Louvered Door Research and Development for User Needs and Energy Efficiency in Thailand's Context

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louvered door, thermal comfort, energy efficiency, human dimension, user needs

Thailand's tropical climate makes it is necessary for air-conditioned interior spaces so that high temperature and high humidity can be brought down to meet human thermal comfort. In Thailand, louvered doors are widely used to naturally ventilate buildings, not only to provide human comfort but also allow for electricity conservation. However, to date, louvered doors are usually installed between naturally ventilated areas and air-conditioned areas (i.e. bathrooms and kitchens) where there are needs to eliminate excessive humidity and strong smell. In this case, louvered doors naturally become unintentional openings that permit buildings' infiltration or ex-filtration, which becomes a significant burden on the cooling load of air-conditioning systems. Until now, there has not been enough research and development of energy-efficient louvered doors. Moreover, available louvered doors have usually been designed without concern for the human dimension. Even though, some of these louvered doors feature angle-adjustable louvers to accommodate energy efficiency needs in air-conditioned buildings, it has been found that these louvers are usually left opened all the time. With this in mind, these doors do not aid in energy efficiency with respect to air-conditioning systems as intended.

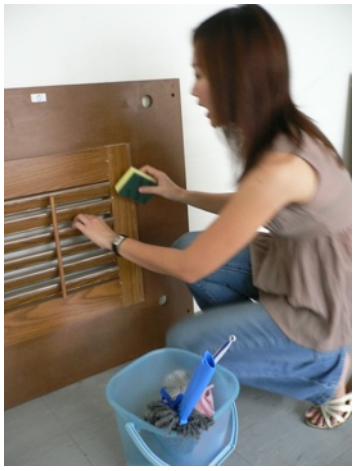
Louvered doors installed between naturally ventilated areas and air-conditioned areas

Angle-adjustable louvers accommodating energy efficiency in air-conditioned buildings

This research and development project aims to investigate and propose practical louvered door solutions in terms of energy saving, human dimension (physical, psychology, social and cultural human factors) as well as feasibility in production and market. One success of the project comes from an interdisciplinary collaboration among specialists in indoor air quality and energy management, user centered design, as well as product design and engineering. To achieve energy efficiency where practicality could be reached, the research results have led to design criteria in three aspects including architecture and indoor environment (energy efficiency, thermal comfort and indoor air quality), human dimension (convenience in operation and maintenance, styling preferences, privacy and security), as well as product design and engineering (feasibility in material, production and market). Four design directions were generated and produced. Prototypes of each design direction were tested for four main aspects including energy-efficiency performance in a laboratory via the blower door technique (area leakage, pressure and air flow volume), usability by scenario testing with follow-up interview, styling preferences through visual tool kits with follow-up interview, and production feasibility by expert testing and interview.



Energy-efficiency performance testing

Usability testing

Styling preference testing

In assessing all the aspects, and based on conclusions drawn from evaluation, the most promising design direction does not correspond with the best energy-efficiency performance; rather, it is the direction that best compromises between energy efficiency and human dimension. Apparently, to achieve designing energy efficient architecture, design solutions should not be concerned solely with technical and scientific aspects, but must accept a need to integrate additional dimensions that influence energy efficiency for both practicality and acceptability purposes.