DEFINING THE METRICS TO ASSESS THE IAQ IN LOW-ENERGY RESIDENTIAL BUILDINGS: RESULTS FROM IEA EBC ANNEX 68 SUBTASK 1

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1 EXTENDED ABSTRACT

1.1 About IEA EBC Annex 68

The overall objective of the IEA EBC Annex 68 is to provide scientific basis usable for optimal and practically applicable design and control strategies for high Indoor Air Quality (IAQ) in residential buildings. These strategies are intended to ensure minimal possible energy use. Consequently, Annex 68 is focused on low-energy residential buildings. The work of the Annex is organized into five subtasks (Figure 1): Subtask 1 is setting up the metrics to assess the performance of low-energy buildings as regards indoor air quality combining the aspirations to achieve very high energy performance without compromising indoor environmental quality. Subtask 2 is gathering the existing knowledge and providing new data about indoor air pollutants as well as combined heat, air and moisture transfer. Subtask 3 is identifying and developing modelling tools that can assist designers and managers of buildings in accounting for IAQ. Subtask 4 is developing design and control strategies for energy efficient ventilation in residential buildings that will not compromise indoor air quality. Subtask 5 is conducting field measurements to examine and optimize different control and design strategies.

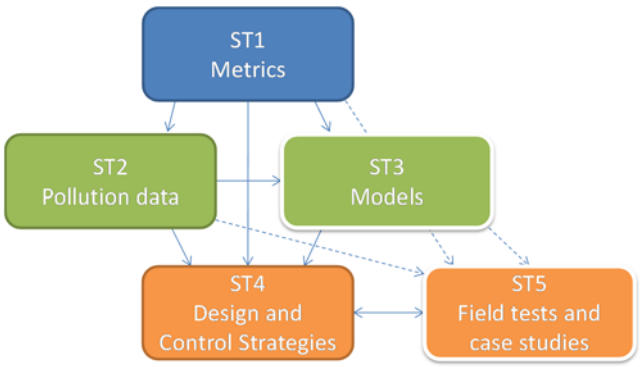

Figure 1: Schematic overview of the subtasks in Annex 68 and their interrelations.

1.2 Research Methodology

The working plan executed in Subtask 1 consists of the subsequent steps:

- Collection of data on indoor air pollution in residential buildings with a particular focus on low-energy buildings to provide an overview of the exposure of occupants to contaminants in residential buildings and to identify differences, if any, between low-energy buildings and the buildings that cannot be termed as low-energy (representative of the current building stock).
- Identification of target pollutants relative to indoor air.
- Compilation of pollutant Exposure Limit Values (ELV) relevant for the current project.
- Surveying IAQ indices developed previously.

- Defining the metric(s) that can be used to achieve the objectives of Annex 68 project considering the aspect of energy consumption.

1.3 Main Research Outcomes

From the pollutant concentrations collected and compiled in this study, lower pollutant concentration levels have been found in the newest low-energy buildings. However, some exceptions from this rule have been detected as for the case of France and Japan where new buildings presented higher levels for some pollutants coming from wood construction. By comparing collected concentration levels in this study with ELV, a list of target pollutants for long-term exposure has been defined: *acetaldehyde, acrolein, α-pinene, benzene, formaldehyde, naphthalene, nitrogen dioxide, PM10, PM2.5, radon, styrene, toluene and trichloroethylene*. Regarding the short-term exposure, this analysis led to the following shorter list: *acrolein, formaldehyde, nitrogen dioxide, PM10, PM2.5, radon and TVOC*. Two approaches to define metric for assessing the importance of measured concentrations of pollutants were selected from the literature survey on IAQ metrics. The first approach refers to the comparison of typical exposure concentrations to the existing exposure standards (ELV). In this approach the unbiased aggregation of indices for specific pollutants is achieved by selecting maximum index. The second approach is evaluating the direct health impacts of the pollution through the estimation of the Disability-Adjusted Life Years (DALYs). Finally, a graphical representation is proposed to facilitate the visual and quantitative comparison among a reference IAQ/Energy situation and possible air cleaning solutions. This representation provides an example of the possible approach for labelling indoor environments as regards IAQ and energy performance (Figure 2).

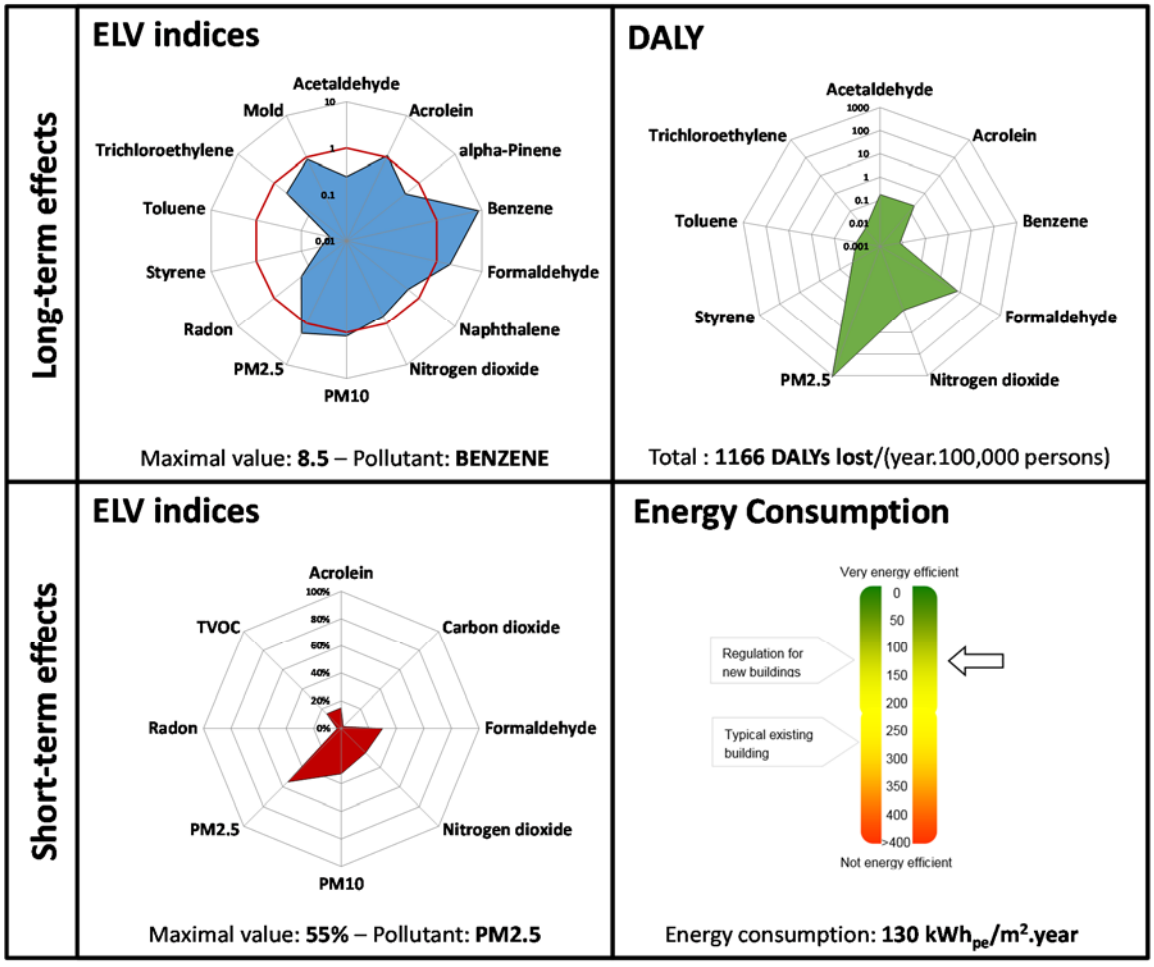

Figure 2: An example of IAQ/Energy dashboard for low-energy residential buildings (data represented here are just for display and do not represent actual situation).

KEYWORDS

Indoor Air Quality, Residential Buildings, Metrics, Exposure Limit Values, DALYs