

### Session 3

# Techniques and control activities on the EPC data to evaluate the reliability of certificate information

Presenter: Mamak P. Tootkaboni (Politecnico di Torino)

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Politecnico  
di Torino



REPUBLIC OF SLOVENIA  
MINISTRY OF THE ENVIRONMENT,  
CLIMATE AND ENERGY

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Institute for  
Sustainable Energy and  
Resources Availability

# EPC data contents assessment

## PURPOSES:

- Identification of deficiencies in current energy certificates
- To establish the validity of the EPC data in order to exploit them for carrying out benchmarking and large-scale analyses
- Identifying potential improvements in current EPC data quality

## METHODS:

- *Qualitative assessment through the comparative analysis of EPC data*
- *Quantitative assessment through **rules and score attribution** applied to EPC data*

# EPC data parameters

Non-critical parameter ⇒ EPC data whose validity does not drastically affect the statistical analysis. The non-compliance rules for non-critical parameters determine that the specific *EPC data* will be discarded.

Critical parameter ⇒ EPC data whose validity is considered fundamental for statistical analysis. The non-compliance rules for critical parameters determine that the *EPC data set* will be discarded.

# EPC data critical parameters

Data name <b>(Critical parameter*)</b>
Assessed object
Application type
<b>EPC ID code*</b>
Building city
Number of building units
Building typology
Building constructive typology
<b>Building category</b>
<b>Year of construction</b>
Climatic region
Heating degree days
<b>Thermally heated/cooled floor area</b>
<b>Thermally heated/cooled gross volume</b>
Compactness ratio
<b>Thermal envelope area</b>
Opaque/transparent thermal envelope area
Mean thermal transmittance of the total building envelope
Mean thermal transmittance of the opaque building envelope
Mean thermal transmittance of the transparent building envelope
Heating/cooling/domestic hot water energy service
Energy carrier per heating/cooling/domestic hot water
Main technical building system (TBS) type of space heating generator
Overall mean seasonal efficiency of the heating/cooling/domestic hot water system

Data name <b>(Critical parameter*)</b>
Mean seasonal efficiency of the heating generation
Mean seasonal efficiency of the heating distribution/control/emission sub-system
<b>Energy need for space heating</b>
Energy need for space cooling
<b>Overall non-renewable energy performance</b>
Delivered natural gas/electricity/ thermal energy from district heating
Recommended energy efficiency measures

# EPC data quality checking

Three groups of rules are summarised as follows:

- (D) Data types of checks evaluate the data types (e.g., integer, string, a boolean value, etc.) of the data analysed
- (P) Physical impossibility checks evaluate the order of magnitude of EPC data, comparing them with the physical admissibility for that parameter
- (C) Consistency checks represent that set of rules that determine the validity of a parameter compared to another one

# EPC data quality checking

Rules integrated in a MS Excel spreadsheet

Data name (Critical parameter*)	Typology of rules	Rule	Respected rule (score)	Unrespected rule (score)
Assessed object	D	string not null	0,000	$1/(n - m)$
Application type	D	string not null	0,000	$1/(n - m)$
<u>EPC ID code*</u>	D	string not null	0,000	1,000
Building city	D	string not null	0,000	$1/(n - m)$
Number of building units	D	string not null <i>or</i> integer $\geq 0$	0,000	$1/(n - m)$
Building typology	D	string not null	0,000	$1/(n - m)$
Building constructive typology	D	string not null	0,000	$1/(n - m)$
<u>Building category</u>	D	string not null	0,000	1,000
<u>Year of construction</u>	D, P	integer $> 0$	0,000	1,000
Climatic region	D	string not null	0,000	$1/(n - m)$
Heating degree days	D, P	integer $> 0$	0,000	$1/(n - m)$
<u>Thermally heated/cooled floor area</u>	D, P, C	decimal $> 0$ if the space heating/cooling service exists	0,000	1,000
<u>Thermally heated/cooled gross volume</u>	D, P, C	decimal $> 0$ if the space heating/cooling service exists	0,000	1,000
Compactness ratio	D, P	decimal $> 0$	0,000	$1/(n - m)$
<u>Thermal envelope area</u>	D, P	decimal $> 0$	0,000	1,000
Opaque/transparent thermal envelope area	D, P	decimal $> 0$	0,000	$1/(n - m)$

... and other EPC data

# EPC data quality score attribution

$n$  = total number of EPC data

Data name (Critical parameter*)	Typology of rules	Rule	Respected rule (score)	Unrespected rule (score)
Assessed object	D	string not null	0,000	$1/(n - m)$
Application type	D	string not null	0,000	$1/(n - m)$
<u>EPC ID code*</u>	D	string not null	0,000	1,000 $m_1$
Building city	D	string not null	0,000	$1/(n - m)$
Number of building units	D	string not null <i>or</i> integer $\geq 0$	0,000	$1/(n - m)$
Building typology	D	string not null	0,000	$1/(n - m)$
Building constructive typology	D	string not null	0,000	$1/(n - m)$
<u>Building category</u>	D	string not null	0,000	1,000 $m_2$
<u>Year of construction</u>	D, P	integer $> 0$	0,000	1,000 $m_3$
Climatic region	D	string not null	0,000	$1/(n - m)$
Heating degree days	D, P	integer $> 0$	0,000	$1/(n - m)$
<u>Thermally heated/cooled floor area</u>	D, P, C	decimal $> 0$ if the space heating/cooling service exists	0,000	1,000 $m_4$
<u>Thermally heated/cooled gross volume</u>	D, P, C	decimal $> 0$ if the space heating/cooling service exists	0,000	1,000 $m_5$
Compactness ratio	D, P	decimal $> 0$	0,000	$1/(n - m)$
<u>Thermal envelope area</u>	D, P	decimal $> 0$	0,000	1,000 $m_6$
Opaque/transparent thermal envelope area	D, P	decimal $> 0$	0,000	$1/(n - m)$

... and other EPC data

$n$  = total number of EPC data

$m$  = total number of critical parameters

$s$  = non-critical parameter score =  $1/(n - m)$

$e$  = acceptability threshold value =  $\frac{(n \cdot s)}{2}$   
( $< 1$ )



[x-tendo.eu/toolboxes/epc-databases](https://x-tendo.eu/toolboxes/epc-databases)

# EPC data quality checking – Piemonte region case

EPC ID	Error (critical parameter)		Error (non-critical parameter)	
	Thermally cooled gross volume	Compactness ratio	Thermal envelope area	Opaque thermal envelope area
	$V_{C,g}$	$CR$	$A_{env}$	$A_{op}$
	$[m^3]$	$[m^{-1}]$	$[m^2]$	$[m^2]$
920_2_2017	0,000	0,000	0,000	0,000
968_8_2022	0,000	0,000	0,000	0,026
1743_14_2017	1,000	0,000	0,000	0,026
1952_21_2019	1,000	0,000	0,000	0,000

If overall EPC score  $\leq$  acceptability threshold value

- reliable EPC (rows 1, 2)
- discarded EPC (rows 3, 4)

A dashed arrow points from the  $A_{op}$  value of 0,026 in the second row to the text "A<sub>op</sub> discarded".

A green double-headed arrow at the bottom indicates the "Set of rules and scores section" covering the entire table.

Each EPC data have been associated with a rule and a score!



# Score attribution– Piemonte region case

$n$  = total number of EPC data

Data name (Critical parameter*)	Typology of rules	Rule	Respected rule (score)	Unrespected rule (score)
Assessed object	D	string not null	0,000	$1/(n - m)$
Application type	D	string not null	0,000	$1/(n - m)$
<u>EPC ID code*</u>	D	string not null	0,000	1,000 $m_1$
Building city	D	string not null	0,000	$1/(n - m)$
Number of building units	D	string not null <i>or</i> integer $\geq 0$	0,000	$1/(n - m)$
Building typology	D	string not null	0,000	$1/(n - m)$
Building constructive typology	D	string not null	0,000	$1/(n - m)$
<u>Building category</u>	D	string not null	0,000	1,000 $m_2$
<u>Year of construction</u>	D, P	integer $> 0$	0,000	1,000 $m_3$
Climatic region	D	string not null	0,000	$1/(n - m)$
Heating degree days	D, P	integer $> 0$	0,000	$1/(n - m)$
<u>Thermally heated/cooled floor area</u>	D, P, C	decimal $> 0$ if the space heating/cooling service exists	0,000	1,000 $m_4$
<u>Thermally heated/cooled gross volume</u>	D, P, C	decimal $> 0$ if the space heating/cooling service exists	0,000	1,000 $m_5$
Compactness ratio	D, P	decimal $> 0$	0,000	$1/(n - m)$
<u>Thermal envelope area</u>	D, P	decimal $> 0$	0,000	1,000 $m_6$
Opaque/transparent thermal envelope area	D, P	decimal $> 0$	0,000	$1/(n - m)$

... and other EPC data

$n$  = total number of EPC data = 48

$m$  = total number of critical parameters = 10

$s$  = non-critical parameter score

$s = 1/(n - m) = 1/(48 - 10) = 0,026$

$e$  = acceptability threshold value

$e = (n \cdot s)/2 = (48 \cdot 0,026)/2 = 0,631$

# EPC data quality checking – Piemonte region case

MS Excel spreadsheet structure per building typology

	EPC ID	EPC data quality score	Climatic region	Building category	Year of construction	Assessed object	Application type
(EPC) <sub>1</sub> →	1743_14_2017	4,368	E	E1(1)	1900	Unita' immobiliare	Passaggio di proprieta'
(EPC) <sub>2</sub> →	1952_21_2019	2,105	E	E1(1)	1800	Unita' immobiliare	Locazione
(EPC) <sub>3</sub> →	1977_11_2022	0,000	E	E1(1)	1750	Unita' immobiliare	Locazione
(EPC) <sub>4</sub> →	1977_12_2022	0,000	E	E1(1)	1750	Unita' immobiliare	Locazione
(EPC) <sub>5</sub> →	2037_1_2021	2,158	E	E1(1)	1900	Unita' immobiliare	Passaggio di proprieta'
	2037_2_2021	2,158	E	E1(1)	1900	Unita' immobiliare	Passaggio di proprieta'
	2037_4_2020	2,158	E	E1(1)	1900	Unita' immobiliare	Passaggio di proprieta'
	2037_18_2017	2,105	E	E1(1)	1700	Unita' immobiliare	Locazione
	2037_40_2022	2,105	E	E1(1)	1900	Unita' immobiliare	Passaggio di proprieta'
	2185_14_2022	0,000	E	E1(1)	1890	Unita' immobiliare	Altro
							...
(EPC) <sub>n</sub> →	...						

↓
↓
↓
↓
↓

(EPC data)<sub>1</sub>
(EPC data)<sub>2</sub>
(EPC data)<sub>3</sub>
(EPC data)<sub>4</sub>
(EPC data)<sub>m</sub>

# EPC data quality checking – Piemonte region case

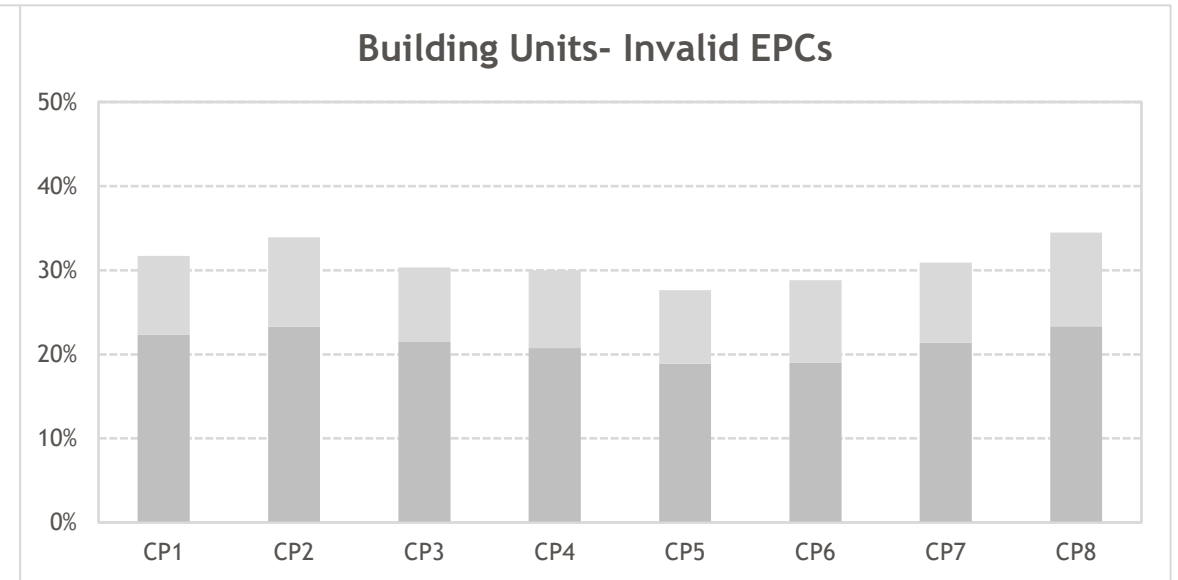
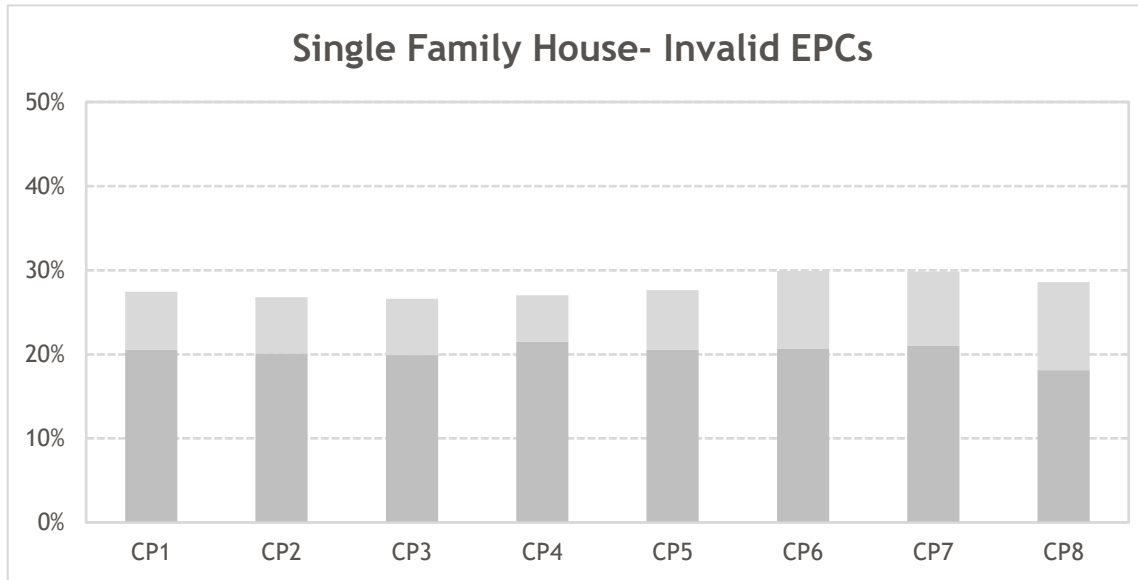
MS Excel spreadsheet structure per building typology

EPC ID	EPC data quality score	Climatic region	Building category	Year of construction	Assessed object	Application type
1743_14_2017	4,368	E	E1(1)	1900	Unita' immobiliare	Passaggio di proprieta'
1952_21_2019	2,105	E	E1(1)	1800	Unita' immobiliare	Locazione
1977_11_2022	0,000	E	E1(1)	1750	Unita' immobiliare	Locazione
1977_12_2022	0,000	E	E1(1)	1750	Unita' immobiliare	Locazione
2037_1_2021	2,158	E	E1(1)	1900	Unita' immobiliare	Passaggio di proprieta'
2037_2_2021	2,158	E	E1(1)	1900	Unita' immobiliare	Passaggio di proprieta'
2037_4_2020	2,158	E	E1(1)	1900	Unita' immobiliare	Passaggio di proprieta'
2037_18_2017	2,105	E	E1(1)	1700	Unita' immobiliare	Locazione
2037_40_2022	2,105	E	E1(1)	1900	Unita' immobiliare	Locazione
2185_14_2022	0,000	E	E1(1)	1890	Unita' immobiliare	Passaggio di proprieta'

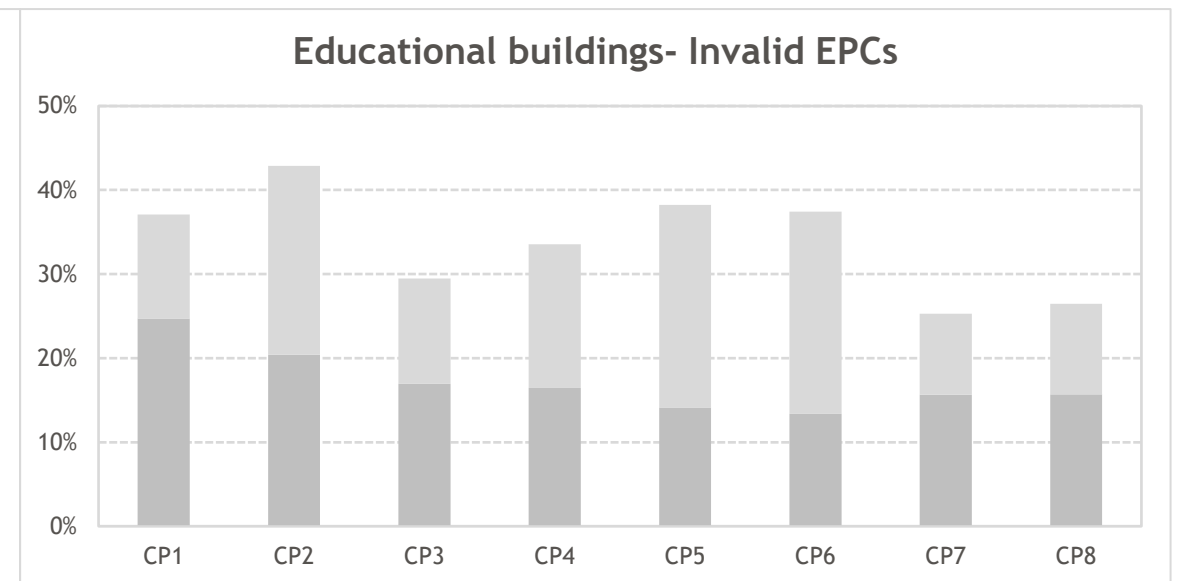
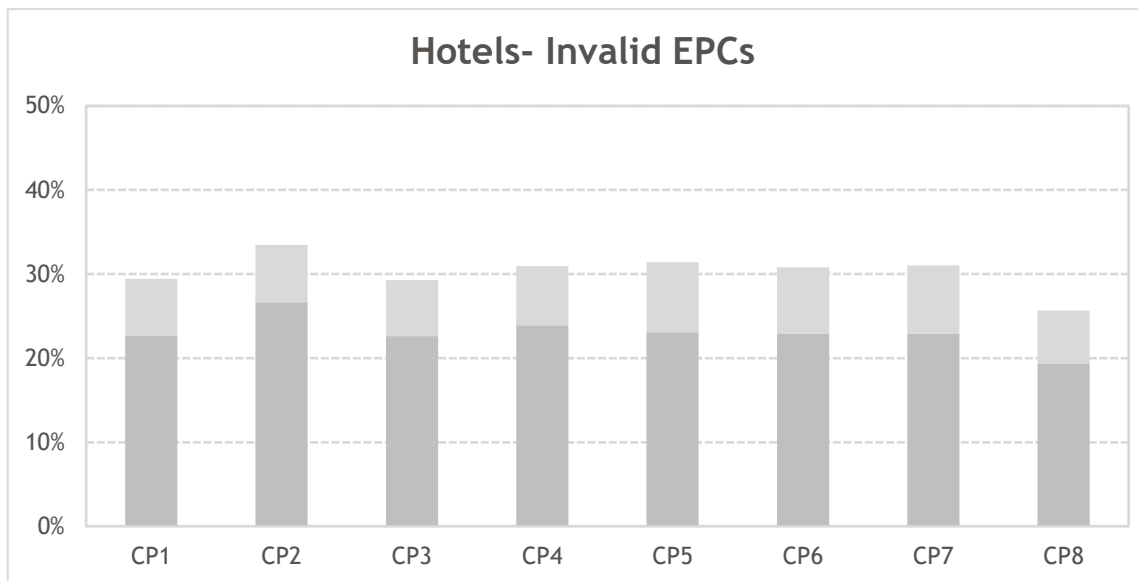
If the overall EPC score is greater than 0,631 (the acceptability threshold value), ALL the data contained in the EPC will be discarded.

# EPC data quality checking – Piemonte region case

Invalid EPCs due to other rules



Invalid EPCs due to U-value rules



**If you would like more information,  
please visit [www.timepac.eu](http://www.timepac.eu) or contact us at  
[mamak.ptootkaboni@polito.it](mailto:mamak.ptootkaboni@polito.it)**

Thanks for your attention!