Your service center for information and technical support on the new set of EPB standards

Update of spreadsheets on ISO 52010-1 and ISO 52016-1

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Start: 21 September 2018 for 3 years

November 20, 2019

Spreadsheets

- As part of the Mandate M/480 from EC: for each calculation standard *(separately…)* a publicly available **spreadsheet** has been made
  - To demonstrate the correctness of the EPB calculation procedures
  - To enable a check of the list of input and output variables
- **Disclaimer:**
  - each spreadsheet was developed in parallel with the corresponding EPB standard: to detect omissions in the standard and mismatches in input-output relations
  - Not every detail of the calculation procedures is covered (e.g: no sunspace, only one type of ground-floor, …)
  - ➔ most recently available version of spreadsheet often reflects draft version of the standard (from 2014 or 2015)
    ➔ not updated to be in line with published version of the standard (summer 2017)
  - **But some key spreadsheets are being updated during the project (EC contract):** e.g. H&C needs, ventilation, heat pumps/chillers

(EN) ISO 52010-1

Energy performance of buildings – External climatic conditions– Part 1: Conversion of climatic data for energy calculations

Description:

- EN ISO 52010-1 specifies a calculation procedure for the conversion of climatic data for energy calculations
- The main element in EN ISO 52010-1 is the **calculation of solar irradiance on a surface with arbitrary orientation and tilt**, using measured data from weather station (such as solar irradiance on horizontal plane)

(EN) ISO 52016-1

Energy performance of buildings – Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads– Part 1: Calculation procedures

Description:

- EN ISO 52016-1:2017 (replacing EN ISO 13790:2008)
  - Contains (improved) -fully described- **hourly** calculation method
  - Contains (improved) **monthly** calculation method
  - **NEW! Hourly method has been tailored to the goal**: the input data asked from the user are the same for hourly and monthly method

No extra input data needed for hourly calculation!!

EN ISO 52016-1: parallel hourly and monthly calculation methods

Hourly calculation of
- energy needs for heating and cooling
- both sensible and latent heat
- indoor temperatures
- heating and cooling load

Same input data and boundary conditions

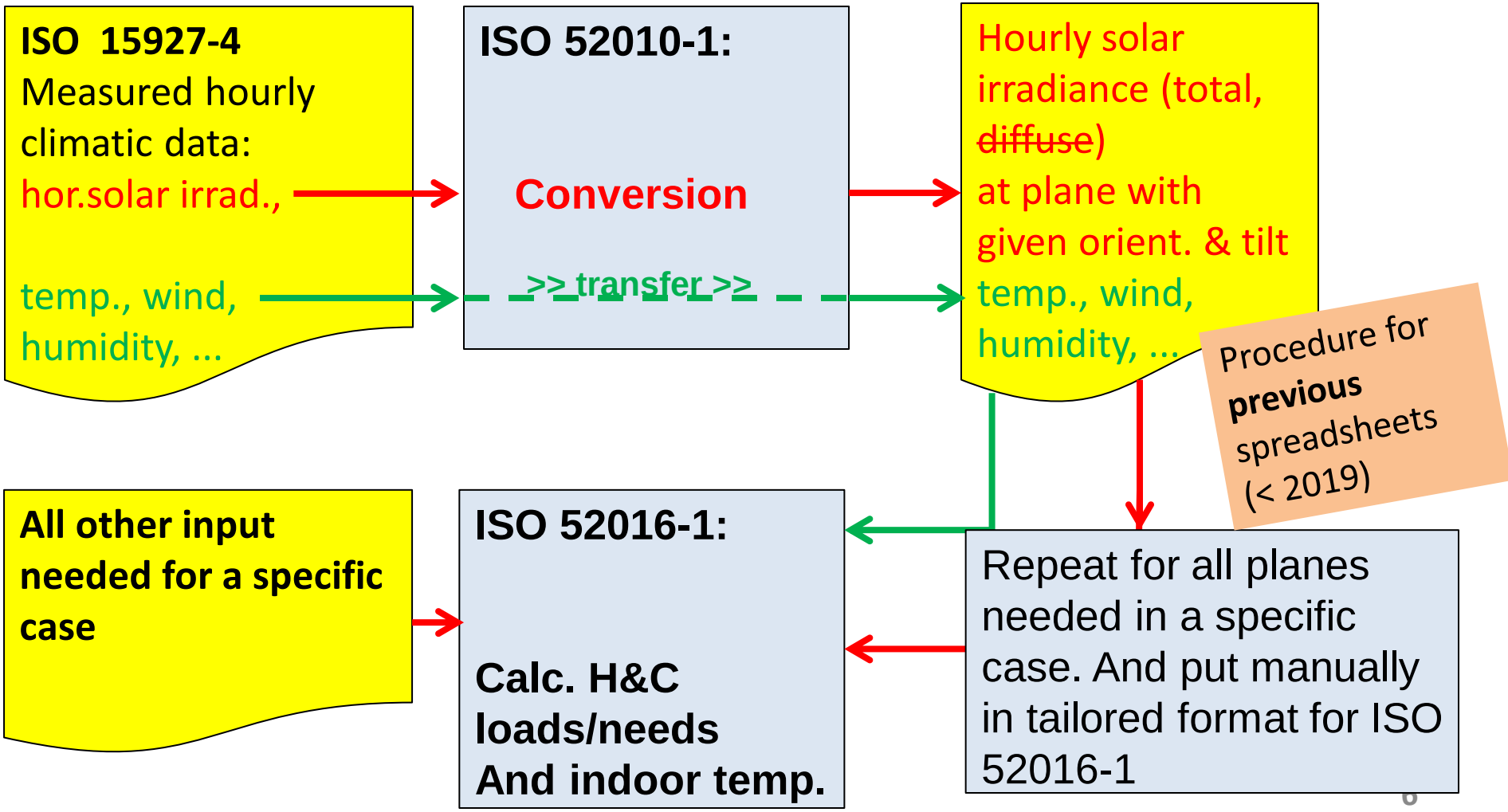
Extra output:
- Monthly characteristics
- Can be used as basis for generating or validating correlation factors for monthly method

Demonstrated in Updated spreadsheet

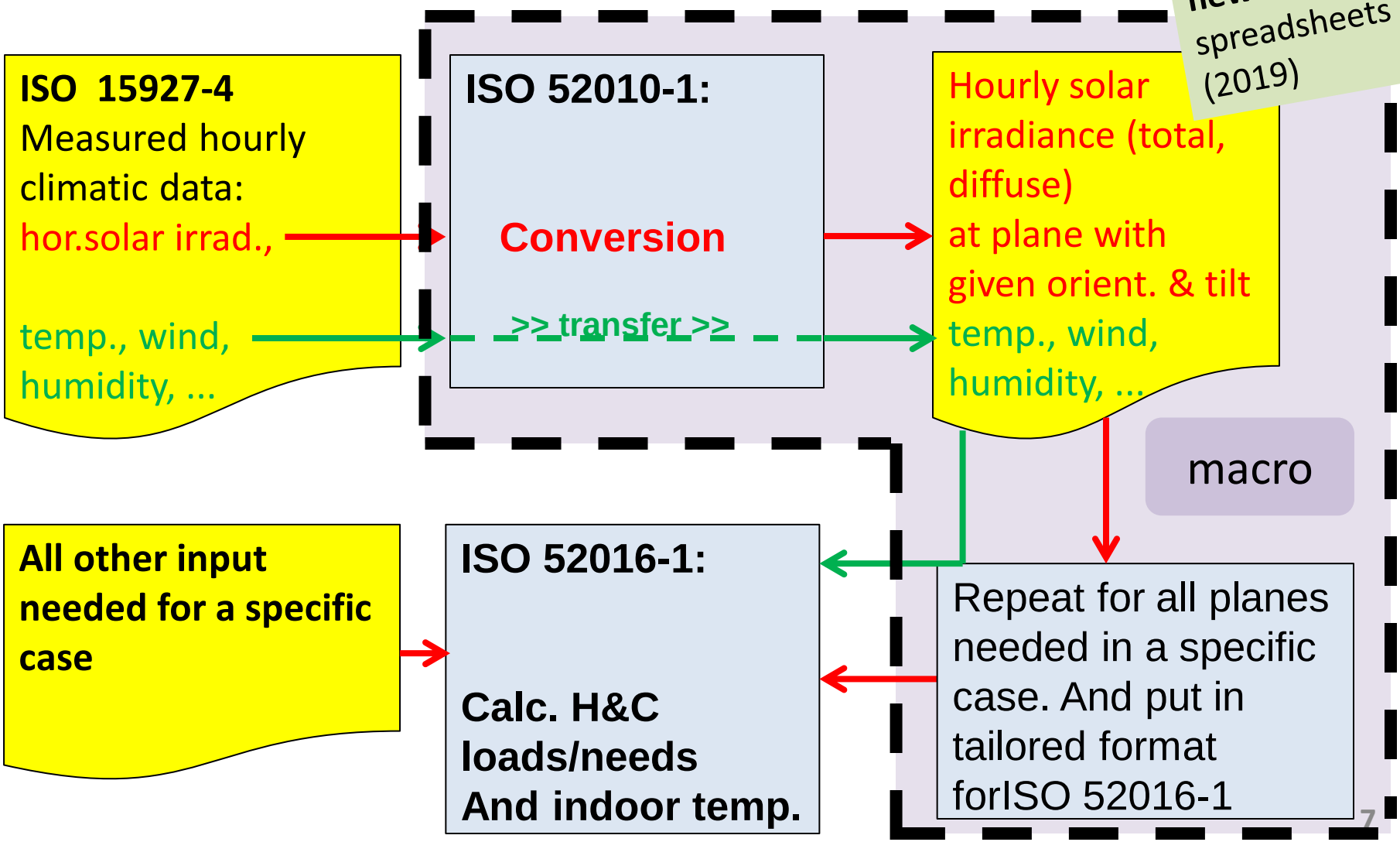
Monthly calculation of energy needs for heating and cooling

using national correlation factors to take into account dynamic effects
- E.g. solar and internal gains, varying conditions of use (temperature and ventilation settings), ..

Links between ISO 52010-1 & 52016-1 (➔ also for spreadsheets)



NEW: macro on spreadsheet for ISO 52010-1



Screenshot config file

New spreadsheet (2019)

f Excel file with calculation procedures	Demo_ISO_52010-1_Calc_V2019.09	
ame of Excel file with input climate data	Demo_ISO_52010-1_Input_DRYCOL _2019.09.19.xlsx	
Name of the Excel sheet in that file	DRYCOLD_TMY	**Expla**
initialization period (TRUE or FALSE)?	TRUE	If TRU be pre reque
Id.	NV	Identi
γ_{ic}	180	Orien the ge proje
β_{ic}	90	Tilt a meas
Id.	EV	As ma
γ_{ic}	90	
β_{ic}	90	
Id.	SV	As ma
γ_{ic}	0	

Screenshot output file

New spreadsheet (2019)

Output file for Excel sheet on ISO 52010-1	
Date:	Date: 2019-05-25
Time start -> end:	16:10:31 -> 16:17:07
Configuration file (workbook):	XLS_ISO_52010-1_Config_V2.0_DRYCOLD_TMY_2019.05.25.xlsm
Climatic input data file (workbook/sheet):	XLS_ISO_52010-1_Input_DRYCOLD_TMY_2019.05.20.xlsx/DRYCOLD_TMY
Station data------:	
Station name:	DRYCOLD.TMY (Denver (Col, USA))
Station note(1):	Denver-Stapleton,CO,USA
Station note(2):	Winter: MST = UTC - 7
Station note(3):	Summer: MDT = UTC - 6
Latitude (degr.):	39,76
Longitude (degr.):	-104,86
Elevation (m):	1611
Timezone (hr):	-7
Calender details------:	
Day/wk Jan.1:	1
DST?:	Applicable for this station, but disregarded
Leapday incl.?:	No
Specific other info:	None
Ref.(e.g.applic.):	ASHRAE 140

Screenshot output file

New spreadsheet (2019)

								Isol = Calculated irradiar	
				Identification of orientation & tilt ->			Id:	NV	NVd
			Azimuth (orient.) angle, degrees, S=0, E=pos, W=neg ->				Gamma:	180	180
				Tilt angle, degrees from horiz. ->			Beta:	90	90
Air temp.	Wind speed	Wind dir.	Air pressure	Air moist. content	Solar alt	Solar azim	Grnd refl.	Isol_tot	Isol_dif
Degr. C	m/s	Degrees	Pa	g/kg	degrees	degrees	-	W/m2	W/m2
-1,2	3,5			4,2	0	150,5089	0,2	0	0
-2,6	3,1			3,8	0	122,1064	0,2	0	0
-3,6	3			3,5	0	105,4162	0,2	0	0

Updated spreadsheet publicly available at the EPB Center website since late Nov. 2019

Previous spreadsheet for ISO 52016-1

All input for a specific case is inside the calculation spreadsheet

Consequently:
at each update of calculation spreadsheet:
All input for each case needs to be copied to new version...

Procedure for **previous** spreadsheet (< 2019)

ISO 52016-1 spreadsheet

Input properties all constr.elements

Input hourly occupancy schedules

All other input (geometry, properties, settings, ...

Climatic data, incl. solar on all constr. elements

Ground floor properties acc. to ISO 13370

Hourly & monthly calculation gr.floor ISO 13370:2017

Calculation of heating and cooling loads / needs and indoor temperatures
Hourly and monthly calculation

Note: macro used to solve matrix for hourly thermal balance (indoor air + all constr.elements)

NEW: macro on spreadsheet for ISO 52016-1

All input (except clim.data) for a specific case
In a **separate input Excel data file**

Macro used to copy all input data (except climatic data) into the calculation file

Tailored climatic data file (as shown before)

ISO 52016-1 spreadsheet

Input properties all constr.elements

Input hourly occupancy schedules

All other input (geometry, properties, settings, ...

Climatic data, incl. solar on all constr. elements

Ground floor properties acc. to ISO 13370

Hourly & monthly calculation gr.floor ISO 13370:2017

Calculation of heating and cooling loads / needs and indoor temperatures
Hourly and monthly calculation

And calc.spreadsheet can still be used as stand alone

Demo spreadsheet ISO 52016-1

- Presentation of the input data file, showing the limited number of data needed, also for the hourly calculation
- Presentation of some of the graphical output:
  - Time series of outdoor and indoor temperatures, heating and cooling loads, etc.
  - Monthly heating and cooling loads from monthly and hourly method side by side
  - Energy signature
  - Monthly correlation factors generated by the hourly calulation method as basis for correlation factors that are needed to construct a simple monthly method
  - Heating and cooling load duration curves
  - ....

Updated spreadsheet publicly available at the EPB Center website since late Nov. 2019

Solar shading by obstacles

- Solar shading by external obstacles (distant, remote or from own building elements) was covered in previous spreadsheet on EN ISO 52010-1
- Will now be covered in separate spreadsheet (in preparation)
- The updated spreadsheets on ISO 52010-1 and 52016-1 have been prepared for dealing with solar shading
  - E.g.: both total and diffuse hourly solar irradiance is calculated in the spreadsheet on ISO 52010-1 and available as input in the spreadsheet on ISO 52016-1

Thank you!

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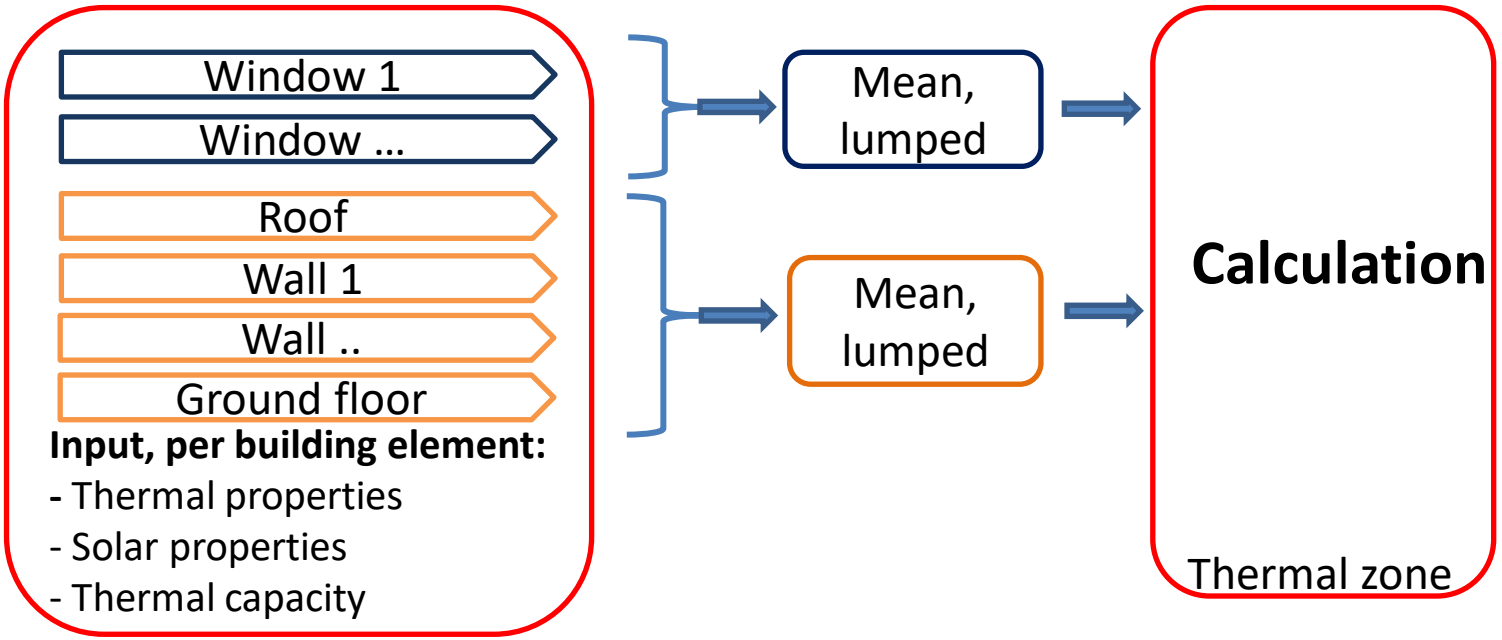
More information on
the set of EPB standards:

www.epb.center

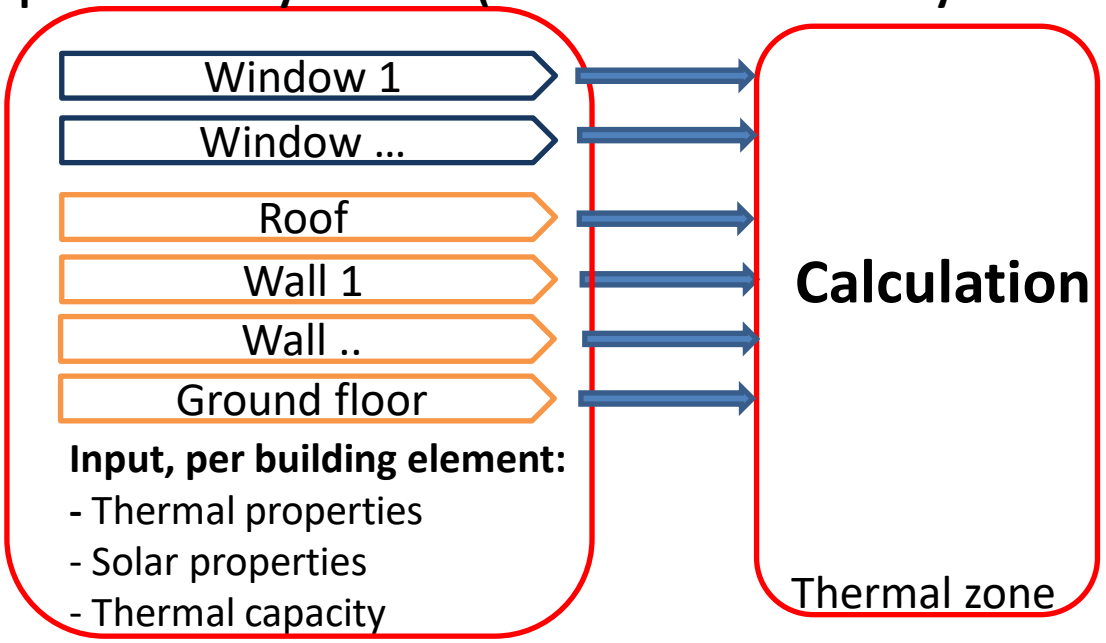
Contact: info@epb.center

Disclaimer: The information and views set out in this document are those of the author(s) and do not necessarily reflect the opinion of the Commission or it's agencies

a) Simplified hourly method in ISO 13790:2008



b) Improved hourly method (and similar for monthly method) in ISO 52016-1



Result:

- No longer loss of information per building element
- Differences in individual building elements are respected