Mapping failures in energy and environmental performance of buildings

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Highlights

- Buildings often fail to meet standards of energy efficiency, IEQ and occupant satisfaction.
- The failure modes are categorised and evaluated by impact and correction procedures.
- O&M procedures have the greatest impact on performance and occupant satisfaction.
- Significant energy savings and comfort improvements can be achieved by correcting failures.
- In small- and medium-sized buildings, procedures can be automated.

Abstract

Buildings regularly fail to perform at optimum levels and often do not meet design predictions. These failures impact energy efficiency, provision of adequate indoor environmental quality (IEQ) and occupant satisfaction. Detailed energy audits of 33 office buildings in Brazil are used to map and categorise the performance issues which lead to energy inefficiency and inadequate IEQ. Four buildings use occupant satisfaction questionnaires to complement the audit and evaluate the impact of failures on users. A total of 333 failures are identified and categorised in 51 separate modes. The causes of failures are identified as errors in building design and construction (D&C) or operations and maintenance (O&M). Some issues require retrofit procedures, but most can be corrected by adapting O&M procedures. Small- and medium-sized offices generally repeat the same failure modes; automated procedures or checklists and training could optimise performance in these buildings. Large offices are likely to require commissioning expertise in newer buildings, while older buildings require automation systems or full retrofits. The effects of O&M and building management are seen to have greater impacts on performance and occupant satisfaction than factors such as design, year of construction or building HVAC system.
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