This document serves as Supplementary Material to the paper "Exploring residential space use pattern: Findings from a multi-country survey" (Bagheri et al. 2024) published in the Journal of *Energy Efficiency*.

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Validation Process of the collected sample

Validation Component	Description	Number of Invalid Responses
	All responses from the studied countries: 6012	
Speeders	A common method used for validating survey data is to identify *speeders*, which are respondents that complete the survey extremely fast. The common standard measure used for identifying speeders is the following: those that complete the survey in a time that is less than or equal to 30% of the average completion time are considered speeders and are not considered in the results (Greszki et al. 2014). In this survey the completion time was recorded in the online survey portal. The average time was 789 seconds, therefore any survey completion time that was 263 seconds or less was considered invalid.	235
"Attention" check	A math question (*What is the answer to 5+1)* was asked halfway through the survey to check if respondents were paying attention. Various answers were inputted. The absolute correct answer is simply "6", however, since this question is not merely looking for a correct answer, but if the respondents were paying attention, other answers were also considered valid (such as "5+1", "6/"). However, answers that were very random, such as "59" or "71", and seemingly had nothing to do with the question, were cross checked with two other open questions (space use and number of rooms) to determine if the person was inputting invalid data. If both of the other two open questions were answered outside of the range of valid input for space (m^2) and number of rooms, then that data was deemed as invalid.	13
	Valid responses with "Speeders" and "Attention check": 5766	
Space (m^2) validation	Respondents were asked for the size of their current residence in m^2 and responded in an open-ended text box. Various answers were recorded, however, there were some that seemed highly unlikely. The average m^2 of a residence varies across countries, but generally ranges between 85 and 100 m^2, and answers in this survey ranged from 1 to 1000 m^2. A minimum standard for living space was searched for in the literature to identify a range for valid answers. Minimum standards for individual bedrooms were identified for Germany and Portugal, both at 6 m^2, but not for Sweden or Poland. A minimum living room standard	55

	was identified for Portugal, at 10 m^2. It was decided that the minimum room standard of 6 m^2 was likely to be too small for a total living space (highly unlikely to include kitchen and bathroom areas). A minimum living standard was found for the Netherlands, at 10 m^2 for existing buildings and 18 m^2 for new buildings. Considering the minimum size of a bedroom (6 m^2), and the (at minimum) shared access to a kitchen and bathroom, 10 m^2 has been considered to be a reasonable assumption based on expert judgement for a minimum living space for inhabitants in the countries assessed. A maximum was not identified for the valid range of space (m^2) of the residence. A maximum living space was not identified in literature. Averages sizes of residences in Germany, Sweden, and Portugal were found in literature, at approximately 94.3 m^2, 99.7 m^2 and 106.4 m^2, respectively. Furthermore, it was realised after the completion of the survey that the question asking for space (m^2) did not specify "heated space" or "built space", thus, it is possible that the respondent interpreted the question to include backyard or land area, which could be extensive if residing in the countryside. Thus, no maximum valid answer for space (m^2) was set. Additionally, those with very large residences were deemed as valuable for the survey results as they hold potential for renting or sharing their space. The figures are taken from Appolloni and D'Alessandro (2021).	
Valid responses with "Speeders", "Attention check" and "Space validation": 5710		
Number of rooms	The average number of rooms per person in the EU was 1.6 in 2021 (Eurostat 2021). However, no "maximum" number of rooms in a household was identified. Considering there can be large student housing or social housing residences, as well as large estates, it is possible for the number of rooms to be large. However, a residence exceeding 20 rooms, was considered to be highly unlikely, and, answers such as 60, 68 or 90, were considered to be invalid and likely a mistake. Thus, the valid range of answers for "number of rooms" was between 1 and 20.	244
Valid responses with "Speeders", "Attention Check" and "Number of rooms": 5521		
Total people	Similarly to the number of rooms, the valid number of people in a residence was set as 20. A maximum standard number of people in a household was not identified in literature, however, large student housing or cohousing units do exist, particularly in student cities, thus 20 was deemed as a reasonable maximum number of people in a residence based on expert judgement.	48

Table SM2. 1 *An overview of the factors considered in validating the survey data*

These data validation checks were not applied uniformly. The "speeders" and "attention check" were applied to all data. The "space", "number of rooms" and "total people" were applied only to questions where that component is relevant. So, for example, the valid "space" data was applied to responses concerning m^2 or m^2/capita. This was to increase the validity of the answers for those specific questions, while not removing further data from other answers, as while they may have answered the space question incorrectly, possibly because of interpretation that does not mean their answers to other questions were not valid. Thus, for the sake of maintaining a reasonable sample size, the validation filters were not applied to all questions analysed.

References

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Greszki, R., Meyer, M., & Schoen, H. (2014). *The impact of speeding on data quality in nonprobability and freshly recruited probability-based online panels* .