# Renovation rate as a tool towards achieving SDGs 11 and 13

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**Abstract**. The building stock being a huge energy consumer, is an important sector for SDG 11 on sustainable cities and SDG 13 on climate action. Therefore, retrofitting the existing buildings is a priority for most EU countries. Long term goals for the energy performance of buildings are premised. However, to be able to monitor the progress and feasibility to achieve the goals in 2050, knowledge of the actual renovation rate is indispensable. Since years an overall renovation rate of 1% for the EU is communicated. This number is withheld in several countries to stimulate retrofitting (Belgium, Italy, The Netherlands). However, it is not clear how this renovation rate reflects the actual renovation rate and the actual energy savings because accurate knowledge on this is lacking in most countries. This paper focusses on elaborating our knowledge of the renovation rate by analysing its definition and providing a possible, more accurate calculation method. A literature study shows that there is no commonly used definition of 'renovation rate' in the EU. Instead different approaches are being used, often depending on available data. A case study for Flanders, Belgium reconstructs the communicated renovation rate of 0.7% to 1% by means of a database of the renovation activity of approximately 6000 homeowners (2012-2018). The used survey concept shows that the actual renovation rate exceeds 1% and is able to provide extra insights on the energy renovation depth in Flanders. In a next step this could be extended to calculate the actual energy savings due to renovations. As this survey concept can easily be adopted in other EU countries, it could form the base of an aligned monitoring of the progress towards a sustainable built environment.

## 1. Introduction

To limit warming to 1.5C, global net CO2 emissions must drop by 45% between 2010 and 2030, and reach net zero around 2050. The energy consumption in buildings accounts for roughly 40 % of EU's total final energy consumption. The share of households is 27 % of the total [1]. Higher energy efficiency and use of renewable energy in existing and new buildings are expected to play a major role in achieving the CO2 emission drop. Therefore, the building stock is an important sector for SDG 11 on sustainable cities and SDG 13 on climate action. As existing dwellings exceed the number of newly built dwellings in most developed countries, the European Commission has indicated the increase of the renovation rate and renovation depth as one of the building blocks to achieve a climate neutral economy [2]. But therefore, a good knowledge of the actual renovation rate and the actual depth of renovation is indispensable for policy makers to be able to follow up the progress towards this ambition.

This paper firstly discusses the outcome of a literature study which illustrates that a common definition for renovation rate and renovation depth is lacking in Europe. Secondly, a case study for

Flanders reconstructs the communicated renovation rate by means of an online survey among homeowners. The used survey concept provides additional insights in the renovation rate and depth which can be translated into actual energy savings. As this concept could easily be adopted in other EU countries, it could be the base for a common definition and calculation method which allows a unified and accurate monitoring of the progress of retrofitting the building stock.

## 2. Renovation rate in existing literature

Despite a commonly striving for a higher renovation rate in national roadmaps, an official definition or calculation method of it is missing [3,4]. A study of the term renovation rate in literature indicates that the renovation rate and its evolution is often discussed without a clear definition. The rate itself is based on a variety of calculation methods and these methods are often only implicitly specified [5,6].

Generally the renovation rate is considered a percentage of the building stock that has been renovated [4]. However, the used measuring unit to represent the renovated building stock is often not or only implicitly specified: number of renovated buildings, number of renovated dwellings, renovated floor area, renovated area of building element (roof, façade,…),… [1]. Also the type of buildings considered is often not specified. Mostly it only concerns residential buildings or even a subgroup of residential buildings (e.g. privately held houses) [5,7]. And even if the same measuring unit is applied, the same term may not have the same meaning in different countries.

Furthermore, the renovation rate as such, regardless of how it is calculated, does not inform on the number and/or type of renovation works (whether or not energy-related) and it does not take into account the renovation depth. It therefore cannot be translated in actual energy savings. Some studies try to define levels of renovation depth and even try to estimate the energy savings, but this remains a very rough estimation [4].

Alternative methods try to determine renovation progress through indirect indicators, such as confidence of contractors, number of house loans, overall VAT related to renovation, … [8]. However, none of these indicators proved to be adequate to monitor the progress of the energy efficient retrofit of the building stock.

## 3. A case study for Flanders

In its Renovation Pact of 2014, the Flemish government set long term goals for the overall energy performance of the residential building stock. A current renovation rate of 0,7 to 1% is mentioned, but without specifying the method or data source used [9]. We were able to reconstruct this figure by calculating the ratio of renovation permits for single family houses to the total number of existing houses, for the period 2012-2018 in Flanders (Table 1). The reconstruction was made for the total building stock and for buildings built before the introduction of the energy performance legislation (1/1/2006). This suggests that the communicated renovation rate only includes renovations with building permit.

**Table 1.** Overview of renovation permits and existing building stock for single family houses of Statbel for the period 2012-2018 (Flanders) [10]

| | Building permits | Building stock | Renovation Rate | Building stock 1/1/2006 | Renovation Rate of buildings before 1/1/2006 |
|---|---|---|---|---|---|
| Avg 2012-2018 | 14 294 | 2 104 187 | 0.68% | 2 008 884 | 0.71% |

However, as in Flanders only renovations that include structural adjustments or a larger extension of the living area need a building permit, this renovation rate does not exclusively represent energy renovations. And it excludes many energy-related renovation works that are executed without building permit, such as insulating roofs or walls, replacing single glazing with double or triple glazing, … . Therefore, an alternative method and data source has been explored to determine a more accurate energy

renovation rate. The database of Essencia Marketing was used, a marketing agency specialized in construction. It yearly surveys the renovation activities of a sample of 2500 home-owners of the Belgian population, representative by region, age and education resulting in renovation data of 5449 respondents for the period 2012-2018 [11]. The survey distinguishes general, structural and energy related works.

To prove the validity of this database, first the 'official' renovation rate of 0.7% to 1% was reconstructed based on the following assumptions and summarized in Table 2.

(1) A survey, instructed by the Flemish government, among 3 000 households in 2018 about the living conditions in Flanders showed that 71% of the households is home owner-occupier [12].

(2) As the Essencia Marketing survey only takes into account single family houses, the owner-occupiers of apartments (14%) were left out, leading to a correction factor of 86%. The implicit assumption of no energy-related renovation of owner-occupied apartments causes an underestimation.

(3) Since 1/1/2006 energy performance legislation is compulsory for new dwellings in line with EPBD, thus retrofitting buildings built before 2006 has highest priority. An average of almost 96% of the existing single family houses between 2012 and 2018 dates from before 2006.

(4) Overall, the results of the Essencia marketing survey show that between 2012-2018 on average yearly 37% of home-owners executes at least one of the surveyed renovation works. For energy-related works this is on average 24.6% of home-owners per year.

(5) While the Essencia Marketing survey takes into account all renovation works, the mentioned renovation rate in the Renovation Pact is focused on major energy renovations, which require a building permit. Therefore, only renovators with building permit are withheld: 13.1% in general (table 2, renovations with building permit) and 17.4% for the energy related renovators (table 2, energy renovations with building permit). If all energy related renovations are considered (with and without building permit), all energy renovators are withheld (100%) (table 2, energy renovations).

(6) A renovation can span several years whereas the renovation rate is expressed per year. Therefore, the renovation period should be taken into account. In the Essencia Marketing survey a weighted average of 3.8 years is obtained as renovation period for permitted renovations and 4 years for energy-related (permitted) renovations. Therefore, the correction of 26.3% and 24.8% is calculated, as a single renovation can appear almost 4 times in a yearly renovation rate (1/3.8 = 26.3% and 1/4.03 = 24.8%).

**Table 2**. Calculation of the correction factor for transposing Essencia Marketing results.

| Renovations with building permit | | Correction | Source | Assumption |
|---|---|---|---|---|
| Flemish household population | 100% | | | |
| Households owning a dwelling | 71% | 71% | Steunpunt wonen | Rented dwellings are not part of the survey (1) |
| Households owning a single family house | 61% | 86% | Essencia | Apartments are not part of the survey (2) |
| Housing stock < 1/1/2006 | 58% | 96% | StatBel | EPB compulsory for new dwellings (3) |
| Renovators of at least 1 work | 22% | 37% | Essencia | Renovation activity (4) |
| Renovators with building permit | 3% | 13% | Essencia | Only renovations with building permit (5) |
| Renovation period | **0,74%** | 26% | Essencia | A weighted avg of 4 years for permitted renovation works (6) |
| | | | | |
| **Energy** renovations with building permit | | Correction | Source | Assumption |
| Flemish household population | 100% | | | |
| Households owning a dwelling | 71% | 71% | Steunpunt wonen | Rented dwellings are not part of the survey (1) |
| Households owning a single family house | 61% | 86% | Essencia | Apartments are not part of the survey (2) |
| Housing stock < 1/1/2006 | 58% | 96% | StatBel | EPB compulsory for new dwellings (3) |
| Renovators of at least 1 energy-related work | 14% | 25% | Essencia | Energy related renovation activity (4) |
| Renovators with building permit | 2% | 17% | Essencia | Only energy related renovations with building permit (5) |
| Renovation period | **0,60%** | 25% | Essencia | A weighted avg of 4 years for permitted renovation works (6) |
| | | | | |
| **All energy** renovations | | Correction | Source | Assumption |
| Flemish household population | 100% | | | |
| Households owning a dwelling | 71% | 71% | Steunpunt wonen | Rented dwellings are not part of the survey (1) |
| Households owning a single family house | 61% | 86% | Essencia | Apartments are not part of the survey (2) |
| Housing stock < 1/1/2006 | 58% | 96% | StatBel | EPB compulsory for new dwellings (3) |
| Renovators of at least 1 energy-related work | 14% | 25% | Essencia | Energy related renovation activity (4) |
| Renovators with or without building permit | 14% | 100% | Essencia | Energy related renovation activity with or without permit (5) |
| Renovation period | **3,56%** | 25% | Essencia | A weighted avg of 4 years for permitted renovation works (6) |

## 4. Conclusion

At this moment a uniform definition of the renovation rate is lacking and different calculation methods are used. This impedes the monitoring of the achievability of the spelled out SDG's towards a sustainable built environment by 2050. If the EU Commission wants EU countries to speed up their renovation rate, a uniform definition and calculation method should be provided to allow a more accurate monitoring of the progress. A case study for Flanders, Belgium illustrates a survey concept and calculation method which provides detailed insights in the renovation rate. It allows the reconstruction of the 'official' renovation rate of 0.74% for renovations with building permit, as mentioned in the Renovation Pact. It also allows to determine that per year only 0.60% of the building stock undergoes an energy renovation with building permit. But more importantly it shows that the renovation rate of all energy renovations, which could be called the actual renovation rate, is 3.56%. It proves that the actual renovation rate is much higher than the officially communicated renovation rate. This should be taken into account by policymakers. Furthermore, as this survey also has information on the type of energy renovation works, also levels of renovation depth could be defined, and in a next step actual energy savings due to the renovations can be estimated. The authors plan to perform these further research steps in the near future. Finally, as the used survey concept is based on an online survey among home-owners, the same procedure and definitions can easily be adopted in other countries. This could form the base for a common guideline to monitor more accurately the renovation rate in Europe. The results of the online surveys show that home owners are able to inform on the type of renovation. However, the survey concept has some limitations. Firstly, there is an underrepresentation of socio-economically weaker households and elderly people due to a lower use of the internet. Secondly, the survey only questions the renovation works of the previous year, without taking into account renovation works that might have been done in the past by former home owners. The accuracy of responses on this might be low, as current homeowners tend to rely on what the former homeowner told them.

## 5. References

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