

# Summary of Results

## EU Reference House Study for Renovation:

### How to Reduce H&C Energy Demand while Providing the Highest Comfort in Building Renovation

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#### SUMMARY

A new study, looking at the benefits of building renovation, shows that the right combination of active and passive technologies represents the optimal solution to unleash the contribution of buildings to both societal climate and energy goals while, at the same time, improving the individual comfort and well-being of citizens.

Carried out by Transsolar and Tribuenergie, with the support of Eurima, the study models the effect of residential building renovation under three different scenarios in 3 different climatic zones, in order to show the benefits of a good and excellent level of renovation across Europe.

The study "Heating and Cooling Research" shows the unique benefits of building renovation in terms of enhancing individual comfort and addressing climate and energy objectives at the same time.

It demonstrates that the best results in terms of energy savings (80-86%) and CO<sub>2</sub> emission reductions (80-91%) are reached through a combination of building envelope renovation and active technologies. It highlights the fundamental role of a highly performing building envelope to guarantee individual comfort and well-being to the occupants throughout the whole year.

A right enabling regulatory framework must steer Member States towards the broad societal project of renovation strategies. If well designed and implemented, these strategies will deliver the combined benefits of greenhouse gas reductions, energy savings and increased comfort and well-being at home. Enabling citizens to enjoy all these benefits at the same time is essential to create large buy-in for renovation.

#### CONTEXT

The "Clean Energy for all Europeans" package, in its review of the Energy Efficiency Directive, proposes a 30% binding EU Energy Efficiency target. The European Commission recognizes that this target can only be met by substantially increasing the EU renovation rates.

At the same time, the package puts the consumers at the heart of its future chances on success. Consumers' support is key. Delivery of savings and, not less important, noticeable improvement of living comfort and well-being at home will enable such broad consumer acceptance of renovation programmes and provide the necessary dynamics to ensure a transition towards a decarbonised building stock.

The enabling legal framework therefore needs to address the societal climate and energy objectives and the individual comfort and well-being objectives at the same time.

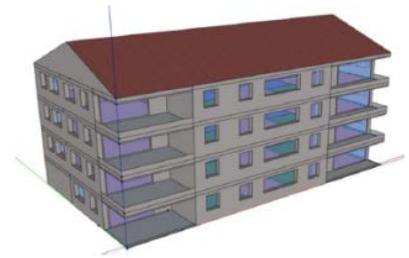
## OBJECTIVE OF THE STUDY

The objective of this study, carried out by Transsolar and Tribuenergie, was to investigate the improvement potential of both a “good-level” and an “excellent-level” renovation, from an energy performance perspective as well as in terms of improved thermal comfort-levels for the occupant, using existing active and passive technologies.

## METHODOLOGY

The assumptions of the study have been defined so as to give as much as possible a realistic European picture; these are:

- **Type of building.** The renovation of a multi-family building (MFD) in 3 different European climatic regions (Paris, Helsinki, Naples) has been considered, with the objective to identify its improvement potential regarding energy consumption, global warming potential, economic return and comfort increase. The reason for choosing a MFD is that it represents a typical building type across the EU while capturing different consumer behaviours and demographics.
- **Level of renovation.** The study uses three levels of renovation and a base case which represents a building from the current building stock.
  - Case 1: a first series of calculations represents the renovation to a “good level”<sup>1</sup> but only for the building envelope<sup>2</sup> or for the equipment<sup>3</sup>.
  - Case 2: In these calculations, the renovation is completed on the “good level”, through both an improved building envelope and equipment.
  - Case 3 has been put at the level of nZEB (for a renovated building)<sup>4</sup>.
- **No on-site renewables have been assessed.** In all the studied cases it would be possible to add on-site renewables. The share of the total consumption that can be covered by renewables will be depending on the energy demand. The lower the energy demand, the higher the part that could be covered by renewables.
- In parallel to results in energy efficiency and CO<sub>2</sub>, the study also delivers results for thermal comfort on the basis of a dynamic modelling.
- The synergies between envelope and equipment improvements have been analysed in depth.



## MAIN OUTCOMES

### 1) Renovation of the building envelope delivers individual comfort

A good performing building envelope can provide twice the comfort hours in a year compared to a low performing one (respectively, 97% and 49% of yearly hours, in a range of 21-26 degree). This translates in 355 versus 179 days. **A good building envelope can therefore ensure comfort to occupants throughout the whole year.**

<sup>1</sup> The good level has been defined as a renovation in compliance with the current legislation.

<sup>2</sup> Improvement of the following components: wall, roof, floor, windows, air tightness, thermal bridge corridor, ventilation.

<sup>3</sup> Heat pump, boiler and automation.

<sup>4</sup> For good case: we took current easily available applications and products. Excellent case: we took currently available but very good (not common) products and thicknesses).

2) **Renovation of the building envelope plays a pivotal role in delivering Climate and Energy objectives**

The envelope renovation is the only way to drastically lower the energy consumption and CO<sub>2</sub> emissions (60-70%) while at the same time lowering the operating costs (60-70%) and increasing the comfort level of the building.

3) **Well combined with active technologies, envelope improvement measures provide the best results in delivering climate and energy objectives**

A good envelope renovation accompanied by better equipment and automation represents the optimal situation, deploying the full potential of the building stock in achieving climate and energy targets. Energy consumption and CO<sub>2</sub> emissions can be lowered by 80-86% and 81-90% respectively.

4) **Renovation of the envelope is a key enabler for the future energy grids, facilitating the decarbonisation of the energy supply**

The refurbishment of the envelope translates in a significant reduction of the peak energy demand of the building by 61% (-132kW). This has the double benefit to facilitate the decarbonisation of the energy supply and, at the same time, provide extra flexibility for the grid. In addition, lowering the intrinsic demand for heating and cooling makes it easier to have on-site renewables to cover the demand.

#### CONCLUSIONS

The study shows that the thermal comfort dimension needs to be better accounted for in renovation strategies and programmes, not least because the benefits are huge considering the rising energy poverty and health costs associated with poor buildings throughout Europe.

Similarly, at individual building level, any EU citizen should be offered guidance throughout a renovation in order to benefit from both energy savings and increased comfort at the same time, and decide for which renovation path to take in full awareness of the benefits associated with the various measures.