Level(s) and EU standards – tighten cooperation

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Level(s), the common EU framework of core indicators developed by the European Joint Research Center (JRC), wish to develop a common language of sustainability for buildings. The European standardisation and European funded H2020 project ALDREN have the same goal. Responsible experts from these three entities met together to harmonise the common language on the Level(s) indicator 1.1 related to the use stage energy performance. The main discussion points are reported hereafter.

Keywords: Renovation wave, Taxonomy, EU standards, Buildings Energy efficiency, Common sustainability indicators

Context

Developed as a common EU framework of core indicators by the European Joint Research Center (JRC) for the sustainability of office and residential buildings, Level(s) provides a set of indicators and common metrics for measuring the performance of buildings along their life cycle.

Level(s) is an important step towards a common EU framework of core indicators. This common language should enable actions, to be taken at building level, that can make a clear contribution to broader European environmental policy objectives and support the EU taxonomy.

Level(s) completes, and is completed, by additional work done in European standardisation (especially under mandate M/480[1)]) and European funded H2020 projects (e.g. ALDREN https://aldren.eu/, CEN-CE https://www.cen-ce.eu/) which are providing more detailed methods, practical tools for application, training and certification of experts within the common framework comparable with Level(s).

The goal of Level(s)s is to create a common language. Therefore, it is extremely important that all this complementary work done in Level(s), the EU standards and the EU funded projects, use the same vocabulary (e.g. definitions, procedures, etc) to be well understood by the building professionals. Only if Level(s) is as much as possible in line with CEN and ISO standards (the technical tools of building professionals) and with common indicators already widely used, the goal of a common language will be reached and "spoken" between the main actors involved in building energy and sustainability performance.

Level(s) is structured around:

- an overarching set of 6 macro-objectives in areas such as energy, material use, waste management, water and indoor air quality;
- a set of 16 common indicators.

1) The EU Commission gave mandate (M480) to CEN and financed the development of a set of EPB ISO/CEN standards for the calculation of energy performance of buildings. Some of these standards are referenced in the EPBD.

The set of 6 macro-objectives in Level(s).

One of the Level(s) indicators is Level(s) indicator 1.1: Use stage energy performance. Primary energy use is the required metric for reporting on the energy performance of buildings across the EU. The energy performance of a building, expressed in primary energy, is used for both compliance with minimum energy performance requirements and for the Energy Performance Certificates (EPCs)

The primary energy use is also the main indicator developed in EN ISO 52000-1 "Energy performance of buildings — Overarching EPB assessment — Part 1: General framework and procedures".

In the European H2020 project ALDREN, a proposal for a European Energy Performance Certificate, the ALDREN EPC, has been developed.

Therefore, following an open letter addressed by CEN/TC 371 Energy Performance of Building to JRC, the leadership from CEN/TC 371, EPB Center, the ALDREN project and the JRC expert involved met together trying to cross fertilise and harmonise the different approaches in the JRC Technical Reports on Level(s) indictor 1.1 (actually under revision).

Instructions for three Levels:

⁘ Level 1

This level is for those users who would like to:
- Understand the energy uses associated with the type of building they are working on, and
- Know where they can focus attention in order to reduce the primary energy use associated with the building's delivered energy during the use stage.

⁘ Level 2

This level is for those users who are at the stage of needing to calculate the delivered and primary energy use of a building for the purpose of design comparisons, building permitting or tendering.

⁘ Level 3

This level is for those users who would like to:
- Collect metered data in order to understand the energy use associated with the building they are working on, and
- Carry out testing of the building in use in order to identify any performance issues with the building fabric and technical services.

Due to the short time, **proposals for future harmonisation** are **focussed on level 2** (to calculate the energy needs and primary energy use).

The main discussion points

Hereafter are resumed the main discussions. The crucial issues were:

- common definitions (e.g. energy needs, energy use, delivered energy, primary energy);
- sharing the same concept (e.g. only one assessment boundary);
- define the unit of measurement (e.g. non-renewable primary energy);
- precise the boundary conditions and hypothesis (e.g. treatment of exported energy).

	Level(s)	Comment	Proposal
	Introductory briefing		
1	Unit of measurement (page 7) **total** primary energy demand in the use stage of a building	More and more Member States move from **total** to **non-renewable** primary energy. If in some countries on-site renewable energy is subtracted from the total primary energy, total primary does not **valorise renewable energy production e.g. at "nearby" level** (e.g. biomass at district heating). Using total primary energy will also require **separate valuation of use of ratio of RES**. *Note: See Recommendation for NZEB by European Commission (2016) referring to EPBD Concerted Action III book, 2016:* It is indirectly recommended to use **non-renewable primary energy factors**: *"The concept of NZEB reflects the fact that renewable energy and efficiency measures work together…. Therefore, higher and more demanding requirements for highly efficient NZEB will also drive an increased use of on-building renewables and should result in adaptation of primary energy factors for off-site energy carriers, taking their renewable energy content into account."*	Change to "**non-renewable"** primary energy
2	System boundary (page 7) assessment boundary is the **building**	The "**functionality"** of "assessment boundary" is essential to understand 5200-1	**Add definition** of the "assessment boundary" *boundary where the delivered and exported energy are measured or calculated*
3	System boundary (page 7) **Inside** the assessment boundary, **primary energy factors** shall apply to all forms of energy generation that supply the delivered energy **needs** of the building, as well as any exports	According to 52000-1: **Primary energy factors** are used **outside** the assessment boundary to take into account the outside losses of the energy chain and to convert delivered energy into primary energy. **Inside** the assessment boundary the energy losses are calculated explicitly. Energy "**needs**" are defined as e.g. for heat the energy delivered ("needed") to a thermally conditioned space to maintain the set point temperature. This make the difference with "energy use" and "delivered energy". The losses of the technical systems are not considered in "needs" but are considered in the energy use (energy needs + system losses = energy **use**).	Change "inside" to "outside" Delete "**needs**" **Check the use of "needs" in the whole document.** The definitions of the ISO/CEN standards should be used.
4	Scope (page 7) The minimum scope of the indicator reflects those energy **needs** defined by the Energy Performance of Building Directive - heating, cooling, ventilation, domestic hot water and (built-in) lighting and other technical building systems.	See comment before	Replace "**needs**" by "**delivered energy and the losses of the whole energy chain**" *Note:* *Sometimes "energy demand" is used in general sentences that does not refer to a specific indicator but to service.*
5	Calculation method and reference standards (page 7) …they must be compliant with the EN ISO **52000-1** series	EN ISO 52000-1 is the overarching standard (one standard). The series of EPB standards in ISO the 52000 family. see for a complete overview of the set of EPB standards https://epb.center/documents/	Delete "**-1**"

	Level(s)	Comment	Proposal
	Instructions for Level 2 (p 11)	**for those users who are at the stage of needing to calculate the energy needs and primary energy use…**	
6	L2.2 Step-by-step instructions **Point 8.** Apply primary energy factors to the energy carriers used for the calculated **energy needs** in order to obtain the **total** primary energy.	It is recalled that the energy "**needs"** are without the technical system losses. Therefore, the primary energy factors cannot be applied on the energy needs	Replace "energy needs" by "**delivered energy**"
7	L2.3 What do you need to make an assessment? (page 11) An appropriate calculation software tool that is compliant **with the national or regional calculation method for the relevant Member State**	In "*Options for ensuring the consistency of the energy calculation method used*"(p19) **compliant options** available to users of the Level(s) framework across the EU are indicated including standards developed under mandate M/480	Complete "…for the relevant Member States... **or compliant options based on CEN standards developed under mandate M/480"**. Complete it in whole level(s).
8	L2.5 Ensuring the comparability of results (page 12) The primary energy factors associated with extraction / generation and transport of energy carried to the building	There are many other boundary conditions related to the primary energy factors like related to the time horizon, net or gross calorific values, conventions related to energy conversion etc. All these choices are reported in CEN EN 17423.	Replace " …PEF associated with extraction…." by "**the choices related to primary energy factors should be reported according to EN 17423**".
9	L2.7 Format for **reporting** the results of an assessment (P12) Delivered energy **needs** assessment	See comments related to "needs" before. The reporting format is very limited and not sufficient to provide a clear picture of the energy performance of a building. The ALDREN EPC provide a complete set of indicators and reporting.	Replace "Energy needs" by "**Energy use**". Take over the reporting of the ALDREN EPC
10	L2.7 Format for **reporting** the results of an assessment (P12) exported energy is missing	In "L2.2 – Steps 1-2: The calculation methodology to be used" (p20) it is mentioned "It is important to note that exported renewable energy is to be reported separately".	**add** "**energy export**" to the **reporting table**
11	L2.7 Format for **reporting** the results of an assessment (P13) L2.2 **Unregulated** total primary energy	Unregulated total primary energy (e.g. plugin loads, lifts, etc) is mostly not taken into account in national regulation, neither in the 52000 series.	**Make the reporting** of unregulated total primary energy **optional.**

	Level(s)	Comment	Proposal
	Guidance and further information for using the indicator – for using level 2		
12	L2.2 – Steps 1-2: The calc. methodology to be used (p 19) …national calculation methods …. **shall** be the **main reference** methods for reporting …. **Compliant options** available to users of the Level(s) framework across the EU include…	Levels clearly state to principle of "**equivalences**". Why introduce a hierarchy between options? There is not transparency and comparability between national calculation methods. In some MSs even seasonal method can be used and some systems are not included (e.g. cooling).	Replace "shall be the main reference" by "could be used as reference "
13	L2.2 – Steps 1-2: The calc. methodology to be used (p 20) The **primary energy factors** represent the **overall system efficiency** of the building's technical systems …and the fuels and energy carriers used.	The primary energy factors **only represent** the efficiency of the energy chain outside the assessment boundary and therefore not the "overall system efficiency".	Replace "…the overall system efficiency of the building's technical systems (HVAC installation, heat and power generation, domestic hot water supply, built-in lighting installation) and the fuels and energy carriers used" by **"...the efficiency of the energy chain outside the assessment boundaries**".
14	L2.2 – Steps 1-2: The calc. methodology to be used (p20) This **energy use** can then potentially be **disaggregated into its non-renewable and renewable components**.	Sentence and following bullets point not understood and **not in line with EN ISO 52000-1**. It is the "delivered energy" which can be disaggregated.	Replace "energy use" by "delivered energy.
15	L2.2 – Steps 1-2: The calc. methodology to be used (page 20) It is important to note that **exported renewable energy** is to be reported separately.	The calculation step is not defined in the whole document while it is essential particularly for calculation of exported energy. **The conventions adopted concerning the exported energy will change completely the indicator.** ***Note**: The time step is determining for the calculation of exported energy and auto consumption. The hourly time step is recommended in CEN/ISO standards.* *A smaller time step is mentioned also in Recommendation for NZEB (European Commission 2016).*	Provide information on the calculation of exported energy Add: The conventions adopted concerning the exported energy will change completely the indicator.
16	Table 4. Specification of the main data requirements and potential sources (page 21) EN ISO 13790 (Annex G) EN ISO 15603 (Annex E) EN ISO 13790 (Annex j) … etc	Standard EN ISO 13790 and EN 15603 referenced in table 4 and in the whole text are replaced by new standards. See for current the set of EPB standards (published by 2017-2018) https://epb.center/documents/	Replace these references by the new standards

Further information and recommendations

⁘ Reference calculation methods

Levels requires that national calculation methods shall be the main reference methods for reporting (because mandatory) but that compliant options or equivalences could be used. The figure below shows an analysis of conformity to annexe 1 of EPBD of the 34 national and regional calculation methods. The red dots signal non-conformity.

This report only focussed on the items related to annex 1 and even not on the quality of the calculation methods.

To ensure the comparability of results, the calculation methods must have a comparable quality.

Mentioning national calculation methods without any quality check as main reference methods for reporting seems to be risky.

Therefore, we would propose to change the reference calculation method as follows.

- Calculation method: Compliant with standards developed under Mandate M/480

⁘ Boundary conditions

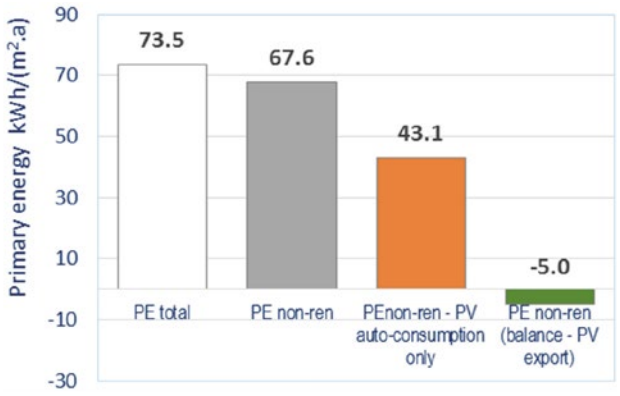
The value of an indicator (e.g. total primary energy use) is directly linked to the calculation procedure (see before) and the boundary conditions.

Hereafter are shown the results on the primary energy use for the same building, using the same calculation method, but with different boundary conditions only related to the use of PV. The numeric indicators vary from 75,5 kWh/m²year of total primary energy use (or 67,6 non-renewable primary energy use) to - 5 kWh/m²year of non-renewable primary energy use.

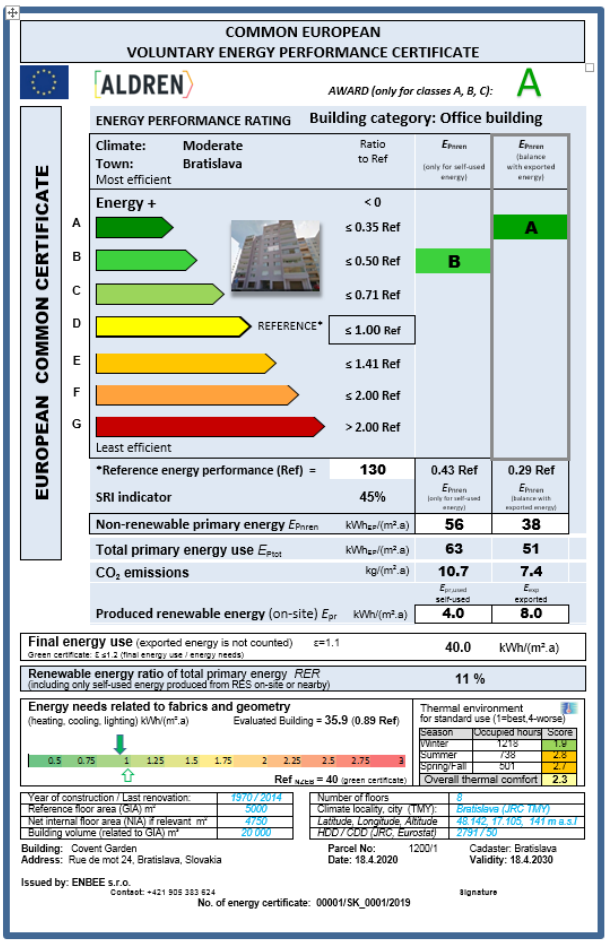
The same building may be qualified either as a "energy consuming building" or as an "energy positive building".

Qst	Methodology	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	Scr
5.1	All build. cat. covered?	y	n	n	n	y	y	y	y	y	y	y	y	p	p	y	y	y	p	p	y	y	y	p	y	y	y	y	y	y	y	p	y	y	y	-12
1.1	Building definition fits?	y	p	p	p	y	y	y	y	y	y	y	y	p	y	y	y	y	p	p	p	y	y	y	p	y	y	y	y	y	y	y	y	y	y	-8
1.2	Is the EP determined?	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	y	y	p	p	y	y	y	p	y	y	y	y	y	y	y	y	y	y	y	-4
1.3	All build. services incl.?	y	p	p	p	y	p	y	y	y	y	y	p	p	y	y	y	y	p	p	p	y	y	p	y	y	y	y	p	y	y	p	y	y	y	-12
1.4	Typical use addressed?	y	y	y	y	p	y	y	p	p	p	y	p	p	p	y	p	y	y	y	y	p	y	p	y	y	p	y	y	p	p	p	p	y	y	-15
2.1	Can EP be compared?	y	p	p	p	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	-3
2.2	EP indicator defined?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	y	y	y	y	y	y	y	y	-1
2.3	PE indicator defined?	y	y	y	y	y	p	y	y	y	y	y	y	p	y	y	y	y	y	y	y	y	y	p	p	p	y	y	n	y	y	y	n	n	n	-15
3a.1	Thermal charact. consid?	y	p	p	p	y	y	y	y	y	y	y	y	p	y	y	y	p	y	y	y	y	y	p	p	y	p	p	y	p	p	y	p	p	p	-15
3b.1	Hating inst. considered?	y	y	y	y	y	p	y	y	y	y	y	y	0	y	y	y	y	y	y	y	y	y	p	y	y	y	y	y	y	y	p	y	y	y	-3
3b.2	DHW inst. considered?	y	p	p	p	y	p	y	y	y	y	y	y	n	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	p	y	y	-8
3c.1	HVAC inst. considered?	p	y	y	y	p	p	y	y	y	y	y	y	p	y	y	y	p	n	n	p	y	y	p	y	y	y	y	y	p	y	y	p	y	y	-13
3d.2	Natural vent. syst. ?	y	y	y	y	p	y	y	y	y	y	y	y	y	y	y	y	y	n	n	n	y	y	n	y	y	y	y	n	y	n	p	n	n	n	-20
3d.3	Mech. Vent. Syst. ?	y	y	y	y	p	y	y	y	y	y	y	y	n	y	y	y	y	n	n	p	y	y	y	p	y	y	y	y	p	y	y	p	y	y	-11
3e.1	Built in lighting inst. ?	p	p	p	p	y	p	y	y	y	y	y	p	p	y	y	p	y	n	p	p	y	y	p	y	p	p	p	y	p	y	p	p	y	y	-19
3f.1	Build. Design consid.?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	-1
3.f.2	Build. Position consid.?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	-1
3.f.3	Outdoor climate?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	-1
3g.1	Passive sol. Sys. Consid	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	n	y	y	-2
3g.2	Solar protection?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	n	y	y	-2
3h.1	Indoor climate?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	y	y	y	y	y	y	y	y	p	y	y	-2
3i.1	Internal loads	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	n	y	y	-2
4a.1	Local solar exposition?	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	p	y	y	-1
4a.2	Active solar systems?	y	y	y	y	p	p	y	y	y	y	y	y	p	y	y	y	y	y	y	y	n	y	y	y	y	p	y	p	y	y	y	p	y	y	-8
4a.3	Other renew. heat. syst.?	y	y	y	y	p	p	y	y	y	y	y	y	0	y	y	y	y	y	y	y	p	y	y	y	y	y	y	y	y	y	y	p	y	y	-4
4a.4	Other renew. Elect. Syst?	n	y	y	y	p	n	y	y	y	y	y	y	0	y	n	n	y	y	y	y	n	y	p	y	n	n	y	n	y	n	n	n	y	y	-24
4b.1	Cogeneration?	n	y	y	y	p	p	y	y	y	y	y	y	n	y	y	y	y	y	y	y	n	n	p	n	y	n	n	n	y	n	p	n	y	y	-24
4c.1	District or block heating?	y	y	y	y	y	p	y	y	y	y	y	y	0	y	y	y	y	y	y	y	n	y	y	n	y	y	n	n	y	y	n	n	p	p	-16
4c.2	District or block cooling	n	p	p	p	y	n	n	y	y	y	y	p	n	y	n	y	n	n	n	n	n	n	p	n	y	n	n	n	n	n	n	n	p	p	-46
4d.1	Natural lighting?	y	p	p	p	p	n	y	y	y	p	p	p	n	p	p	p	p	n	p	p	n	n	p	y	n	n	n	n	p	n	n	n	y	y	-39
	Score Annex I	-8	-10	-10	-10	-10	-17	-2	-1	-1	-2	-1	-5	-20	-3	-5	-5	-5	-16	-14	-10	-15	-6	-14	-12	-6	-12	-10	-13	-10	-10	-14	-36	-8	-7	-7	

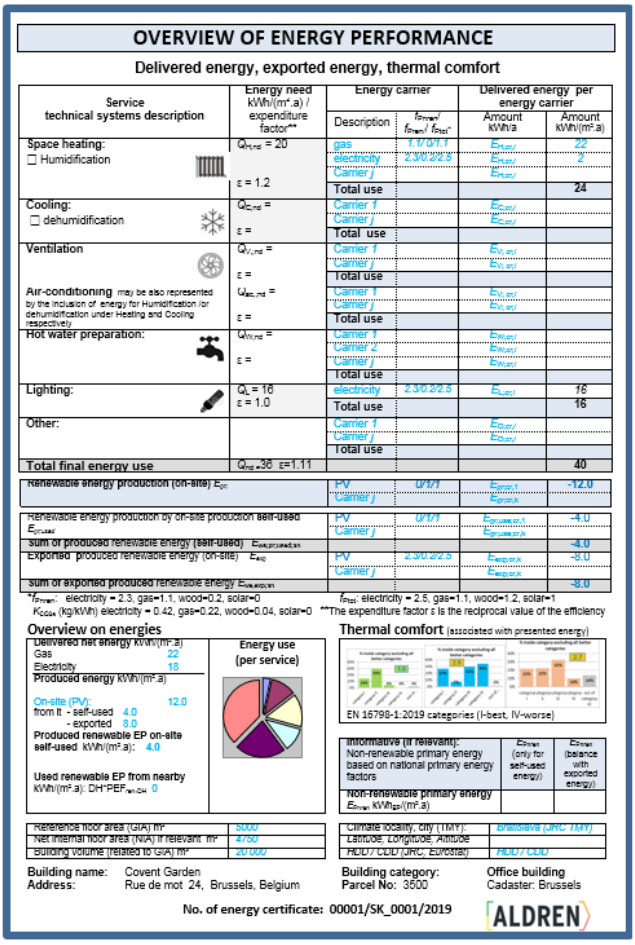
Technical assessment of national/regional calculation methodologies for the energy performance of buildings. (Source: Service contract number: ENER/C3/2013-425/SI2.679523, Final report 2015)



Example of numeric indicator of primary energy use for the same building. (Source: ALDREN project)



Page 1 – ALDREN Energy performance certificate and Energy label.



Page 2 – Overview of energy performance

It is fundamental to define the calculation method and the boundary conditions.

Recast EPBD request Member States to describe their national calculation methodology following the annexes of the overarching standards, developed under mandate M/480 given by the Commission to the European Committee for Standardisation (CEN). These descriptions include the boundary conditions.

But these descriptions can only efficiently be used if the national calculation methods follow the calculation procedure of the CEN standards (e.g. the calculation on the exported energy defined by an exporting factor k_{exp}).

To ensure a minimum level of the comparability of results the Level(s) reporting table should be completed by topics as on-site produced renewable energy (differentiated by self-used and exported) (see ALDREN EPC). ■