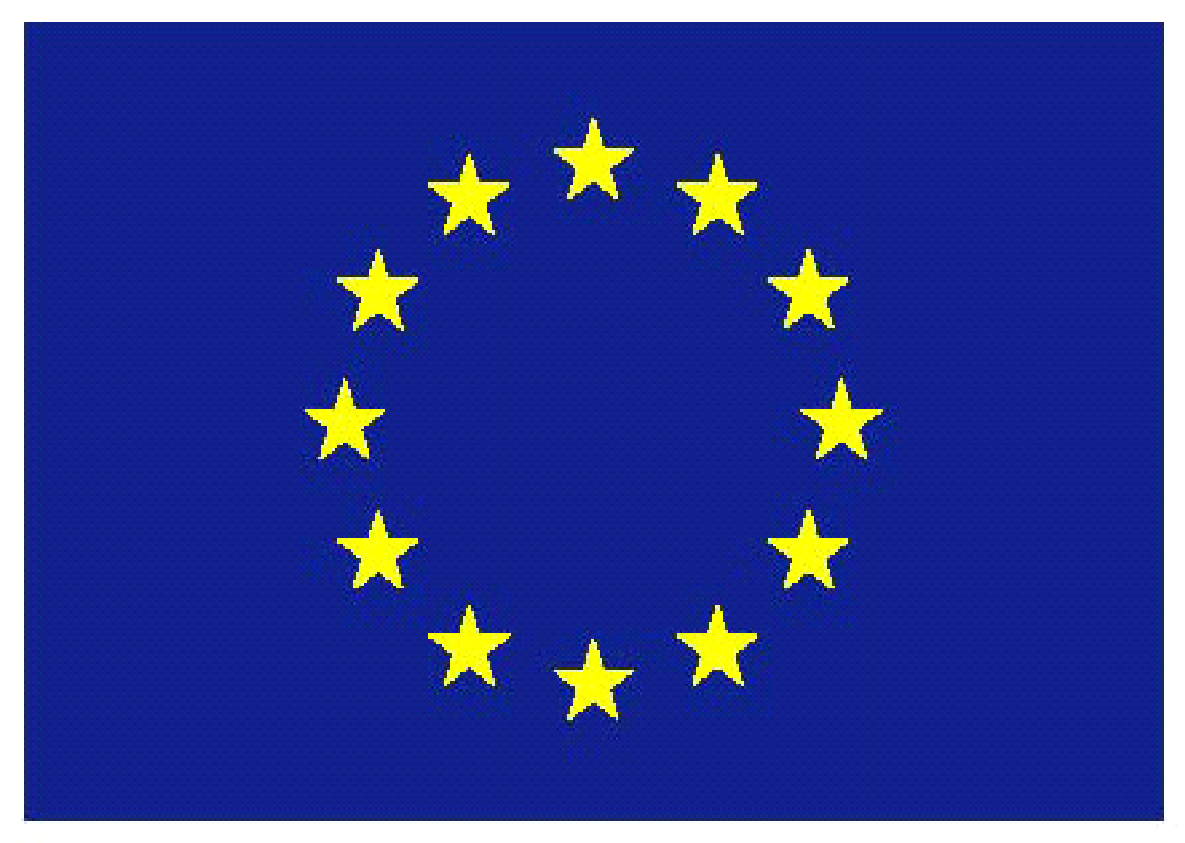


ENERGY PERFORMANCE PROTOCOL

ANNEX A: INDEX OF NATIONAL RESOURCES

VERSION EU 0.1 – OCTOBER 2015



This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 649836. The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the European Union.  Neither the EASME nor the European Commission are responsible for any use that may be made of the information contained therein.

**TABLE OF CONTENTS**

[**INTRODUCTION**](#h.tyjcwt)

[**Austria**](#h.1t3h5sf)

[**Bulgaria**](#h.4d34og8)

[**Czech Republic**](#h.2s8eyo1)

[**Germany**](#h.17dp8vu)

[**Greece**](#h.3rdcrjn)

[**Italy**](#h.26in1rg)

[**Lithuania**](#h.lnxbz9)

[**Netherlands**](#h.35nkun2)

[**Poland**](#h.1ksv4uv)

[**Portugal**](#h.44sinio)

[**Romania**](#h.2jxsxqh)

[**Spain**](#h.z337ya)

[**Sweden**](#h.3j2qqm3)

[**Switzerland**](#h.1y810tw)

[**United Kingdom**](#h.4i7ojhp)

# INTRODUCTION

The Investor Confidence Project (ICP) Europe, is an Energy Efficiency (EE) initiative addressing investment market barriers, which have been repeatedly identified as the main impediments to mass scaling of EE investments in Europe, by the International Energy Agency, the Buildings Performance Institute Europe, the Energy Efficiency Financial Institutions Group, as well as other relevant EE stakeholders in Europe.

The initiative builds on the successful experience of its United States counterpart, which has been pointed out as a best-practice approach by the Energy Efficiency Financial Institutions Group and the International Energy Agency.

The project is supported by the Horizon 2020 European Research and Innovation Programme and by the Stiftung Family Foundation and aims to establish itself as an EU-wide, open access system, to provide more stable, predictable, and reliable savings outcomes and to enable greater private investment through a more efficient transparent marketplace.

At the core of the system are ICP Europe protocols which provide comprehensive and robust guidance for project development at a European level, allowing market entities to dramatically streamline project underwriting processes related to project performance.

The application of these protocols is complemented by a certification scheme for project developers and third-party quality assurance providers, and the Investor Ready Energy Efficiency (IREETM) label, which recognizes full accomplishment of system application.

This is Annex A: Index of national resources. This should be read in conjunction with the ICP Europe protocols, along with the Project Development Specifications document which compiles all relevant information for system application. This document summarises information gathered to date by country on national standards, guidance documents or sources of information which can be used to support in-country ICP projects. These resources may be used as optional alternative resources to the European or international standards where identified in the protocols. National resources are shown for tertiary and for residential buildings in the last two columns of each country table. Where we do not believe an equivalent national resource currently exists, it is shown with a dash ‘-’. Blank cells indicate that no equivalent national resource has been identified and we do not yet know if one exists.

**Remaining countries awaiting information on relevant national standards:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| * Belgium * Croatia * Cyprus | * Denmark * Estonia * Finland | * France * Hungary * Ireland | * Latvia * Luxembourg * Malta | * Norway * Slovakia * Slovenia |

# Austria

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | ÖN B 1800, details in ÖNORM B 8110-6 | ÖN B 1800, details in ÖNORM B 8110-6 |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | Guideline "Energietechnisches Verhalten von Gebäuden" (OIB-330.6-011/15): Section 2.4 refering to Austrian Standard ÖNORM B 8110-5 | Guideline "Energietechnisches Verhalten von Gebäuden" (OIB-330.6-003/12): Section 2.4 refering to Austrian Standard ÖNORM B 8110-5 |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | Guideline "Energietechnisches Verhalten von Gebäuden" (OIB-330.6-011/15): Section 2.5, refering to OIB-Richtlinie 6: OIB-330.6-009/15 - Section 9 | Guideline "Energietechnisches Verhalten von Gebäuden" (OIB-330.6-011/15): Section 2.5, refering to OIB-Richtlinie 6: OIB-330.6-009/15 - Section 9 |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | ÖNORM B 8110-6 | ÖNORM B 8110-6 |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | General Information in: Guideline "Energietechnisches Verhalten von Gebäuden" (OIB-330.6-011/15) | General Information in: Guideline "Energietechnisches Verhalten von Gebäuden" (OIB-330.6-011/15) |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) |  |  |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) | Calculation information: ÖNORM B8110-6, ÖNORM H 5057, ÖNORM H 5056, ÖNORM H 5058, ÖNORM H 5059 | Calculation information: ÖNORM B8110-6, ÖNORM H 5057, ÖNORM H 5056, ÖNORM H 5058, ÖNORM H 5059 |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | The ÖGNI System (DGNB) | The ÖGNI System (DGNB) |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* | Guideline OIB-Richtlinie 6: OIB-330.6-009/15 | Guideline OIB-Richtlinie 6: OIB-330.6-009/15 |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) |  |  |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) |  |  |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification |  |  |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |
|  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) | ÖNORM EN ISO 52016-1, 1. März 2015. Energetische Bewertung von Gebäuden und Bauteilen - Berechnung von wahrnehmbarem und inhärentem energetischen Wärmebedarf in Gebäuden oder in einer Zone - Teil 1: Berechnungsverfahren (ISO/DIS 52016-1:2015). |  |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A |  |  |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices |  |  |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | ÖNORM B 1801, ÖN 7140, ÖNORM EN 15459, VDI 2067, EN 15643-4 | ÖNORM B 1801, ÖN 7140, ÖNORM EN 15459, VDI 2067, EN 15643-4 |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) |  |  |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance |  |  |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings |  |  |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) |  |  |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification |  |  |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Bulgaria

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | ЗАКОН ЗА УСТРОЙСТВО НА ТЕРИТОРИЯТА Допълнителни разпоредби, § 5. | ЗАКОН ЗА УСТРОЙСТВО НА ТЕРИТОРИЯТА Допълнителни разпоредби, § 5. |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) |  | ЗАКОН ЗА УПРАВЛЕНИЕ НА ЕТАЖНАТА СОБСТВЕНОСТ |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | НАРЕДБА № 16-1594 от 13.11.2013 г. за обследване за енергийна ефективност, сертифициране и оценка на енергийните спестявания на сгради Чл. 9., ал. 3 | НАРЕДБА № 16-1594 от 13.11.2013 г. за обследване за енергийна ефективност, сертифициране и оценка на енергийните спестявания на сгради Чл. 9., ал. 3 |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | НАРЕДБА № РД-16-1058 ОТ 10 ДЕКЕМВРИ 2009 Г. ЗА ПОКАЗАТЕЛИТЕ ЗА РАЗХОД НА ЕНЕРГИЯ И ЕНЕРГИЙНИТЕ ХАРАКТЕРИСТИКИ НА СГРАДИТЕ | НАРЕДБА № РД-16-1058 ОТ 10 ДЕКЕМВРИ 2009 Г. ЗА ПОКАЗАТЕЛИТЕ ЗА РАЗХОД НА ЕНЕРГИЯ И ЕНЕРГИЙНИТЕ ХАРАКТЕРИСТИКИ НА СГРАДИТЕ |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | НАРЕДБА № РД-16-1058 ОТ 10 ДЕКЕМВРИ 2009 Г. ЗА ПОКАЗАТЕЛИТЕ ЗА РАЗХОД НА ЕНЕРГИЯ И ЕНЕРГИЙНИТЕ ХАРАКТЕРИСТИКИ НА СГРАДИТЕ | НАРЕДБА № РД-16-1058 ОТ 10 ДЕКЕМВРИ 2009 Г. ЗА ПОКАЗАТЕЛИТЕ ЗА РАЗХОД НА ЕНЕРГИЯ И ЕНЕРГИЙНИТЕ ХАРАКТЕРИСТИКИ НА СГРАДИТЕ |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) |  |  |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) | Наредба № 7 от 2004 г. за енергийна ефективност | Наредба № 7 от 2004 г. за енергийна ефективност |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | - | - |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* |  |  |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) | ЗАКОН ЗА ЕНЕРГИЙНАТА ЕФЕКТИВНОСТ Чл. 43. | ЗАКОН ЗА ЕНЕРГИЙНАТА ЕФЕКТИВНОСТ Чл. 43. |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) | НАРЕДБА № РД-16-1058 ОТ 10 ДЕКЕМВРИ 2009 Г. ЗА ПОКАЗАТЕЛИТЕ ЗА РАЗХОД НА ЕНЕРГИЯ И ЕНЕРГИЙНИТЕ ХАРАКТЕРИСТИКИ НА СГРАДИТЕ | НАРЕДБА № РД-16-1058 ОТ 10 ДЕКЕМВРИ 2009 Г. ЗА ПОКАЗАТЕЛИТЕ ЗА РАЗХОД НА ЕНЕРГИЯ И ЕНЕРГИЙНИТЕ ХАРАКТЕРИСТИКИ НА СГРАДИТЕ |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | Наредба № 7 от 2004 г. за енергийна ефективност | Наредба № 7 от 2004 г. за енергийна ефективност |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations | - | - |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |
|  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) | DGNB Bulgaria | DGNB Bulgaria |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A | - | - |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | Национален Статистически Институт Инфлация и индекси на потребителските цени | Национален Статистически Институт Инфлация и индекси на потребителските цени |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) | Разходни норми в строителството Уедрени сметни норми Справочник за цените в строителствот | Разходни норми в строителството Уедрени сметни норми Справочник за цените в строителствот |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | - | - |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | ЗАКОН ЗА ЕНЕРГИЙНАТА ЕФЕКТИВНОСТ Раздел V Управление потреблението на енергия | ЗАКОН ЗА ЕНЕРГИЙНАТА ЕФЕКТИВНОСТ Раздел V Управление потреблението на енергия |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance |  |  |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings |  |  |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) |  |  |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification |  |  |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Czech Republic

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | Act No. 107/2006 Coll. on increasing of the rent, Decree No. 372/2001 Coll. on calculation of the cost for heat | Act No. 107/2006 Coll. on increasing of the rent, Decree No. 372/2001 Coll. on calculation of the cost for heat |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | Act No. 406/2000 Coll. Energy Management Act, § 10h, Decree No. 480/2012 on energy audits and energy assessment, Decree No.78/2013 on Energy performance of buildings | Act No. 406/2000 Coll. Energy Management Act, § 10h, Decree No. 480/2012 on energy audits and energy assessment, Decree No.78/2013 on Energy performance of buildings |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | ČSN EN 16247-2 Energy audits buildings, Decree No. 480/2012 on energy audits and energy assessment | ČSN EN 16247-2 Energy audits buildings, Decree No. 480/2012 on energy audits and energy assessment |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | Decree No.78/2013 on Energy performance of buildings, Part in TNI 73 0331 on Energy performance of buildings | Decree No.78/2013 on Energy performance of buildings, Part in TNI 73 0331 on Energy performance of buildings |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | ISO 50006:2014 - Energy management systems - in implementation | ISO 50006:2014 - Energy management systems - in implementation |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) | - | - |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) | Decree No.78/2013 on Energy performance of buildings | Decree No.78/2013 on Energy performance of buildings |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | - | - |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* |  |  |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) | - | - |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) | - | - |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | ČSN EN 16247-2 Energy audits buildings ČSN EN ISO 50001, Decree No. 480/2012 on energy audits and energy assessment | ČSN EN 16247-2 Energy audits buildings ČSN EN ISO 50001, Decree No. 480/2012 on energy audits and energy assessment |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) | NKN- national calculation tool (Národní Kalkulační Nástroj) | NKN- national calculation tool (Národní Kalkulační Nástroj) |
|  |  |  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  | - | - |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) | - | - |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A | - | - |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | Decree No. 480/2012 on energy audits and energy assessment (individual calculation) | Decree No. 480/2012 on energy audits and energy assessment (individual calculation) |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | - | - |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | ISO 50002:2014 - Energy audits | ISO 50002:2014 - Energy audits |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance | Act. No 183/2006 on Building code - basic definitions | Act. No 183/2006 on Building code - basic definitions |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings |  |  |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) | - | - |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification | - | - |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Germany

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | DIN 277 | DIN 277 |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | DIN V 4701-10, DIN V 4701-12 with PAS 1027, DIN V 4108-6, VDI 3807, VDI 3808 | DIN V 4701-10, DIN V 4701-12 with PAS 1027, DIN V 4108-6, VDI 3807, VDI 3809 |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | Baubeschreibung Building Description (Form) DIN EN 15232 | Baubeschreibung Building Description (Form) DIN EN 15232 |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | Energieausweis  Energy Pass (EnEV / DIN 18599) | Energieausweis  Energy Pass (EnEV / DIN 18599 / DIN V 4108-6 & DIN V 4701-10) |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | VDI 6020 | VDI 6020 |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) | DIN 18599 Qualitätssicherung | Energieausweis  Energy Pass (EnEV / DIN 18599 / DIN V 4108-6 & DIN V 4701-10) |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) | DIN V 18599 | DIN V 18599 |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | GEFMA DIN V 18599 | DIN V 18599 |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* | - | - |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) |  |  |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) |  |  |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | DIN 18599 Passivhaus Projektierungs Paket PHPP | DIN 18599 / DIN V 4108-6 & DIN V 4701-10 Passivhaus Projektierungs Paket PHPP |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |
|  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) | CMVP | CMVP |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A |  |  |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | DIN 276 VDI 2067 | DIN 276 VDI 2067 |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |  |  |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | GEFMA, KEM VDI 2067 | VDI 2067 |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | Energieausweis (energy performance certificate; EnEV) | Energieausweis (energy performance certificate; EnEV) |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance | Baubeschreibung Building Description (Form) | Baubeschreibung Building Description (Form) |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings | VDI 3810 | VDI 3810 |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) | VDI 3810 | CDI 3810 |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol 1, DIN 4710 | IPMVP Vol 1, DIN 4710 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification |  |  |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Greece

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | TOTEE 20701-1 and -4/2010 | TOTEE 20701-1 and -4/2010 |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | TEE-KENAK TOTEE 20701-1/2010 | TEE-KENAK TOTEE 20701-1/2010 |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | TOTEE 20701-4/2010 | TOTEE 20701-4/2010 |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | TOTEE 20701-1 and -4/2010 | TOTEE 20701-1 and -4/2010 |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | KENAK and TOTEE 20701-1/2010 | KENAK and TOTEE 20701-1/2010 |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) |  |  |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) |  | KENAK and TOTEE 20701-1/2010 |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | E.G. Dascalaki et al., Energy Certification of Hellenic Buildings: First Findings, Energy & Buildings, Vol. 65, p. 429-437, 2013. K.G. Droutsa et al., Mapping the Energy Performance of Hellenic Buildings Through the Energy Certificates, 10th National Conference “Soft Energy Sources”, Vol. B, p. 1047-1056, Thessaloniki, 26 – 27 November, 2014 | E.G. Dascalaki et al., Energy Certification of Hellenic Buildings: First Findings, Energy & Buildings, Vol. 65, p. 429-437, 2013. K.G. Droutsa et al., Mapping the Energy Performance of Hellenic Buildings Through the Energy Certificates, 10th National Conference “Soft Energy Sources”, Vol. B, p. 1047-1056, Thessaloniki, 26 – 27 November, 2014 |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* | TEE-KENAK (Overview in Dascalaki et al, Energy Performance of Buildings - EPBD in Greece, Energy Policy, Vol. 45, p. 469-477, 2012) | TEE-KENAK (Overview in Dascalaki et al, Energy Performance of Buildings - EPBD in Greece, Energy Policy, Vol. 45, p. 469-477, 2012) |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) | KENAK and national law N.4315/2014 | KENAK and national law N.4315/2014 |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) | Technical guideline TOTEE 20701-1 and -4/2010 | Technical guideline TOTEE 20701-1 and -4/2010 |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | TEE-KENAK | TEE-KENAK |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |  |  |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) | www.cres.gr | www.energycon.org/ekia.html |
|  |  |  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |  |  |
| Type 2 |  |  |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) |  |  |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A |  | TEE-KENAK |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | Hellenic Statistical Authority | Hellenic Statistical Authority |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |  |  |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | National law N.4122/2013 | National law N.4122/2013 |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | TOTEE 20701-4/2010 | TOTEE 20701-4/2010 |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance |  |  |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings |  |  |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) |  |  |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification |  |  |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Italy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) |  |  |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | UNI CEI EN 16247-2 | UNI CEI EN 16247-2; UNI-TS 11300 1-4 |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | UNI CEI EN 16247-2 | UNI CEI EN 16247-2 |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) |  |  |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | UNI CEI EN 16231 | UNI CEI EN 16231 |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) |  |  |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) |  |  |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | UNI CEI EN 16231 | UNI CEI EN 16231 |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* |  |  |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) |  |  |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) |  |  |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | UNI CEI EN 16212 | UNI CEI EN 16212 |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations | UNI CEI EN 16212 | UNI CEI EN 16212 |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |  |  |
|  |  |  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |  |  |
| Type 2 |  |  |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) |  |  |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A |  |  |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | ISTAT (Italian Statistics Institute) | ISTAT (Italian Statistics Institute) |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |  |  |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | UNI EN 15459 | UNI EN 15459 |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | UNI CEI EN ISO 50002 | UNI CEI EN ISO 50002 |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance |  |  |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings |  |  |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) |  |  |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification | UNI CEI 11339:2009 for Energy Managers - UNI CEI 11352:2014 for ESCOs | UNI CEI 11339:2009 for Energy Managers - UNI CEI 11352:2014 for ESCOs |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Lithuania

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | STR 1.14.01:1999 "PASTATŲ PLOTŲ IR TŪRIŲ SKAIČIAVIMO TVARKA" STR 2.01.09:2005 "PASTATŲ ENERGINIS NAUDINGUMAS. energinio naudingumo sertifikavimas", Annex 7 | STR 1.14.01:1999 "PASTATŲ PLOTŲ IR TŪRIŲ SKAIČIAVIMO TVARKA" STR 2.01.09:2005 "PASTATŲ ENERGINIS NAUDINGUMAS. energinio naudingumo sertifikavimas", Annex 7 |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | LIETUVOS RESPUBLIKOS ŪKIO MINISTRO ĮSAKYMAS "DĖL IŠSAMIOJO ENERGIJOS, ENERGIJOS IŠTEKLIŲ IR ŠALTO VANDENS VARTOJIMO AUDITO ATLIKIMO VIEŠOJO NAUDOJIMO PASKIRTIES PASTATUOSE METODIKOS PATVIRTINIMO" 2008 m. balandžio 29 d. Nr. 4-184 Vilnius | LIETUVOS RESPUBLIKOS ŪKIO MINISTRO ĮSAKYMAS "DĖL IŠSAMIOJO ENERGIJOS, ENERGIJOS IŠTEKLIŲ IR ŠALTO VANDENS VARTOJIMO AUDITO ATLIKIMO VIEŠOJO NAUDOJIMO PASKIRTIES PASTATUOSE METODIKOS PATVIRTINIMO" 2008 m. balandžio 29 d. Nr. 4-184 Vilnius |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | LIETUVOS RESPUBLIKOS ŪKIO MINISTRO ĮSAKYMAS "DĖL IŠSAMIOJO ENERGIJOS, ENERGIJOS IŠTEKLIŲ IR ŠALTO VANDENS VARTOJIMO AUDITO ATLIKIMO VIEŠOJO NAUDOJIMO PASKIRTIES PASTATUOSE METODIKOS PATVIRTINIMO" 2008 m. balandžio 29 d. Nr. 4-184 Vilnius | LIETUVOS RESPUBLIKOS ŪKIO MINISTRO ĮSAKYMAS "DĖL IŠSAMIOJO ENERGIJOS, ENERGIJOS IŠTEKLIŲ IR ŠALTO VANDENS VARTOJIMO AUDITO ATLIKIMO VIEŠOJO NAUDOJIMO PASKIRTIES PASTATUOSE METODIKOS PATVIRTINIMO" 2008 m. balandžio 29 d. Nr. 4-184 Vilnius |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | LIETUVOS RESPUBLIKOS ŪKIO MINISTRO ĮSAKYMAS "DĖL IŠSAMIOJO ENERGIJOS, ENERGIJOS IŠTEKLIŲ IR ŠALTO VANDENS VARTOJIMO AUDITO ATLIKIMO VIEŠOJO NAUDOJIMO PASKIRTIES PASTATUOSE METODIKOS PATVIRTINIMO" 2008 m. balandžio 29 d. Nr. 4-184 Vilnius STR 2.01.09:2005 "PASTATŲ ENERGINIS NAUDINGUMAS. energinio naudingumo sertifikavimas" | LIETUVOS RESPUBLIKOS ŪKIO MINISTRO ĮSAKYMAS "DĖL IŠSAMIOJO ENERGIJOS, ENERGIJOS IŠTEKLIŲ IR ŠALTO VANDENS VARTOJIMO AUDITO ATLIKIMO VIEŠOJO NAUDOJIMO PASKIRTIES PASTATUOSE METODIKOS PATVIRTINIMO" 2008 m. balandžio 29 d. Nr. 4-184 Vilnius STR 2.01.09:2005 "PASTATŲ ENERGINIS NAUDINGUMAS. energinio naudingumo sertifikavimas" |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | LIETUVOS RESPUBLIKOS ŪKIO MINISTRO ĮSAKYMAS "DĖL IŠSAMIOJO ENERGIJOS, ENERGIJOS IŠTEKLIŲ IR ŠALTO VANDENS VARTOJIMO AUDITO ATLIKIMO VIEŠOJO NAUDOJIMO PASKIRTIES PASTATUOSE METODIKOS PATVIRTINIMO" 2008 m. balandžio 29 d. Nr. 4-184 Vilnius | LIETUVOS RESPUBLIKOS ŪKIO MINISTRO ĮSAKYMAS "DĖL IŠSAMIOJO ENERGIJOS, ENERGIJOS IŠTEKLIŲ IR ŠALTO VANDENS VARTOJIMO AUDITO ATLIKIMO VIEŠOJO NAUDOJIMO PASKIRTIES PASTATUOSE METODIKOS PATVIRTINIMO" 2008 m. balandžio 29 d. Nr. 4-184 Vilnius |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) | - | - |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) | - | - |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | STR 2.01.09:2005 "PASTATŲ ENERGINIS NAUDINGUMAS. energinio naudingumo sertifikavimas", Annex 7 | STR 2.01.09:2005 "PASTATŲ ENERGINIS NAUDINGUMAS. energinio naudingumo sertifikavimas", Annex 7 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* | - |  |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) |  |  |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) |  |  |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification |  |  |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |  |  |
|  |  |
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |  |  |
|  |  |  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |  |  |
| Type 2 |  |  |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) |  |  |
|  |  |
| Large residential only | Residential simulation methodology guide | N/A | N/A |  |  |
|  |  |
|  |  |
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | Department of Statistics of Lithuania. http://www.stat.gov.lt/en/home |  |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |  |  |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing |  |  |
|  |  |
|  |  |
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) |  |  |
|  |  |
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance |  |  |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings |  | STATYBOS TECHNINIS REGLAMENTAS STR 1.12.05:2002 GYVENAMŲJŲ NAMŲ NAUDOJIMO IR PRIEŽIŪROS PRIVALOMIEJI REIKALAVIMAI  IR JŲ ĮGYVENDINIMO TVARKA |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) |  |  |
|  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 |  |  |
| Option B: All parameter measurement savings |  |  |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 |  |  |
|  |  |
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 |  |  |
| (energy-governing factors, expected to change routinely |  |  |
| during the reporting period, such as weather or production volume) |  |  |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification |  |  |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 |  |  |

# Netherlands

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | NEN 2580 | NEN 2580 |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | ISSO 75.2 | ISSO 82.2 |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | ISSO 75.1 en 75.2 | Isso 82.1 en ISSO 82.2 |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | ISSO 75.1 (but not the average daily usage) | ISSO 75.1 (but not the average daily usage) |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | ISSO 75.1 en ISSO 75.3 | ISSO 82.1 en ISSO 82.3 |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) | - | - |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) | - | - |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | - | - |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* | EPA-U (VABI) | EPA-W (VABI), EPAVIEW (Delto), Raak (Raak IT) |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) | BRL 9500 (KvI NL) | BRL 9500 (KvI NL) |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) | ISSO 54 (EDR tests) and BRL 9501 | ISSO 54 (EDR tests) and BRL 9501 |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | ISSO 75.2 en ISSO 75.3 | ISSO 82.2 en ISSO 82.3 |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations | - | - |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) | http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/duurzame-gebouwen/gebouwfasen/beheer-en-onderhoud/gebouwgebonden-energie/energiebesparingsverkenner-utiliteitsbouw | http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/woningbouw/energiebesparingsverkenner |
|  |  |  | EPA-U (VABI) | EPA-W (VABI), EPAVIEW (Delto), Raak (Raak IT) |
| Certification/credentials for individual carrying out analysis | Type 1 |  |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) |  |  |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A | ISSO 75.2 en ISSO 75.3 | ISSO 82.2 en ISSO 82.3 |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | NEN 8088 | NEN 8088 |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | - | - |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | ISSO 75.1, ISSO 75.2 | ISSO 82.1 en ISSO 82.2 |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance | - | - |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings | ISSO 106 'functional inspection method' | - |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) |  |  |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification |  |  |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Poland

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | Minister of Infrastructure Regulation of 17 March 2009 | Minister of Infrastructure Regulation of 17 March 2009 |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | Minister of Infrastructure Regulation of 17 March 2009 | Minister of Infrastructure Regulation of 17 March 2009 |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | Minister of Infrastructure Regulation of 17 March 2009 | Minister of Infrastructure Regulation of 17 March 2009 |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) |  |  |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) |  |  |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) |  |  |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) | Minister of Infrastructure Regulation of 17 March 2009 | Minister of Infrastructure Regulation of 17 March 2009 |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) |  |  |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* |  |  |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) |  |  |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) |  |  |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | Minister of Infrastructure Regulation of 17 March 2009 | Minister of Infrastructure Regulation of 17 March 2009 |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |
|  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) | Minister of Infrastructure Regulation of 17 March 2009 | Minister of Infrastructure Regulation of 17 March 2009 |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A | Minister of Infrastructure Regulation of 17 March 2009 | Minister of Infrastructure Regulation of 17 March 2009 |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | Minister of Infrastructure Regulation of 17 March 2009 | Minister of Infrastructure Regulation of 17 March 2009 |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing |  |  |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | Minister of Infrastructure Regulation of 17 March 2009 (Table 1. page 4075, Table A. page 4088) | Minister of Infrastructure Regulation of 17 March 2009 (Table 1. page 4075, Table A. page 4088) |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance |  |  |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings |  |  |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) |  |  |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification |  |  |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Portugal

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | Decreto-Lei n.º 118/2013, de 20 de agosto / Decreto-Lei n.º 194/2015 | Decreto-Lei n.º 118/2013, de 20 de agosto / Decreto-Lei n.º 194/2015 |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | Decreto-Lei n.º 118/2013, de 20 de agosto |  |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | Decreto-Lei n.º 118/2013, de 20 de agosto Portaria n.º 349-D/2013 de 2 de dezembro Decreto-lei n.º68-A/2015 |  |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) |  |  |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | Decreto-Lei n.º 29/2011 de 28 de Fevereiro (EPC legal framework) and Portaria n.º 60/2013 de 5 de fevereiro de 2013 state that the M&V plan (and all the issues related to M&V) must be executed with IPMVP |  |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) |  |  |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) |  |  |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) |  |  |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* | Decreto-Lei n.º 118/2013, de 20 de agosto (EPBD) Portaria n.º 349-D/2013 de 2 de dezembro: "Dynamic Simulation Multi-zone should be performed by program accredited by ASHRAE 140" |  |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) | Decreto-Lei n.º 118/2013, de 20 de agosto (EPBD) Lei n.º 58/2013 de 20 de agosto |  |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) |  |  |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | Climatic/meteorology Data: CLIMAS-SCE - Software para o Sistema Nacional de Certificação de Edifícios: http://www.lneg.pt/servicos/328/2263/ |  |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |
|  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) |  |  |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A |  |  |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | Índice de preços ao consumidor excluindo habitação by INE - Instituto Nacional de Estatística, IP (Statistics Portugal) www.ine.pt |  |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |  |  |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing |  |  |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | National legislation referencies for intensive energy consumers (SGCIE) |  |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance | Portaria n.º 701-H/2008 de 29 de Julho |  |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings | Decreto-Lei n.º 118/2013, de 20 de agosto (EPBD) |  |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) |  |  |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification | CMVP | CMVP |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Romania

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | Norm C 107/2005 regarding the thermotechnical calculation of building construction elements | Norm C 107/2005 regarding the thermotechnical calculation of building construction elements |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | Normative NP 048-2000 for thermal and energetic expertise of existing buildings and of the heating and hot water consumption related installations (Annex 4 - Average occupancy index fot dwellings in Romania); Standard 1478-90: Plumbing - Water supply to industrial and civil construction. Basic requirements for design; Decision no. 273 of 14 June 1994 - Regulation regarding the reception of construction works and related installations and equipment - ANNEX 6: Technical book of building; Technical norms of 7 November 2008 for compiling a technical construction book | Normative NP 048-2000 for thermal and energetic expertise of existing buildings and of the heating and hot water consumption related installations (Annex 4 - Average occupancy index fot dwellings in Romania); Standard 1478-90: Plumbing - Water supply to industrial and civil construction. Basic requirements for design; Decision no. 273 of 14 June 1994 - Regulation regarding the reception of construction works and related installations and equipment - ANNEX 6: Technical book of building; Technical norms of 7 November 2008 for compiling a technical construction book |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | Methodology for calculating energy performance of buildings (Mc 001) approved by Order of the Minister of Transport, Constructions and Tourism no.157/2007; 3rd part, Annex 1: Data sheet on thermal and energetic analysis of building | Methodology for calculating energy performance of buildings (Mc 001) approved by Order of the Minister of Transport, Constructions and Tourism no.157/2007; 3rd part, Annex 1: Data sheet on thermal and energetic analysis of building |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | Standard 4839/1997: heating, annual number of degrees-days; Methodology for calculating energy performance of buildings (Mc 001) approved by Order of the Minister of Transport, Constructions and Tourism no.157/2007; 6rd part: Climatic parameters required to determine the energy performance of new and existing buildings, sizing of air conditioning installation of buildings and higrothermal sizing of building envelope | Standard 4839/1997: heating, annual number of degrees-days; Methodology for calculating energy performance of buildings (Mc 001) approved by Order of the Minister of Transport, Constructions and Tourism no.157/2007; 6rd part: Climatic parameters required to determine the energy performance of new and existing buildings, sizing of air conditioning installation of buildings and higrothermal sizing of building envelope |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | Normative NP 048-2000 for thermal and energetic expertise of existing buildings and of the heating and hot water consumption related installations (Annex 8: determination of the thermal characteristics of heat supply - by linear regression) | Normative NP 048-2000 for thermal and energetic expertise of existing buildings and of the heating and hot water consumption related installations (Annex 8: determination of the thermal characteristics of heat supply - by linear regression) |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) | - | - |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) | - | - |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | - | - |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* | - | - |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) | Order no. 2.237 / 2010 approving the technical regulation "Regulation on certification of building energy auditors" | Order no. 2.237 / 2010 approving the technical regulation "Regulation on certification of building energy auditors" |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) | - | - |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | Methodology for calculating energy performance of buildings (Mc 001) approved by Order of the Minister of Transport, Constructions and Tourism no.157/2007; [EN 16212 Energy efficiency and savings calculations - translated in 2013; EN16247-2 - translated in november 17, 2014; not included in Mc 001]; Regulation on the certification of energy auditors for buildings 30.09.2010: Energy auditor grade 1 (all type of buildings) | Methodology for calculating energy performance of buildings (Mc 001) approved by Order of the Minister of Transport, Constructions and Tourism no.157/2007; [EN 16212 Energy efficiency and savings calculations - translated in 2013; EN16247-2 - translated in november 17, 2014; not included in Mc 001]; Regulation on the certification of energy auditors for buildings 30.09.2010: Energy auditor grade 2 (block of flats and apartments) |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |
|  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) | Regulation on the certification of energy auditors for buildings 30.09.2010: Energy auditor grade 1 (Buildings) | Regulation on the certification of energy auditors for buildings 30.09.2010: Energy auditor grade 2 (block of flats and apartments) |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A | - | - |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | National Institute of Statistics; Methodology for calculating energy performance of buildings (Mc 001) approved by Order of the Minister of Transport, Constructions and Tourism no.157/2007 | National Institute of Statistics; SCOST–04-01/MDRT - Cost standard for bloc of flats buildings (2012); Methodology for calculating energy performance of buildings (Mc 001) approved by Order of the Minister of Transport, Constructions and Tourism no.157/2007 |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | - | - |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | Methodology for calculating energy performance of buildings (Mc 001) approved by Order of the Minister of Transport, Constructions and Tourism no.157/2007 | Methodology for calculating energy performance of buildings (Mc 001) approved by Order of the Minister of Transport, Constructions and Tourism no.157/2007 |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance | Decision no. 273 of 14 June 1994 (as amended and supplemented) regarding approval of Regulation on the acception of construction works and related installation Annex 6 | Decision no. 273 of 14 June 1994 (as amended and supplemented) regarding approval of Regulation on the acception of construction works and related installation Annex 6 |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings | REGULATION I5 of 22 June 2011 for design, execution and operation of ventilation and air conditioning installations; Regulation I 13/1 regarding operation of central heating instalations; Regulation I9/1 regarding operation of plumbing instalations; Regulation I 7 regarding design, execution and operation of power instalations; Regulation P 130-199 on behavior of construction during operation; etc. | REGULATION I5 of 22 June 2011 for design, execution and operation of ventilation and air conditioning installations; Regulation I 13/1 regarding operation of central heating instalations; Regulation I9/1 regarding operation of plumbing instalations; Regulation I 7 regarding design, execution and operation of power instalations; Regulation P 130-199 on behavior of construction during operation; etc. |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) | - | Ministry of Public Finance 2003: guide of large residential building owners associations; Law 230/2007 of residential building owners associations, updated in 2014 |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | Methodology MP-037-04 regarding determinations on building thermography | GUIDE GP 123 - 2013 regarding design and execution of thermal rehabilitation works of residential buildings; Methodology MP-037-04 regarding determinations on building thermography |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | Methodology for calculating energy performance of buildings (Mc 001) | Methodology for calculating energy performance of buildings (Mc 001) |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | - | - |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification | Order no. 777/2003 of 26.05 / 2003 approving the technical regulation "Technical Guide for professional certification of technical experts working in construction"; Regulation on the certification of energy auditors for buildings 30.09.2010 | Order no. 777/2003 of 26.05 / 2003 approving the technical regulation "Technical Guide for professional certification of technical experts working in construction"; Regulation on the certification of energy auditors for buildings 30.09.2010 |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | - | - |

# Spain

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | CALENER GT tool | CALENER VYP tool |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | UNE-EN-16247-2 | UNE-EN-16247-2 |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | UNE-EN 16247-2 | UNE-EN 16247-2 |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | I.D.A.E GUIDELINES 007. Frecuencias horarias de repetición | I.D.A.E GUIDELINES 007. Frecuencias horarias de repetición |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) |  |  |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) |  |  |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) |  |  |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | I.D.A.E. Guidelines: Escala de calificación energética. Edificios nuevos y edificios existentes . | I.D.A.E. Guidelines: Escala de calificación energética. Edificios nuevos y edificios existentes . |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* |  |  |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) |  |  |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) |  |  |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification |  |  |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |
|  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) |  |  |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A |  |  |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices |  |  |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | UNE-EN-16643-1, UNE -EN-16643-2, UNE-EN-15978 | UNE-EN-16643-1, UNE -EN-16643-2, UNE-EN-15978 |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | ISO 16247-1 / ISO 16247-2 | ISO 16247-1 / ISO 16247-2 |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance |  | DB-HE, Orden FOM 1635/2013 Documento Basico de Ahorro de Energia,Codigo Tecnico de Edificación |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings | RD 165/2006 libro del edificio | RD 165/2006 libro del edificio |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) | RD 165/2006 libro del edificio | RD 165/2006 libro del edificio |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification |  |  |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Sweden

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | Atemp - defined in national building regulation | Atemp - defined in national building regulation |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) |  |  |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | SIS-handboken, SS EN 16247-2 |  |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | Energisignatur |  |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | Energisignatur |  |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) |  |  |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) |  |  |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | STIL 2, SCB, Gripen |  |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* |  |  |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) |  |  |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) |  |  |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification |  |  |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |
|  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) |  |  |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A |  |  |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices |  |  |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) | REPAB |  |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing |  |  |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) |  |  |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance | AMA - Byggtjänst |  |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings |  |  |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) |  |  |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | SVEBYs mätföreskrifter och energiverifikat | IPMVP Vol 1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | Instructions according to SVEBY | IPMVP Vol 1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification |  |  |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol 1 | IPMVP Vol 1 |

# Switzerland

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | SIA 416 | SIA 416 |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | SIA 2024 | SIA 2024 |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | SIA 2031, (EnAW) | SIA 2031 |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | SIA 380 | SIA 380 |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | - | - |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) | - | - |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) | - | - |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | - | - |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* | SIA 382/2 | Software porfile for SIA 380/1 (monthly energy balance) |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) | - | GEAK conultants (www.geak.ch) |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) | - | - |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | SIA 382/2 | SIA 380/1, SIA 380/4, SIA 382/1, SIA 385/2 |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) |
|  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) |  | SIA 2031 |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A |  | SIA 2031 |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | SIA 480, www.kbob.ch | SIA 480, www.kbob.ch |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | www.ifma.ch | www.ifma.ch |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | SIA 2031 | SIA 2031, SIA 2047, GEAK |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance | www.kbob.admin.ch/kbob/de/home/publikationen/bauweksdokumentation-im-hochbau.html | www.kbob.admin.ch/kbob/de/home/publikationen/bauweksdokumentation-im-hochbau.html |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings | SWKI VA104-02, SWKI RE101-01, SWKI HE101-01 | SWKI VA104-02, SWKI RE101-01, SWKI HE101-01 |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) | www.pruefung-hauswart.ch | www.pruefung-hauswart.ch |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | SIA 2031 | SIA 2031 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP | IPMVP |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | SIA 2031 | SIA 2031 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification | - | www.geak.ch |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | none | none |

# United Kingdom

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Protocol stage** | **Applicable protocols** | **Protocol component** | **European Reference Provision** | **Relevant European reference (where available)** | **National equivalent standard: tertiary** | **National equivalent standard: residential** |
| **2. Baselining - Core Requirements** | All | Accurate total floor area | How to calculate total conditioned floor area (e.g. measured from inside, outside or middle of walls) | EN ISO 13790-2008 (Section 3.2.6) | CIBSE TM47: Operational Ratings and Display Energy Certificates | CIBSE TM47: Operational Ratings and Display Energy Certificates |
| Occupancy data | Different occupancy (number of people) times/patterns, extended hours behaviour and internal loads. Also includes information such as previous energy audits, details on when the building was built and refurbished, set points and occupant behaviour. | EN 16247-2 Energy audits buildings - Part 2: Buildings (Section 5.3.2) | CIBSE TM47: Operational Ratings and Display Energy Certificates | CIBSE TM47: Operational Ratings and Display Energy Certificates |
|
| Material specifications/inventories | Detailed checklist of information to collect during a survey (e.g. light fitting type, heating system type, controls information etc.), including by building type e.g. industrial, multi-family | EN 16247-2 Energy audits - Part 2: Buildings (Section 5.3.2 and Annex D) | CIBSE Guide F: Energy Efficiency in Buildings, Table 18.2 | CIBSE Guide F: Energy Efficiency in Buildings, Table 18.2 |
| Data calendarisation | How periods are consolidated to the integer years /months periods applied. | ISO 16346:2013 Energy Performance of Buildings – Assessment of Overall Energy Performance (section 8.2.2) | CIBSE TM47: Operational Ratings and Display Energy Certificates | CIBSE TM47: Operational Ratings and Display Energy Certificates |
| Determine average daily usage during each partial month covered, and summing the daily average usage over the number of days in the calendar month. |
| Baseline regression model methodology | Explains the concept of normalisation (linear regression), and provides examples. | ISO 50006:2014 Energy Management Systems – Measuring Energy Performance Using Energy Baselines and Energy Performance Indicators methodology (Annex D) | CIBSE Guide F: Energy Efficiency in Buildings (Section 19) | CIBSE Guide F: Energy Efficiency in Buildings (Section 19) |
| Accuracy (appropriate goodness of fit of energy data to independent variables) | Explains Uncertainty Analysis, including how to calculate CV (RMSE). | IPMVP vol1 2012 (Appendix B) | CIBSE Guide F: Energy Efficiency in Buildings (Section 19) | CIBSE Guide F: Energy Efficiency in Buildings (Section 19) |
| Residential and targeted only | Baseline energy use characteristics of the equipment | Summarises how to estimate energy savings based on energy use characteristics i.e. load and hours-of-use, and the significant of whether components are constant or variable. | IPMVP vol1 2012 (section 4.7.1) | CIBSE TM22 - Energy Assessment and Reporting Methodology | CIBSE TM22 - Energy Assessment and Reporting Methodology |
|
| All | Commercial benchmarking of energy end use | Database which can be filtered based on building type and country. Outputs total energy consumption data and energy end use data (heating, cooling, lighting and total) to give a reality check against estimates. | Buildings Performance Institute Europe’s Data Hub for the Energy Performance of Buildings (see http://www.buildingsdata.eu/) | CIBSE TM46 - Energy Benchmarks | CIBSE TM46 - Energy Benchmarks |
| **4. Savings calculations** | Large tertiary and large residential only | Software | EN ISO 13790 specifies how to calculate the energy needs for heating and cooling (taking into account losses and gains) and zoning arrangements, while implementation of the calculation methodology needs to be validated according to the criteria in EN 15265. | EN ISO 13790:2008 Energy performance of buildings – Calculation of energy use for space heating and cooling *(used to check software calculations are appropriate)*  EN 15265:2007 Energy performance of buildings – Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures *(used to validate software calculations)* | The Building Regulations 2010 Conservation of Fuel and Power Approved Document L2A | The Building Regulations 2010 Conservation of Fuel and Power Approved Document L1A |
|
| Nationally recognised software modelling certification | Simulation development by an individual with appropriate qualification(s). | N/A (nationally recognised accreditation) | CIBSE Low Carbon Energy Assessor (LCEA) Level 5 certification OR Stroma Certification Ltd EPC level 5 | National Skills standard level 3,4,5 |
| Software modelling accuracy | Provides guidance on process for establishing results are reasonable, by comparing the simulation results to metered energy performance. | IPMVP Volume 1: 2012 (section 4.9.2) | CIBSE TM54 - Evaluating operational energy performance of buildings at design stage | CIBSE TM54 - Evaluating operational energy performance of buildings at design stage |
| Standard and targeted only | “Open-book” calculation methods/tools, and sound engineering methods | Describes how to determine and report energy savings. | IPMVP Vol 1 Section 4.5 Savings verification | - | - |
| Detailed guidelines for calculation methods and best practices | IPMVP provides an approach for evaluating, measuring, and verifying savings for systems and measures.  EN 16212 describes the principles for calculating energy savings. | IPMVP Vol 1 Section 4.7 Options A & B: retrofit isolation EN 16212 Section 6 Bottom-up saving calculations | CIBSE Guide F: Energy Efficiency in Buildings (section 18.8) | CIBSE Guide F: Energy Efficiency in Buildings (section 18.8) |
|
| Vetted calculation tools for calculation methods | N/A | N/A (nationally recognised tools, e.g. software, calculators, data sets, and databases) | - | - |
|  |  |  |  |  |
| Certification/credentials for individual carrying out analysis | Type 1 |  | - | - |
| Type 2 |  |
| Standard and targeted residential only | Certifications for individuals carrying out savings calculation development | N/A | N/A (nationally recognised certifications) | - | - |
|
| Large residential only | Residential simulation methodology guide | N/A | N/A | - | - |
|
|
| All | Inflation values | Source of European-wide inflation values, produced by the European Central Bank | ECB's Harmonised Index of Consumer Prices | UK Retail Prices Index | UK Retail Prices Index |
| Cost estimates for measures | Nationally recognised data source | N/A (national resource is required) | Spon's Price Book | Spon's Price Book |
| Guidance on carrying out Lifecycle Cost Analysis (LCCA) | Gives guidelines for performing life-cycle cost analyses of buildings and constructed assets and their parts. | ISO 15686-5:2008 Buildings and constructed assets - Service-life planning - Part 5: Life-cycle costing | UK Office of Government Commerce - Whole-life costing Guide 7 | UK Office of Government Commerce - Whole-life costing Guide 7 |
|
|
| Industry standard for report presentation of ECM, building, and energy use data | Sets out detailed requirements for reports. | ISO 50002:2014 Energy audits – Requirements with guidance for use (section 5.8, and Annex A.3 following Type 3) | CIBSE Guide F: Energy Efficiency in Buildings (Section 18.9) | CIBSE Guide F: Energy Efficiency in Buildings (Section 18.9) |
|
| **5. Design, construction and verification** | All | Systems manual preparation of all new and modified systems and equipment | Guidance on the technical documentation to be supplied with equipment or systems, in order to support its maintenance, and the documentation required the operation and maintenance requirements | EN 13460:2009 Maintenance – Documents for maintenance | CIBSE Guide M: Maintenance Engineering and Management (Section 9) | CIBSE Guide M: Maintenance Engineering and Management (Section 9) |
| **6. Operations, maintenance and monitoring** | All | Operator training in proper maintenance best-practices for all new systems and equipment | Description of best practices for the planning, management and control of maintenance in buildings | EN 15331:2011 Criteria for design, management and control of maintenance services for buildings | CIBSE Guide M: Maintenance Engineering and Management | CIBSE Guide M: Maintenance Engineering and Management |
| Large and standard residential only | Training standards for Residential Operator | N/A | N/A (National resource is required e.g. maintenance checklist) | CIBSE Guide M: Maintenance Engineering and Management | CIBSE Guide M: Maintenance Engineering and Management |
|
| **7. Measurement and verification** | All | Protocol option for large buildings | Option A: Key parameter measurement savings | IPMVP Vol 1 | IPMVP Vol1 | IPMVP Vol1 |
| Option B: All parameter measurement savings |
| Alternative protocol option for large buildings where there is no baseline data | Savings are determined through simulation of the energy use of the whole facility, or of a sub-facility | IPMVP Vol 1 | IPMVP Vol1 | IPMVP Vol1 |
|
| Routine adjustments | Procedure for carrying out routine adjustments | IPMVP Vol 1 | IPMVP Vol1 | IPMVP Vol1 |
| (energy-governing factors, expected to change routinely |
| during the reporting period, such as weather or production volume) |
| Certification/credentials for individual carrying out measurement and verification | Either certification with appropriate body or at least five years of demonstrated M&V experience, documented in the form of a CV outlining relevant project experience | AEE CMVP certification | CMVP | CMVP |
| Monitoring and measurement details and uncertainty guidebook | Provides draft protocols for systems and measures e.g. residential lighting, chillers, variable speed drives | IPMVP Vol 1 | IPMVP Vol1 | IPMVP Vol1 |