# Innovation Systems and Transformation in Industries: the Case of Energy Efficiency innovations in the Nordic Housing Markets

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A wide range of energy efficiency enhancing innovations has been available to the housing industry for quite some time. These innovations can be located at the material and component level, at the sub-system integration level and at the design level. Evidence suggests that many of these solutions can be considered economically and technologically mature. Even so, it is still mostly confined to niche applications. Widespread and systematic use of energy efficiency in the housing industry has not materialized; there are very limited examples of large-scale adoption of energy efficiency in housing developments. Concerned with the greater diffusion of energy efficiency enhancing innovations, the Nordic Council of Ministers, funded a 2 year project focusing on how innovation policy and systems can support such efforts.

In this paper we present findings from this project. The paper analyse the development and emergence of energy efficiency enhancing innovations in Nordic housing markets through case studies from Sweden, Denmark, Finland and Norway. The case studies were constructed through using qualitative data, such as thematic interviews of the relevant actors and written materials. A case study framework was created with the help of the innovation system literature to function as a basis for collecting and analysing the empirical data. The cases of development and diffusion of energy efficiency enhancing innovations at the three levels of materials and components, sub-system, and design are analysed from the perspective of the innovation systems concept. The paper explores the enabling and constraining factors for greater diffusion of energy efficiency innovations and relates the analysis to previous theories on the role of national innovation systems and logic and structure of the housing industry.

The initial results of the research show that, while Nordic innovation systems seems to be facilitating and supporting energy efficiency innovations at the component and materials level, they are ineffective at facilitating change at the levels of sub-systems, design and integration in housing developments. Due to the logic and structure of the housing industry, closing learning loops, knowledge management and transfer plays crucial parts in the success of energy efficiency integration in housing developments. Innovation and diffusion support measures need address this weakness in the knowledge management and learning at the project level for wider integration of energy efficiency enhancing innovation.