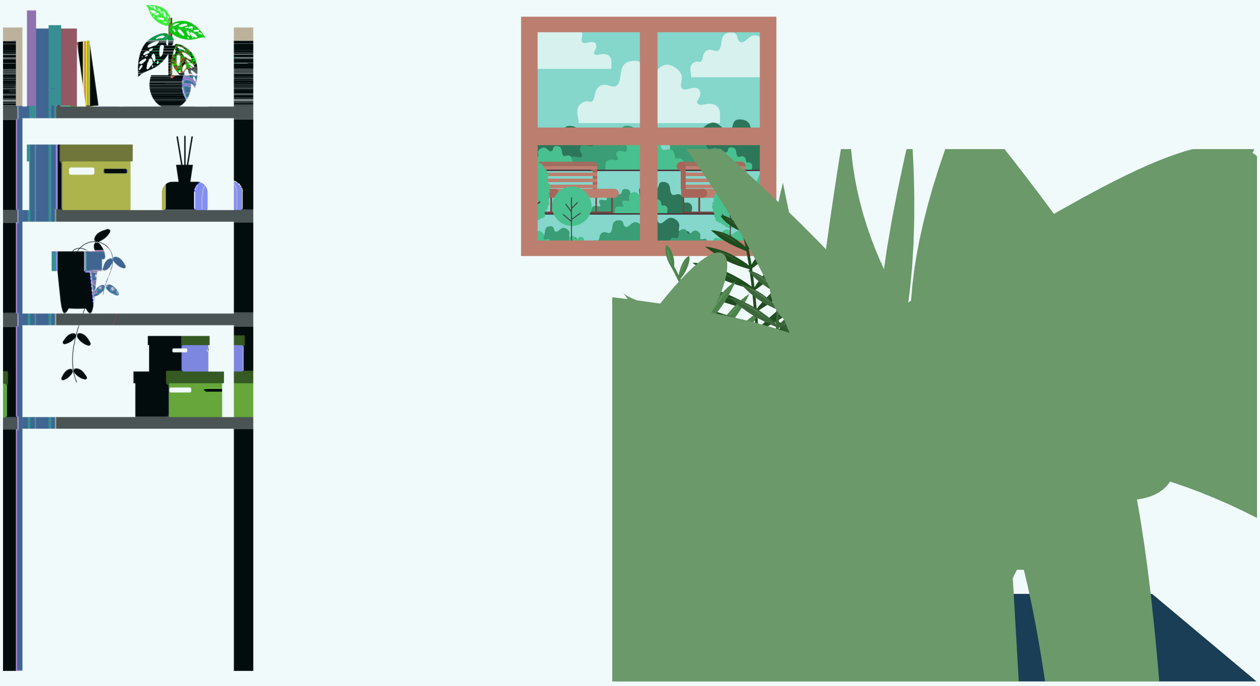
MICAT
Multiple Impacts Calculation Tool

Empirical basis of
Social Impacts
Reduced or avoided excess cold weather mortality due to energy efficiency improvements in the residential building sector



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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101000132.

Quantification method

Description

The indicator is calculated by comparing the mortality cases during the cold weather period prior to and projected excess cold weather mortality after the implementation of energy efficiency measures.

The first modelling step is calculating excess cold weather mortality (ECWD). MICAT will adopt the estimates of ECWDs from the COMBI project funding from EU Horizon 2020, where a methodological upgrade in excess cold weather mortality was proposed in response to a recent academic critique (Mzavanadze 2018). A cold weather period includes at least 85% of a specific country's average annual heat degree days (HDD). At the city level, ECWD is assumed to be proportion to the share of the city population in the country.

Excess cold weather death due to indoor cold (WDI) is thus calculated as follows:

$$WDI = ECWDc \times AINc$$

EWCDc: Total excess cold weather mortality in a specific country

AINc: Share of ECWDs attributable to indoor cold in a specific country

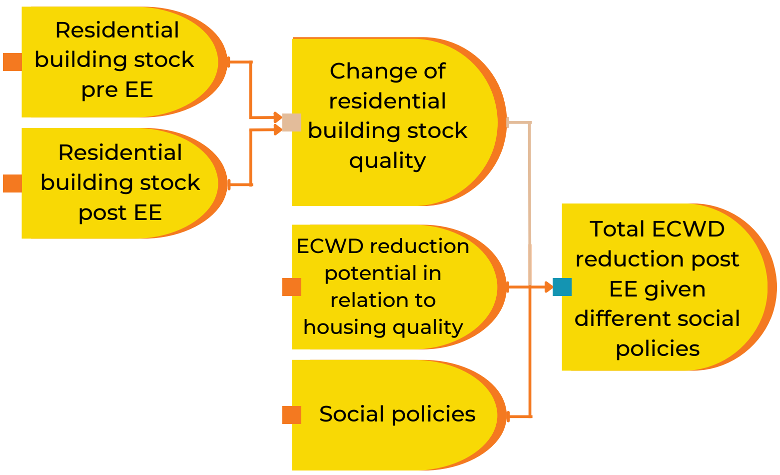

Figure 2 : Main calculation steps

According to expert observations, only a part of ECWDs can be attributable to indoor cold (Eurowinter Group, 1997; Braubach *et al.*, 2011). Thus, a second modelling step is the attribution of premature mortality due to indoor cold exposure. It is assumed that this part of ECWDs could be avoided if thermal comfort could be ensured for all members of the population in question.

No robust methodologies are available yet to estimate the attribution of ECWDs to pro-longed indoor cold exposure. Thus, expert observations have been used to estimate excess seasonal mortality. Mzavanadze (2018) found only a few European countries with expert estimates on the excess winter deaths attributed to indoor cold, with a value ranging from 10% to 50%. Ideally, such expert observation would be available for every European country. The WHO suggests a universal 30 % attribution value to indoor cold for Europe (Braubach *et al.*, 2011). However, such a universal value for Europe is not robust, considering various social welfare systems and thermal comfort standards in different countries. Thus, MICAT applies a customized attribution as proposed in the COMBI project (Mzavanadze 2018) based on the EU SILC indicator "Population unable to keep home adequately warm by poverty status" of each country (Table 1). The underlying assumption is the more people are exposed to prolonged indoor cold in the society, the bigger the likelihood of a larger share of ECWDs attributable to indoor cold.

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Share of population unable to keep home adequately warm	**ECWDs attributable to indoor cold**
x < 5%	10%
5% < x < 10%	20%
x > 10%	30%

Table 1: Proxies for attribution of excess cold weather deaths to indoor cold. Source: (Mzavanadze, 2018)

Ex-ante and ex-post evaluation

The extent of renovation activities and their energy efficiency level are vital for modelling the potential for excess cold weather mortality reduction. Long-term observational studies have observed a generally positive relationship between improved thermal indoor comfort and reduced ECWD (Wilkinson *et al*., 2001). However, no scientific studies have quantified the relationship between different types of building thermal performance improvements and specific mortality reduction. For instance, deep retrofits are more likely to solve the thermal indoor discomfort rather than light retrofits, which in some cases may be insufficient to achieve thermal comfort. Mzavanadze (2018) proposes a different set of assumptions around different types of housing stock quality changes based on expert judgement. Table 2 shows the assumed relationship between attribution (AIN) reduction (and, thus, WDI reduction potential) and implemented energy retrofits.

Building energy quality	**AIN and WDI reduction potential**
No retrofits	0%
Light retrofits	50%
Medium retrofits	80%
Deep retrofits	100%

Table 2 : Assumptions of reduction potential of ECWD due to indoor cold in relation to housing quality

The population experiencing energy poverty suffers mostly from indoor cold due to their limited financial capacity to afford the heating service needed for cold winters. This group often lacks the financial resources for relatively costly energy efficiency interventions. Therefore, we also introduce a Policy Targetedness Factor (value between 0 and 1)[1]. It represents the percentage of energy renovation of a specific policy or programme targeting energy-poor households.

Methodological challenges

The following estimates and assumptions are associated with high uncertainties:

- The share of ECWD attributable to indoor cold was derived from a limited number of studies.
- The assumptions on the relationship between ECWD reduction potential and energy retrofits is based on judgement of a small group of experts.

[1] See MICAT factsheet "Energy poverty alleviation".

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