%
Traffic Signal - “Man” Walk Signal	C32	25.8%	32.3%	18.9%	23.0%
Traffic Signal - Bi-Modal Walk/Don’t Walk	C33	25.8%	32.3%	18.9%	23.0%
Industrial Motor	C34	47.5%	10.2%	34.8%	7.4%
Industrial Process	C35	47.5%	10.2%	34.8%	7.4%
HVAC Pump Motor (heating)	C36	38.7%	48.6%	5.9%	6.8%
HVAC Pump Motor (cooling)	C37	7.8%	9.8%	36.8%	45.6%
HVAC Pump Motor (unknown use)	C38	23.2%	29.2%	21.4%	26.2%
VFD - Supply fans <10 HP	C39	38.8%	16.1%	28.4%	16.7%
VFD - Return fans <10 HP	C40	38.8%	16.1%	28.4%	16.7%
VFD - Exhaust fans <10 HP	C41	34.8%	23.2%	20.3%	21.7%
VFD - Boiler feedwater pumps <10 HP	C42	42.9%	44.2%	6.6%	6.3%
VFD - Chilled water pumps <10 HP	C43	11.2%	5.5%	40.7%	42.6%
VFD Boiler circulation pumps <10 HP	C44	42.9%	44.2%	6.6%	6.3%

		Winter Peak	Winter Off-peak	Summer Peak	Summer Off-peak
	Loadshape Reference Number	Oct-Apr, M-F, non-holiday, 8AM - 11PM	Oct-Apr, All other time	May-Sept, M-F, non-holiday, 8AM - 11PM	May- Sept, All other time
Refrigeration Economizer	C45	36.3%	50.8%	5.6%	7.3%
Evaporator Fan Control	C46	24.0%	35.9%	16.7%	23.4%
Standby Losses - Commercial Office	C47	8.2%	50.5%	5.6%	35.7%
VFD Boiler draft fans <10 HP	C48	37.3%	48.9%	6.4%	7.3%
VFD Cooling Tower Fans <10 HP	C49	7.9%	5.2%	54.0%	32.9%
Engine Block Heater Timer	C50	26.5%	61.0%	4.1%	8.5%
Door Heater Control	C51	30.4%	69.6%	0.0%	0.0%
Beverage and Snack Machine Controls	C52	10.0%	48.3%	7.4%	34.3%
Flat	C53	36.3%	21.8%	26.2%	15.7%
Religious Indoor Lighting	C54	26.8%	31.4%	18.9%	22.8%

Table 3.5: Loadshapes by Month and Day of Week

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
Residential Clothes Washer	R01	7.0%	1.6%	6.3%	1.5%	6.6%	1.7%	6.7%	1.5%	6.9%	1.6%	6.5%	1.6%	7.1%	1.5%	6.8%	1.7%	6.6%	1.6%	7.0%	1.5%	6.5%	1.7%	6.9%	1.6%
Residential Dish Washer	R02	7.3%	1.2%	6.6%	1.2%	7.0%	1.4%	7.1%	1.2%	7.3%	1.2%	6.9%	1.3%	7.4%	1.2%	7.1%	1.3%	7.0%	1.2%	7.4%	1.2%	6.8%	1.3%	7.2%	1.3%
Residential Electric DHW	R03	6.4%	2.9%	5.8%	2.7%	6.1%	3.3%	6.2%	2.8%	5.0%	2.3%	4.7%	2.4%	5.1%	2.2%	4.9%	2.5%	4.8%	2.3%	6.5%	2.8%	6.0%	3.1%	6.3%	3.0%
Residential Freezer	R04	5.8%	2.3%	5.2%	2.2%	5.5%	2.6%	5.6%	2.2%	6.4%	2.6%	6.1%	2.7%	6.6%	2.5%	6.3%	2.8%	6.1%	2.6%	5.8%	2.2%	5.4%	2.4%	5.7%	2.4%
Residential Refrigerator	R05	5.5%	2.6%	4.9%	2.4%	5.2%	2.9%	5.3%	2.5%	6.2%	2.9%	5.8%	3.0%	6.3%	2.8%	6.0%	3.1%	5.9%	2.9%	5.5%	2.5%	5.1%	2.7%	5.4%	2.6%
Residential Indoor Lighting	R06	7.1%	2.2%	6.4%	2.1%	6.8%	2.4%	6.9%	2.1%	5.3%	2.1%	5.0%	2.2%	5.4%	2.0%	5.2%	2.2%	5.1%	2.1%	7.2%	2.1%	6.6%	2.3%	7.0%	2.2%
Residential Outdoor Lighting	R07	2.7%	6.2%	2.4%	5.9%	2.6%	7.0%	2.6%	6.0%	1.9%	5.7%	1.8%	5.8%	2.0%	5.3%	1.9%	6.0%	1.8%	5.7%	2.7%	6.0%	2.5%	6.6%	2.6%	6.4%
Residential Cooling	R08	0.6%	0.1%	0.5%	0.1%	0.6%	0.1%	0.6%	0.1%	14.6%	4.8%	13.7%	4.9%	14.9%	4.5%	14.2%	5.0%	13.9%	4.8%	0.6%	0.1%	0.6%	0.1%	0.6%	0.1%
Residential Electric Space Heat	R09	8.6%	5.5%	7.7%	5.1%	8.2%	6.1%	8.3%	5.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.3%	0.3%	0.4%	0.3%	0.3%	8.7%	5.3%	8.0%	5.8%	8.5%	5.6%
Residential Electric Heating and Cooling	R10	5.2%	3.2%	4.7%	3.0%	5.0%	3.6%	5.0%	3.1%	6.3%	2.2%	6.0%	2.3%	6.5%	2.1%	6.2%	2.3%	6.0%	2.2%	5.3%	3.1%	4.9%	3.4%	5.2%	3.3%
Residential Ventilation	R11	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Residential - Dehumidifier	R12	1.9%	2.3%	1.7%	2.2%	1.8%	2.6%	1.8%	2.2%	6.5%	7.8%	6.1%	8.0%	6.6%	7.3%	6.3%	8.2%	6.2%	7.8%	1.9%	2.2%	1.8%	2.4%	1.9%	2.4%
Residential Standby Losses - Entertainmen t Center	R13	3.8%	4.6%	3.5%	4.3%	3.7%	5.1%	3.7%	4.4%	3.9%	4.5%	3.7%	4.6%	4.0%	4.2%	3.8%	4.8%	3.7%	4.5%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Residential	R14	3.5%	4.9%	3.2%	4.6%	3.4%	5.5%	3.4%	4.7%	3.5%	4.9%	3.3%	5.0%	3.5%	4.6%	3.4%	5.2%	3.3%	4.9%	3.6%	4.7%	3.3%	5.2%	3.5%	5.0%

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
Standby Losses - Home Office																									
Commercial Electric Cooking	C01	6.0%	2.6%	5.4%	2.4%	5.7%	2.9%	5.8%	2.5%	5.9%	2.5%	5.5%	2.6%	6.0%	2.4%	5.7%	2.6%	5.6%	2.5%	6.1%	2.5%	5.6%	2.7%	5.9%	2.6%
Commercial Electric DHW	C02	6.0%	2.6%	5.4%	2.4%	5.7%	2.9%	5.8%	2.5%	5.8%	2.5%	5.5%	2.6%	6.0%	2.4%	5.7%	2.7%	5.6%	2.5%	6.1%	2.5%	5.6%	2.7%	5.9%	2.6%
Commercial Cooling	C03	0.7%	0.1%	0.6%	0.1%	0.7%	0.1%	0.7%	0.1%	13.6%	5.5%	12.8%	5.7%	13.9%	5.2%	13.3%	5.9%	13.0%	5.5%	0.7%	0.1%	0.7%	0.1%	0.7%	0.1%
Commercial Electric Heating	C04	7.9%	6.1%	7.1%	5.7%	7.6%	6.8%	7.7%	5.9%	0.4%	0.3%	0.4%	0.3%	0.4%	0.3%	0.4%	0.3%	0.4%	0.3%	8.0%	5.9%	7.4%	6.5%	7.8%	6.3%
Commercial Electric Heating and Cooling	C05	2.9%	1.9%	2.6%	1.8%	2.8%	2.1%	2.8%	1.9%	9.6%	4.0%	9.1%	4.1%	9.8%	3.7%	9.4%	4.2%	9.2%	4.0%	2.9%	1.9%	2.7%	2.0%	2.8%	2.0%
Commercial Indoor Lighting	C06	5.9%	2.6%	5.3%	2.5%	5.7%	2.9%	5.7%	2.6%	5.8%	2.6%	5.5%	2.6%	5.9%	2.4%	5.7%	2.7%	5.5%	2.6%	6.0%	2.6%	5.5%	2.8%	5.9%	2.7%
Grocery/Conv. Store Indoor Lighting	C07	4.7%	3.7%	4.2%	3.5%	4.4%	4.2%	4.5%	3.6%	4.7%	3.8%	4.4%	3.9%	4.8%	3.6%	4.6%	4.1%	4.5%	3.8%	4.7%	3.6%	4.3%	3.9%	4.6%	3.8%
Hospital Indoor Lighting	C08	4.3%	4.1%	3.9%	3.8%	4.1%	4.6%	4.2%	4.0%	4.3%	4.2%	4.0%	4.3%	4.4%	3.9%	4.2%	4.4%	4.1%	4.2%	4.4%	4.0%	4.0%	4.3%	4.3%	4.2%
Office Indoor Lighting	C09	6.2%	2.3%	5.6%	2.1%	6.0%	2.5%	6.0%	2.2%	6.2%	2.3%	5.9%	2.4%	6.4%	2.2%	6.1%	2.4%	5.9%	2.3%	6.3%	2.2%	5.8%	2.4%	6.2%	2.3%
Restaurant Indoor Lighting	C10	4.8%	3.6%	4.3%	3.4%	4.5%	4.1%	4.6%	3.5%	4.8%	3.7%	4.5%	3.8%	4.9%	3.5%	4.7%	4.0%	4.6%	3.7%	4.8%	3.5%	4.4%	3.8%	4.7%	3.7%
Retail Indoor Lighting	C11	5.3%	3.1%	4.7%	3.0%	5.0%	3.5%	5.1%	3.1%	5.3%	3.2%	5.0%	3.3%	5.4%	3.1%	5.2%	3.4%	5.0%	3.2%	5.3%	3.1%	4.9%	3.3%	5.2%	3.2%
Warehouse Indoor Lighting	C12	5.8%	2.6%	5.2%	2.5%	5.6%	2.9%	5.6%	2.5%	5.8%	2.7%	5.5%	2.8%	6.0%	2.5%	5.7%	2.8%	5.6%	2.7%	5.9%	2.5%	5.4%	2.8%	5.8%	2.7%

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
K-12 School Indoor Lighting	C13	6.8%	3.2%	6.1%	3.0%	6.5%	3.6%	6.6%	3.1%	4.1%	2.3%	3.9%	2.3%	4.2%	2.1%	4.0%	2.4%	3.9%	2.3%	6.9%	3.1%	6.3%	3.4%	6.7%	3.3%
Indust. 1-shift (8/5) (e.g., comp. air, lights)	C14	7.5%	1.0%	6.7%	1.0%	7.1%	1.1%	7.2%	1.0%	7.5%	1.1%	7.1%	1.1%	7.7%	1.0%	7.4%	1.1%	7.2%	1.1%	7.6%	1.0%	7.0%	1.1%	7.4%	1.0%
Indust. 2-shift (16/5) (e.g., comp. air, lights)	C15	7.0%	1.4%	6.3%	1.4%	6.7%	1.6%	6.8%	1.4%	7.1%	1.5%	6.7%	1.5%	7.3%	1.4%	6.9%	1.6%	6.8%	1.5%	7.1%	1.4%	6.6%	1.5%	7.0%	1.5%
Indust. 3-shift (24/5) (e.g., comp. air, lights)	C16	5.1%	3.3%	4.6%	3.1%	4.9%	3.7%	5.0%	3.2%	5.2%	3.3%	4.9%	3.4%	5.3%	3.1%	5.1%	3.5%	5.0%	3.3%	5.2%	3.2%	4.8%	3.5%	5.1%	3.4%
Indust. 4-shift (24/7) (e.g., comp. air, lights)	C17	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Industrial Indoor Lighting	C18	6.6%	1.9%	5.9%	1.8%	6.3%	2.1%	6.3%	1.9%	6.6%	1.9%	6.2%	2.0%	6.8%	1.8%	6.5%	2.0%	6.3%	1.9%	6.6%	1.9%	6.1%	2.0%	6.5%	2.0%
Industrial Outdoor Lighting	C19	2.7%	6.2%	2.4%	5.9%	2.6%	7.0%	2.6%	6.0%	1.9%	5.7%	1.8%	5.8%	2.0%	5.3%	1.9%	6.0%	1.8%	5.7%	2.7%	6.0%	2.5%	6.6%	2.6%	6.4%
Commercial Outdoor Lighting	C20	3.5%	5.0%	3.1%	4.7%	3.3%	5.6%	3.3%	4.8%	2.7%	5.6%	2.5%	5.8%	2.7%	5.3%	2.6%	5.9%	2.5%	5.6%	3.5%	4.8%	3.2%	5.3%	3.4%	5.1%
Commercial Office Equipment	C21	5.6%	3.0%	5.0%	2.8%	5.3%	3.3%	5.4%	2.9%	5.4%	2.9%	5.1%	3.0%	5.6%	2.7%	5.3%	3.1%	5.2%	2.9%	5.6%	2.9%	5.2%	3.1%	5.5%	3.0%
Commercial Refrigeration	C22	5.7%	2.9%	5.1%	2.7%	5.4%	3.2%	5.5%	2.8%	5.5%	2.8%	5.1%	2.9%	5.6%	2.7%	5.3%	3.0%	5.2%	2.8%	5.8%	2.8%	5.3%	3.1%	5.6%	3.0%
Commercial Ventilation	C23	5.6%	2.9%	5.1%	2.7%	5.4%	3.3%	5.4%	2.8%	6.1%	2.3%	5.7%	2.4%	6.2%	2.2%	5.9%	2.4%	5.8%	2.3%	5.7%	2.8%	5.3%	3.1%	5.6%	3.0%
Traffic Signal - Red Balls, always	C24	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
changing or flashing																									
Traffic Signal - Red Balls, changing day, off night	C25	5.5%	2.9%	4.9%	2.8%	5.2%	3.3%	5.3%	2.9%	5.5%	3.0%	5.2%	3.1%	5.7%	2.8%	5.4%	3.1%	5.3%	3.0%	5.5%	2.9%	5.1%	3.1%	5.4%	3.0%
Traffic Signal - Green Balls, always changing	C26	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - Green Balls, changing day, off night	C27	5.5%	2.9%	4.9%	2.8%	5.2%	3.3%	5.3%	2.9%	5.5%	3.0%	5.2%	3.1%	5.7%	2.8%	5.4%	3.1%	5.3%	3.0%	5.5%	2.9%	5.1%	3.1%	5.4%	3.0%
Traffic Signal - Red Arrows	C28	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - Green Arrows	C29	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - Flashing Yellows	C30	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - “Hand” Don’t Walk Signal	C31	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - “Man” Walk Signal	C32	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Traffic Signal - Bi-Modal Walk/Don’t Walk	C33	3.8%	4.6%	3.4%	4.3%	3.6%	5.1%	3.7%	4.4%	3.8%	4.6%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.6%	3.9%	4.4%	3.6%	4.8%	3.8%	4.7%
Industrial Motor	C34	7.0%	1.4%	6.3%	1.4%	6.7%	1.6%	6.8%	1.4%	7.1%	1.5%	6.7%	1.5%	7.3%	1.4%	6.9%	1.6%	6.8%	1.5%	7.1%	1.4%	6.6%	1.5%	7.0%	1.5%
Industrial Process	C35	7.0%	1.4%	6.3%	1.4%	6.7%	1.6%	6.8%	1.4%	7.1%	1.5%	6.7%	1.5%	7.3%	1.4%	6.9%	1.6%	6.8%	1.5%	7.1%	1.4%	6.6%	1.5%	7.0%	1.5%
HVAC Pump Motor (heating)	C36	5.7%	6.9%	5.2%	6.4%	5.5%	7.7%	5.5%	6.6%	1.2%	1.4%	1.1%	1.4%	1.2%	1.3%	1.2%	1.4%	1.2%	1.4%	5.8%	6.6%	5.3%	7.3%	5.7%	7.1%

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
HVAC Pump Motor (cooling)	C37	1.2%	1.4%	1.0%	1.3%	1.1%	1.5%	1.1%	1.3%	7.5%	9.1%	7.1%	9.3%	7.7%	8.5%	7.3%	9.6%	7.2%	9.1%	1.2%	1.3%	1.1%	1.5%	1.1%	1.4%
HVAC Pump Motor (unknown use)	C38	3.4%	4.1%	3.1%	3.9%	3.3%	4.6%	3.3%	4.0%	4.4%	5.2%	4.1%	5.4%	4.5%	4.9%	4.3%	5.5%	4.2%	5.2%	3.5%	4.0%	3.2%	4.4%	3.4%	4.2%
VFD - Supply fans <10 HP	C39	5.7%	2.3%	5.2%	2.1%	5.5%	2.5%	5.6%	2.2%	5.8%	3.3%	5.5%	3.4%	5.9%	3.1%	5.7%	3.5%	5.5%	3.3%	5.8%	2.2%	5.4%	2.4%	5.7%	2.3%
VFD - Return fans <10 HP	C40	5.7%	2.3%	5.2%	2.1%	5.5%	2.5%	5.6%	2.2%	5.8%	3.3%	5.5%	3.4%	5.9%	3.1%	5.7%	3.5%	5.5%	3.3%	5.8%	2.2%	5.4%	2.4%	5.7%	2.3%
VFD - Exhaust fans <10 HP	C41	5.1%	3.3%	4.6%	3.1%	4.9%	3.7%	5.0%	3.2%	4.1%	4.3%	3.9%	4.4%	4.2%	4.1%	4.1%	4.6%	4.0%	4.3%	5.2%	3.2%	4.8%	3.5%	5.1%	3.4%
VFD - Boiler feedwater pumps <10 HP	C42	6.4%	6.2%	5.7%	5.9%	6.1%	7.0%	6.1%	6.0%	1.3%	1.3%	1.3%	1.3%	1.4%	1.2%	1.3%	1.3%	1.3%	1.3%	6.4%	6.0%	5.9%	6.6%	6.3%	6.4%
VFD - Chilled water pumps <10 HP	C43	1.7%	0.8%	1.5%	0.7%	1.6%	0.9%	1.6%	0.8%	8.3%	8.5%	7.8%	8.7%	8.5%	8.0%	8.1%	8.9%	7.9%	8.5%	1.7%	0.8%	1.6%	0.8%	1.6%	0.8%
VFD Boiler circulation pumps <10 HP	C44	6.4%	6.2%	5.7%	5.9%	6.1%	7.0%	6.1%	6.0%	1.3%	1.3%	1.3%	1.3%	1.4%	1.2%	1.3%	1.3%	1.3%	1.3%	6.4%	6.0%	5.9%	6.6%	6.3%	6.4%
Refrigeration Economizer	C45	5.4%	7.2%	4.8%	6.7%	5.1%	8.0%	5.2%	7.0%	1.1%	1.5%	1.1%	1.5%	1.2%	1.4%	1.1%	1.5%	1.1%	1.5%	5.4%	7.0%	5.0%	7.6%	5.3%	7.4%
Evaporator Fan Control	C46	3.6%	5.1%	3.2%	4.8%	3.4%	5.7%	3.4%	4.9%	3.4%	4.7%	3.2%	4.8%	3.5%	4.4%	3.3%	4.9%	3.3%	4.7%	3.6%	4.9%	3.3%	5.4%	3.5%	5.2%
Standby Losses - Commercial Office	C47	1.2%	7.1%	1.1%	6.7%	1.2%	8.0%	1.2%	6.9%	1.1%	7.1%	1.1%	7.3%	1.2%	6.7%	1.1%	7.5%	1.1%	7.1%	1.2%	6.9%	1.1%	7.5%	1.2%	7.3%
VFD Boiler draft fans <10 HP	C48	5.5%	6.9%	5.0%	6.5%	5.3%	7.7%	5.3%	6.7%	1.3%	1.5%	1.2%	1.5%	1.3%	1.4%	1.3%	1.5%	1.2%	1.5%	5.6%	6.7%	5.2%	7.3%	5.5%	7.1%
VFD Cooling Tower Fans	C49	1.2%	0.7%	1.1%	0.7%	1.1%	0.8%	1.1%	0.7%	11.0%	6.5%	10.4%	6.7%	11.3%	6.2%	10.8%	6.9%	10.5%	6.5%	1.2%	0.7%	1.1%	0.8%	1.2%	0.8%

		Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S	M-F	S-S
<10 HP																									
Engine Block Heater Timer	C50	3.9%	8.6%	3.5%	8.1%	3.7%	9.6%	3.8%	8.3%	0.8%	1.7%	0.8%	1.7%	0.8%	1.6%	0.8%	1.8%	0.8%	1.7%	4.0%	8.3%	3.7%	9.1%	3.9%	8.9%
Door Heater Control	C51	4.5%	9.8%	4.0%	9.2%	4.3%	11.0%	4.3%	9.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%	9.5%	4.2%	10.4%	4.4%	10.1 %
Beverage and Snack Machine Controls	C52	1.5%	6.8%	1.3%	6.4%	1.4%	7.6%	1.4%	6.6%	1.5%	6.8%	1.4%	7.0%	1.5%	6.4%	1.5%	7.2%	1.4%	6.8%	1.5%	6.6%	1.4%	7.2%	1.5%	7.0%
Flat	C53	5.4%	3.1%	4.8%	2.9%	5.1%	3.4%	5.2%	3.0%	5.3%	3.1%	5.0%	3.2%	5.5%	2.9%	5.2%	3.3%	5.1%	3.1%	5.4%	3.0%	5.0%	3.3%	5.3%	3.2%
Religious Indoor Lighting	C54	4.0%	4.4%	3.6%	4.2%	3.8%	5.0%	3.8%	4.3%	3.9%	4.5%	3.6%	4.7%	3.9%	4.3%	3.8%	4.8%	3.7%	4.5%	4.0%	4.3%	3.7%	4.7%	3.9%	4.6%

3.6 Summer Peak Period Definition (kW)

To estimate the impact that an efficiency measure has on a utility's system peak, the peak itself needs to be defined. Illinois spans two different electrical control areas, the Pennsylvania – Jersey – Maryland (PJM) and the Midwest Independent System Operators (MISO). As a result, there is some disparity in the peak definition across the state. However, only PJM has a forward capacity market where an efficiency program can potentially participate. Because ComEd is part of the PJM control area, their definition of summer peak is being applied statewide in this TRM.

Because Illinois is a summer peaking state, only the summer peak period is defined for the purpose of this TRM. The coincident summer peak period is defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August.

Summer peak coincidence factors can be found within each measure characterization. The source is provided and is based upon evaluation results, analysis of load shape data (e.g., the Itron eShapes data provided by Ameren), or through a calculation using stated assumptions.

For measures that are not weather-sensitive, the summer peak coincidence factor is estimated whenever possible as the average of savings within the peak period defined above. For weather sensitive measures such as cooling, the summer peak coincidence factor is provided in two different ways. The first method is to estimate demand savings during the utility's peak hour (as provided by Ameren). This is likely to be the most indicative of actual peak benefits. The second way represents the average savings over the summer peak period, consistent with the non-weather sensitive end uses, and is presented so that savings can be bid into PJM's Forward Capacity Market.

3.7 Heating and Cooling Degree-Day Data

Many measures are weather sensitive. Because there is a range of climactic conditions across the state, VEIC engaged the Utilities to provide their preferences for what airports and cities are the best proxies for the weather in their service territories. The result of this engagement is in the table below. All of the data represents 30-year normals[29] from the National Climactic Data Center (NCDC). Note that the base temperature for the calculation of heating degree-days in this document does not follow the historical 65F degree base temperature convention. Instead VEIC used several different temperatures in this TRM to more accurately reflect the outdoor temperature when a heating or cooling system turns on.

Residential heating is based on 60F, in accordance with regression analysis of heating fuel use and weather by state by the Pacific Northwest National Laboratory[30]. Residential cooling is based on 65F in agreement with a field study in Wisconsin[31]. These are lower than typical thermostat set points because internal gains such as appliances, lighting, and people provide some heating. In C&I settings, internal gains are often much higher; the base temperatures for both heating and cooling is 55F[32]. Custom degree-days with building specific base temperatures are recommended for large C&I projects.

[29] 30-year normals have been used instead of Typical Meteorological Year (TMY) data due to the fact that few of the measures in the TRM are significantly affected by solar insolation, which is one of the primary benefits of using the TMY approach.
[30] Belzer and Cort, Pacific Northwest National Laboratory in "Statistical Analysis of Historical State-Level Residential Energy Consumption Trends," 2004.
[31] Energy Center of Wisconsin, May 2008 metering study; "Central Air Conditioning in Wisconsin, A Compilation of Recent Field Research", p. 32 (amended in 2010).
[32] This value is based upon experience, and it is preferable to use building-specific base temperatures when available.

Table 3.6: Degree-Day Zones and Values by Market Sector

	Residential		C&I		
Zone	HDD	CDD	HDD	CDD	Weather Station / City
1	5,352	820	4,272	2,173	Rockford AP / Rockford
2	5,113	842	4,029	3,357	Chicago O'Hare AP / Chicago
3	4,379	1,108	3,406	2,666	Springfield #2 / Springfield
4	3,378	1,570	2,515	3,090	Belleville SIU RSCH / Belleville
5	3,438	1,370	2,546	2,182	Carbondale Southern IL AP / Marion
Average	4,860	947	3,812	3,051	Weighted by occupied housing units
Base Temp	60F	65F	55F	55F	30 year climate normals, 1981-2010

This table assigns each of the proxy cities to one of five climate zones. The following graphics from the Illinois State Water Survey show isobars (lines of equal degree-days) and we have color-coded the counties in each of these graphics using those isobars as a dividing line. Using this approach, the state divides into five cooling degree-day zones and five heating degree-day zones. Note that although the heating and cooling degree-day maps are similar, they are not the same, and the result is that there are a total of 10 climate zones in the state. The counties are listed in the tables following the figures for ease of reference.

Figure 3.1: Cooling Degree-Day Zones by County

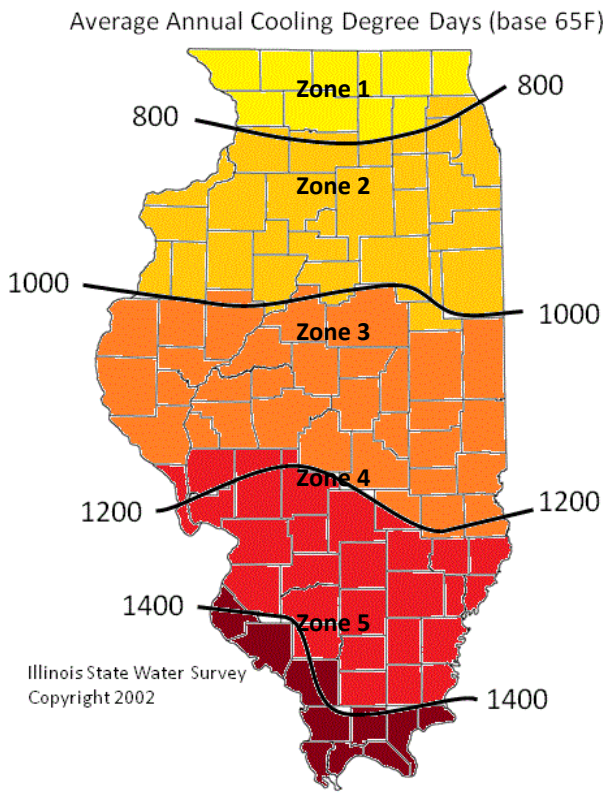

Figure 3.2: Heating Degree-Day Zones by County

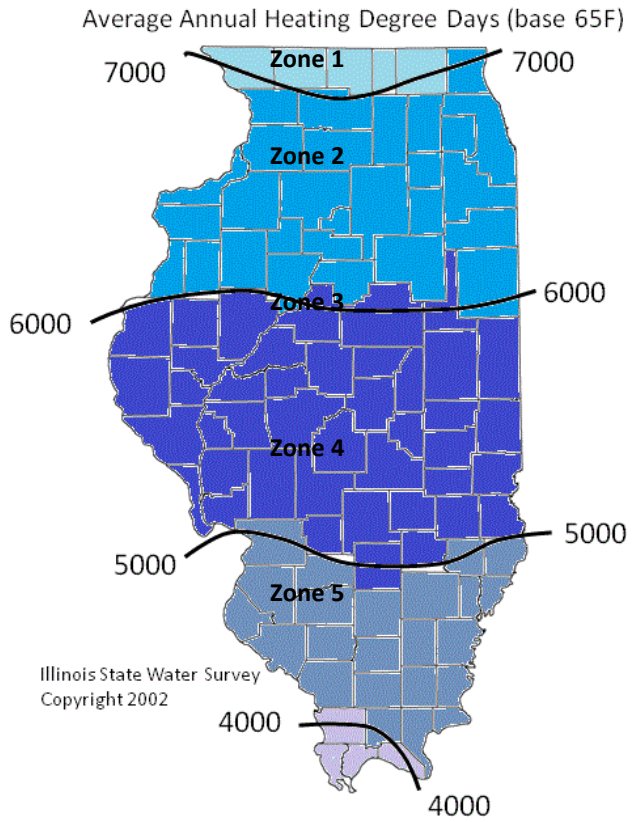

Table 3.7: Heating Degree-Day Zones by County

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Boone County	Bureau County	Adams County	Clinton County	Alexander County
Jo Daviess County	Carroll County	Bond County	Edwards County	Massac County
Stephenson County	Cook County	Brown County	Franklin County	Pulaski County
Winnebago County	DeKalb County	Calhoun County	Gallatin County	Union County
	DuPage County	Cass County	Hamilton County	
	Grundy County	Champaign County	Hardin County	
	Henderson County	Christian County	Jackson County	
	Henry County	Clark County	Jefferson County	
	Iroquois County	Clay County	Johnson County	
	Kane County	Coles County	Lawrence County	
	Kankakee County	Crawford County	Madison County	
	Kendall County	Cumberland County	Marion County	
	Knox County	De Witt County	Monroe County	
	Lake County	Douglas County	Perry County	
	LaSalle County	Edgar County	Pope County	
	Lee County	Effingham County	Randolph County	
	Livingston County	Fayette County	Richland County	
	Marshall County	Ford County	Saline County	
	McHenry County	Fulton County	St. Clair County	
	Mercer County	Greene County	Wabash County	
	Ogle County	Hancock County	Washington County	
	Peoria County	Jasper County	Wayne County	
	Putnam County	Jersey County	White County	
	Rock Island County	Logan County	Williamson County	
	Stark County	Macon County		
	Warren County	Macoupin County		
	Whiteside County	Mason County		
	Will County	McDonough County		
	Woodford County	McLean County		
		Menard County		
		Montgomery		
		Morgan County		
		Moultrie County		
		Piatt County		
		Pike County		
		Sangamon County		
		Schuyler County		
		Scott County		
		Shelby County		
		Tazewell County		
		Vermilion County		

Table 3.8: Cooling Degree-day Zones by County

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
Boone County	Bureau County	Adams County	Bond County	Alexander County
Carroll County	Cook County	Brown County	Clay County	Hardin County
DeKalb County	DuPage County	Calhoun County	Clinton County	Johnson County
Jo Daviess County	Grundy County	Cass County	Edwards County	Massac County
Kane County	Henderson County	Champaign County	Fayette County	Pope County
Lake County	Henry County	Christian County	Franklin County	Pulaski County
McHenry County	Iroquois County	Clark County	Gallatin County	Randolph County
Ogle County	Kankakee County	Coles County	Hamilton County	Union County
Stephenson County	Kendall County	Crawford County	Jackson County	
Winnebago County	Knox County	Cumberland County	Jefferson County	
	LaSalle County	De Witt County	Jersey County	
	Lee County	Douglas County	Lawrence County	
	Livingston County	Edgar County	Macoupin County	
	Marshall County	Effingham County	Madison County	
	Mercer County	Ford County	Marion County	
	Peoria County	Fulton County	Monroe County	
	Putnam County	Greene County	Montgomery	
	Rock Island County	Hancock County	Perry County	
	Stark County	Jasper County	Richland County	
	Warren County	Logan County	Saline County	
	Whiteside County	Macon County	St. Clair County	
	Will County	Mason County	Wabash County	
	Woodford County	McDonough County	Washington County	
		McLean County	Wayne County	
		Menard County	White County	
		Morgan County	Williamson County	
		Moultrie County		
		Piatt County		
		Pike County		
		Sangamon County		
		Schuyler County		
		Scott County		
		Shelby County		
		Tazewell County		
		Vermilion County		

3.8 Measure Incremental Cost Definition

Incremental Costs means the difference between the cost of the efficient Measure and the cost of the most relevant baseline measure that would have been installed (if any) in the absence of the efficiency Program. Installation costs (material and labor) and Operations and Maintenance (O&M) costs shall be included if there is a difference between the efficient Measure and the baseline measure. In cases where the efficient Measure has a significantly shorter or longer life than the relevant baseline measure (e.g., LEDs versus halogens), the avoided baseline replacement measure costs should be accounted for in the TRC analysis. The Customer's value of service lost, the Customer's value of their lost amenity, and the Customer's transaction costs shall be included in the TRC analysis where a reasonable estimate or proxy of such costs can be easily obtained (e.g., Program Administrator payment to a Customer to reduce load during a demand response event, Program Administrator payment to a Customer as an inducement to give up duplicative functioning equipment). This Incremental Cost input in the TRC analysis is not reduced by the amount of any Incentives (any Financial Incentives Paid to Customers or Incentives Paid to Third Parties by a Program Administrator that is intended to reduce the price of the efficient Measure to the Customer). Incremental Cost calculations will vary depending on the type of efficient Measure being implemented, as outlined in the examples provided below and as set forth in the IL-TRM

Examples of Incremental Cost calculations include:

a. The Incremental Cost for an efficient Measure that is installed in new construction or is being purchased at the time of natural installation, investment, or replacement is the additional cost incurred to purchase an efficient Measure over and above the cost of the baseline/standard (i.e., less efficient) measure (including any incremental installation, replacement, or O&M costs if there is a difference between the efficient Measure and baseline measure).

b. For a retrofit Measure where the efficiency Program caused the Customer to update their existing equipment, facility, or processes (e.g., air sealing, insulation, tank wrap, controls), where the Customer would not have otherwise made a purchase, the appropriate baseline is zero expenditure, and the Incremental Cost is the full cost of the new retrofit Measure (including installation costs).

c. For the early replacement of a functioning measure with a new efficient Measure, where the Customer would not have otherwise made a purchase for a number of years, the appropriate baseline is a dual baseline that begins as the existing measure and shifts to the new standard measure after the expected remaining useful life of the existing measure ends. Thus, the Incremental Cost is the full cost of the new efficient Measure (including installation costs) being purchased to replace a still-functioning measure less the present value of the assumed deferred replacement cost of replacing the existing measure with a new baseline measure at the end of the existing measure's life (described in section 3.9). This deferred credit may not be necessary when the lifetime of the measure is short, the costs are very low, or for other reasons (e.g., certain Direct Install Measures, Measures provided in Kits to Customers).

d. For study-based services (e.g., facility energy audits, energy surveys, energy assessments, retro-commissioning) that are truly necessary for a Customer to implement efficient Measures, as opposed to being principally intended to be a form of marketing, the Incremental Cost is the full cost of the study-based service. Even if the study-based service is performed entirely by a Program Administrator's implementation contractor, the full cost of the study-based service charged by the implementation contractor is the Incremental Cost, because this is assumed to be the cost of the study-based service that would have been incurred by the Customer if the Customer were to have the study-based service performed in the absence of the efficiency Program. If the Customer implements efficient Measures as a result of the study-based service provided by the efficiency Program, the Incremental Cost for those efficient Measures should also be classified as Incremental Costs in the TRC analysis.

e. For the early retirement of duplicative functioning equipment before its expected life is over (e.g., appliance recycling Programs), the Incremental Costs are composed of the Customer's value placed on their lost amenity, any Customer transaction costs, and the pickup and recycling cost. The Incremental

Costs include the actual cost of the pickup and recycling of the equipment (often paid for by a Program Administrator to an implementation contractor) because this is assumed to be the cost of recycling the equipment that would have been incurred by the Customer if the Customer were to recycle the equipment on their own in the absence of the efficiency Program. The payment a Program Administrator makes to the Customer serves as a proxy for the value the Customer places on their lost amenity and any Customer transaction costs.

3.9 Inflation Rates, O&M Costs and the Weighted Average Cost of Capital (WACC)

The Illinois utilities utilize screening tools that apply the utility's weighted average cost of capital (WACC) to discount any future costs or benefits. The WACC is a combination of common equity, preferred stock, short and long term debt, that includes inflationary risks. Therefore any future costs provided within the TRM (e.g. in early replacement measures where a deferred baseline replacement cost is provided) should include inflation rates. The TAC agreed to use the 20-year Treasury (yield versus Real yield) as a proxy for inflation of 1.91%.

Some measures specify an operations and maintenance (O&M) parameter that describes the incremental O&M cost savings that can be expected over the measure's lifetime. When estimating the cost effectiveness of these measures, it is necessary to calculate the net present value (NPV) of O&M costs over the life of the measure, which requires an appropriate discount rate. The utility's WACC is the most commonly used discount rate that is used in this context.

Each utility has a unique WACC that will vary over time. As a result, the TRM does not specify the NPV of the O&M costs. Instead, the necessary information required to calculate the NPV is included. An example is provided below to demonstrate how to calculate the NPV of O&M costs.

Baseline Case:	O&M costs equal $150 every two years.
Efficient Case:	O&M costs equal $50 every five years.

Given this information, the incremental O&M costs can be determined by discounting the cash flows in the Baseline Case and the Efficient Case separately using the applicable WACC. Then the NPV of the incremental O&M costs is calculated by subtracting one NPV from the other. This value is then used in each utility's cost-effectiveness screening process.

Those measures that include baseline shifts that result in multiple component costs and lifetimes cannot be calculated by this standard method. In only these cases, the O&M costs are presented both as Annual Levelized equivalent cost (i.e., the annual payment that results in an equivalent NPV to the actual stream of O&M costs) and as NPVs using a statewide average real discount rate of 5.34%[33].

[33] Calculated using the average of ComEd and Ameren's WACC and the rate of inflation 1.91%.

3.10 Interactive Effects

The TRM presents engineering equations for most measures. This approach is desirable because it conveys information clearly and transparently, and is widely accepted in the industry. Unlike simulation model results, engineering equations also provide flexibility and the opportunity for users to substitute local, specific information for specific input values. Furthermore, the parameters can be changed in TRM updates to be applied in future years as better information becomes available.

One limitation is that some interactive effects between measures are not automatically captured. Because we cannot know what measures will be implemented at the same time with the same customer, we cannot always capture the interactions between multiple measures within individual measure characterizations. However, interactive effects with different end-uses are included in individual measure characterizations whenever possible[34]. For instance, waste heat factors are included in the lighting characterizations to capture the interaction between more-efficient lighting measures and the amount of heating and/or cooling that is subsequently needed in the building.

By contrast, no effort is made to account for interactive effects between an efficient air conditioning measure and an efficient lighting measure, because it is impossible to know the specifics of the other measure in advance of its installation. For custom measures and projects where a bundle of measures is being implemented at the same time, these kinds of interactive effects should be estimated.

[34] For more information, please refer to the document, 'Dealing with interactive Effects During Measure Characterization" Memo to the Stakeholder Advisory Group dated 12/13/11.
http://portal.veic.org/projects/illinoistrm/Shared%20Documents/Memos/Interactive_Effects_Memo_121311.docx