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Hitting two birds with one stone: the role of tenants in energy efficiency as means to combat energy poverty

An inquiry using regulatory focus theory to explain the attitude of Dutch tenants towards energy efficiency

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Abstract

The rising global energy prices have evoked increasing attention to energy poverty. Improved energy efficiency is a fundamental and effective way to address this problematic matter. The perspective of social housing tenants remains overlooked in scientific literature despite its importance, being the reason why this inquiry attempts to get a better understanding of the attitude of social housing tenants towards energy efficiency. Regulatory focus theory by Higgins (1997) was consulted to establish an understanding of the attitude of tenants based on basic human needs for either growth and advancement (promotion focus) or safety and security (prevention focus). A questionnaire was distributed to 374 social housing tenants within the Netherlands. The data was analysed with factor analysis and subsequently with regression analysis. The results show that tenants with a promotion focus tend to be positive towards energy efficient renovation, while tenants with a prevention focus show a more cautious attitude. Furthermore, the regression results with moderator variable 'experienced energy poverty' provide evidence that tenants with a prevention focus exhibit an increasingly negative attitude as experienced energy amongst tenants rises.

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Introduction

Due to the rapidly growing energy prices (CBS, 2022), energy poverty has consequently become one of the hottest topics of the current political debate. In the Netherlands, energy poverty occurs when a household has a low income in combination with high energy costs or a house of insufficient energy quality (TNO, 2021). Around 7% of Dutch households lived in energy poverty in 2019, which is expected to rise to over 9% (TNO, 2021). However, recent trends regarding the hyperinflation of energy sources provoke additional concern (Appendix A), indicating that this number will increase even further. The worrying energy prices make the societal relevance of addressing the battle against energy poverty extremely high. Moreover, pressure on the Dutch government regarding appropriate policy measures has increased. In response, the authorities announced to spend 2.6 billion euros on reduced tax on energy, compensation for low-income households, and promotion of sustainable housing (Rijksoverheid, 2022a). However, along with previous energy poverty measures, these relatively small interferences don't fundamentally address the problem of energy poverty. Energy poverty is a multidimensional issue (Bartiaux et al., 2021), making the solution to this problem reach further than one-time financial support packages.

Due to the concept of housing corporations, people with a relatively lower income are more often tenants of social housing than wealthy people. TNO (2021) found that 75% of the 550.000 households that live in energy poverty live in a residence of a housing corporation. Knowing that only around 25% of all houses are owned by housing corporations (CBS, 2020), we can conclude that this small group of residents makes up a vast majority of the people who live in energy poverty, indicating that predominantly social housing tenants are confronted with energy poverty. Therefore, the main group of interest in this inquiry will be social housing tenants in the Netherlands.

One effective way of alleviating energy poverty in households is by improving the energy efficiency of those houses (Zhao et al., 2022; Karpinska & Smiech, 2020 & Rodriguez-Alvarez et al., 2021). Improving energy efficiency is the act of reducing energy use per unit of output by producers and consumers of energy products, without affecting the level of service provided (Rodriguez-Ubinas et al., 2014). Frequently used practical implementations are for example solar panels, proper isolation, or a heat pump. Essentially, energy efficient renovation generally leads to less energy consumption (Rodriguez-Ubinas et al., 2014), consequently leading to less periodical energy costs and therefore reduced energy poverty. Evidence backing up this positive relationship comes from Karpinska & Smiech (2020), who find that low household energy consumption is driven by budgetary constraints and low energy efficiency. Knowing that low energy consumption is one of the major indicators of energy poverty (Day et al., 2016), it becomes evident that low energy efficiency leads to more energy poverty. Moreover, Rodriguez-Alvarez et al. (2021) find that, amongst financial considerations, increasing energy efficiency has significantly been beneficial to combat energy poverty in European

countries. Due to the prevalent, effective, and proven relationship between higher energy efficiency of houses and reduced energy poverty of those households, improving energy efficiency will be the central means within this inquiry to address the challenge of alleviating energy poverty among social housing tenants.

When faced with the challenge to improve energy efficiency of social houses, the perspective of social housing tenants is extremely relevant since the cooperation of tenants with energy efficient renovation is important, but not always easily achieved. Currently, a vast majority of scientific literature revolves around the perspective of policymakers when addressing energy efficiency and energy poverty (Primc et al., 2021). However, perceptions and attitudes of tenants within the energy efficiency debate are often overlooked. Palm et al. (2020) note that limited research has been conducted on what social housing tenants think of energy efficiency measures and their attitude towards energy efficient renovation, indicating a scientific gap. Too little research has been done on the attitude of tenants towards energy consumption, energy efficiency, and their influence on these matters (Ambrose et al., 2016 & Ambrose and McCarthy, 2019). Ambrose et al. (2016) specifically state that tenants are under-researched and underrepresented in the energy efficiency debate.

Hayles and Dean (2015) stress that it's becoming more and more evident that this missing perspective is important to research. Tenants are an important factor within the energy efficiency transition, making it necessary to understand their perception and actions (Hayles & Dean, 2015). Implementation of improvements regarding energy efficiency in social housing can only be achieved with the support and participation of the final energy consumer (Gianfrate, 2017). Tenants play a critical, but poorly understood role, proving that the attitude of tenants is vital to better understand to address the energy efficiency issue (Janda, 2011). Due to the lack of scientific literature and the importance of this perspective, this inquiry will try to get a better understanding of the attitude of social housing tenants towards the improvement of the energy efficiency of their houses.

The attitude of tenants will be analysed using regulatory focus theory (RFT) by Higgins (1997). In the small amount of previous research on attitude towards energy efficiency such as in Palm et al. (2020) and Jansma et al. (2020), different attitudes were analysed and potentially categorised. These inquiries result in mere accumulation of knowledge and observations about the actual behaviour and attitudes of tenants. Even though this knowledge is valuable, regulatory focus theory allows to fundamentally understand and explain an attitude by means of basic human needs for growth and nurturance or security and safety. The theory views motivation in such a way that we can understand the foundational ways people approach certain tasks, goals, and decisions (Higgins, 1997). How people approach these tasks, goals, and decisions essentially reflect the attitude of individuals (Fishbein, 1963).

Regulatory focus theory by Higgins (1997) emphasizes that actions and strategy play an important role in people's self-regulatory orientation towards future end states. Higgins (1997) mainly

distinguishes between a promotion focus and a prevention focus. When a person is guided by growth and nurturance needs, he/she has a promotion focus. If a person is led by security needs and safety, he/she has a prevention focus.

An important aspect of RFT is that not only the outcomes are valuable for individuals, but also how these outcomes are approached (Pereira & Coelho, 2020). Regulatory focus plays an important role in the nature of attitudes as motivational principle (Higgins, 1998). Higgins (1997) noted that when considering motivation and behaviour, having a promotion or prevention focus already makes a big difference. Differences in self-regulation orientations influence how individuals respond to their social surroundings (Florack et al. 2013), such as energy efficiency. Florack et al. (2013) also note that behaviour can be better understood when differences between self-regulatory strategies are considered, which is exactly why RFT is used to analyse the attitude of tenants towards energy efficiency. Due to the proven influence of somebody's regulatory focus on their responses; choices; judgements; and behaviour (Florack et al., 2013), a better understanding of attitude towards energy efficiency can be established by taking regulatory focus as explanatory variable in this research.

When only the relationship between regulatory focus and attitude of tenants towards energy efficiency is investigated, it will not be possible to differentiate between energy poor tenants and non-energy poor tenants. If the degree of energy poverty of tenants is included in the model, it becomes possible to incorporate the current (financial) state of a person into the model, since this specific state could have a significant influence on their attitude. When experienced energy poverty is included, it becomes possible to analyse whether the degree of experienced energy poverty influences the relationship between attitude and regulatory focus. Therefore, experienced energy poverty will be included as a moderator variable.

Coming together, the research objective of this inquiry is to get a better understanding of the attitude of social housing tenants in the Netherlands towards energy efficiency by using regulatory focus theory. This understanding is targeted to contribute to the scientific literature about energy efficiency of housing and alleviation of energy poverty. This results in the following research question:

What is the effect of regulatory focus of social housing tenants in the Netherlands on their attitude towards energy efficiency, and is this relation moderated by experienced energy poverty?

The deliberate choice has been made to address this question with quantitative data analysis. Firstly, quantitative research often has a higher generalisability (Hair et al., 2018). Also, statistical tools used in quantitative analysis allow for direct objective measurement between the variables of interest, allowing to identify whether there is a direct link between a person's regulatory focus and their attitude towards energy efficiency. Data collection will happen through a questionnaire, which will be sent to tenants of two housing corporations, living in municipalities Gemert-Bakel and Doetinchem.

The questions regarding regulatory focus will be based on a standardized question set of 4 questions to quickly determine regulatory focus (Cunningham et al., 2005). The other questions will be about the attitude towards energy efficiency and their experienced energy poverty. Consequently, factor analysis will be performed to form the constructs of the variables, while regression analysis is used to measure the underlying relationship between the regulatory focus of tenants and their attitude towards energy efficiency, as well as the moderating role of experienced energy poverty.

This paper proceeds with the theoretical overview, serving the purpose of getting a better understanding of the three main concepts that will be addressed and their underlying relationship. The second part of the paper contains the methodology and the results. This paper comes to an end with the conclusion, in which the answer to the research question will be given, and a discussion. The discussion will contain practical implications, theoretical and methodological reflection, and suggestions for further research.

Theoretical background

The theoretical background has been divided into four sections. The first three sections reflect one key concept, while the fourth section is the conceptual model which is derived from those three sections. First, 'attitude of tenants towards energy efficiency' will be described. Then, an analysis of regulatory focus theory will be provided, as regulatory focus will be the independent variable in this research. The relationship between regulatory focus and the attitude of tenants towards energy efficiency will also be discussed in this section. Lastly, an overview of the moderator variable 'experienced energy poverty' will be provided.

Attitude of tenants towards energy efficiency

Attitude is a social psychological construct, defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly & Chaiken, 1993, p. 1). Attitude can be seen as a predisposed state of mind and is formed through previous experiences. Through time, individuals evaluate situations based on judgments about a broad variety of targets and rely on these judgments when deciding their future courses of action (Crawley & Koballa, 1994). Attitude reflects the responsive expression towards oneself, a person, circumstance, thing, or event, influencing thoughts and actions of individuals (Fishbein, 1963). Energy efficiency can be seen as a circumstance or event, allowing for a responsive expression by individuals.

When looking at energy efficiency, tenants are often dependent on housing corporations since the ownership of the property is with the corporation. They have limited choice over the property along with a low agency to improve its conditions (Barton, 2012; Gousy, 2014). However, as noted, human attitude of tenants still plays a critical role in the energy efficiency issue, as the people who live in the buildings are the ones that determine the efficiency of energy consumption and are the ones whose cooperation is required to engage in energy efficient renovation (Hayles and Dean, 2015 & Santangelo and Tondelli, 2017). The absence of house-ownership by tenants causes a fundamentally different situation for tenants than for house-owners, which means that tenants have a different attitude towards energy efficiency than house-owners (Coyne et al., 2018). Jansma et al. (2020) found that there is a significant distinction between the attitude of these two groups towards becoming natural gas free, being the dependent variable. They identified that tenants are more positive to become gas-free, feel a lower need to be engaged in the sustainable transition, are less interested in its various aspects, and have less knowledge about the transition than home-owners. Although both groups deem the local government as responsible, homeowners primarily see themselves as responsible for the transition towards sustainable housing, while tenants see the housing corporations as predominantly responsible (Jansma et al., 2020).

Carroll et al. (2016) investigated the willingness to invest in both the social- and private-rental sectors and found that both groups of tenants attach value to energy efficiency. Their main interest was in the difference of willingness to invest in energy efficiency between lower and higher energy efficiency households. They found that willingness to invest is highest for apartments and houses that are least efficient, and that tenants will pay more for increasingly higher levels of energy efficiency. The main reason for the choice of a more energy efficient home is the desire for warmer and more comfortable homes which are affordable to heat, and not necessarily the will to save energy (Ambrose & McCarthy, 2019). A positive attitude tends to be incentivised by the desire for solving financial issues, rather than the aim of increasing energy efficiency from an environmental perspective (Banfi et al., 2008; Farsi, 2010; & Bruel and Hoekstra, 2005). From these findings, a fundamental criterion for combatting energy poverty can be derived, namely that tenants do see the value of energy efficiency, and that tenants are willing to commit and engage into a more energy efficient living situation, predominantly when households already have a low level of energy efficiency.

Furthermore, Carroll et al. (2016) found the presence of information asymmetry in the housing sector, meaning that tenants often possess less information regarding energy efficiency than landlords. Complementarily, Murtishaw and Sathaye (2006) found that this will cause sub-optimal outcomes regarding energy efficiency standards. Simply the inability to spot and analyse possibilities is a common problem among tenants (TNO, 2020). These findings indicate that the level of knowledge and information is an important aspect of the attitude of tenants since the absence of information leads to both low willingness, as well as sub-optimal energy efficiency. Tardy and Lee (2019) confirm this, as they note that tenants might sometimes not even be aware of the level of efficiency or potential for improvement in their residence. In fact, social housing tenants are often also unaware of the fact that energy efficient renovation most of the time leads to lower periodical energy costs.

Important insights into the categorization of attitudes of tenants come from Palm et al., (2020). They focussed on public housing tenants and their attitude towards energy efficient renovations and the extent to which they feel motivated and able to influence these renovation projects. Through empirical observations, they identified six attitudes, being satisfied, demanding, conservative, resigned, sceptical, and resistant. Surprisingly enough, four of the six categories are negative, while the only two positive categories (satisfied and demanding) are only moderately positive towards energy efficient renovation. Respondents with a conservative, resigned, sceptical, and resistant attitude were all negatively opposed in some sort of way. Again, Palm et al. (2020) also find that the leading underlying dimension playing an important role within these negative attitudes is lack of understanding and knowledge. According to Palm et al. (2020), there is a high indication to believe that a continuous returning factor within most attitudes of tenants is the need and want for more information and the distrust of information that is provided. This problem is referred to as the principal-agent problem (Palm et al., 2020).

From the findings of Palm et al. (2020), as well as the other findings in this section, a more negative attitude of tenants is somewhat more prevalent over a positive attitude. However, research such as from Carroll et al. (2016) proves that positive attitudes are also identified, showing that there is somewhat contradicting evidence within scientific literature. Therefore, achieving a fundamental understanding of the attitude of tenants by means of their natural basic needs for either growth and nurturance, or safety and security, can help to form a simple framework to analyse how attitude towards energy efficiency is formed. In the next section, regulatory focus will be analysed, after which it will be analysed in combination with the attitude of tenants.

Regulatory focus

The independent variable in this research is 'regulatory focus', which is drawn from the theory of Higgins (1997), being regulatory focus theory. The theory is drawn upon the act of pursuing goals by means of maximizing pleasant feelings and minimizing unpleasant feelings, which is referred to as the hedonic principle (Higgins, 1997). The theory states that people pursue their goals in ways that fit their personal values and belief, referred to as their regulatory orientation (Avnet & Higgins, 2003). The theory is most prominent in the psychological field. Generally, there is no universal definition, but the act of aligning yourself with your standards and goals is frequently used within scientific literature as definition. When individuals make decisions to achieve certain goals, they approach these decisions with their individual standards and beliefs, which are reflected by any of the two regulatory foci perspectives.

An individual's regulatory focus can either be prevention oriented or promotion oriented. One can focus on promotion, being the process of aligning with one's ideal self. When you are promotion oriented, you are guided by growth, nurturance, and advancement needs. People with a promotion focus are sensitive to positive outcomes and attempt to move the status quo to a better state. On the other side, one can focus on prevention, which is the process of aligning with one's 'ought' self. People that are prevention focussed are led by security, safety, and responsibility needs. Individuals with a prevention focus are sensitive to negative outcomes, and try to maintain the current satisfactory status quo, while preventing it from worsening (Higgins & Pinelli, 2020). Promotion focus is associated with receptiveness to potential gains, while prevention focus has a high affinity with loss aversion (Higgins, 1997). Both the foci are not opposites of each other, meaning they are not mutually exclusive (Scholer & Higgins, 2008). People can score high on one, both, or neither foci.

The regulatory focus of a person is not always fixed. Promotion and prevention concerns refer to motivational states, which are formed by personal characteristics or situational cues. This means that an individual can possess a certain regulatory focus as 'trait', but these foci can also be situationally induced, which is referred to as a 'state'. Regulatory focus as a trait refers to chronic behaviour which represents either a prevention or promotion focus. However, this preference does not necessarily hold in all situations, meaning individuals can situationally exhibit any of the two foci as

temporary state. Whether an individual is either promotion or prevention oriented can influence their decision-making process, as well as determine the way that people approach and achieve their goals (Higgins, 1997). Since this inquiry attempts to get a better understanding of attitude based on the actual motivational well-being of tenants, regulatory focus as 'trait' is consulted. Attitude of tenants towards energy efficiency is represented best by their regulatory focus as trait, since this attitude shows the longer-term way of thinking of individuals. Preferences of tenants regarding this matter are not situational and short-term, meaning that it doesn't make sense to study the regulatory focus of tenants as situational state.

Relationship between regulatory focus and attitude towards energy efficiency

The link between regulatory focus theory and energy efficiency is reflected by the moment at which tenants would prefer to take action against their energy poverty. Are tenants willing to partake in long-term cost-efficient renovations, or do they simply prefer to avoid any risk by sticking to the status quo of their homes? Whether tenants are either promotion oriented or prevention oriented can have a direct effect on their attitude towards energy efficiency. There hasn't been any previous research on the link between regulatory focus and attitude towards energy efficiency. Therefore, the hypotheses will be formed based on previous research of regulatory focus linked with concepts that have high affinity with attitude towards energy efficiency, or based on previous research of attitude towards energy efficiency linked with aspects that have high affinity with regulatory focus. The coming sections will contain arguments that indicate towards a possible link between a prevention/promotion focus and a positive/negative attitude towards energy efficiency.

The first argument can be formed with information from the previous section on the attitude of tenants, as one of the conclusions based on insights of Carroll et al. (2016) is that tenants attach value to energy efficiency, mainly driven by the need for improved living conditions and a better financial situation (Ambrose and McCarthy, 2019). Regulatory focus theory notes that people with a promotion focus tend to focus on enhancement and improvement of their situation (Higgins, 1997). This perfectly translates to the attitude of tenants since the need for improved living conditions fits a promotion focus. Furthermore, tenants with this drive for better living conditions attach value to energy efficiency, which can be seen as a positive attitude towards energy efficiency. These findings give indication to believe that tenants with a promotion focus will also tend to be more positive towards energy efficient renovation.

Gabe and Rehm (2014) find that tenants are often hampered by the fear of rent premiums and costs, driven by the (unconscious) shortage of knowledge and information about the fact that energy efficient alternatives will often be cost-efficient in the middle- and long-term. Rent premiums are additional post-hoc periodical costs caused by the energy efficient renovation on top of the ex-ante renting costs. Avoiding something due to fear can be seen as the need for safety and security, which

reflects a prevention focus. The fact that tenants are hampered to partake in energy efficient renovations can be associated with a more negative attitude towards energy efficiency. Therefore, there is grounded reason to believe that people with a prevention focus tend to be more negative towards energy efficient renovation.

The second argument stems from research on the relationship between regulatory focus and risk-taking behaviour. Among numerous others, both Crowe & Higgins (1997) and Hamstra et al. (2011) find that there is a close connection between people's regulatory focus and their willingness to make risky decisions. When somebody has a prevention focus and focuses on safety and security needs, he will consequently tend to be more risk-averse. On the other hand, a promotion focus means that people are looking for growth and improvement possibilities, consequently involving themselves in more risky situations and decisions to achieve this growth. To strengthen this claim, Florack et al. (2013) state that people with a promotion focus tend to follow opportunities despite a higher risk for mistakes, while people with a prevention focus are inclined to show less risky and more conservative behaviour. Also, Kuehberger and Wiener (2012) set up two experiments and found strong evidence in both experiments that people with a prevention focus avoided risk, and that individuals with a promotion focus preferred risk.

Due to uncertainty and potential loss, energy efficient renovations are often perceived as risky by tenants. Mehdi (2010) found that risk considerations play an important role in attitude towards energy efficiency, and that the perception of risk guides people's decisions and attitudes when actual risk is not explicitly observed. Despite the fact that energy efficient renovation might not necessarily cost the tenants any extra money, energy efficient renovation and investments regarding this matter are often perceived as risky, predominantly caused by lack of knowledge and information (Palm et al., 2020). Therefore, either driven by the actual riskiness, but more often driven by the perception of riskiness due to lack of knowledge and information, the link between regulatory focus and risk attitude of tenants can help explain the link between regulatory focus and the attitude of tenants towards energy efficiency.

To conclude the second argument, energy efficient renovation comes with risk, and risk considerations are an important factor in attitude of tenants towards energy efficiency. Therefore, as people with a promotion focus tend to be more risk-seeking, it can be argued that these people will have a more positive attitude towards energy efficient renovation, since these renovations are often (perceived as) risky. Also, people with a prevention focus are more risk averse, which means that a more negative attitude towards energy efficient renovation can be expected. To strengthen this last claim, Mehdi (2010) emphasizes that new technologies are undervalued by tenants with risk aversion. This finding also gives indication to believe that people with a prevention focus relatively tend to have a more negative attitude towards energy efficiency.

Based on the previous analysis, there are two main arguments coming from scientific literature which indicate a certain relationship between the regulatory focus of tenants and their attitude towards energy efficiency. The first indication comes from the desire for improved living conditions as a result of energy efficient renovation, matching a promotion focus, and the fear of costs and rent premiums, matching a prevention focus. Secondly, risk-seeking behaviour matches a promotion focus, while risk-averse behaviour matches a prevention focus. Energy efficient renovation is (perceived as) risky, which means that a more positive attitude relates to a promotion focus, while a more negative attitude relates to a prevention focus. Based on these findings, hypotheses 1 and 2 are formed. Lastly, it's important to note that a negative attitude does not necessarily mean that this person has a 'negative' attitude. A more positive attitude means that this tenant is more willing to partake in energy efficient renovation, while a negative attitude means that the tenant is more inclined to remain with the status quo of the house, preferably not partaking in (risky) sustainable renovation.

Hypothesis 1

Tenants with a promotion focus are willing to partake in energy efficient renovation of their houses.

Hypothesis 2

Tenants with a prevention focus prefer to remain with the current status quo of their houses.

Experienced energy poverty

The deliberate choice has been made to take 'experienced' energy poverty as concept, since concretizing energy poverty is more or less impossible. This is because of the multidimensional character of the phenomenon (Bartiaux et al., 2021), as well as the multiple definitions that have arisen due to the complexity of the problem and a non-existing uniform definition (Villalobos et al., 2021). The most concrete and accepted classification comes down to that a household is said to be energy poor if it needs to spend more than 10% of its disposable income on fuel to maintain an adequate level of warmth (Boardman, 1991), while the average spending is around 5% (EC-Europe, 2020). It's important to note that there are two practical dimensions to this definition. Within this definition, a household is either energy poor when it spends more than 10% of its disposable income on energy, or/and when it does not possess an adequate level of energy. However, this adequate level of energy is open to context, and therefore not objectively measurable. Furthermore, Villalobos et al. (2021) note that the circumstances determine the energy-related well-being of residents. Therefore, energy poverty can differ between and within societies, which makes the context and experience of residents important.

The important question that remains is how to determine the experienced energy poverty of tenants. Concerning this matter, the Multi-dimensional Energy Poverty Index (MEPI) of Berry (2018) will be consulted. In line with the previously mentioned multidimensional aspect of energy poverty, she

developed this index to capture the experienced energy poverty by households in its various dimensions. Two indices about housing and transport were developed, but only the index on housing will be consulted. This index perfectly fits the goal of this inquiry to capture the 'experienced' energy poverty of tenants. The identified dimensions are restriction, housing conditions, equipment, energy spending, and standard of living. These dimensions together form the degree of experienced energy poverty, which is why these dimensions will be used in this inquiry. These dimensions also contain indicators, but more in-depth information will be provided in the 'operationalisation' section.

Relationship between experienced energy poverty, regulatory focus, and attitude towards energy efficiency

There is little theory in scientific literature that could suggest what the influence of the moderator variable will be on the relationship. Though, interesting findings come from Gabe and Rehm (2014), who looked into energy efficient rent premiums and concluded that tenants are not willing to pay for energy efficiency. Particularly low-income tenants, the main observation group within this paper, tend to be conservative and passive when looking at rent premiums. It's important to note that, in this specific inquiry, there was no emphasis given to the notion that a more efficient home most likely leads to saving of money. However, this information is also not disclosed in a real-world situation, which is the area of interest for this research. As noted, a lack of knowledge and information about energy efficient renovation often exists among tenants, causing the idea that these renovations will result in higher costs for the tenants, while, in reality, these costs are often lowered. Anyhow, as the level of income is very closely related to (experienced) energy poverty, it can be expected that when somebody experiences its energy poverty situation as more severe, he will also generally prefer the status quo of their homes. Moreover, a person with a more average income, that is, higher than a low-income, will be more willing to partake in energy efficient renovation of their homes (Gabe and Rehm, 2014).

Including experienced energy poverty into the model allows to analyse if the degree of energy poverty has any influence on the relationship between regulatory focus and attitude. When this variable is included, the relationships between a promotion/prevention focus and attitude towards energy efficiency from hypotheses 1 and 2 change, as we know that tenants with a high level of experienced energy poverty are more likely to be negatively minded towards energy efficiency. The perception of low-income tenants that energy efficient renovation leads to higher costs results in the expectation that they will be increasingly opposed to energy efficient renovation when their experienced energy poverty increases. This means that the moderator variable will have a negative effect on attitude towards energy efficient renovation in both relationships. The positive effect of a promotion focus on a positive attitude towards energy efficient renovation will be negatively influenced by an increasing level of experienced energy poverty. Also, the positive effect of a prevention focus of tenants on the

desire to remain with the status quo of their house will be strengthened by an increasing level of experienced energy poverty. Based on these assumptions, the following hypotheses are formed.

Hypothesis 3

As the experienced energy poverty increases, the positive relationship between tenants with a promotion focus and the willingness to partake in energy efficient renovation of their houses decreases.

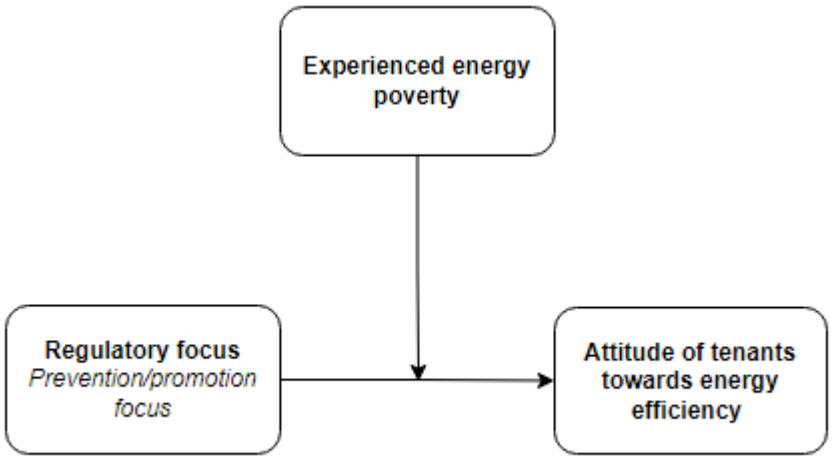
Hypothesis 4

As the experienced energy poverty increases, the positive relationship between tenants with a prevention focus and the preference to remain with the current status quo of their houses increases.

Conceptual framework

The conceptual model is composed based on the relationship between the three key concepts that will be researched. Regulatory focus is the independent variable. The independent variable can either be a prevention focus or a promotion focus, depending on the regulatory focus of the tenants. Following, the dependent variable is the 'attitude of tenants towards energy efficiency'. As described, this attitude reflects the willingness to partake in energy efficient renovation, or oppositely, the preference to remain with the current status quo of the house. Lastly, the moderator variable is the experienced energy poverty, since this variable has a high likelihood to have a moderating effect on the relationship between the independent and the dependent variable. This variable also allows to find whether the degree of energy poverty influences the relationship. The relationship of interest looks as follows.

Figure 1: Conceptual model



Methodology

Research method

The aim of this research is to gain a better insight into the attitude of tenants towards energy efficiency and the relationship with regulatory focus, as well as the influence of the severity of the experienced energy poverty on this relationship. The observation unit is 'tenants of social housing'. The research method used for this inquiry is quantitative research, being the process of collecting and analysing numerical data (Hair, 2018). Quantitative research is generally more reliable, objective, and more generalizable than qualitative research (Hair, 2018). Since all three variables can be measured quantitatively, the previously mentioned advantages benefit the results of this research, which is why a quantitative approach will be used.

Information on the three variables will be collected through a survey. Tenants will be asked to fill in a questionnaire based on a 6-point Likert scale (Likert, 1932), which means that the questionnaire will only contain closed questions. The results of the survey will be analysed with factor analysis and the underlying relationship will be tested with regression analysis.

This research expands on the regulatory focus principle and attempts to add to the already existing theoretical framework. Therefore, a deductive research methodology is adopted, since the theory of regulatory focus is used. The advantage of deductive research is that causal relationships between variables can be explained, which is what this inquiry also attempts to do. Besides, this research has consulted theory to form hypotheses, which can only be done when a deductive approach is applied. Lastly, new insight will be developed on the attitude of tenants towards energy efficiency as and the relationship with regulatory focus, which has not been done in academic literature before.

Data collection

Data collection in this research will be done through means of a survey to collect a sample of the population. As described in the theoretical overview, attitude influences the thoughts and actions of individuals (Fishbein, 1963). This relationship allows for concrete measurement since the thoughts and actions of individuals can therefore be captured, giving insight into the attitude of an individual. Regarding attitude, Swamy (2007) notes that consulting a questionnaire in psychological research as methodology is generally seen as reliable and scientific. A questionnaire can be seen as a research instrument, allowing to measure thoughts, actions, experiences, and opinions. Therefore, using a questionnaire will be very suitable, as it allows to get a better understanding of attitudes, reflected by thoughts and actions of tenants. The questionnaire will contain three sections with questions to determine the experienced energy poverty, the attitude towards energy efficiency, and the regulatory focus. All these three variables will be grouped into one questionnaire. More in-depth information about the structure of the questionnaire will be in the operationalisation section.

The questionnaire will only contain closed questions. The answers should be filled in based on a 6-point Likert scale (Likert, 1932). A 6-point Likert scale does not allow for an indifferent opinion. It encourages people to think more carefully about their opinion which will always lean towards either a positive or negative attitude. The questions will be about the individual, and the answers will be in the range of (1) Strongly disagree; (2) Disagree; (3) Somewhat disagree; (4) Somewhat Agree; (5) Agree; (6) Strongly agree. The questions will be formed as statements, to which the respondent will fill in either of the six possible answer possibilities.

Lastly, some difficulties of research with survey data should be addressed. The first difficulty is response bias, being the tendency for respondents to falsely or inaccurately respond to questions. This can be a serious problem, as it can significantly influence the results. Considering this research, this problem can certainly occur as well. Questions about attitude and regulatory focus are open to this bias. However, especially poverty is a sensitive topic, of which people are often ashamed (Yongmie, 2013). Based on this idea, one can expect that this might result in inaccurate responses. Therefore, it's extremely important to make sure that all respondents are informed that their responses will be completely anonymous. Additionally, phrasing questions neutrally and non-leading will reduce the chance of response bias, which is why this research will make use of these techniques.

Another problem that might occur is nonresponse bias. The longer the questionnaire, the less people will be inclined to fill in and send back the answers. Therefore, the number of questions and words will be reduced to the least amount possible. Introducing information and questions should be as short and clear as possible, while still giving the possibility to collect useful results. The questions will be tested beforehand with external participants in a pilot-format to determine whether the questions are easy to understand and clear. A problem that is somewhat related to this is undercoverage. This problem occurs when one or several groups are left out of the selection. The questionnaire will be sent out to a vast majority of the tenants of the cooperating housing corporations. It will be sent out through e-mail, which means that about 2 to 5% of tenants will not be reached. This can be seen as a critical shortcoming of this research that is hard to overcome. One can reasonably assume that tenants without technologies such as these could also have a 'different-than-average' opinion on energy efficiency, since energy efficient renovations are often part of modern technologies.

The last difficulty is the challenge of phrasing good questions. As noted, attitude and experienced energy poverty are not variables that can be measured objectively. Neither does regulatory focus, but the questions that will be used are already confirmed to be accurate questions to determine the regulatory focus of an individual. As noted, questions should be clear and short, but should also accurately represent the underlying variables. To combat this problem, the questions that will be formed will be based on dimensions from previous research, as well as on questions that were used before to determine attitude, such as from Jansma et al., (2020). Some questions might be copied or slightly adjusted to fit the dependent variable within this research.

Respondents

The data will be collected from tenants of two housing corporations. The first corporation possesses 2800 houses in municipality Gemert-Bakel in the Netherlands. The corporation will distribute the questionnaire to all its tenants and answers can be filled in through an online survey tool. The second corporation possesses 8000 houses around Doetinchem and Hummelo, and will send the questionnaire to a random sample of 300 houses. Generally, the low level of interaction will most likely result in a low response rate. Field (2017) mentions that the minimum sample size should be 5 respondents per question. The amount of questions is 28, which means the minimum amount of participants should be 140. The amount of responses is 374, meaning that the sample is quite large.

Challenges regarding the respondent arise as well, as the investigated population is: 'tenants of housing corporations in the Netherlands', while only two municipalities are researched. Therefore, the results of this research should not automatically be adopted as results for the whole of the Netherlands. However, since there isn't any reason to believe that these municipalities are non-representative for an average municipality in the Netherlands regarding socio-demographic characteristics, there isn't any indication that the results of this paper should be un-generalizable to the Dutch population. However, it also does not mean that these results can be blindly accepted as attitude of Dutch tenants, since the sample is not taken from the whole population. To conclude, there is indication that the results of this study can be somewhat expected for the average municipality as well, but this does not mean that there is evidence that these results are completely generalizable to the whole of the Netherlands.

Operationalisation

At the end of the survey, there will be three questions for the purpose of getting some insight into differences among socio-demographic characteristics. These questions will be open, and will be about 'age', 'municipality', and 'gender'. There will be no other questions regarding health, education, or other privacy-sensitive information which can scare respondents off. Besides, this information is not important for the research.

Experienced energy poverty

As noted, the questionnaire will consist of 3 sections. The first section will be about experienced energy poverty. There is some discussion about the right indicators and measurement of energy poverty. A generally accepted notion is that a household suffers from energy poverty when they spend more than 10% of disposable income on energy to acquire an adequate living standard (Boardman, 1991). However, in some cases, this indicator can be seen as not inclusive enough or too inclusive, as some households might be falsely included or excluded. Therefore, it's often argued that energy poverty is more multidimensional which is not suitable for one single factor. (Chapman & Okushima, 2019; Nussbaumer et al., 2012). Academic literature generally agrees that there are multiple rough categories that define energy poverty (income, energy price, household efficiency). Especially

experienced energy poverty is not objectively measurable through a single factor. Therefore, several questions will be added to the questionnaire to determine the degree of experienced energy poverty.

This inquiry assumes the Multi-dimensional Energy Poverty Index (MEPI) of Berry (2018). This index was made to identify the dimensions of energy poverty. However, a fitting questionnaire was not explicitly added, which means that the questions will be formed based on the 8 indicators provided by Berry (2018). The dimensions are restriction, housing conditions, equipment, energy spending, and standard of living. The indicators that fit the dimensions can be found in Appendix B. It's important to note that the questions that will be formed will remain as close as possible to the purpose of the indicator. Also, the questions will be based purely on experience of the tenants, and not on any objective measurement. This section contains 8 questions to determine the experienced energy poverty, which are the following:

1) I turn the heating down because of the high energy costs.
2) In winter I feel cold in my house.
3) I live in an energy efficient house.
4) My household appliances use a lot of energy.
5) The heating in my house works well.
6) My energy bill is so high that I have to save on costs for groceries, clothing, and other important foodstuffs.
7) I spend more than 10% of my net income on energy costs.
8) If energy prices continue to rise, I will have financial problems.

Regulatory focus

Regulatory focus is measurable with the standardized set of eleven questions from Higgins et al. (2001). However, the aim is to keep the questionnaire as short as possible. A long and tedious questionnaire should be prevented to keep the attention of the respondents. Therefore, a shortened version of the regulatory focus questionnaire will be used, as proposed by Cunningham et al. (2005). It's referred to as the 'regulatory focus quick assessment' (Gorman et al., 2012), and is used to measure whether an individual has a promotion or prevention focus. It consists of four statements: *I focus on opportunities that will enhance my life; I focus on ensuring that I will avoid potential mishaps or negative events; I am primarily motivated by seeking potential successes; I am primarily motivated by avoiding failure.* The promotion score will be calculated with the average score of questions one and three, while the prevention score is obtained through the average score of questions two and four. Tests by Farb and Cunningham (2005) prove that this test is highly correlated with other measures of self-regulatory focus. Furthermore, a multitrait-multimethod examination of the validity of the scales pointed out that this test is at least as valid, if not more valid, as other available measures (Cunningham et al., 2005).

Attitude of tenants towards energy efficiency

Attitude of tenants towards energy efficiency will be measured through a set of statements, also making use of the 6-point Likert scale to determine the degree of agreement (Likert, 1932). The dimensions that will be used to measure attitude are based on predictors of attitude by Jansma et al. (2020). He notes that in academic literature, five main categories have been identified which are underlying factors for attitude of tenants. These categories are financial aspects, knowledge and information, process-related factors, environmental aspects, and socio-demographic characteristics. However, Jansma et al. (2020) focussed their questions more on the 'attitudes towards the transition'. Due to the high affinity of this attitude and the attitude of interest in this research, questions from Jansma et al. (2020) can partly be used.

The questions will be formed in such a way that they are fitting to either a promotion or prevention orientation. The questions will be formed based on the feelings, emotions, and characteristics that fit a certain regulatory focus. This is done to increase the chance of finding a relationship between the dependent variable and independent variables. The feelings and emotions for a promotion focus are eagerness, sense of achievement, accomplishment, and playing to win. For a prevention focus, these are cautiousness, obligations, duties, and playing not to lose. The questions are also partly inspired by research of Zwaan (2020), who looked at attitude of homeowners towards renewable energy systems. All questions within this research had a Cronbach's alpha of over 0.6. Due to the high similarity with attitude towards energy efficiency, only slight adjustments have to be made to the questions. In short, the dimensions that will be focussed on are financial aspects, environmental concerns, and attitude towards energy efficient renovation. All questions are either related to a more positive attitude towards the willingness to partake in energy efficient renovation, or a more positive attitude towards the preference to remain with the status quo. Lastly, question 17 will be the only open question to collect information about knowledge of the respondents regarding energy efficiency. The questions are as follows:

9) In general, I think my generation is responsible for the environment.
10) In general, I hope that my generation can improve the environment a little bit.
11) Switching to sustainable energy is necessary to keep our world liveable.
12) Switching to sustainable energy improves our world.
13) The transition to sustainable energy must be made carefully, in small steps.
14) It is smart if different ways to make energy more sustainable are tried out at the same time.
15) The idea that we can stop global warming reassures me.
16) It makes me happy to think that renewable energy will replace fossil fuels in the future.
17) In my opinion, making my home more sustainable means:
18) I see it as my duty to contribute to making my home more sustainable.
19) I am satisfied with my house as it is now.
20) I am afraid that energy-efficient sustainability will lead to higher housing costs.
21) I hope that energy-efficient sustainability will lead to more pleasant living.
22) I am afraid that making my home more sustainable will cause a lot of nuisance and hassle.
23) I look forward to enjoying the benefits of a more sustainable home.

24) I see it as growth and progress when my house becomes more sustainable.

Data analysis

Factor analysis

Factor analysis will be used to analyse the three variables from the survey. The Kaiser-Meyer-Olkin test was conducted to measure whether the sample adequately represents the population (Hair et al., 2018). Furthermore, the Barlett's test of sphericity was performed to test whether there is any correlation among the variables. If this is the case, factor analysis can be performed. Discussion of the results will be done in the results section, but experienced energy poverty and attitude towards energy efficiency require additional methodological explanation regarding the preceding steps to reach the final models.

Experienced energy poverty

Even though the statements concerning experienced energy poverty are based on theoretical ground, the variable does not have a known construct yet. Therefore, exploratory factor analysis will be applied. The fitting extraction method for this is principal component analysis (Hair et al., 2018). After first running the factor analysis with oblique rotation (oblimin), there is no correlation between the factors higher than 0.3, meaning that orthogonal rotation (varimax) should be used (Hair et al., 2018). Factors were chosen based on an eigenvalue higher than 1. Two factors were found, being item 1,2,6,7,8 & 3,4,5. Cronbach's alpha is used to measure the reliability of the constructs. Only factor two had a worrying alpha, being 0.378. Even though there is much debate in scientific literature about an appropriate alpha, a minimum level of 0.5 is generally seen as required (Hair et al., 2018). Factor 1 had an alpha of 0.815 with financial considerations as shared theme among the items. The items within factor two were incoherent. Therefore, due to an alpha of factor two under the minimum value, a lack of coherence among the items of factor two, and factor one having very much the theme of interest (financial considerations) for the research goal of this inquiry, the decision was made to systematically drop the items from factor 2. The final model with one factor that followed can be found in the results section.

Attitude towards energy efficiency

Exploratory factor analysis was also applied to attitude towards energy efficiency, with principal component analysis being the matching extraction method (Hair et al., 2018). Again, the analysis was first run with oblique (oblimin) rotation. This time, there was correlation between components 1 and 3 of 0.381, which means oblimin rotation should be used as this number is higher than the minimum value of 0.3 (Hair et al., 2018). The first model consisted of 4 factors with item 15 having cross-loadings, with the highest being 0.392 on factor 1, which lead to the deletion of this item. Subsequently, item 18 was deleted due to a highest loading of 0.433, while 0.5 should be accepted as

the minimum value (Hair et al., 2018). Lastly, item 19 was deleted due to a relatively low factor loading and a significant Cronbach's alpha increase of 0.653 to 0.761 of factor 3 when item 19 was deleted. The final model has three factors, as can be seen in the results section.

Regression analysis

To test the relationship between the variables, multiple regression analysis will be performed. This method is used to determine what the underlying relationship is between one dependent variable and multiple independent variables. This inquiry makes use of cross-sectional data, as the questionnaire is only answered at one point in time. The model is linearly estimated through ordinary least squares (OLS). The Durbin-Watson (DW) statistic will be used to test for autocorrelation. The variance inflation factor (VIF) test is used to test for multicollinearity.

As stated, attitude towards energy efficiency has three factors. As this is the dependent variable, all three factors will be used separately as dependent variables with the other two factors as control variables. This results in three estimations. The moderator effect is formulated as an interaction effect between experienced energy poverty and regulatory focus. Each model will also be separately predicted for a promotion focus and a prevention focus with their corresponding interaction terms, resulting in six total models. Not using both foci in the same model has several reasons, as it reduces multicollinearity, reduces the chance of estimation error, and avoids a high number of independent variables in the model which is generally undesirable.

The corresponding regression estimation is composed as follows.

$$A_x = \beta_0 + \beta_1 * RF + \beta_2 * RF * EEP + \beta_3 * A_x + \beta_4 * A_x$$

Where A_x is represented by the attitude of tenants towards energy efficiency, where x can either be factor 1,2, or 3 with the other two as independent variables, β_0 is the constant, $\beta_1; \beta_2; \beta_3 \& \beta_4$ are the slope coefficients, RF is regulatory focus which can either be a promotion focus or a prevention focus, EEP is experienced energy poverty, and $RF * EEP$ is the interaction effect between regulatory focus and experienced energy poverty, being either a promotion interaction effect or a prevention interaction effect. The main focus will be on the RF and the $RF * EEP$ coefficients, as these represent the variables of interest in this study.

Limitations

The two foremost limitations of quantitative research are the challenge of achieving internal and external validity. Internal validity is desirable, as this makes the conclusion of a relationship credible and trustworthy. Without internal validity, a causal relationship can't be established. One way to increase internal validity is by blinding the respondents regarding the outcomes. Even though it will become evident what the topic of the research is, it's not necessary to exactly inform the respondents

about the research that is done with the outcomes. Therefore, a general direction of the research will be given, such that the respondents understand what the research is generally about. However, the exact relationship of interest is not disclosed. Furthermore, due to the little research on attitude of tenants towards energy efficiency, there is a certain possibility of a confounding variable. From theoretical analysis, there is no indication for this, but there always remains a possibility when the topic has not been researched much. In conclusion, actions to improve the internal validity are done, but the limitation of a lower internal validity remains.

Next, external validity is another limitation of this quantitative study. This research will be performed in the Netherlands, making the results of this inquiry only applicable to Dutch tenants and not to any bigger geographical area. This is because cultural differences play an important role in attitude of people (Kaba & Osei-Bryson, 2013). Therefore, there is no indication that the results from this inquiry can also be generalized to other parts of the world. This is a limitation, as research always opts to produce generalizable knowledge about the real world. Furthermore, the results from this inquiry might not necessarily be generalizable to the whole of the Netherlands. However, there is no indication that the studied municipality is very different than the average municipality when looking at socio-demographic characteristics. Therefore, there is a reason to believe that the results of this inquiry can generally also be expected for other municipalities which are not far from average.

Research ethics

Firstly, it should be clear to all respondents that participation is voluntary. Besides, they should be aware that there are no risks involved. The benefits of this research for the tenants can potentially be that housing corporations will adjust or step up their actions towards energy poverty of tenants in a more effective way, as suggested by the results of the inquiry. There will be no questions about personal information, besides age and gender. Also, all disclosed information will be and remain anonymous. As mentioned earlier, respondents will be informed about this anonymity. There will also be a note that the researcher is in no way linked or partnered with the housing corporation besides this research. There will also be an explanation of what exactly the gathered data will be used for. Furthermore, the tenants will be informed formally through an introduction text. The number of questions and the approximate time to fill in the questionnaire will be disclosed at the start, just like the purpose of this study. Very briefly, there will also be an explanation of what their contribution will mean to the researcher, as well as to the academic literature. Afterwards, they will also be informed about what the procedure is of what happens after they fill in the form, with corresponding dates. At the end of the questionnaire, they can leave their mail-address if they wish to be informed about the results of the paper, as well as any other information they wish to obtain. The questionnaire will also contain the personal contact details of the researcher in case they have questions or are interested in the results of the study.

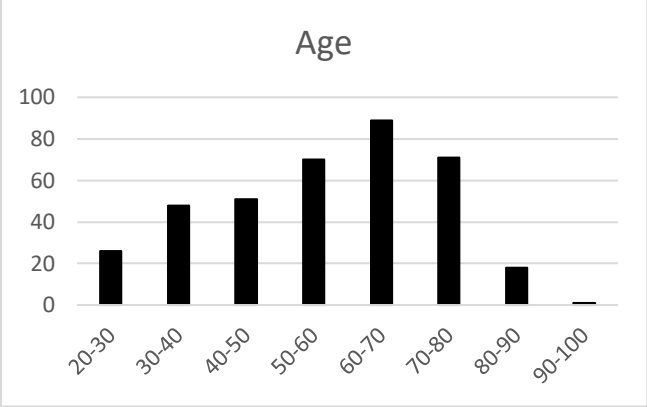
Results

The results section commences with descriptive statistics and general information about the results. As noted, factor analysis and multiple regressions analysis were consecutively used to analyse the acquired data to come to a conclusion. Therefore, both the factor analysis and the regression analysis will be documented in two separate sections.

Figure 2: Descriptive statistics of respondents

Gender	Male 181	Female 193	
Municipality	Gemert-Bakel 335	Bronckhorst 1	Doetinchem 38
Regulatory focus	Promotion 176	Prevention 150	Indifferent 48

Figure 3: Age of respondents



Figures 2 and figure 3 show the descriptive statistics and the age of the respondents. Out of the 374 people, 181 were male and 193 female. As these numbers are relatively equal, there should be no concern for an unrepresentative sample regarding gender. Furthermore, a relatively high response rate in municipality Gemert-Bakel could impose problems regarding a representative sample for the Netherlands. However, in the methodology section, this issue was discussed and it was argued that there is little indication that any of the respondents in the municipalities are structurally different than an average Dutch municipality, but that these results should not be blindly accepted as for the whole of the Netherlands.

The third row shows the dominant preference of the respondents regarding regulatory focus. Even though respondents can score high on both a prevention and a promotion focus, these numbers show their preference as mutually exclusive. 176 respondents have a promotion focus and 150 a prevention focus while 48 are indifferent. This implies that more people have a promotion focus than a prevention

focus. As touched upon in the methodology section, undercoverage was expected to be a potential issue. Since the survey was only mailed out, elderly were expected to be underrepresented. However, when figure 3 is compared to the population pyramid of the Netherlands, there are no significant differences to be spotted.

Factor analysis

Factor analysis was performed for all three variables, being 'experienced energy poverty', 'regulatory focus', and 'attitude towards energy efficiency'. The extracted factors will consecutively be used for the regression analysis. The final results of the factor analysis will be documented in this section.

Experienced energy poverty

Figure 4: factor analysis experienced energy poverty

Item	Factor 1
6) My energy bill is so high that I have to save on costs for groceries, clothing, and other important foodstuffs.	0.863
8) If energy prices continue to rise, I will have financial problems.	0.84
7) I spend more than 10% of my net income on energy costs.	0.795
2) In winter I feel cold in my house.	0.697
1) I turn the heating down because of the high energy costs.	0.582

Note. N = 374.
Extraction Method: Principal components. Cronbach's alpha = 0.815.
Eigenvalue as % of variance = 58.153%.
Kaiser-Meyer-Olkin Measure of sampling adequacy = 0.821.
Bartlett's Test of Sphericity (sig) = <0.001.

The factor matrix of the items of experienced energy poverty is displayed in figure 4. The scale has high reliability ($\alpha = 0.815$). It seems like the recurring theme of these items is financial considerations. The Kaiser-Meyer-Olkin (KMO) value is 0.821 and Bartlett's test of sphericity (<0.001) are both excellent values for factor analysis. The KMO value should generally be over 0.7 for the sample to be adequate (Hair et al., 2018). The eigenvalue as % of variance is also close to the desired level of 60% (Hair et al., 2018). Only the factor loading of item 1 is relatively low, which shouldn't necessarily impose any problems.

Regulatory focus

Figure 5: factor analysis regulatory focus

Item	Factor 1
27) I am mainly motivated by looking for possible successes.	0.792
28) I am mainly motivated by avoiding failure.	0.638
25) I focus on opportunities that will improve my life.	0.635
26) I focus on preventing possible accidents or negative events.	0.633

Note. N = 374.
Extraction Method: Principal axis factoring. Cronbach's alpha's = 0.765.
Eigenvalue as % of variance = 59.091%.
Kaiser-Meyer-Olkin Measure of sampling adequacy = 0.722.
Bartlett's Test of Sphericity (sig) = <0.001.

Confirmatory factor analysis was performed, as the construct of regulatory focus is already scientifically grounded. The matching extraction method for confirmatory factor analysis is principal axis factoring (Hair et al., 2018). The four items have a great internal consistency with a Cronbach's alpha of 0.765. The eigenvalue percentage, KMO test, and Bartlett's test are all satisfactory. All items have a good enough factor loading and are relatively the same.

Attitude towards energy efficiency

Figure 6: factor analysis attitude towards energy efficiency

Item	Factor 1	Factor 2	Factor 3
10) In general, I hope that my generation can improve the environment a little bit.	0.819		
9) In general, I think my generation is responsible for the environment.	0.772		
11) Switching to sustainable energy is necessary to keep our world liveable.	0.703		
16) It makes me happy to think that renewable energy will replace fossil fuels in the future.	0.692		
12) Switching to sustainable energy improves our world.	0.650		
14) It is smart if different ways to make energy more sustainable are tried out at the same time.	0.533		
20) I am afraid that energy-efficient sustainability will lead to higher housing costs.		0.764	
13) The transition to sustainable energy must be made carefully, in small steps.		0.637	
22) I am afraid that making my home more sustainable will cause a lot of nuisance and hassle.		0.614	
23) I look forward to enjoying the benefits of a more sustainable home.			0.832
24) I see it as growth and progress when my house becomes more sustainable.			0.772
21) I hope that energy-efficient sustainability will lead to more pleasant living.			0.660

Note. N = 374.
Extraction Method: Principal components. Cronbach's alpha's = 0.828, 0.499, 0.761.
Rotation method: Direct oblimin.
Eigenvalue as % of variance = 59.151%.
Kaiser-Meyer-Olkin Measure of sampling adequacy = 0.836.
Bartlett's Test of Sphericity (sig) = <0.001.

Attitude towards energy efficiency has 12 items and 3 factors, as depicted in figure 6. The rotation method used was direct oblimin due to the moderate correlation between factors 1 and 3. The eigenvalue, KMO value, and Bartlett's test have excellent values. Only Cronbach's alpha of factor two can be seen as critical. The minimum value imposed by Hair et al. (2018) is 0.5, which means the internal consistency can be seen as relatively weak. However, the recurring themes within the items can be seen as great potential for correlation between the variables for the following reason. The

overarching concept of factor one is environmental behaviour. Scoring high on these items can be seen as a positive attitude towards a clean environment and sustainable energy. The items within the second factor represent a more cautious attitude towards energy-efficiency of people's houses. Scoring high on these items means respondents have a more 'negative' attitude towards energy efficient renovation. In other words, respondents that score high on these factors prefer to be less involved in energy efficient renovation and prefer to remain with the status quo of their homes. Lastly, the third factor represents a positive attitude towards energy efficiency/energy efficient renovation. Scoring high on factor three means a more positive attitude towards energy efficiency. This inquiry attempts to identify the link between someone's regulatory focus and the relationship with either a positive or negative attitude towards energy efficient renovation, which is why factors 2 and 3 are perfectly fit to identify this relationship since these two factors represent these positive and negative attitudes.

Regression analysis

Using multiple regression, six estimations were performed, where each figure displays two of them. The number of respondents, Durbin-Watson statistic, and R-squared are displayed at the bottom of the estimations. Experienced energy poverty (EEP) is used to construct the interaction terms. The three figures all have a different dependent variable. The first DV is factor one of attitude towards energy efficiency (AF1), the second DV is factor two of attitude (AF2) and the third DV is factor three of attitude (AF3). The left side of the column represents the promotion focus (promotion) estimation with its corresponding interaction term (EEP*promotion). The right side of the column contains the prevention focus (prevention) estimation with the corresponding interaction term (EEP*prevention).

Factor 1 attitude towards energy efficiency (AF1)

Figure 7: Regression analysis factor 1

	Promotion AF1	Prevention AF1
Promotion	0.117**	
	(0.055)	
EEP*Promotion	0.001	
	(0.008)	
AF2	-0.032	-0.037
	(0.044)	(0.044)
AF3	0.444***	0.449***
	(0.051)	(0.050)
Prevention		0.096**
		(0.048)
EEP*Prevention		0.006
		(0.008)
Constant	2.017***	2.052***
	(0.359)	(0.355)
Observations	374	374
DW-Stat	2.062	2.063
R-squared	0.256	0.259

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The Durbin-Watson boundaries are 1.735 and 2.265, meaning that the DW-statistic should be within these values to rule out autocorrelation. The values of all six models are within the boundaries, signifying that there is no autocorrelation within the models on a 1% significance level. The number of observations is the same for each model, being 374. All variables are normally distributed. All models were tested for multicollinearity with the variance inflation factor (VIF) test. All VIF values were far under the critical value of 3, the highest being 1.817, proving that multicollinearity among the variables can be ruled out. A high R-squared is not expected, since there was no previous research that suggests control variables with high predicting power for the DV. Besides, models with real world data often contain a lower R-squared, indicating that an r-squared around 0.15-0.4 is not necessarily a problem. In these two models, the R-squared values are 0.256 and 0.259.

The first thing that stands out from the coefficients and the significance levels is that both the prevention focus and the promotion focus are statistically significant at the 5% level. As a reminder, factor one represented a positive attitude towards a clean environment and sustainable energy. There seems to be a positive relationship between both foci and this factor. It gives indication to believe that both people with a promotion and a prevention focus tend to have an increasingly positive attitude

towards sustainable energy and a sustainable environment. Both moderators are statistically insignificant, meaning that the level of energy poverty likely does not influence this relationship. This is also not expected since factor one has little to do with any financial considerations. Lastly, the values for attitude towards energy efficiency factor 3 (AF3) in both models are statistically significant at the 1% level. The significant positive beta coefficients of factor two (0.444*** & 0.449***) show that there is a positive relationship between AF1 and AF3. This is expected since both factors represent a 'positive' attitude towards similar themes. Factor two (AF2) shows no statistically significant relationship with factor 1 (AF1).

Factor 2 attitude towards energy efficiency (AF2)

Figure 8: Regression analysis factor 2

	Promotion AF2	Prevention AF2
Promotion	0.004	
	(0.065)	
EEP*Promotion	0.020**	
	(0.009)	
AF1	-0.044	-0.053
	(0.061)	(0.061)
AF3	-0.401***	-0.401***
	(0.062)	(0.061)
Prevention		0.098***
		(0.045)
EEP*Prevention		0.023***
		(0.010)
Constant	5.925***	5.583***
	(0.312)	(0.326)
Observations	374	374
DW-Stat	1.763	1.759
R-squared	0.145	0.147

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 8 shows the regression results with factor two of attitude towards energy efficiency as the dependent variable. The third and fourth estimations have the lowest R-squared values of 0.145 and 0.147. These values are relatively small, making the predictive power of the model relatively low. From the factor analysis it was concluded that the general concept of factor two is a cautious attitude towards energy efficient renovation. From the left column it becomes clear that there is no significant link between a promotion focus and AF2. As there is no direct link between these variables, the significance of the interaction effect (EEP*Promotion) has no meaning. There's also no direct

relationship between factors 1 and 2 of attitude. However, there is a strong negative significant relationship between factors 2 and 3 of attitude. This means that there is an inverse relationship between a more positive attitude towards energy efficiency (AF2) and a cautious attitude towards energy efficiency (AF3), which makes sense. The beta coefficients are -0.401*** and -0.401***.

Though, the most interesting finding here is that there is a significantly positive link between a prevention focus and a cautious, more negative attitude towards energy efficiency. This indicates that there is a high probability that people with a prevention focus are less inclined to partake in energy efficient renovation and more often prefer to remain with the status quo of their homes. Furthermore, the interaction term for a prevention focus (EEP*Prevention) is positive and significant at the 1% level (0.023***). Scoring high on experienced energy poverty (EEP) means that respondents experience a higher degree of energy poverty. Therefore, the more energy poor respondents become, the stronger the effect of a prevention focus on this cautious attitude. This is in line with Gabe and Rehm (2014), who found that especially lower income tenants often have a more negative attitude towards energy efficiency than middle- and higher-income tenants.

Factor 3 attitude towards energy efficiency (AF3)

Figure 9: Regression analysis factor 3

	Promotion AF3	Prevention AF3
Promotion	0.127**	
	(0.051)	
EEP*Promotion	0.007	
	(0.007)	
AF1	0.384***	0.400***
	(0.044)	(0.044)
AF2	-0.253***	-0.257***
	(0.039)	(0.040)
Prevention		0.050
		(0.046)
EEP*Prevention		0.011
		(0.008)
Constant	3.330***	3.564***
	(0.302)	(0.297)
Observations	374	374
DW-Stat	1.945	1.916
R-squared	0.339	0.325

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The last figure (9) contains the fifth and sixth regression output, both having a more positive attitude towards energy efficiency (AF3) as dependent variable. The R-squared values are 0.339 and 0.325, which are the highest out of all estimations. There is a significant positive relationship at the 1% level between AF3 and AF1. This was expected, since this relationship was also found when AF1 was the dependent variable. The sixth estimation shows that there is no significant relationship between both the prevention focus and the prevention moderator with a positive attitude towards energy efficient renovation. Now, the most interesting finding within figure 9 is that there is a positive significant relationship at the 5% level between a promotion focus and AF3 (0.127**). This proves that respondents with a promotion focus are more likely to exhibit a positive attitude towards energy efficient renovation.

Another interesting finding which can be concluded from the second to sixth estimation is that the direct link between a promotion focus and a positive attitude towards energy efficient renovation does not necessarily mean that there is a negative link between a prevention focus and a positive attitude. This also works vice versa, the identified positive link between a prevention focus and a more cautious attitude does not inherently mean that a promotion focus has a significantly negative link with a cautious attitude. A possible argument for this is that the factors are not mutually exclusive. A more positive attitude towards energy efficient renovation does not inherently mean somebody can't also be cautious. However, the highly significant negative relationship between AF2 and AF3 (-0.253*** & -0.257*** in figure 9 and -0.401*** & -0.401*** in figure 8) proves that, in general, respondents with a positive attitude towards energy efficient renovation (AF3) will not exhibit a cautious attitude (AF2), and vice versa. Thus, scoring high on a more positive attitude towards energy efficiency (AF3) renovation will generally also lead to an inversed score on a cautious attitude (AF2).

The last interesting finding is that people with a prevention focus have a positive relationship (0.096**) with a positive attitude towards a clean environment and sustainable energy, taken from the right column in figure 7, while also having a positive relationship with a more negative attitude towards energy efficient renovation of their house (0.098*** from figure 8, right column). It seems like respondents with a prevention focus tend to see the value of sustainable energy, but when they have to engage themselves into bringing this into practise through energy efficient renovation of their house, they are less inclined to participate. On the other side, people with a promotion focus tend to have the same positive attitude towards sustainable energy (0.117** from figure 7), but they also prefer to engage in energy efficient renovation, proven by the positive relationship with factor 3 (0.127** from figure 9).

Conclusion

What is the effect of regulatory focus of social housing tenants in the Netherlands on their attitude towards energy efficiency, and is this relation moderated by experienced energy poverty?

The results have shown that there is a significant relationship between the regulatory focus of an individual and their attitude towards energy efficiency. This means that there is a significant effect between both a promotion and prevention focus and respectively a positive and negative attitude towards energy efficiency. Experienced energy poverty only has a modest influence on this relationship. A discussion of the hypotheses will entail a more detailed answer to the research question.

H1: *Tenants with a promotion focus are willing to partake in energy efficient renovation of their houses.*

The results are consistent with hypothesis one. From figure 9 it has become evident that tenants with a promotion focus have a positive attitude towards energy efficient renovation. The positive relationship stems from the need for growth and nurturance by people with a promotion focus. Energy efficient renovation is likely seen as an improvement of living conditions, which is what people with a promotion focus strive for.

H2: *Tenants with a prevention focus prefer to remain with the current status quo of their houses.*

The results of this research are also consistent with hypothesis two. Despite the positive relationship between a prevention focus and a positive attitude towards sustainable energy and a clean environment, tenants with a prevention focus still show a cautious attitude towards energy efficient renovation. This preference to not engage in energy efficient renovation stems from the typical characteristics of prevention focus oriented people to aim for safety and security. Renovation of people's houses is seen as an uncertain situation with risks involved, which is why prevention focus tenants would rather remain with the current status quo of their houses.

H3: *As the experienced energy poverty increases, the positive relationship between tenants with a promotion focus and the willingness to partake in energy efficient renovation of their houses decreases.*

There is no evidence to support this statement. The moderator variable in figure 9 shows insignificant, meaning that there is no moderation effect for people with a promotion focus. This implies that the level of energy poverty does not influence the positive relationship between a promotion focus and a positive attitude towards energy efficient renovation. The degree of experienced energy poverty simply does not matter when tenants have a promotion focus.

H4: *As the experienced energy poverty increases, the positive relationship between tenants with a prevention focus and the preference to remain with the current status quo of their houses increases.*

The results are consistent with this hypothesis. When prevention focussed tenants are generally more cautious towards energy efficient renovation, it shows that their financial situation plays a role in this attitude. As shown in figure 8, when experienced energy poverty increases, tenants with a prevention focus tend to develop an increasingly negative attitude towards energy efficient renovation. The more energy poor these tenants become, the more likely they prefer to remain with the status quo of their house. This result can be seen as undesirable when considering the purpose of energy efficient renovation. Energy efficiency is used as means to combat energy poverty. Therefore, the more energy poor a household is, the more desirable it is that this household engages in energy efficient renovation. Even though this moderation effect was expected based on literature and also found in the results of this inquiry, there is no reason documented in scientific literature why more (energy) poor tenants have a more negative attitude towards energy efficiency. More in-depth research of a qualitative nature could investigate why this moderation effect exists.

All in all, it can be concluded that the regulatory focus of a tenant has a significant influence on their attitude towards energy efficient renovation. Experienced energy poverty only has a significant impact on this relationship when the tenants are prevention orientated. Regulatory focus of tenants is therefore an important concept when social housing corporations consider energy efficient renovation as means to combat energy poverty.

Discussion

Theoretical reflection

As noted in the introduction, the existence of the relationship between improved energy efficiency and reduced energy poverty and the lacking scientific literature on the perspective of tenants regarding energy efficient renovation gave reason to investigate this perspective further. Moreover, as there has been no research into the attitude of tenants and the relationship with their regulatory focus, this inquiry gives a whole new perspective to literature about attitudes of tenants towards energy efficiency. Analysing attitude with regulatory focus theory allowed to express attitude of tenants in simple terms of basic human needs for advancement or safety. For instance, Palm et al. (2020) identified six attitudes of which four were negative and two were moderately positive. With the results of this inquiry, it has become possible to go beyond the categorisation of attitudes, as these attitudes can now be explained by means of basic human needs. It can be established that tenants within the negative categories are more likely to have a prevention focus, while tenants within the moderately positive categories are more likely to have a promotion focus. These additional insights help to generally understand why these specific individuals either have a more positive or negative attitude.

From the results section it became clear that people with a promotion focus tend to have a more positive attitude towards energy efficiency. This is in line with Carroll et al. (2016) and Ambrose & McCarthy (2019), who found that tenants attach value to energy efficiency, driven by the need for improved living conditions. This need can be compared to a promotion focus in which tenants strive for improvement and growth. The positive relationship between a more cautious attitude and a prevention focus is in line with Gabe and Rehm (2014), who find that a more negative attitude is caused by the fear of rent premiums and increased costs. Avoiding this fear means that tenants fulfil their need for safety, which can be seen as a prevention focus.

Another consistency is found when considering the finding of Gabe and Rehm (2014) that tenants in general, but predominantly low-income tenants, are not willing to engage in energy efficient renovation. This finding is completely in line with the results of this research when considering the effect of experienced energy poverty on the relationship between a prevention focus and a cautious attitude towards energy efficient renovation. When tenants become increasingly energy poor, their attitude towards energy efficiency becomes more negative. An increased level of energy poverty generally implies that a person is also a lower-income tenant, meaning that these results from both inquiries are in line. However, the results of this inquiry provide additional insights, being that this increased cautiousness only exists when tenants already have a negative look at energy efficiency. The promotion moderator variable wasn't significant, meaning that increased energy poverty doesn't necessarily lead to a more negative attitude when tenants exhibit a positive attitude in general. This more detailed insight proves that only tenants who already have a negative attitude will become more

negative when income decreases, while this isn't necessarily the case for tenants with a positive attitude.

Carrol et al. (2016) noted in their research that social housing tenants generally attach value to energy efficiency. Even though the findings of this inquiry support this statement partly, it's possible to go more into detail and expand upon this finding. The results section showed a difference between attitude towards energy efficiency and attitude towards sustainable energy, being that a positive attitude towards a clean environment and sustainable energy (AF1) does not necessarily lead to a positive attitude towards energy efficient renovation (AF3). In fact, people with a prevention focus showed a significantly positive attitude towards a clean environment and sustainable energy, while also showing a significantly negative attitude towards energy efficient renovation. This finding strengthens the assumption of regulatory focus theory that people with a prevention focus tend to be more cautious in their actions, striving towards security and safety of their living space. However, this finding also shows that people can exhibit progressive thoughts about a clean environment, while they are not willing to commit to any actions themselves. The support for a progressive way of energy consumption is there, but when these people must involve themselves, they prefer not to, likely based on this intrinsic need for safe and secure living conditions.

Practical implications

Regulatory focus is often associated with message framing, as persuasion can be improved when the focus of the message is matched to the regulatory focus of a person (Yi and Baumgartner, 2009). When an individual with a promotion focus is approached with a message focused on gains, growth, and nurturance, the effectiveness of the message will enhance. Also, a message framed based on potential loss, safety and security will be more effective when it's sent to an individual with a prevention focus. Therefore, when social housing corporations attempt to engage tenants in energy efficient renovation, it's important to frame the message such that it matches the regulatory focus of the tenant. However, it would be too costly and unpractical to assess the regulatory focus of tenants. Therefore, even though this inquiry considered regulatory focus as motivational trait, regulatory focus theory also describes that it can be situationally induced as a state (Higgins, 1997). As the results proved that only a promotion focus influences a positive attitude of tenants towards energy efficient renovation, it's desirable for housing corporations to induce a promotion focus when messaging. This can generally be achieved by focussing on growth, accomplishments, hopes, inspirations, constant development, and cheerfulness (Higgins, 1998; Scholer et al., 2014; Roney et al., 1995). If, through this way of message framing, more regulatory promotion states can be induced, it can be expected tenants will more often have a positive towards energy efficient renovation.

Another important practical implication is that the results showed that a positive attitude towards sustainable energy and a clean environment has little affinity with a positive attitude towards energy

efficient renovation. When housing corporations vouch for energy efficient renovation, it should be kept in mind that triggering tenants to engage by emphasizing the environmental impact will not be half as effective as informing tenants about potential reduction in costs and improved living conditions. From the theoretical overview it became clear that tenants often have a more negative attitude towards energy efficiency due to a lack of knowledge and information. Tenants frequently have the impression that renovation of their homes leads to increased living costs, even though this might not necessarily be the case. The results of this inquiry showed that increasing experienced energy poverty can cause a more negative attitude. Financial considerations are of great importance when tenants consider renovation. Therefore, openness towards tenants about the financial consequences is important, especially when renovation does indeed lead to lower periodical costs for the tenants. When there is a net-positive financial gain for the tenant, it should be easy to address this in such a way that it can also lead to the inducement of a promotion state, as discussed in the previous paragraph.

Within this inquiry, the concept of improving energy efficiency of houses was used as means to combat energy poverty. However, energy efficient renovation doesn't only serve this specific purpose. Another great benefit is the contribution to the sustainable energy transition. In various countries around the world there is political and societal debate about the transition from traditional fossil fuels towards renewable energy sources (Afonso et al., 2021). Vega et al. (2022) note that energy efficiency is an important pillar of the energy transition, while Afonso et al. (2021) also say that improving the efficiency of energy consumption is crucial for the sustainable energy transition. Therefore, when social housing corporations use the results of this inquiry to ease the process of energy efficient renovation, not only energy poverty will decrease, but this will also have other positive externalities such as contributing to the sustainable energy transition.

Methodological reflection

As there isn't an already available questionnaire within scientific literature to measure attitude towards energy efficiency, the questionnaire was constructed based on indicators of other research. Therefore, this questionnaire can be seen as the first step towards building a valid and accepted method to measure this attitude. Regarding improvements for future research, in the questionnaire there could have been more emphasis on questions regarding energy efficient renovation/energy efficiency. Even though the topics energy efficient renovation and sustainable energy seem to be very much related in this context, the regressions results proved that there is a big difference between these two topics. The questions in the questionnaire regarding attitude were chosen with best knowledge, but it wasn't certain that these questions would measure everything accurately. The three different factors gave very interesting results. The estimations of factors two and three were essentially the results that covered the answer to the research question, while factor one (attitude towards sustainable energy) gave additional interesting insights, such as that both people with a prevention and promotion focus tend to

have a positive attitude towards sustainable energy. Despite these insights from factor one, it should be noted that the focus of this inquiry was to investigate the attitude of tenants towards energy efficiency of their homes, and therefore it should be acknowledged that continued work on this questionnaire should focus less on opinions about sustainable energy and more on specifically energy efficient renovation.

Achieving external validity was arguably the hardest challenge. In the methodology section it was stated that there is little reason to believe that the results of this inquiry will be completely different than for tenants of the Netherlands completely. However, it's simply not possible to assume that the results of this research can be assumed for all tenants in the Netherlands, since the sample was not a balanced sample of all social housing tenants in the Netherlands. Therefore, a lower external validity is a limitation of this study. Nevertheless, several methodological decisions have greatly benefitted the internal validity of the results. For example, no information was disclosed about the purpose of the results. The only information about this matter which was provided was that the research was to study what tenants think about energy consumption.

Lastly, even though the relatively low R-squared values were not necessarily a critical problem for the interpretation of the results, it should be noted that higher R-squared values are always desirable, so the model explains more variability. Therefore, further research should focus additionally on adding high predicting control variables of factors two and three, such that a higher R-squared will be achieved.

Recommendations for further research

As noted, the results suggest that tenants with a prevention focus are influenced by energy poverty when considering their attitude towards energy efficiency. However, there is no evidence within this inquiry that could explain why this moderation effect occurs. From research by Palm et al. (2020), it became clear that a lower level of knowledge and information generally leads to a more negative attitude towards energy efficiency. Therefore, it could be argued that it's possible that a high level of energy poverty also comes with a lower level of intelligence/education and therefore a lower possession of knowledge and information about energy efficiency. However, as the moderation effect does not occur for the tenants with a promotion focus, this assertion is only an educated guess. Therefore, further research into the moderation effect of experienced energy poverty on the relationship between regulatory focus and attitude towards energy efficient renovation could look at the reason why a prevention focus is moderated by the level of energy poverty, as well as why a promotion focus is not moderated. This research should be of a more qualitative nature since detailed thoughts and reasoning of tenants should be analysed.

It has been stated several times that this is the first inquiry that looked at attitude towards energy efficiency from the perspective of regulatory focus theory. The results came out quite straightforward. However, just the results of one inquiry don't provide enough information to address the dependent variable with regulatory focus theory. More research should be done to acquire more information and evidence to address this relationship, potentially with additional independent or moderator variables and different survey questions.

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Appendices

Appendix A: Energy prices Netherlands

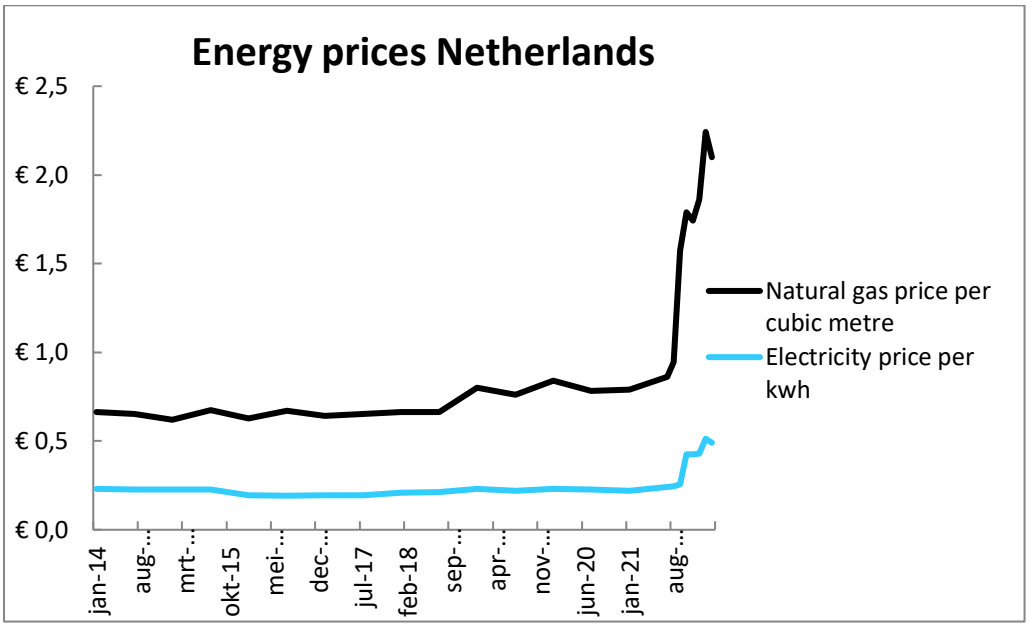

Figure 10: Prices of natural gas and electricity from 2014-2022 in the Netherlands (CBS, 2022) .

Appendix B: Measurement of experienced energy poverty

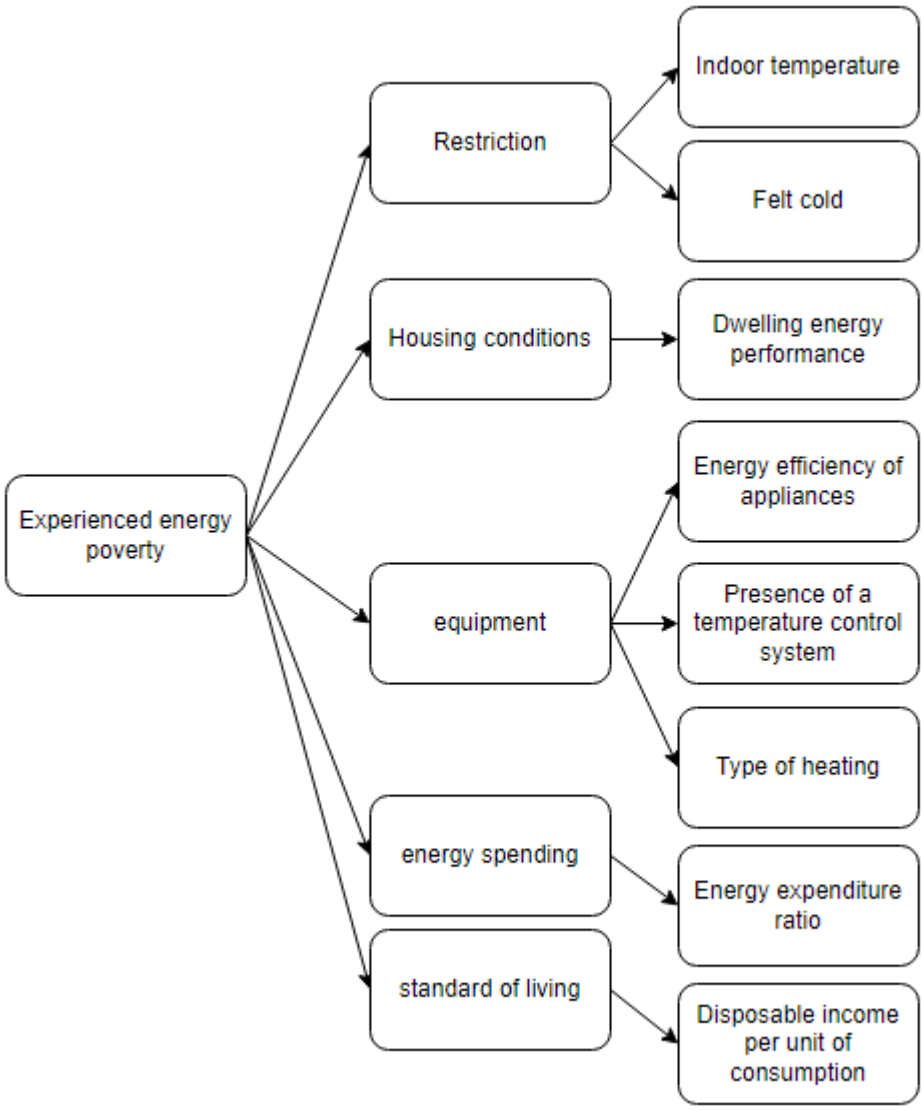

Figure 11: Dimensions and indicators of experienced energy poverty