

GLOBAL ECONOMIC POTENTIAL FROM MODERATE AND DEEP RETROFIT OF BUILDING ENVELOPES IN RESIDENTIAL AND SERVICES SECTORS FROM AN ENERGY SYSTEM PERSPECTIVE

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Overview

This paper examines the economic potential for improving building envelopes to improve energy efficiency and thereby reduce energy intensity in the building sector. Five key-regions are examined: United States, Western Europe, Former Soviet Union, India, and China. The purposes of the study are: 1) determining the most cost-effective measures to retrofit the building envelope by comparing deep vs. moderate retrofit options, in both residential and service sectors from an energy system perspective; 2) calculating the investments required to achieve 30 percent of energy savings in buildings from moderate retrofit and 60 percent from deep retrofit; 3) analysing the importance of the lock-in of energy savings effect; and 4) identifying which of the five regions under analysis have the greatest energy saving potential for energy efficiency improvement in buildings. Deep retrofits are expected to have larger economic potential than moderate retrofits in regions with a suboptimal building insulation standard.

Method

An Integrated Assessment Model (IAM) was selected to carry out this analysis, namely ETSAP-TIAM model. It was chosen due to its comprehensive technology database which includes over a thousand technologies in all the sectors of the energy system. This feature allows us examining the economic potential from retrofitting buildings for both moderate and deep retrofit options. Furthermore, the IAM approach is suitable to compare competing technologies, e.g. building retrofit vs. replacement of HVAC systems, choosing the most cost-effective technology based on linear optimization.

Global buildings performance-based models have demonstrated the cost-effectiveness of deep retrofit in buildings. However, from an energy system perspective these models not always follow the cost-optimization logic, thus missing the overall effect on the energy system when energy efficiency measures are implemented. Therefore, In order to overcome the limitations of global buildings performance-based models, this analysis combines both approaches to have a comprehensive understanding on the energy savings potential from deep and moderate retrofit of building envelopes under the cost-optimization logic.

Results

Preliminary results show that deep retrofit has larger economic potential than moderate retrofit in three out of five regions investigated: Former Soviet Union, China and India. The reason is that these regions have on average lower building insulation standards than US and Western Europe, and therefore deep retrofit enables significant energy savings in both residential and service sectors. Additionally, energy savings potential from deep retrofit that may be locked-in is significant only in Former Soviet Union. Finally it should be pointed out that investments in deep retrofit are expected to occur in the mid and long-term (2020-2050).

Conclusion

The study demonstrates that from an energy system perspective deep retrofit in buildings are a cost-effective option for space heat and cooling savings in both residential and service buildings, particularly in regions which have low building standard. Another remarkable point is that energy savings from deep retrofit can be locked-in if energy policies support moderate instead of deep retrofit in the mid and long-term.

References

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