EN ISO 52010, the overarching EPB standard on external environment conditions

The new standard EN ISO 52010-1 provides the common standard climatic data to be used as input by all EPB standards. It builds on EN ISO 15927 (part 1, 2, and 4) and completes a missing link: the calculation of the distribution of solar irradiation and illuminance on a non-horizontal plane based on measured hourly solar radiation data on a horizontal surface; with or without taking into account solar shading.

Keywords: energy performance of buildings, EPB, EPB standards, EPB regulations, climatic data, solar radiation, daylight, Perez model.

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Standard EN ISO 52010-1 [1], accompanied by the technical report CEN ISO/TR ISO 52010-2 [2], provides the common standard climatic data to be used for all relevant EPB standards. It gives procedures to calculate the hourly distribution of solar irradiation on a non-horizontal plane based on measured hourly solar radiation data on a horizontal surface, obtained from EN ISO 15927 (part 1, 2 and 4) [3]. The calculation procedure described in this standard is based on the widely used "simplified Perez model" [4] proposed in the early 90's.

The procedures include assumptions to assess the impact of surrounding obstacles on the irradiation (shading). A simple method for conversion of hourly solar irradiance to illuminance is provided.

The technical report CEN ISO/TR ISO 52010-2 provides background information, explanation (including examples) and justification (including validation cases).

Main output

The main output from EN ISO 52010-1 is the solar irradiance and illuminance on a surface with arbitrary orientation and tilt, needed as input for energy and daylighting calculations.

Shading by distant objects is (optionally) taken into account through a shading correction coefficient, Shading by fins and overhangs is calculated in EN ISO 52016-1 [5].

The standard contains procedures for the use of (other) output from EN ISO 15927 (part 1, 2, and 4) [3] as input for the EPB assessment, such as:

- air temperature;
- atmospheric humidity;
- wind speed;
- precipitation;
- solar radiation;
- longwave radiation.

The reason for passing these data via this standard is to have one single and consistent source for all EPB standards and to enable any conversion or other treatment if needed for specific application.

Accompanying spreadsheet

In line with the common template for all EPB standards, a spreadsheet has been prepared for demonstration and validation. This spreadsheet shows an overview of all input variables, the (step by step) hourly calculation procedures and an overview of all output variables.

This accompanying calculation spreadsheet (July 2016) provides:

- full year of hourly calculations of solar irradiance (split in components) on a plane with any azimuth and tilt angle;
- validated against BESTEST cases;
- hourly calculations of solar shading by multiple shading objects along the skyline. These calculations also cover the calculation procedures for overhangs from EN ISO 52016 1 [5]; see parallel article Van Dijk on EN ISO 52016 & EN ISO 52017.

Flexibility

Options for national choices provided in "Annex A/ Annex B" of EN ISO 52010-1 comprise:

- Selection of hourly measured climatic data set.
- Different choices of type of measured irradiation, depending on availability.
- Value(s) for ground reflectivity.
- Include or exclude impact of solar shading by external objects. If excluded: the solar shading calculation is done in application standards, such as EN ISO 52016-1, enabling to calculate the impact of all shading objects in a coherent way without duplications. If included: a choice is given between different levels of detail.
- Choice between the given simplified Illuminance calculation method or alternative methods.

Validation

The calculation procedures have been validated by using relevant cases from the so called BESTEST series. The BESTEST cases are well established since decades, widely used worldwide and well described. More background information is given in the technical report, CEN ISO/TR 52010-2. Relevant BESTEST cases are also chosen for the validation of the hourly calculation procedures of EN ISO 52016-1, as presented in the parallel article (see also previous article [6]).

Figures 1-3 show examples of the results of the validation cases. The validation cases concern the hourly calculation of the solar irradiation at vertical planes, using the measured data from a given climate data file.

The results of the comparison show that the method in EN ISO 52010-1 is very fit for purpose. It has to be taken into consideration that not each software program whose results are available for the comparison use nowadays state-of-the-art algorithms (in that sense these are not

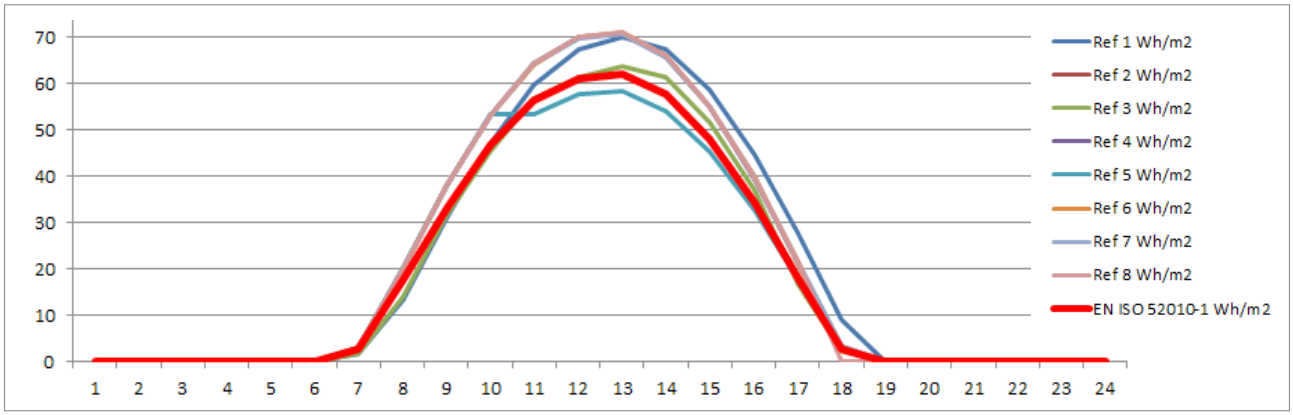

Figure 1. BESTEST validation result: Hourly irradiation on vertical West plane, cloudy day.

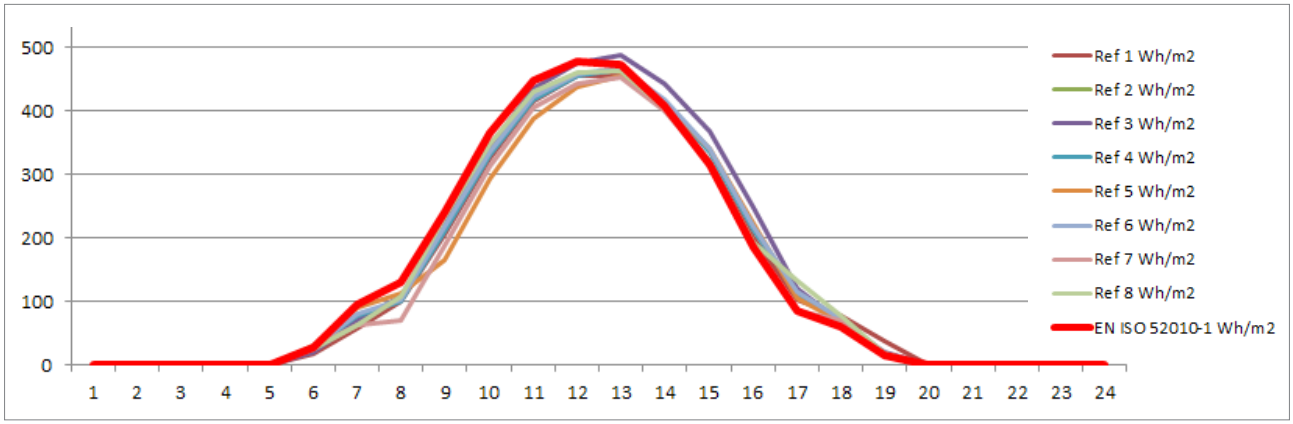

Figure 2. BESTEST validation result: Hourly irradiation on vertical South plane, clear day.

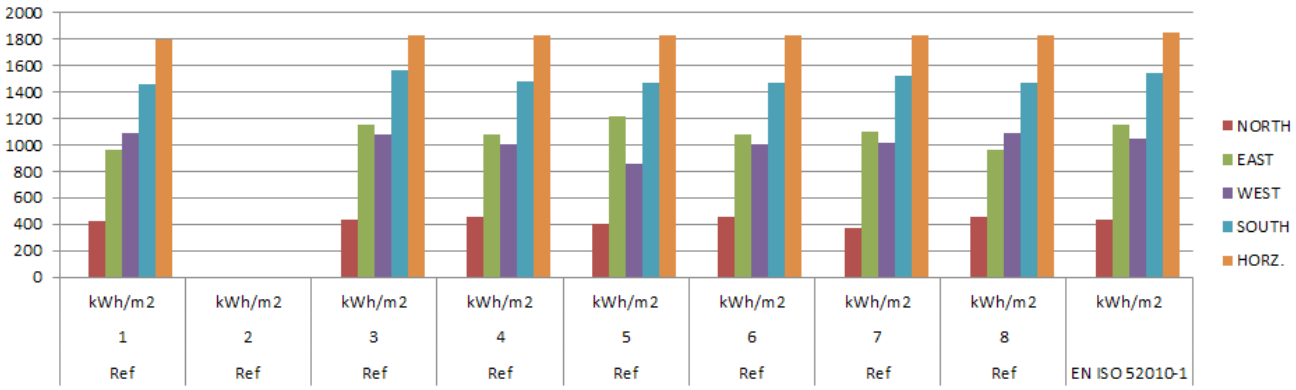

Figure 3. BESTEST validation result: Annual solar radiation on five different planes.

reference results). This is because these base cases of the BESTEST series were created and tested many years ago.

More tests are described in the technical report, CEN ISO/TR 52010-2.

Conclusion

The new EN ISO 52010-1 completes the (until now) missing link in the conversion of climatic data for energy calculations. The procedures have been validated. Choices are possible at national or regional level to accommodate the specific national or regional situation. ■

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