

The findings suggest that electric bus heating set-points may be more conservative than necessary for passengers and that moderate cabin temperature reductions may be feasible without substantially reducing comfort.

The key result is the mismatch between perception and action: More than 80% of passengers who felt warm did not reduce clothing insulation, indicating strong behavioural inertia during short urban trips

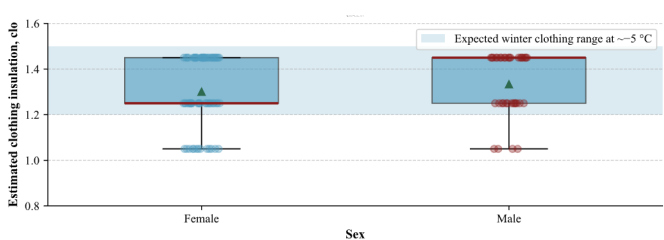
This suggests that short-duration bus passengers tolerate mild overheating rather than adapting their clothing, which creates an opportunity for more energy-efficient electric bus heating strategies.

Introduction

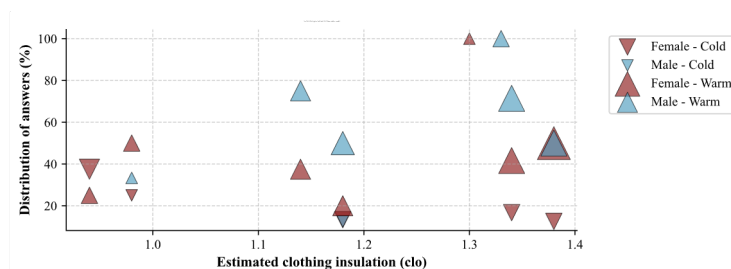
Cabin heating is a major energy challenge for battery electric buses in cold climates because heat must be supplied from the traction battery rather than from engine waste heat. At the same time, heating strategies must maintain acceptable passenger comfort. This study examines whether winter bus passengers in Riga actually require high cabin temperatures, considering that they usually remain dressed in outdoor winter clothing during short urban trips. The research focuses on the relationship between perceived thermal comfort, estimated clothing insulation, and observable clothing-adjustment behaviour.

Results

Most passengers remained dressed for outdoor winter conditions. Heavy winter coats or parkas were worn by 47.6% of passengers, medium jackets by 35.9%, and lighter outerwear by 16.5%. Hats and gloves were each observed in 95.1% of passengers, while scarves were observed in 60.2%.



Thermal comfort responses were mainly neutral to warm. Overall, 46.6% of passengers reported feeling comfortable, 42.7% reported feeling warm, and only 10.7% reported feeling cold.

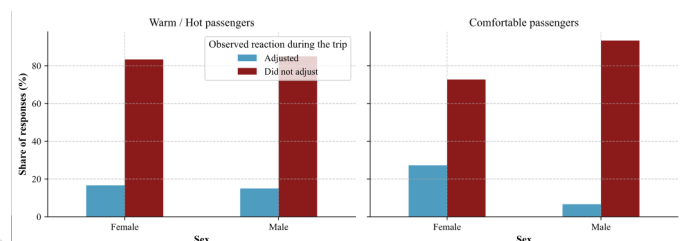


Methodology

The study used a mixed-methods field design combining a short passenger questionnaire with structured onboard observation. Data were collected on operational urban buses in Riga over three consecutive winter days, with outdoor temperatures between -5°C and 0°C . A total of 103 passengers participated. Each passenger was asked about perceived thermal comfort, time spent in the bus, and willingness to accept slightly lower cabin temperatures for energy saving.

In parallel, the researcher recorded visible clothing levels, winter accessories, clothing-adjustment behaviour, indoor and outdoor temperature, passenger density, and contextual conditions. Clothing insulation was estimated using simplified ISO 9920-based categories, combining visible outerwear and accessories with an assumed base layer of 0.8 clo for underlying garments. The analysis used descriptive statistics and cross-tabulation to compare reported thermal perception with actual behavioural

Behavioural adaptation was limited. Only 21.4% of passengers made any visible clothing adjustment, while 78.6% did not adjust their clothing.



The findings also highlight the need for a differentiated approach to thermal management. While passengers can tolerate a wider range of thermal conditions due to short exposure durations, drivers represent a distinct user group requiring more stable and controlled thermal environments. This suggests that future HVAC strategies should consider zonal or user-specific control approaches.