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What Is Contained In Guideline 14-2023?

Guideline 14-2023 contains 10 sections and six appendices. As with most guidelines, sections one through three cover the purpose, scope and definitions. Section four covers the requirements and common elements, including a description of the measurement approaches, common elements of the approaches, compliance requirements and a discussion about the design and implementation of the savings measurement process. Section five covers the specific measurement approaches, including the retrofit-isolation approach, the whole-building approach and the calibrated simulation approach. Section six covers issues involving instrumentation and data management. Sections seven through 10 were added in 2014. Sections seven through nine cover water, electric demand and renewable energy technologies. Section 10 contains normative references and a bibliography.

Due to the importance of a number of related issues, seven appendices were added to the guideline that contain material that supplements the guideline. In Annex A, supplementary information is provided about the physical measurements required to accomplish the specific measurement approaches, including information about sensors, calibration techniques, laboratory measurement standards, costs and instrumentation error information.

Annex B contains procedures and examples for determining the uncertainty of the savings analysis, including the sources of uncertainty, formula for calculating uncertainty and discussions about the impact of uncertainty calculations on the required level of measurement and verification. Annex C contains examples of the application of the whole-building approach and retrofit isolation approach. This is followed by Annex D that discusses the regression techniques needed to calculate savings, Annex E that discusses techniques for retrofit isolation calculations and finally Annex F that contains informative references and bibliography.

Who Created Guideline 14-2023 and How Was It Written?

Guideline 14-2023 was created by a committee of ASHRAE members who represented future guideline users, producers of products that would be affected by the guideline (i.e., software, hardware or services) and ASHRAE members with a general interest in the guideline. In general, the members of Guideline 14 were ASHRAE members who are widely recognized for their experience and contributions to the field of measurement and verification.

Table 1: *Examples of Retrofit Isolation applications and metering required to calculate energy and demand savings.*

Pre-Retrofit	**Retrofit changes**	**Required metering**	
		Pre-retrofit	**Post-retrofit**
CL/TS	Load but still CL	One-time load msmt	One-time load msmt
CL/TS	Load to VL	One-time load msmt	Sufficient load msmts to characterize load
CL/TS	Schedule but still TS	One-time load msmt (either pre- or post-retrofit)	
CL/TS	Schedule to VS	One-time load msmt (either pre- or post-retrofit)	Sufficient msmt of runtime
CL/TS	Load but still CL and schedule but still TS	One-time load msmt	One-time load msmt
CL/TS	Load to VL and schedule but still TS	One-time load msmt	Sufficient load msmts to characterize load
CL/TS	Load but still CL and schedule to VS	One-time load msmt	One-time load msmt and sufficient msmt of runtime
CL/TS	Load to VL and schedule to VS	One-time load msmt	Sufficient load msmts to characterize load
CL/VS	Load but still CL	One-time load msmt and sufficient msmt of runtime	One-time load msmt and sufficient msmt of runtime
CL/VS	Load to VL	One-time load msmt and sufficient msmt of runtime	Sufficient load msmts to characterize load
CL/VS	Schedule to TS	One-time load msmt (either pre- or post-retrofit) and sufficient msmt of runtime	
CL/VS	Schedule but still VS	One-time load msmt (either pre- or post-retrofit) and sufficient msmt of runtime	Sufficient msmt of runtime
CL/VS	Load but still CL and schedule to TS	One-time load msmt and sufficient msmt of runtime	One-time load msmt
CL/VS	Load to VL and schedule but still TS	One-time load msmt and sufficient msmt of runtime	Sufficient load msmts to characterize load
CL/VS	Load but still CL and schedule to VS	One-time load msmt and sufficient msmt of runtime	One-time load msmt and sufficient msmt of runtime
CL/VS	Load to VL and schedule but still VS	One-time load msmt and sufficient msmt of runtime	Sufficient load msmts to characterize load
VL/TS or VS	Load to CL	Sufficient load msmts to characterize load	One-time load msmt and sufficient msmt of runtime

VL/TS or VS	Load but still VL	Sufficient load msmts to characterize load	Sufficient load msmts to characterize load
VL/TS or VS	Schedule still or to TS	Sufficient load msmts to characterize load	Sufficient load msmts to characterize load
VL/TS or VS	Schedule to or still VS	Sufficient load msmts to characterize load	Sufficient load msmts to characterize load
VL/TS or VS	Load to CL and schedule still or to TS	Sufficient load msmts to characterize load	One-time load msmt
VL/TS or VS	Load but still VL and schedule still or to TS	Sufficient load msmts to characterize load	Sufficient load msmts to characterize load
VL/TS or VS	Load to CL and schedule to or still VS	Sufficient load msmts to characterize load	One-time load msmt and sufficient msmt of runtime
VL/TS or VS	Load but still VL and schedule to or still VS	Sufficient load msmts to characterize load	Sufficient load msmts to characterize load

CL = constant load msmt = measurements
TS = timed (known) schedule VL = variable load
VS = variable (unknown) schedule

Table 2: *Recommended Models for Whole-Building Approach*

Name	Independent Variables	Form	Examples
No adjustment/ constant model	None	$E = E_b$	Weather independent use
Day-adjusted model	None	$E = E_b \times day_b / day_c$	Weather independent use
Two-parameter model	Temperature	$E = C + B_1(T)$	Weather independent use
Three-parameter model	Temperature	$E = C + B_1(B_2 - T)^+$ $E = C + B_1(T - B_2)^+$	Weather dependent use (fuel or electric in winter, electricity in summer for cooling)
Three-parameter model	Degree-days	$E = C + B_1(DD_{BT})$	Degree-days calculation to balance-point temperature
Four-parameter model	Temperature	$E = C + B_1(B_3 - T)^+ - B_2(T - B_3)^+$ $E = C - B_1(B_3 - T)^+ + B_2(T - B_3)^+$	Weather dependent use change-point model (fuel or electricity in winter, electricity in summer for cooling)
Five-parameter model	Temperature	$E = C + B_1(B_3 - T)^+ + B_2(T - B_4)^+$	Weather dependent use, heating and cooling supplied by same meter
Five-parameter model	Degree-days	$E = C + B_1(DD_{TH}) + B_2(DD_{TC})$	Weather dependent use, degree-days calculated to balance-point temperature, heating and cooling supplied by same meter.
Multivariate model	Degree-days, temperature, other independent variables	General form: $E = C_0 - C_1X_1 + C_2X_2 + \ldots C_nX_n$	Weather dependent use and other non-temperature-based variables (i.e. occupancy, production, etc.) Linear model shown