DESCRIPTION OF METHODOLOGIES AND CONCEPTS FOR THE TECHNICAL IMPLEMENTATION OF FEATURES ON IMPROVED HANDLING AND USE OF EPC DATA IN SELECTED COUNTRIES - EPC DATABASES

JUNE 2022

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 845958.

X-tendo

eXTENDing the energy performance assessment and certification schemes via a mOdular approach

D4.4 Description of methodologies and concepts for the technical implementation of each feature regarding improved handling and use of EPC data in selected implementing countries

June 2022

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 845958.

Project Acronym	X-tendo
Project Name	eXTENDing the energy performance assessment and certification schemes via a mOdular approach
Project Coordinator	Lukas Kranzl und Iná Maia – TU Wien
Project Duration	2019 - 2022
Website	https://x-tendo.eu/

Deliverable No.	D4.4
Dissemination Level	Public
Work Package	WP4
Lead beneficiary	Technische Universität Wien
Contributing beneficiary(ies)	BPIE, ADENE, DEA, TREA, ENEA, CRES
Author(s)	Iná Maia and Lukas Kranzl (TUW), Zsolt Toth and Jonathan Volt (BPIE), Cláudia Monteiro and Rui Fragoso (ADENE)
Co-author(s)	Kalle Virkus (TREA), George Koras, Lena Lampro and Elpida Polychroni (CRES)
Reviewed by	Casper Thielsen (DEA), Peter Mellwig (ifeu), Mieke Duerinck (VEA), Chris Hughes (SEAI), Nuno Baptista (ADENE), Silvia Urra (TECNALIA) and Benigna Boza-Kiss (IIASA)
Date	June, 2022
File Name	D4.4_final

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https://x-tendo.eu/wp-content/uploads/2022/08/X-tendo-D4.4_v4_rev07_RDA_with-cover.pdf

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EXECUTIVE SUMMARY

The X-tendo project is developing a framework of ten "next-generation Energy Performance Certificates (EPC) features", aiming to improve compliance, usability and reliability of the EPC. These features are divided in two categories: 1) innovative indicators and 2) innovative data handling practices.

This report describes the methodologies and concepts for the technical implementation of each innovative data handling feature - **EPC databases, building logbook, enhanced recommendations, financing options and one-stop-shops**. It also presents in detail the country-specific implementation of the developed methodologies in the X-tendo target countries.

The present report builds on past projects activities and provides input to upcoming technical implementation tools and guidelines (excel spread and programming code), as well as the testing of the methodologies in each implementing country. For additional information and further background, previous project reports are listed below:

1. Introductory reports of the 10 innovative EPC features (Deliverable 2.3)
2. Description of implementing partners' user needs and detailed technical specifications regarding features on handling and use of EPC data (Deliverable 4.2)
3. Summary of implementing partners' user needs and detailed technical specifications (Deliverable 4.3)
4. Tools, concepts and guidelines for features: building logbook, enhanced recommendations and EPC databases (Toolbox – area per each feature)
5. Recommendations and replicability potential (Toolbox – area per each feature)

The described methodologies and concepts will be implemented and tested during the forthcoming stages of the project. Together with the general feature concept, also country-specific aspects of the methodology are presented. The complete set of materials will be accessible online via the X-tendo Toolbox (https://x-tendo.eu/toolbox/).

This document is the revised version of the report completed in April 2021.

INTRODUCTION

This report describes the methodologies and concepts for the technical implementation of each innovative EPC data handling feature - EPC databases, building logbook, enhanced recommendations, financing options and one-stop-shops.

Energy performance certificates (EPCs) are an important instrument across Europe to assess and register information about building's energy performance. They have the potential to be used as more than just as a energy label, as they can provide market participants with relevant information to assess, benchmark and plan the improvement of the building's energy performance. Besides the information included in each document, data handling and the effective use of the information for wider building improvement and decision-making purposes are becoming more and more important. The Renovation Wave Communication published by the European Commission in October 2020 reinforced the importance of the existing EPC frameworks to improve the data gathering, storage, data mining, data analysis and overall quality of EPCs. Furthermore, the Commissions' proposal to recast the Energy Performance of Buildings Directive 2018/844 (EPBD) introduces comprehensive improvements, such as rescaling, design, additional indicators, and the requirement for the certificates to be available in digital format.

The, especially in regard to the last point, the five X-tendo features explore different functionalities on how to handle with digital EPC data. The present document describes in detail the methodologies and concepts of each feature: EPC databases (Chapter 2), building logbook (Chapter 3), enhanced recommendations (Chapter 4), Financing options (Chapter 5) and one-stop-shops (Chapter 6). For the features EPC databases, building logbook and enhanced recommendation, the described methodologies will be implemented as tools (project report 4.5 "Tools, concepts and guidelines for features: building logbook, enhanced recommendations and EPC databases").

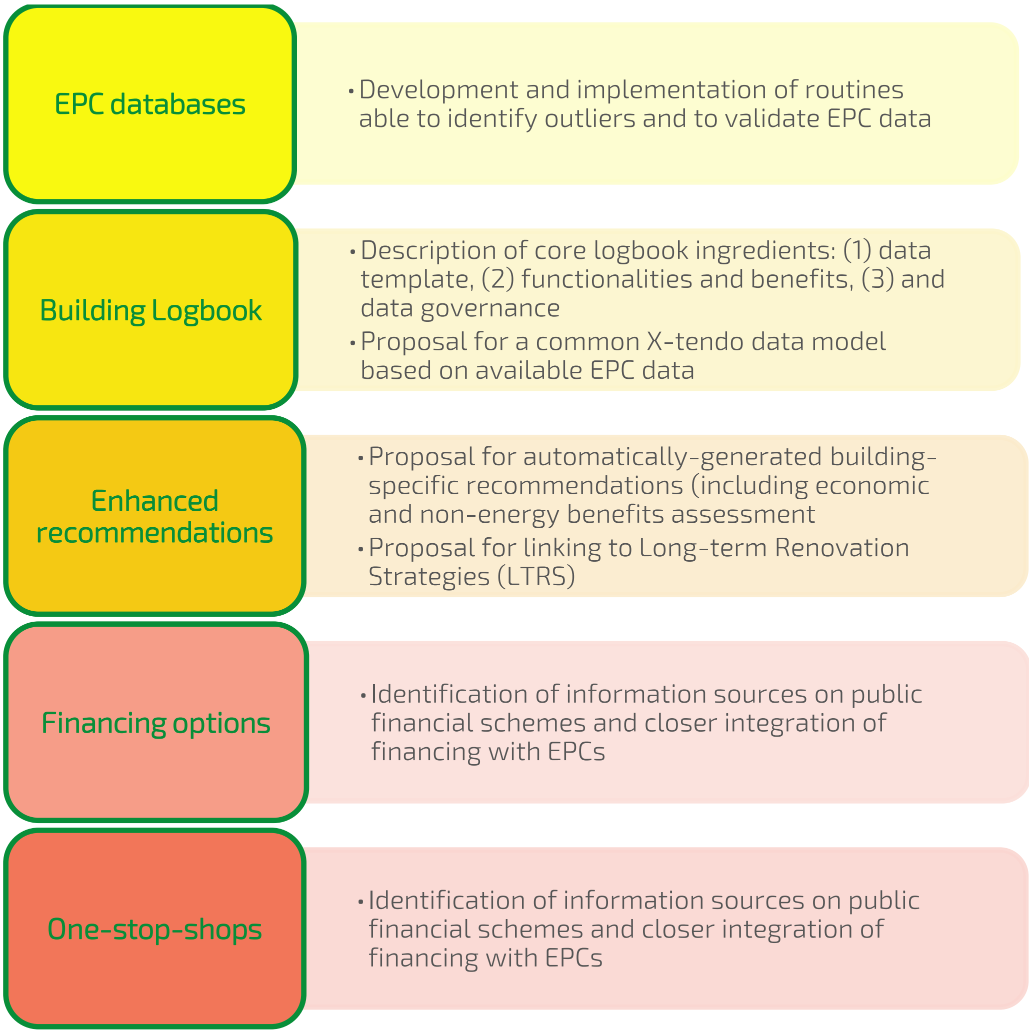

Figure 1: X-tendo methodology for features EPC databases, building logbook, enhanced recommendations, financing options and one-stop-shops

The methodology will be tested in different X-tendo implementing countries, as shown in the Table 1 below. The expert partners were responsible to share their national experience, especially relevant for setting up the final methodology.

	EPC databases	Building Logbook	Enhanced Recommendations	Financing Options	One Stop Shops
Feature lead	*TU Wien*	*BPIE*	*TU Wien*	*ADENE*	*ADENE*
Austria, EAST			Expert		
Denmark, DEA	Implementer		Implementer	Implementer	Implementer
Estonia, TREA		Implementer			
Greece, CRES	Implementer	Implementer			
Italy, ENEA	Implementer				
Poland, NAPE			Implementer	Expert	
Portugal, ADENE		Expert / Implementer		Implementer	Expert
Romania, AAECR				Implementer	Implementer
UK, EST	Expert		Implementer		Implementer

Table 1: Implementing and expert countries per feature

1 EPC DATABASES

1.1 Feature introduction

EPC databases store EPCs and underlying data, making it an important tool that allows public authorities to source building stock information and check compliance. The implementation and improvement of EPC databases involve the consideration of aspects such as how to set up an EPC database, how to gather the data, how to establish the interoperability of different databases, and how to use data and extract relevant insights from it. Finally, ensuring the reliability and accuracy of the information stored in the database through quality assurance processes and data verification remains a key requirement common to all EPC schemes. Because of that, the X-tendo methodology focuses on defining and establishing data quality routines of EPC databases. The Figure 2 below presents the stages of an EPC issuing process, and the appropriate quality control routines that can be applied in each stage:

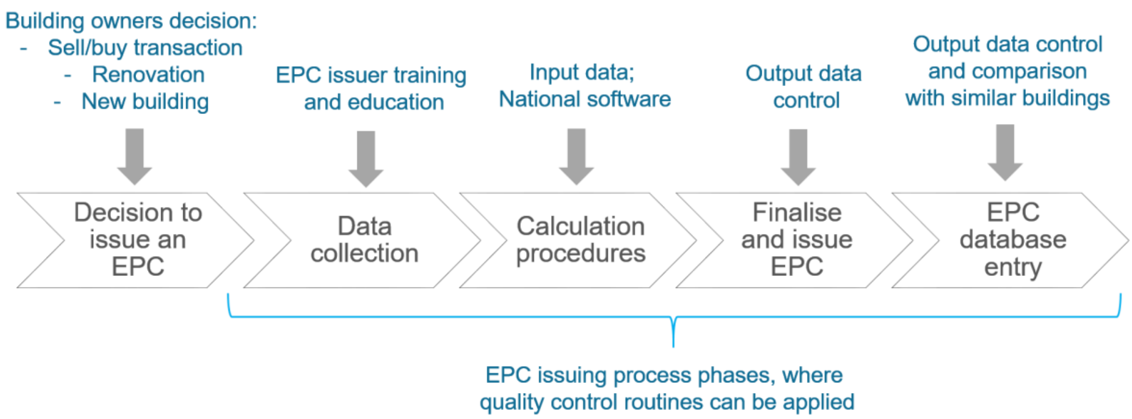

Figure 2: EPC issuing process phases and possible application of quality control routines

In X-tendo, we focus on the last step of the figure above, i.e. on the point where the EPC is fed into the EPC database and where quality control measures can be applied, either before issuing and storing it in the database (for example, directly performed in the EPC issuing program). Or, in other cases, where the EPC is already in the database. This will depend on the regional versus national database structure.

1.2 Proposed methodology

Figure 3 below shows the proposed quality control method developed by the X-tendo project for EPC databases. In some cases, especially if there is an exchange between the EPC database manager and EPC software developer (as it is the case in Denmark), step 1 a can be performed directly during the EPC issuing process. In the context of X-tendo, the steps 1 to 3 described below are performed after the EPC has been issued, directly in the Database. Step 4 consists of describing how an analysis of the verification results can be done:

1) *First threshold value verification* requires all EPCs in the database to be automatically verified. At this stage, a **"broad" threshold value check** (broad range) is performed for a series of EPC parameters, for example whether U-values fulfil the requirement to be greater than (>) 0. The set of rules for this first step is explained in section 1600763124.0.
2) *Second threshold value verification*. In this second stage, a more **"narrow" threshold value check** (narrow range) is performed for previously defined building archetypes. The verification rules are set for different building *archetypes* that are defined by clustering different parameters and their sub-groups (building type, building construction year, climate zone etc.). Like the previous one, this step is being done automatically. The methodology used to define archetypes and threshold values are explained in section 1600763124.0.
3) *EPC flagging* according to the identified faults, notification of the inconsistencies, and indication of EPCs that will require manual checks. The EPC is flagged according to the severity and number of inconsistencies and receives a final score. The calculation of this score is explained in section 1600763124.0. The flagging contributes to a targeted selection of the EPCs which have to be manually audited. However, the manual check is not included in the present X-tendo methodology.
4) *EPC database analysis* refers to the analyse the results from the EPC database quality control. The results of the quality control represent an important feedback loop to improve education curricula of energy auditors and EPC assessors. The main objective is to prevent common mistakes and avoid that not valid EPCs are logged in the database or stays stored.

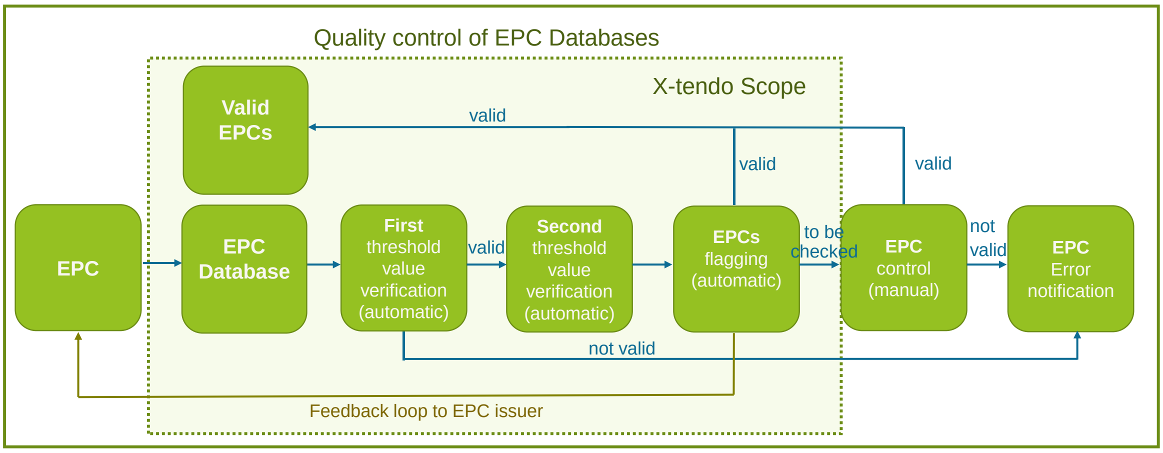

Figure 3: Outline of the proposed quality assurance method

IT architecture

Steps 1 to 3 (as described in the chapter 1.2) will be implemented via a programming code in Python Language. The programming code consists of an interface through a DAO (data access object) between the national EPC databases and the core code. The data source from which the building data is gathered, is not assumed to be uniform among countries, therefore an Abstract DAO specifies a common interface which should be implemented for each country. The Abstract DAO operates as interface between the "country specific" database and the core code that performs the constraints checks. The implementing class is the ideal place to handle database transactions and other persistence-related tasks. The Figure 4 below presents how the DAO interface and the code happens.

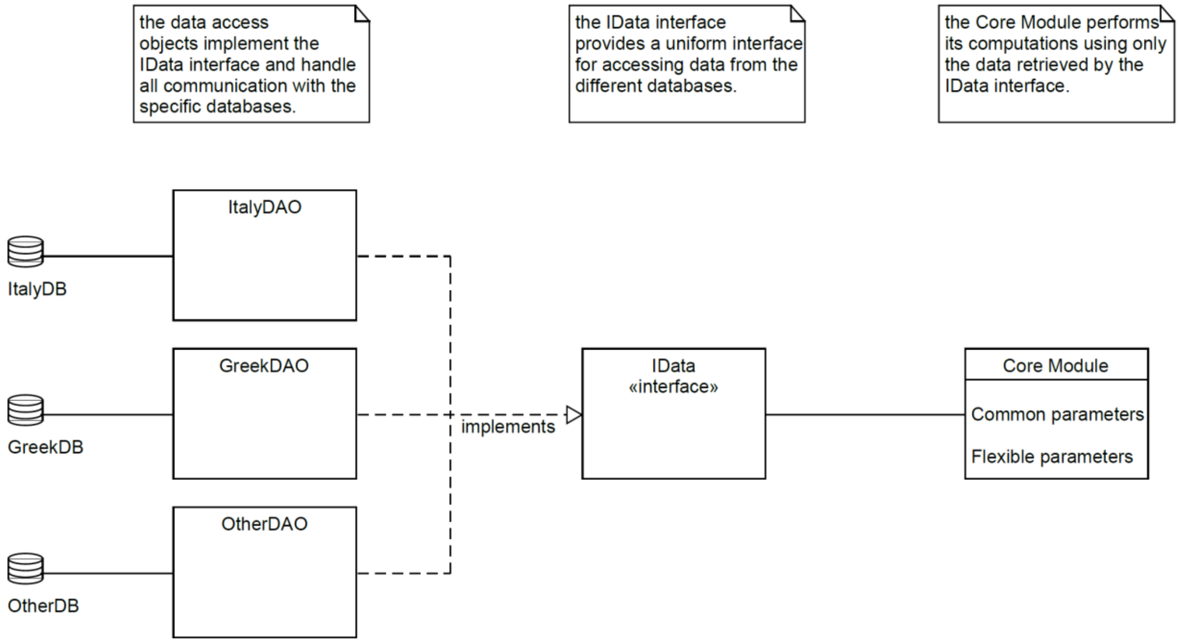

Figure 4: DAO Interface between countries' EPC database and X-tendo core code

The core code performs the verifications based on the rules set for first and second value check. Because of the country specific singularities, models will be developed for each country (Italy and Greece). Each code will be tested by the X-tendo implementing partners by running it on their own EPC database. Together with the programming code, a user handbook and a code documentation will be provided with relevant information as input data, explanations and guidelines on how to use the code[1].

1.3 Countries' implementation

The methods will be applied in the different X-tendo countries as follows:

- **Denmark** will implement and test the concept for an automatised EPC database analysis. As pos-project activity, the results will be used as feedback loop to improve education programmes for energy auditors and EPC assessors

[1] The programming code will be part of the project deliverable "Tools/ IT-Components and related documentation of the proposed calculation and data handling procedures to be tested in WP5" (Project deliverable D4.5)

- **Greece and Italy** will implement and test the first and second verification checks as well as the EPC flagging;

Setting the rules for the first verification check

The first type of checks consists of verifying the EPC parameters in a **"broad" threshold value check** (broad range). For exemaple, "*U-value external wall not empty or smaller than 0*" and "*Surface area external wall not empty or smaller than 0*". At this first checkpoint, the dependence between parameters and their values can also be specified. For example, the value of *heating degree days* has to be in a specific range depending on the *climate zone*. Therefore, it is necessary to define which EPC parameter should be checked and what rules should be applied.

In the X-tendo project, the rules[2] for the first check were determined in a country specific manner. For Italy, a total of 50 rules were set up. For Greece, a total of 45 rules were specified (available in ANNEX II – Rules first threshold check (per country)). In the future, these rules can be extended. In Denmark, about 350 rules have already been implemented before the start of the X-tendo project.

Setting the rules for the second verification check

To define the rules for the second verification check, the following process steps were followed: (1) the definition of EPC parameters that should be checked, (2) the identification of the building parameters and their sub-groups to define building cluster, and (3) a statistical analysis of the actual EPC database to define the threshold values of parameters defined in (1) per building cluster (2). Each of these parts are explained below:

1. Define the EPC parameters

Both X-tendo implementing partners Greece and Italy defined the EPC parameters that should be checked in the second verification. Example of chosen parameters are final energy consumption for heating and final energy consumption for cooling. For Greece 15 parameters were defined, and for Italy 11 (ANNEX IV – Parameters second threshold check (per country)).

2. Definition of building cluster

A building archetype is defined by the combination of different building parameters and their sub-groups. For example: the building parameter *building use* has following sub-groups *residential, office, school etc.* The building parameter *climate zone* might have following sub-groups *subtropical temperate and hot temperate.* An exemplary archetype that

[2] These rules are also implemented in the project deliverable "Tools/ IT-Components and related documentation of the proposed calculation and data handling procedures to be tested in WP5" (Project deliverable D4.5), which is a programming code in Python.

consists of sub-groups from building use, construction period and climate zone is: *residential-until 1910- subtropical* (ANNEX III – Cluster parameters (per country)).

3. Define the threshold values for the parameters defined in *step 1*, for each cluster defined in *step 2*

In this final step, the threshold values were defined. The definition of these values was based on statistical analysis of the current EPC databases. For each EPC parameter and each building cluster defined (previously described in steps 1 and 2), different percentiles (80-99%) were extracted from the actual database. The chosen appropriate percentile (for example, 99%) define the threshold values.

The X-tendo implementing partners Greece and Italy defined both the different building parameters as their sub-groups, allowing that country specific definition of building archetypes according to their building stocks and their country's characteristics. For Greece 324 archetypes were defined, and for Italy 240 – delivered from the information in (ANNEX III – Cluster parameters (per country)).

EPC flagging

Flagging the EPC means calculating a final score, based on the verification rules, to classify the EPC according to the risk (the higher the number of violations, the higher the risk). The final score represents the percentage of violated rules: with 100% riskiness, all rules were violated, while 0% means no violation. Other point, is that if the 1st level rules some parameters specified as "mandatory compliance" are violated, the 1st level score is automatically 100% (risky EPC). Example for these parameters are: energy class, buildings heating energy needs, global carbon dioxid emission, global primary energy demand renewable and global primary energy demand not renewable.

Analysis of EPC inconsistencies

In Denmark, the Danish Energy Agency has already implemented standardised rules[3] to verify the EPCs in the database and to identify potentially risky EPCs, that will be then manually checked. Some of the rules used by the DEA are similar to the verification checks specified in the steps 1 and 2 above. While issuing the EPC in Denmark, the energy auditor can receive automatically generated warnings, according to the input values entered in the software. There are different types of warnings: if the warning is red, the energy auditor cannot finalize the EPC issuing as long as the warning remains. If the warning is yellows, the EPC can be issued (and consequently are logged into the database), but will be flagged

[3] More details about how these rules are set in the Danish case can found in the report "Description of implementing partners' user needs and detailed technical specifications regarding features on handling and user of EPC data".

according to the riskiness (number of warnings). Then, the flagged EPCs will go through the risk-based quality control.

This section describes a routine to provide standardised routine to define rules to assess EPCs as part of the quality control methodology. This routine is described and explained for an illustrative case study applied to the Danish EPC Database. By setting and applying these rules, it is possible to identify which rules are violated frequently and their severity. This evaluation allows improvements in different areas: 1) setting (and adjusting) the validation rules; 2) specification of calculation procedures and tools to specify the value of data fields or 3) informing training materials for energy auditors and professionals accredited to issue EPCs.

The main objective of these evaluation is to verify the consistency of EPCs input data

compared to threshold values. The steps followed in this evaluation are:

1. **Selection of the building element**: the first step is to choose the building elements/and or components that will be evaluated, as windows, roofs, external walls, etc;
2. **Specify the characteristics of these building elements**: in this step, the characteristics are specified, for example: according to the building construction period;
3. **Selection of the EPC parameters and their rules**: for each building element and/or component, the representative EPC parameters and the threshold value, as well as, the rule should be defined. The differentiation according to the historical development of the building code standards might also be taken into account;
4. **Database extraction**: after all the definitions above have been made, the information can be extracted from the database. This activity allows the identification of the number of EPCs per defined category, the number of violations per rules, and consequently the percentage of faulty EPCs.

Table 2 below shows the results obtained from a case study in Denmark, following the steps described above. In this illustrative table, linear thermal transmittance, windows and roofs are chosen, and represented by the parameters y- and U-values. The table also shows that the threshold values vary due to the evaluation of the Danish building code standards that have become more restrictive over the time. The parameters are classified according to different construction periods and user codes. The user codes, in Denmark, represent different building uses, for example: single family house (120) and multifamily house (140). The last column shows the results obtained.

Building element	Constructin period and user codes	Parameter, Rule and Threshold value	Total numbers of EPCs with year and usecode conditions	Number of violations	Percentage Violation
Linear thermal transmittance	Before year 1973	y > 0,80 W/m·K	8611	33	0%
	Year 1973-2000	y > 0,70 W/m·K	3122	141	5%
	Year 2001-2006	y > 0,60 W/m·K	321	18	6%
	After year 2006	y > 0,40 W/m·K	3047	72	2%
Windows	Year 1972	U > 2,8 W/m²·K (1972)	330	71	22%
	Year 1973-2000	U > 2,8 W/m²·K (1973-1994) U > 1,9 W/m²·K (1995-2000)	3140	464	15%
	Year 2001-2006	U > 1,9 W/m²·K (2001-2006)	324	61	19%
	After year 2006	U > 1,9 W/m²·K (2007) U > 1,5 W/m²·K (2008-)	3055	256	8%
Roofs	Year 1960-1972 and usecodes 110, 120, 130, 131 and 132	U > 0,43 W/m²·K (1960-1972)	2750	641	23%
	Year 1973-2000 and usecodes 110, 120, 130, 131 and 132	U > 0,43 W/m²·K (1973-1979) U > 0,30 W/m²·K (1980-1994) U > 0,20 W/m²·K (1995-2000)	2914	698	24%
	Year 2001-2006 and usecodes 110, 120, 130, 131 and 132	U > 0,20 W/m²·K	286	78	27%
	After year 2006 and usecodes 110, 120, 130, 131 and 132	U > 0,20 W/m²·K	2637	42	2%

Table 2: Evaluation of EPC inconsistencies, example from Denmark

The main findings of the analysis done within the X-tendo project suggest that most violations and data inconsistencies concern the input values related to roofs. The analysis and discussions with the X-tendo implementing partner DEA reveal different reasons for this pattern: over the past 20 years, the building documentation, in general, has increased and improved rapidly. Also, digitalisation has been playing an important role, as it enabled that building drawings from the building's planning phase could be saved and used in subsequent stages of the building's lifecycle. This also means, that for the buildings constructed before this period, there is still a lack of documentation, as for example ceiling and roof drawings. Consequently, energy auditors and consultants have to estimate the U-value of the roof. Then, two possible reasons are identified, one is the wrong estimation made by the energy auditor and the other is that in fact the building does not comply with the regulation requirements. In terms of feedback loop, on how to improve the training curricula of energy auditors and other professionals, the present analysis indicates that education programmes should focus on methods of how to accurately estimate U-values for the roofs and additional equipment that help better assessing the thermal performance of roofs.

Other results (showed in the Table 3) from this analysis revealed inconsistencies such as double entries or empty parameter values. However, they are numerically not significant and also not relevant for the main objective of this demonstration.

Linear thermal loss	
EPCs in same category	15101
Doubles	17
EPCs without linear thermal loss	70
	15154
Windows	
EPCs in same category	15171
Doubles	19
EPCs without windows	2
	15154
Roof	
EPCs in same category	15145
Doubles	19
EPCs without roof	28
	15154

Table 3: Secondary identified inconsistencies, example from Denmark

The described method below was implemented in the Danish EPC quality control routine. One of the objectives are to define new rules (for the validation of EPCs), under which the EPCs will be verified. This is the preliminary work of the later performed risk-based EPC control. The risk-based control substitutes control method based on random selection, by a risk-based selection of EPCs. In Denmark, the rules are applied during the EPC issuing processes, which allows that: EPCs that do not comply with certain rules cannot be issued. Or, if other (less serious) rules indicate unrealistic registrations, at least the EPC consultant is forced to thoroughly explain the registration and why it deviates from the rule. In the testing performed (reported in the project deliverable D5.3) the risk-based control is focused on new building EPCs issued in 2019. The results from the control can be used to develop new validation rules and function in other parts of a feedback loop. The control was purely based on data and has already today resulted in new validation rules in Denmark.

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ANNEX I – PRE FABRICATED RECOMMENDATIONS

Number	Benefit
1	Decrease heating energy demand: every degree lower room temperature saves heating energy. Usually 20 to 22 C° is sufficient in living rooms, 18 to 20 C° in the kitchen, 23 C° in the bathroom and 16 to 18 C° in the bedroom.
2	Decrease heating energy demand and increase indoor air quality: tilted windows provide constant fresh air. However they also cool down the air. Correct ventilation should be provided 2 to 3 times a day for about 4 to 5 minutes, with open windows and doors in all rooms. This ensures the necessary air exchange.
3	Decrease heating energy demand by keeping radiators free: Prevent furniture, curtains and curtains in front of radiators so the heat can spread evenly throughout the room.
4	Decrease heating energy demand and increase thermal comfort with automatic regulation: programmable thermostats ensure more comfort and less heating energy consumption. This allows rooms to be heated according to the use of the room, and end-user presence.
5	Decrease heating energy demand and increase indoor air quality with efficiency radiators: if radiators do not warm up properly even though the thermostat is fully turned on, it causes a waste of energy. By using regular valves energy savings can be provided.
6	Decrease heating energy demand and increase indoor air quality by cleaning the radiator regularly. Dust has an insulating effect and reduces the efficiency of the radiator.
7	Decrease heating energy demand: install insulation panels behind radiators. An insulation layer behind the radiator reduces the heat loss via the outer wall. Attention: check regularly whether moisture is forming between the panel and the wall.
8	Decrease heating energy demand: windows insulation by using sealing tape can provide high energy savings with lower investments costs.
9	Decrease heating energy demand: keep blinds and curtains closed at night to prevent heat from escaping the room on cold nights.

ANNEX II – RULES FIRST THRESHOLD CHECK (PER COUNTRY)

Greece

Variable Name	Rule
Climate zone	In the range [1;4]
U-value external wall	Greater than 0
U-value roof	Greater than 0
U-value door	Greater than 0
U-value floor against ground	Greater than 0
Surface area external wall	Greater than 0
Surface area roof	Greater than 0
Surface area door	Greater than 0
Surface area floor against ground	Greater than 0
Surface area window	Greater than 0
Window glazing U-value	Greater than 0
Window g-Value	Greater than 0
Sun protection (Shading)	Greater than 0
Heat Efficiency	Greater than 0
Cooling Efficiency	Greater than 0
Lighting	Greater than 0
Building use	In the range [1;60]
Reason	In the range [1;19] or Equals 99
Suggestions	If the energy class is C or worse, at least one suggestion is required
Primary Energy For Heating	Greater than 0
Primary Energy For Cooling	Greater than 0
Primary Energy For Lighting	Greater than 0
Primary Energy Consumption	Smaller than 5000
Reference Building Primary Energy Consumption	Smaller than 5000
CO2 emmissions	Greater than 0
Gross building area	Greater than 0
Useful building area	Greater than 0 and less than or equal to Gross building area

Useful building volume	Greater than 0
Heated area	Greater than 0 and less than or equal to Gross building area
Cooled area	Greater than 0 and less than or equal to Gross building area
Heating days	In the range [1;364]
Climate region	In the range [1;4]
Windows orientation	In the range [1;359]
Ventilation system type	Is not null
Mechanical ventilation system exists	In the range [0;1]
Heating energy source	Element of ["LPG", "Natural Gas", "Electricity", "Heating Diesel oil", "Transport Diesel oil", "Distrinct Heating (PPC)", "Distrinct Heating (Renewable)", "Biomass", "Standardized Biomass"]
Reference heating energy needs	Greater than 0
Building's heating energy needs	Greater than 0
Domestic hot water energy needs	Greater than 0
Useful heating energy (dhw)	Greater than 0
Useful electricity demand	Greater than 0
Primary energy demand	Greater than 0
Carbon dioxid emission	Greater than 0

Italy

Variable Name	**Rule**
Cadatral identification of buildig ID	Is not null
User profile (name or code)	In the range [0;14]
Statistical code of the Region	In the string range [01;22]
Regional ID of the EPC	Is not null
Heated area	Greater than 0
Cooled area	Greater than 0
Heated bruto-volume	Greater than 0
Cooled bruto-volume	Greater than 0

Building envelope area (heat loss area)	Greater than 0
Compactness (based on heat loss area)	Greater than 0
Heat degree days	Complex table-based check
Climate region	Complex table-based check
Yie-value periodic thermal transmittance	Greater than 0
Equivalent solar Area/net heated area Ratio	Greater than or equal to 0
Mechanical ventilation system exists	Boolean value
Building structure	In the range [0;14]
Heating energy sources	In the range [0;15] if Space heating service exists
Cooling energy sources	In the range [0;15] if Space heating service exists
Energy demand for each energy source	Greater than 0
EPhnd,lim -> indicator	Greater than 0
Building's heating energy needs	Greater than 0
Reference Global primary energy demand (not renewable)	Greater than 0
Global primary energy demand (not renewable)	Greater than or equal to 0
Global primary energy demand (renewable)	Greater than or equal to 0
Global carbon dioxid emission	Greater than 0
Exported eletrical energy (for example: PV)	Greater than or equal to 0 or null
Primary energy demand (not renewable)	Complex table-based check
Space heating service exists	True
Heating primary energy demand (not renewable)	Greater than or equal to 0
Heating primary energy demand (renewable)	Greater than or equal to 0
Heating system efficiency	Greater than 0
Space cooling service exists	Boolean value
Cooling primary energy demand (not renewable)	If Space cooling service exists then Greater than or equal to 0
Cooling primary energy demand (renewable)	If Space cooling service exists then Greater than or equal to 0
Cooling system efficiency	If Space cooling service exists then Greater than to 0
DHW service exists	True if user profile equals 0 or 2

DHW primary energy demand (not renewable)	If DHW service exists then Greater than or equal to 0
DHW primary energy demand (renewable)	If DHW service exists then Greater than or equal to 0
DHW system efficiency	If DHW service exists then Greater than 0
Mech Vent primary energy demand (not renewable)	If Mechanical_Ventilation System Exists then Greater than or equal to 0
Mech Vent primary energy demand (renewable)	If Mechanical_Ventilation System Exists then Greater than or equal to 0
Mech Vent system efficiency	If Mechanical_Ventilation System Exists then Greater than 0
Lightning is considered	Boolean value
Lighting primary energy demand (not renewable)	If Lightning is considered then Greater than or equal to 0
Lighting primary energy demand (renewable)	If Lightning is considered then Greater than or equal to 0
Lighting system efficiency	If Lightning is considered then Greater than 0
Transport systems are considered/exist	Boolean value
Transport primary energy demand (not renewable)	If Transport systems are considered then Greater than or equal to 0
Transport primary energy demand (renewable)	If Transport systems are considered then Greater than or equal to 0
Transport system efficiency	If Transport systems are considered then Greater than 0

ANNEX III – CLUSTER PARAMETERS (PER COUNTRY)

Greece

Building uses

Residential single family houses
Residential multifamily houses
Hotels of continuous yearly operation
Hotels of intermittent operation – summer
Primary education schools
Secondary education schools
Higher education buildings
Hospitals
Offices

Climate zones

A
B
C
D

Construction period

1	Before 1980	no any insulation regulations in force
2	1980-2010	1st Building Insulation Regulation
3	2010-todate	2010-Transposition of EPBD & 1st Energy Performance Regulation

Renovation period

1	No renovation
2	2010-2017
3	after 2017

Italy

Building uses

1	Residential
2	Office buildings
3	Commercial buildings
4	Buildings for industrial and craft activities
5	Other not residential

Building constructions period

1	Before 1945
2	1945-1976
3	1977-1991
4	1992-2005
5	2006-2015
6	From 2016

Climate zone

1	A+B (<= 900 HDD)
2	C (901<=HDD<=1400)
3	D (1401<=HDD<=2100)
4	E (2101<=HDD<=3000)
5	F (HDD>= 3001)

ANNEX IV – PARAMETERS SECOND THRESHOLD CHECK (PER COUNTRY)

Greece

Envelope characteristics	**Unit / comment**
U-value external wall	W/m2K
U-value roof	W/m2K
U-value floor against ground	W/m2K
U-value floor on pilotis	W/m2K
U-value windows	W/m2K
Energy consumption class	
Total Primary Energy Consumption	kWh/m2
HVAC Systems Data	
Heating System Efficiency	SCOP
Cooling System Efficiency	SEER
Mechanical Ventilation system (air supply)	m3/h
Solar Collector Area	m2
Energy Consumption Indicators	
Total final Energy Consumption	kWh/m2
Energy Consumption for Heating (final)	kWh/m2
Energy Consumption for Cooling (final)	kWh/m2
Energy Consumption for Lighting ** (final)	kWh/m2
Energy Consumption for DHW (final	kWh/m2

** only for non-residential

Italy

Building characteristics	**Unit / comments**
compactness	1/m
yie-value periodic thermal transmittance	W/m2K
Equivalent solar Area/net heated area Ratio	[-]
Specific energy demand indicators	
building's heating energy needs	kWh/m²a
Global primary energy demand (not renewable)	kWh/m²a
Global primary energy demand (renewable)	kWh/m²a
Global carbon dioxid emission	kg/m²a
Specific energy demand indicators	
Heating primary energy demand (not renewable)	kWh/m²a
DHW primary energy demand (not renewable)	kWh/m²a
Dimensionless energy indicators	
Heating primary energy demand (not renewable)/building's heating energy needs ratio	[-]
Reachable global primary energy demand (not renewable)/ Global primary energy demand (not renewable) ratio	[-]

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 845958.