Determinants of sustainable energy consumption in public buildings

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Scientific problem

The review of scientific literature reveals that analysis of determinants of energy consumption is important issue regarding energy saving not only in ***residential*** buildings but in other types of buildings including all kinds of ***public*** buildings.

At the same time many scientific papers focus more on improvement of ***technical solutions*** in terms of energy efficiency than on ***behavioral aspects*** of energy saving.

Large part of the total energy is consumed in public buildings but the issues of sustainable energy consumption behavior are less studied in these types of buildings.

Theoretical background

Research into behavioral change models has yielded a range of factors, referred to as determinants that can explain human behavior.

One of the most influential determinant models in that respect is the ***Theory of Planned Behavior***, which has also been applied to energy consumption behavior.

Frederiks, Stenner and Hobman (2015) have classified various individual (socio-demographic and psychological) and situational (contextual and structural) factors that may influence household energy consumption and conservation.

Method

The theoretical approach in presenting groups (socio-demographic, psychological and contextual) of energy saving determinants was applied.

The determinants of energy saving were analyzed grouping them into three sections:

1. psychological and social;
2. socio-demographic and economic;
3. contextual.

*The **systematic literature review** was guided by the following research question:*

what are the determinants of energy consumption behavior in public buildings?

Research

The research questions were operationalized into the following set of search terms:

energy consumption ((energy OR electricity) AND ((consumption OR efficiency OR saving OR conservation OR reduction) OR "energy use" OR "electricity use") AND behav*);

public building (workplace OR office visitor OR “public building” OR service OR compan* OR building OR employee* OR worker) and

determinants (predictor* OR determinant* OR factor* OR attitude* OR value* OR knowledge OR belief* OR habit OR norm*).

Research

Identified as some of the most relevant and accessible outlets for research on determinants of energy consumption, the following sources were consulted:

- ScienceDirect,
- EBSCO (EconLit, GreenFile),
- Emerald,
- WEB of Science,
- Scopus.

Out of the 471 search results, 45 were selected for the review (9,55% acceptance rate).

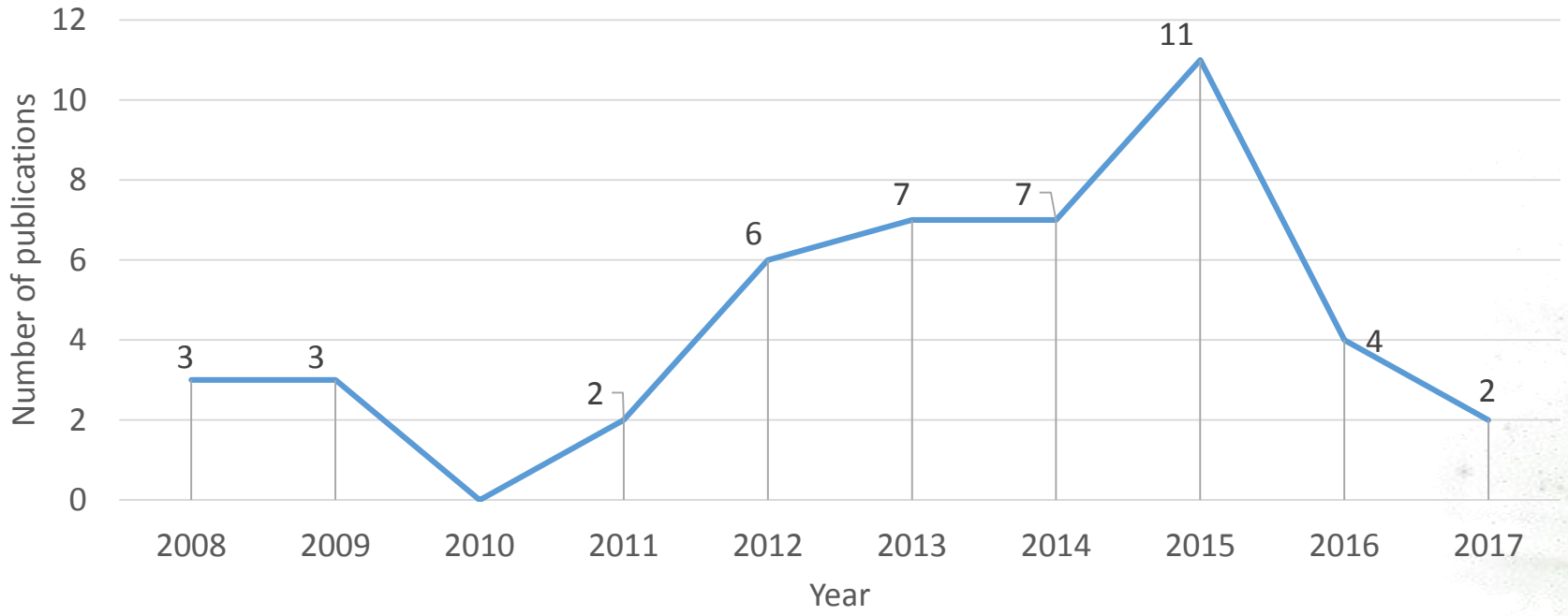
Research

The main reasons for the rejection were:

1. papers were ***out of scope*** in general;
2. studies on ***residential buildings***;
3. studies on ***other sectors*** (e.g. travel, tourism, transport, etc.)
4. studies on ***building-related energy consumption***, efficiency measure, renovation opportunities, emissions, etc. (data-driven, no focus on occupants)
5. ***Scope*** of the studies was ***too broad*** (sustainability, pro-environmental behavior, climate change).

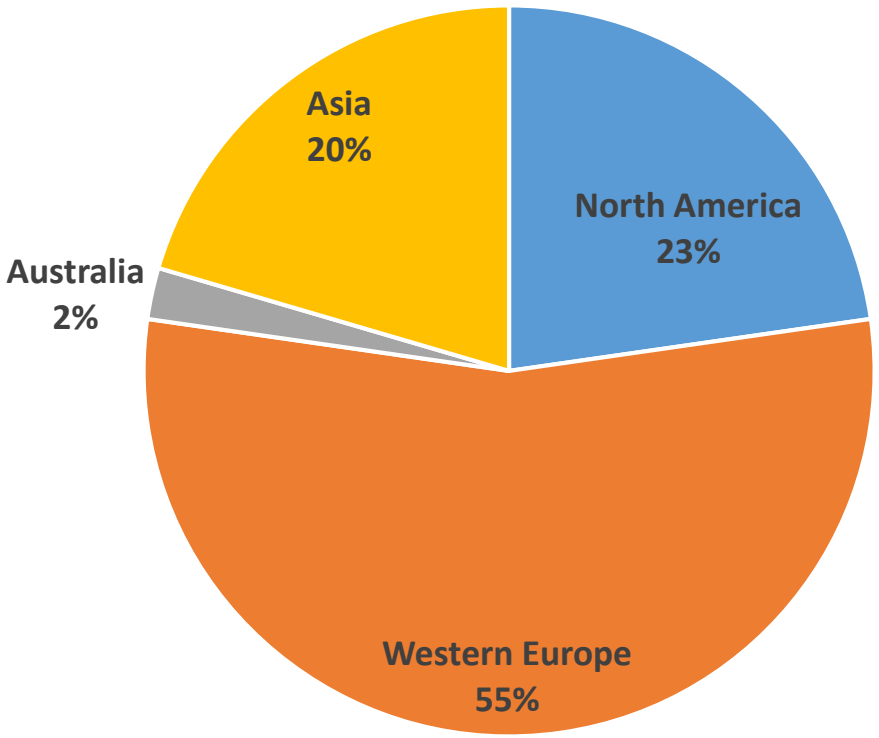
Research

Number of annual publications on sustainable energy consumption in public buildings



Research

Regional distribution of empirical data



Psychological and Social Determinants

In total ***36 papers*** analysed psychological and social determinants of energy consumption and ***39 different psychological and social determinants*** were identified in these papers.

Most often studied psychological and social determinants:

- attitudes,
- subjective norms,
- awareness,
- social norms and
- motivation.

Sociodemographic and Economic Determinants

In total ***eight papers*** analysed sociodemographic and economic determinants of energy consumption and ***15 different determinants*** were identified in these papers.

Climate was studied in two papers and the rest of determinants are analysed each in separate paper.

Sociodemographic and Economic Determinants

Sociodemographic and Economic Determinants :

- Climate
- Quality of social interaction and communication
- Building type factors
- Building size
- Risk and uncertainty
- Lack of time to improve energy efficiency
- Investor/user dilemma
- Split incentives and appropriability
- Operation and maintenance
- Efficient technologies
- Benefit evaluation
- Investments for energy efficiency in buildings
- Hidden costs
- Access to capital
- Motivation to overcome energy efficiency barriers

Contextual Determinants

Nine papers focused on contextual determinant of energy consumption and ***12 different determinants*** were highlighted. There were no papers that analysed the same determinants.

Contextual Determinants

Contextual determinants:

- Environmental norms;
- Technology adoption norms;
- Technological Frustration;
- Window opening and closing;
- Company policy;
- Activity-based;
- ICT support;
- Awareness of the governmental regulation;
- Lack of information about energy consumption;
- Imperfect information;
- Occupancy factors;
- Energy end use factors.

Conclusions

- The occupants of public buildings are far less concerned on energy saving than in residential buildings mainly for the reason that they do not pay the bill and lack information about the amounts of energy consumed.

- The literature reviewed revealed that the following theories and theoretical models were used to investigate determinants of sustainable energy consumption in public buildings: Theory of Planned Behaviour, Value-Belief-Norm Theory, Theory of Collective Action, Theory of Normative Conduct, Self-Determination Theory, Coherent Theory of Environmentally Significant Behaviour and Theory of Basic Values.

Conclusions

The comprehensive review was done on papers analysing psychological, social, sociodemographic, economic and contextual determinants in energy saving and consumption behaviour in public buildings allowed to determine five most important determinants in terms of their influence on energy consumption:

1. Attitudes,
2. Awareness,
3. Social norms,
4. Feedback (information),
5. Organizational encouragement and support.

Thank You for Your attention