# Comparing Energy Performance requirement levels among Member States of Europe (EU ASIEPI project)

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## ABSTRACT

For outsiders, a national energy performance (EP) requirement level is quite a black box. Within the EU Asiepi project (www.asiepi.eu) we are developing a methodology to make a comparison of EP requirement levels possible among member states of the EU.
An unexpected finding has been that far from all EU countries consider all energy uses in their EP method required by the EPBD (Energy Performance of Buildings Directive).The energy use for fans, domestic hot water and cooling are among the energy uses which are not taken into account by various countries. This largely complicates the comparison over Europe. What also complicates the comparison is that sets of energy measures are not equally relevant in all climates in Europe. The recast of the EPBD proposes to take into account a cost optimal level. This might be a way of properly reflecting local issues, although developing such a method on European level is a big challenge.

## KEYWORDS

EPBD, energy performance, EP, requirements, ASIEPI, EU, recast

## INTRODUCTION

In the Netherlands the energy performance (EP) of a house needs to be below 0,8 and in Belgium (Flanders) a house should reach a maximum EP level of E100. Due to the EPBD (Energy performance of Buildings Directive) every Member State of the EU is obliged to have a methodology in place to assess the EP of new and major renovated buildings and set maximum EP requirement levels. As can be seen from the examples in the Netherlands and Flanders, a national EP requirement level is quite a black box. Is the Dutch requirement level of 0,8 stricter than the E100 in Flanders? What do these levels mean and how can we compare these values? In the EU project Asiepi we are developing a methodology to make a comparison between EP requirement levels possible among member states of the EU.

## METHODOLOGY

Generally there are two main routes to make a comparison of EP requirements: The first route uses fixed measures, the second route uses measures per country. Because previous research showed that the first route is far from optimal, within Asiepi we have focused on the second route. The principle of this route is as follows: The starting point is a test building with fixed areas of the building construction and shell. In the project we use the semi-detached house which is shown in figure 1. All countries were asked to determine what measures are needed for this house to meet the national EP requirement level in their country. The result is a set of energy saving measures per country needed to comply with the respective national energy performance regulations.

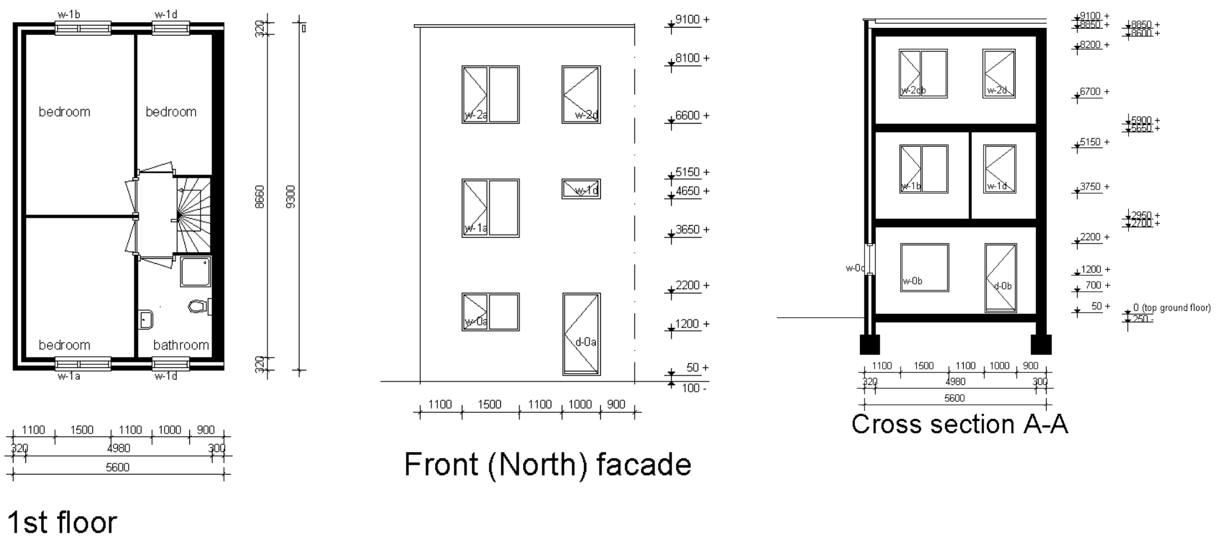


Figure 1: Some views of the test dwelling.

It appeared to be difficult to compare two completely different sets of energy saving measures. Therefore we predefined part of the measures. This resulted in sets of energy saving measures which all contained a condensing boiler to heat the building and the domestic hot water and a mechanical exhaust system for ventilation. Globally, the main variation between the sets of measures is the average insulation value of the construction (insulation of walls, floor and roof and type of glazing and doors).

## RESULTS AND DISCUSSION

The first step of our study resulted in a list of average insulation values (U-values) for the house in figure 1, with which the house (with the predefined systems) complies with the national energy performance requirement level per participating country. The list is given in table 1. The lower the average U-value is, the better the house is insulated. A first step in our comparison study could be to conclude that countries with a low average U-value have a stricter EP requirement level than countries with a high average U-value. Following this route, we could for instance conclude that the Netherlands and Finland lie on one end of the spectrum and Spain and Italy on the other end.

However, this conclusion is a bit too simple. Firstly, the optimal set of energy saving measures depends on national and even regional aspects of which climate is the most obvious (but certainly not the only one). In this line of thinking the U-value is not per definition the most optimal energy saving measure in all regions, so basing the strictness of the EP requirement level on the U-value is not evident. After all, is it logical to state that the EP requirement level in a hot Mediterranean region will be as strict as one in a cold Scandinavian region if the insulation level is comparable? Is insulation a comparable optimal energy saving measure in the North and in the South of Europe?

| **Member State** | **Average U-value [W/m²K** |
|---|---|
| Denmark | 0,36 |
| Poland | 0,38 |
| Czech Republic | 0,50 |
| Spain | 0,80 |
| Germany | 0,47 |
| Belgium (Flanders) | 0,54 |
| France | 0,56 |
| Italy | 0,70 |
| Finland | 0,25 |
| Netherlands | <<0,25[1] |

Table 1: Average U-value with which the house of figure 1 complies with the national energy performance requirement level in the participating countries. Note that this average U-value is, among other things, a function of the fixed building characteristics predefined in the study.

Secondly, we found that the national EP methods differ fundamentally in the type of energy uses which are taken into account. Where France and the Czech Republic even consider daylight in their national EP method for dwellings, other countries, like Finland and Spain, do not consider for instance the energy use for domestic hot water heating and electricity use of fans. Not all countries take into account cooling, some focus only on the heating and cooling needs and leave out the systems or take them into account by using default values only.
It is easy to imagine that these fundamental differences complicate the comparison. A key aspect of a performance method is that the choice of measures is not fixed, but that it is possible to choose between different sets of measures. A national method which looks at heating need only will need a high insulation level when the requirements are strict, while a national method which looks at a broad range of energy uses could be strict by various sets of measures, including ones with much lower insulation levels, because this can be compensated by for instance a solar collector, a heat pump or efficient heat recovery.

Thirdly, by stating the preconditions we assumed that the building conditions in all national calculations in the study are the same except for the insulation value. Of course this assumption is too simple. Consider for instance the condensing boiler. There are various different condensing boilers on the market with different efficiencies, different auxiliary energy uses, etc. Prescribing a concrete condensing boiler (brand X, serial type Y) proved not functional: Boilers sold for instance in Poland are not sold, among other countries, in Spain and vice versa and the declared efficiency values differ between countries due to different measurement methods. The consequence is that it is not evident how to take into account a Spanish boiler in a non-Spanish method. What we finally did was that we prescribe a “non-improved” condensing boiler and performed an in depth study to look into possible differences among the efficiencies of the boilers which were used in the assessment by the countries. The preliminary results of this study show that a spread among the efficiencies exists, but is less than expected.

[1] The EP requirement level in the Netherlands is so strict that it is not possible for the house to comply with the Dutch requirement level when no additional energy saving measures beyond the preconditions are applied.

Another issue with the preconditions is that, for practical reasons, they are quite global. They don't address building details, like air tightness and thermal bridges. In depth studies also have looked into these aspects. The results of the study on air tightness are described in (1). One of the issues on thermal bridges is that some national methods do and some don't take them into account. Transmission losses of course are higher when you do consider thermal bridges, while on the other hand you could imagine that countries which take into account thermal bridges have an incentive for improving them. It is beyond the scope of this paper to go into these aspects in detail. The essence is that these issues complicate a fair and robust comparison of EP requirement levels.

As discussed above, it is questionable whether the average U-value is a proper comparison variable. To be able to take into account climate aspects we performed calculations to transform the national sets of energy saving measures into energy uses. The calculation method used for this has been EPA-NR (2). EPA-NR is a European energy performance calculation model, developed in a European project a few years ago, and is based on the European (CEN) EPBD Standards. An example of the results of this part of the study is given in figure 2. The figure gives the energy use of the test house for the Finish set of energy saving measures and the Italian set of energy saving measures for a cold and hot climate respectively.

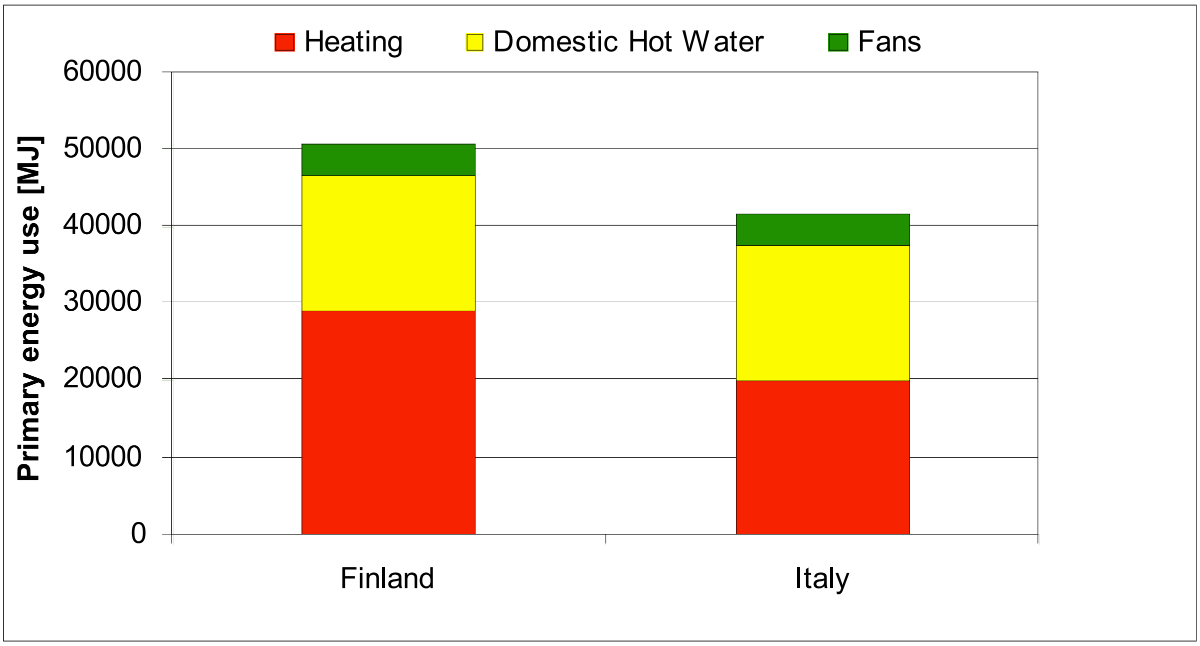


Figure 2: Energy use of the test house for the Finish set of energy saving measures and the Italian set of energy saving measures for a cold and hot climate respectively.

Interesting is to see that while the average U-value of the Finish test house is much lower than the average U-value of the Italian test house, due to the severe climate the actual energy use of the Finish house is higher. The question remains whether the Finish energy performance requirement level is stricter than the Italian one.

## CONCLUSIONS AND FURTHER CONSIDERATIONS

There are several ways of making a comparison of energy performance requirement levels among the member states of the EU. Producing comparison values is easy, but producing values which are fair and robust is less evident. And even if you'll find

fair and robust comparison values, interpreting them in terms of more or less strict also isn't trivial. In this paper we have looked at climate as an aspect which complicates matters, but there are a lot more aspects like that, like building practice, social and cultural aspects, legislation, control, and so on.
The recast of the EPBD proposes to link the energy performance requirement level to a cost optimal level. Apart from the methodology to determine a cost optimal level, it seems logical to judge sets of energy saving measures based on cost effectiveness, because hopefully by looking at cost effectiveness all these complicating matters will be reflected. With all the lessons learned in the Asiepi project we can conclude that developing a methodology linked with cost effectiveness will be a big challenge.

## ACKNOWLEDGEMENTS

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