

1
2
3
4

5 Article

6 **Concerns of owner-occupants in realizing the aims of Energy Transition**7 Mieke Oostra^{1,*} and Nelleke Nelis²8 ¹ Applied Urban Energy Transition, Utrecht University of Applied Sciences, the Netherlands; E-Mail:
9 mieke.oostra@hu.nl10 ² Making Space, the Netherlands; E-Mails: n.nelis@makingspace.nl

11 * Corresponding author

12 Submitted: 31 October 2021 | Accepted: 15 February 2022 | Published: in press

13 **Abstract**

14 Although there is an array of technical solutions available for retrofitting the building stock, the uptake of these by owner-
15 occupants in home improvement activities is lagging. Energy performance improvement is not included in maintenance,
16 redecoration and/or upgrading activities on a scale necessary to achieve the CO₂ reduction aimed for in the built
17 environment. Owner-occupants usually adapt their homes in response to everyday concerns, such as having enough
18 space available, increasing comfort levels or adjusting arrangements as to future proof their living conditions. Home
19 energy improvements should be offered accordingly. Retrofit providers typically offer energy efficiency strategies and/or
20 options for renewable energy generation only and tend to gloss over home comfort and homemaking as key
21 considerations in decision-making for home energy improvement. In fact, retrofit providers struggle with the tension
22 between customization requirements from private homeowners and demand aggregation to streamline their supply
23 chains and upscale their retrofit projects. Customer satisfaction is studied in three different Dutch approaches to retrofit
24 owner-occupied dwellings to increase energy efficiency. For the analysis a customer satisfaction framework is used that
25 makes a distinction between satisfiers, dissatisfiers, criticals and neutrals. This framework makes it possible to identify
26 and structure different factors relevant from the perspective of owner-occupants, allows to visualize gaps with the
27 professional perspective and can assist to improve current propositions.

28 **Keywords**29 Built Environment; Energy Efficiency; Energy Transition; Customer Satisfaction; Dissatisfier; Satisfier; Criticals; Neutrals;
30 Owner-Occupant31 **Issue**32 This article is part of the issue “Zero Energy Renovation: How to Get Users Involved?” edited by Tineke van der Schoor
33 (Hanze University of Applied Sciences) and Fred Sanders (TU Delft).34 © 2022 by the author(s); licensee Cogitatio (Lisbon, Portugal). This article is licensed under a Creative Commons
35 Attribution 4.0 International License (CC BY).36 **1. Introduction**

37 Since the built environment is one of the main emitters of CO₂ globally, a substantial impact can be expected from large
38 scale implementation of energy efficiency measures in the form of building retrofitting and the substitution of fossil fuels
39 for renewable energy sources (Lucon et al., 2014; IEA, 2017; Sandberg et al. 2021). In order to get these implemented,
40 large scale retrofitting programmes and renewable energy generation plans have been developed. Additionally, smooth
41 customer journeys and neighborhood approaches are being created (Looijen Bader et al., 2022). Although there is a wide
42 array of technical solutions available to improve the energy efficiency of the built environment and to generate renewable

43 energy for heat and power, the uptake of these solutions by owner-occupants is lagging (Brouwer, 2019; PBL, 2019; Raad
 44 van State, 2019). Suggestion is these programmes are too closely focused on the optimisation of technology and
 45 economic factors (Bergman & Foxon, 2020). Energy performance improvement is not included in maintenance,
 46 redecoration and/or upgrading activities of owner-occupants on a scale necessary to achieve the CO₂ reduction aimed
 47 for. Owner-occupants usually adapt their homes in response to everyday concerns, such as having enough space available
 48 or adjusting arrangements as to future proof their living conditions (JCHS, 2009). Research shows that renovation
 49 intentions usually emerge from specific conditions in domestic life (Wilson et al., 2015) in which energy efficiency has a
 50 minor role at most. According to Wilson and colleagues (2018) efficiency measures should be bundled into broader types
 51 of retrofitting and home improvements, and incentives should target the underlying reasons why homeowners decide to
 52 retrofit in the first place. Retrofit providers typically offer energy efficiency strategies and/or options for renewable
 53 energy generation only, and tend to gloss over home comfort and homemaking as key considerations in the decision-
 54 making for home energy improvement. In fact, retrofit providers struggle with the tension between customization
 55 requirements from private homeowners and demand aggregation to streamline their supply chains and upscale their
 56 retrofit projects (Oostra & Been 2016). In order to get a better understanding of consumer satisfaction of owner-
 57 occupants in relation to energy retrofit this article will zoom in on concrete experiences from Dutch practices.

58
 59 From marketing theory, it is known that it is very important to address needs fulfilment in combination with customer
 60 satisfaction (Kotler & Armstrong, 2017; Klasens et al., 2016; Giese and Cote, 2000; Dowling, 2002). In management
 61 literature, customer satisfaction is considered important because of its role in creating competitive advantage (e.g.,
 62 Matzler & Hinterhuber, 1998; Mittal et al., 2005; Kotler & Armstrong, 2017). It therefore seems fair to conclude that
 63 insight in customer satisfaction during the customer journey of energy retrofit projects is important to be able to increase
 64 the number of households interested in energy efficiency measures. In this article the following hypotheses are therefore
 65 tested: a customer satisfaction framework can help (1) to identify and structure factors in customer journeys of energy
 66 retrofits, (2) to visualize gaps between the owner-occupants' perspective and the take professionals have on
 67 propositions, and (3) to provide us with insights on how current propositions can be improved. Before the case studies
 68 are introduced first the conceptual framework on consumer satisfaction is presented.

71 **2. Customer satisfaction: on dissatisfiers, satisfiers, criticals and neutrals**

72 Most satisfaction research concentrates on confirmation and/or disconfirmation of a preconsumption standard
 73 responsible for satisfaction and dissatisfaction (Oliver, 2015). Several additional determinants of satisfaction have also
 74 been linked to satisfaction (Heitman, 2007), such as perceived equity, product quality, postdecision regret, consumption-
 75 related emotion, and need fulfillment. In his seminal work on customer satisfaction Richard Oliver (2015) distinguishes
 76 three important approaches: the desires, expectations and needs approach. In this research the needs approach has been
 77 used. Needs are mostly aligned with the fulfilment of deficits, as are most services like home repair, health care and legal
 78 redress (Oliver, 2015). There are two dominant needs theories: Maslow's theory and the theory of Herzberg. Maslow's
 79 theory is discarded since it raises several issues which make it hard to apply in a marketing context. The theory of Herzberg
 80 in contrast, is presented as useful (Oliver, 2015). Theorizing about satisfiers and dissatisfiers dates back to the days human
 81 resource management emerged as part of management theory. Herzberg and others (1959) were studying the working
 82 conditions in factories and discovered motivators and hygiene factors, known as the motivator-hygiene model or the
 83 two-factor theory. Hygiene factors are conditions workers consider to be self-evident, like safety measures, physiological
 84 conditions (e.g., lighting, temperature, noise levels). Motivators, in contrast, are factors that increase personal
 85 satisfaction and motivation to increase production. While their presence increases motivation, their absence does not
 86 cause dissatisfaction.

87
 88 Other researchers built on these results extending theory formation on the topic of job satisfaction (e.g., Soliman, 1970;
 89 Wolf, 1970). Later these ideas were adopted in marketing when analyzing and evaluating the satisfaction of customer
 90 products (e.g., Swan & Combs, 1976; Maddox, 1981; Oliver, 1995), engineering (e.g., Kano et al., 1984; Matzler &
 91 Hinterhuber, 1998) service industries (e.g., Cadotte & Tugeon, 1988; Brandt 1988; Silvestro & Johnston, 1990) and web
 92 site design (e.g., Zhang & Dran, 2000; Holloway et al., 2008). Several terms are used to refer to the different antecedents
 93 of dissatisfaction and satisfaction (see additional information). In this study we adopt the terminology of Cadotte &
 94 Turgeon (1988):

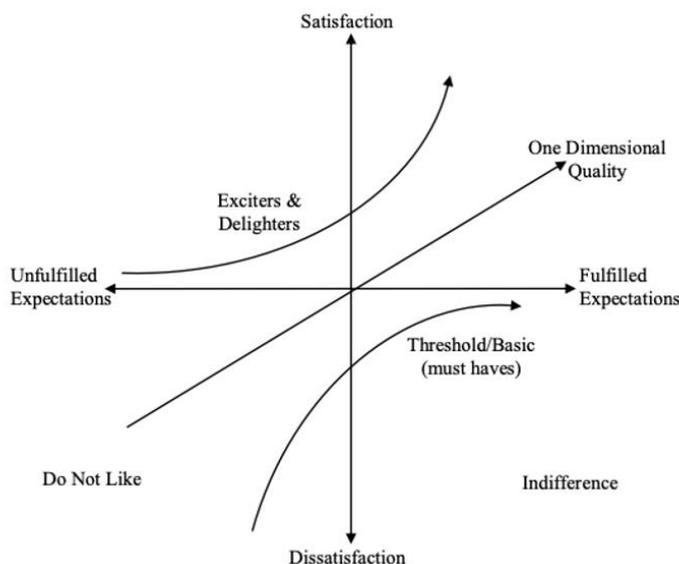
- 95 • dissatisfiers – factors that can cause dissatisfaction, but will not increase satisfaction when addressed. These
 96 usually relate to the minimal requirements in relation to functional performance and extrinsic needs of
 97 customers. If a gap occurs towards customers' perception this can result in complaints;

- 98 • satisfiers – factors that increase satisfaction, but do not increase dissatisfaction while not included. If these
- 99 factors exceed customer expectation it might lead to a compliment. Satisfiers will stimulate customers to come
- 100 into action;
- 101 • criticals – factors that impact both satisfaction and dissatisfaction, examples include the organization of
- 102 information;
- 103 • and neutrals – factors with no impact on both satisfaction and dissatisfaction. Although not mentioned by
- 104 Cadotte & Turgeon, the authors will use this category to identify factors that are essential in the eyes of
- 105 professionals but causes no dissatisfaction or satisfaction of owner-occupants.

106 Satisfaction and dissatisfaction are not to be considered as two extremes on one scale (Kano et al., 1984). They have
 107 separate scales (see Figure 1); unfulfilled or fulfilled satisfaction factors vs addressed or not addressed dissatisfaction
 108 factors.

109 The scientific community is still debating on the exact definitions of consumer satisfaction (Souca, 2014). Despite the fact
 110 that the concept of consumer satisfaction is still not fully understood, and a standard way of measuring is lacking (Souca,
 111 2014), it has proven helpful in a wide array of sectors, e.g. sport products, cosmetics, durable products, food products,
 112 web pages, hotel bookings, health care, bank services (see for more: Oliver, 2015; Souca, 2014; Vargo et al., 2007). The
 113 authors could not find studies evaluating energy retrofitting of dwellings, although there is a study that evaluates
 114 retrofitting of shopping centers (Haase, 2015). The term customer satisfaction is used also in relation to quality evaluation
 115 of builders (e.g., JDPa, 2020; SKB, 2021). When using this model in the context of energy efficient retrofitting the following
 116 insights from research in other sectors can be of value: First, the category to which a factor belongs is not static. Over
 117 time, product attributes that once where satisfiers have a tendency to become criticals, and eventually dissatisfiers
 118 (Brandt 1988; Cadotte & Turgeon, 1988; Kano et al., 1984). Second, in a study of Maddox (1981), studying clothing,
 119 personal care and durables it was discovered that findings in one industry can differ from another, findings are therefore
 120 context-specific. Third, behavior economics research of Kahneman & Tversky (1979) suggests that loss aversion in relation
 121 to dissatisfiers outweighs the impact of satisfiers. Giese and Cote (2000) noted that customer feedback is stronger in
 122 relation to dissatisfiers. Several satisfiers are necessary to compensate for one dissatisfier, to make this strategy work at
 123 all. The implication is probably that dissatisfiers in the form of minimal functional requirements should be met first, in
 124 order for market pull to emerge. Dissatisfiers therefore seem to have priority over satisfiers (Vargo et al, 2007). Satisfiers,
 125 however, can be used in addition to create additional market pull. Finally, a warning is made not to remain focused on
 126 the physical aspects, attributes and actions of products and services only. Attention should also be given to customer
 127 thinking (Oliver, 2015). Most technical specifications and product features are irrelevant to most residents. Crux is to
 128 discover what factors within energy efficient retrofitting do matter in order to make sure the propositions meet the
 129 minimum requirements. And additionally, to identify what factors can be used to make energy efficient retrofitting more
 130 appealing.

131 **Figure 1** Kano’s model (Kano et al., 1984)



132

133 **3. Methodology**

134
 135 This section describes both case study selection and case study methodology. The analysis of the case studies is based on
 136 the framework of satisfiers, dissatisfiers, criticals and neutrals presented in the previous section.

137 *3.1. Case study selection*

138 The Netherlands provides an interesting context for case studies on owner-occupied retrofitting, due to a rather large
 139 percentage of owner-occupied housing (57.2%) in combination with a rather large social housing sector of 29.1% (Housing
 140 Europe, 2021). The main focus of research aiming to further retrofitting of residential buildings was first on housing
 141 associations and renters. The relatively large social rental sector in the Netherlands allowed firms to bundle individual
 142 dwellings into larger, commercially more attractive assignments. First these solutions were applied in larger retrofit
 143 projects of social housing only, later some of these solutions also became available for individual owner-occupants. The
 144 three case studies selected used different instruments implemented to further the uptake of energy efficiency for private
 145 homeowners.

146
 147 Energy Expedition Apeldoorn (#ENEXAP) was part of the *Energiesprong*, a Dutch innovation programme commissioned
 148 by the Dutch Ministry of the Interior and operated by Platform31. The aim was to make various types of buildings zero-
 149 energy and to boost large-scale market-initiatives. In the sub-programme *LALOG* (*Lokaal Alle Lichten Op Groen*), the
 150 owner-occupants were challenging professionals to help them to make their homes zero-energy. It was a process of
 151 learning by doing by residents, builders, municipal officers, installation contractors, appraisers and other professionals.
 152 The subsidized #ENEXAP project ran in the period 2012–December 2014. Author Oostra was member of the #ENEXAP
 153 board from November 2013–April 2015.

154
 155 The *Duurzaam (T)huis Twente (DTT)* loosely translated as “Sustainable Home Twente”, a cooperation of fourteen
 156 municipalities focusing on energy efficiency of owner-occupied dwellings, applied successfully for a grant of VNG (the
 157 association of Dutch municipalities); the VNG scheme for cooperating municipalities. DTT also applied for grants from the
 158 province, as well as additional funding from the municipalities part of DTT. The description of *Duurzaam (T)huis Twente*
 159 is based on the author’s experience as part of the initiative. Author Oostra was member of the DTT board from April 2016
 160 until January 2020.

161
 162 *Verenigingen van Eigenaren (VvE’s)* loosely translated as ‘Association of Owners’. The thirteen associations are based in
 163 the cities Breda and ‘s-Hertogenbosch. Both cities have a subsidy program in which VvE’s are encouraged to draw up an
 164 energy plan. By Dutch law, someone who owns an apartment is automatically member of the subsequent owner’s
 165 association (VvE). The VvE looks after the joint interests of the owners of the apartments, like making sure the building
 166 is maintained, cleaned, and insured. Decisions in the VvE are taken in a democratic fashion. A major challenge for VvE’s
 167 is to make progress in energy efficiency. The process can be complicated, because the collective of owners must tackle
 168 this together. Author Nelis, from the company *Making Space*, advised and guided the VvE’s in drawing up a plan. She did
 169 this together with a cooperative of energy consultants, who all have specific expertise (financial, technical, legal and
 170 process supervision).

171 *3.2. Case study methodology*

172 The three case studies were studied in retrospective. For these case studies the following materials were available for a
 173 qualitative analysis using the theoretical framework presented in section 2:

174
 175 #ENEXAP - memos of board meetings (8), notes of residents’ meetings (4), notes of meetings with one of the energy
 176 directors (3), notes of meetings with *Energiesprong* (2), report from *Energiesprong* (1), notes of a study meetings for
 177 associated companies (5), notes (1), video’s (4) and documents (3) from a meeting in which the propositions were
 178 scrutinized, impressions of a public event (1) and conversations with people related to #ENEXAP (3). The data used in this
 179 article is from the period October 2013–June 2015.

180
 181 DTT - notes of board meetings (30), notes of strategy meetings (2), notes on conversations with the organizer of owner-
 182 occupant meetings (2), notes of meetings with municipalities (3), study meeting for the companies (1), and conversations
 183 to reflect on the outcomes of DTT with people related to DTT (3). The data used in this article is from April 2016–January
 184 2020.

186 VvE's - notes of the board meetings with the VvE's (25), a survey of the residents, a technical and a financial analysis of
 187 all the VvE's involved (13). The data used in this article is from the period January 2017–September 2021.
 188

189 **Table 1** Case study overview.

Case study	#ENEXAP	Duurzaam (T)huis Twente (DTT)	Owner associations (VvE's)
Type of dwellings	row housing & detached housing	row housing & detached housing	Multi-family housing
Amount of buildings	38	4350	13
Households involved	38	4350	612

190 To strengthen the validity of the data collected, the outcomes from the case study analyses were triangulated with: (1)
 191 observations during the retrofit trajectories, (2) the evaluation studies from #ENEXAP (Oostra & Been, 2016) and DTT
 192 (Oostra & Looijen Bader, 2021) on the execution of the programme, as well as the outcomes, and (3) findings from
 193 literature.
 194

195 **4. Energy Expedition Apeldoorn (#ENEXAP)**
 196

197 In 2011, Apeldoorn saw the launch of #ENEXAP, a group around thirty-three households interested in making their homes
 198 zero-energy. During the process, the group expanded to thirty-eight households. The #ENEXAP team comprised next to
 199 local owner-occupants of businesses, civil-society organizations, the municipality of Apeldoorn and the local University
 200 of Applied Sciences (Saxion). The owner-occupants fueled professionals with their ideas and wishes; professionals helped
 201 the owners to make their wishes achievable.
 202

203 Specific goal of the LALOG-subsidy, was to put clients central in the development of propositions of local companies to
 204 improve energy efficiency of occupant-owned homes. These propositions should de-burden owner-occupants in
 205 increasing energy performance towards zero-energy. The planned end-result of this programme: twenty retrofitted
 206 dwellings. Secondary aims, were many. Not only a considerable reduction of the energy bill was required, but also
 207 improvement of the overall comfort level, a healthier indoor climate, the application of environmentally friendly building
 208 products and an increase of property value. During the programme also business cases for companies had to be drawn
 209 up, that would prove energy efficient retrofits for private home-owners to be an interesting market niche.

210 In June 2015, after a process of roughly four years, five dwellings were well on their way of becoming zero-energy. Other
 211 households had started to save energy. By means of all sorts of presentations, meetings, workshops and excursions both
 212 residents and professionals increased their knowledge levels considerably. For professionals it was not always easy to
 213 keep up pace, especially with the very involved retired occupant-owners with technical backgrounds. Owner-occupants
 214 were sharing experiences on the things they had implemented, like the use of LED lighting, the discontinuation of built-
 215 in kitchen boilers, the energy demands of waterbeds and how to persuade teenagers to reduce their time in the shower.
 216 Three different consortia were polishing their propositions for owner-occupants (Oostra & Been, 2016).

217 **Table 2** Dissatisfiers, satisfiers, criticals and neutrals in the perception of owner-occupants involved in #ENEXAP.

Category of assignment	factor	Description
dissatisfiers	Communication	Complaints were made about the time businesses took to prepare an offer, or that no follow-up was received upon questions.
	Lack of choice	The first group of three selected owner-occupants received an offer from three different consortia (April 24, 2014). They were disappointed to find that the consortia came up with a similar set of energy measures. They had hoped to receive alternative retrofit concepts.
	Performance guarantee	Owner-occupants indicated to value a performance guarantee from the consortia. In practice however, no-one actually paid the additional sum to secure the guarantee.

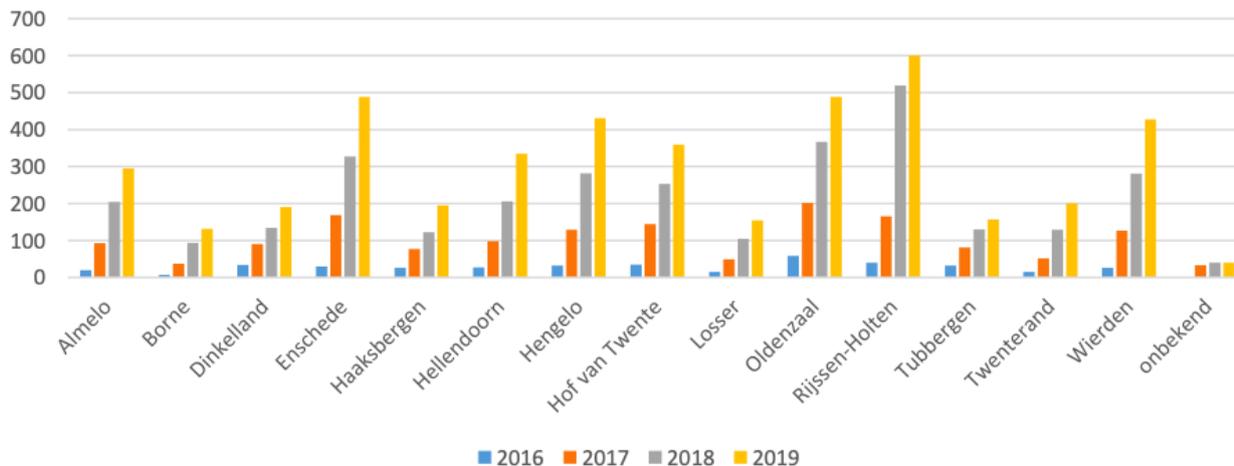
		The simple fact that the consortium dared to offer a performance guarantee functioned as quality proof in the perception of owner-occupants.
	Demolition of recent improvement	For several households it was necessary to take out the flooring in order to ameliorate the energy performance of the ground floor. When this turned out to be a recent home improvement, households preferred to skip this intervention.
satisfiers	Home extension	One household just fell for the idea of adding a conservatory to the house as a way to improve energy efficiency. The idea was introduced by students of the TU Delft as a proof of concept for the Solar Decathlon, an American contest for student teams.
	Future proofing of the home	One of the households was interested in energy efficiency measures in combination with future proofing of their home. Unfortunately the consortium considered the combination too complex.
	Direct feedback	With a Plug-in set from #ENEXAP residents could temporarily measure the energy usage of different appliances. This direct feedback opened the eyes of owner-occupants for the impact of e.g. the built-in kitchen boiler, waterbed or shower-time had on their overall energy consumption.
criticals	Comfort improvement	Energy efficient retrofitting was being promoted with the advantage of improved comfort levels. Consequently, this is what residents expected. When problems with draft and cold traps occurred after retrofitting the owner-occupants turned out to be disappointed.
	Reduction of the energy bill	Complaints were made when the energy bill did not reduce, at least not as much as expected. The residents suspected the supplier was unqualified or, worse, that they were being cheated.
	Financial loan	Several households indicated the availability of financial loans as important.
	Advice report	A lot of time and effort had been put in the assignment of elaborated reports from energy advisors (EPA Super Luxurious). The contractors never seemed to take the outcomes of the reports into consideration.
neutrals	Coaching and training of the firms	For the companies this was essential. For the clients this was not relevant.

218

219 **5. Duurzaam (T)huis Twente (DTT)**

220 Fourteen municipalities in Twente, the eastern part of the Netherlands, decided to collaborate in their efforts to improve
 221 energy efficiency of owner-occupied housing: Almelo, Borne, Dinkelland, Enschede, Haaksbergen, Hellendoorn, Hengelo,
 222 Hof van Twente, Losser, Oldenzaal, Rijssen-Holten, Tubbergen, Twenterand and Wierden. Their first joint action was the
 223 development of a media campaign promoting the uptake of energy efficiency measures by owner-occupants. Several PR
 224 agencies were asked to pitch a media campaign concept. A consultant presented a plan to facilitate citizens in making
 225 their homes more sustainable based on insights from consumer marketing, not the anticipated plan for a media
 226 campaign. This was the route the municipalities decided to take. Other stakeholders of Duurzaam (T)huis Twente were:
 227 owner-occupants, coaches, companies & consortia, communication office, Pioneering (local innovation network in
 228 construction), VNG and other supporting organizations (e.g. Bouwend Nederland, Techniek Nederland) (Oostra & Looijen
 229 Bader, 2021).

230
 231 **Figure 2** Cumulative amount of advice sessions booked by households in various municipalities of the Twente region (DTT,
 232 2020)
 233



234
235
236
237
238
239
240
241
242

An approach was drafted and executed, to support owner-occupants in making their homes more energy efficient. A network of energy coaches was to be created, and additionally a network of companies able to take on the work. This eventually led to the start of Duurzaam (T)huis Twente (DTT) in 2016. Theme’s: improving comfort levels, energy saving, future proof living, retrofit & maintenance, energy generation, preparation to disconnect from natural gas. Dissatisfiers, satisfiers, criticals and neutrals identified in the analysis of the material available can be found in table 3.

Table 3 Dissatisfiers, satisfiers, criticals and neutrals in the perception of owner-occupants involved in DTT.

Category of assignment	factor	Description
dissatisfiers	Communications	Complaints, questions and suggestions were made in relation to information on energy efficiency measures, subsidies and/or events.
	Low quality of work	The work of the associated firms did not always meet the benchmark of owner-occupants.
satisfiers	Future Proofing	A household member was developing difficulty walking and climbing stairs. The couple had the choice to move or to future proof their home. They preferred to stay. An extension was made for a new wheelchair friendly bathroom, while the insulation value of the façade was ameliorated at the same time. Additionally, the heating system was compartmentalized, which made it possible to only heat the rooms in use.
	Home extension	Another household wanted to extend their kitchen into the garden. The kitchen also got a new tile floor, underfloor heating and floor insulation. Electrical cooking replaced cooking on natural gas, as is common in the Netherlands.
	Subsidy	A household who did not expect to be eligible for a subsidy was pleasantly surprised to find out via DTT that they did. This extended their budget and as a result they could make a larger investment in energy efficiency than initially expected.
	Direct feedback	Direct feedback on what members of the household could do to reduce energy consumption by closing a door, switch off a radiator or reduce time in the shower came as a surprise to most people. Thermography also proved a valuable feedback instrument when people were considering a retrofit. As a means to attract newcomers this motivated a lot of new households to contact DTT. However, these new appointments did not result in more households taking energy measures.
criticals	Comfort improvement	Extra comfort was welcomed. Discomfort was however sometimes felt due to sitting next to a cold window after retrofitting, causing complaints.
	Reduction of the energy bill	A household, in which the bread winner became unemployed, was looking for ways to lower the monthly payments. One of the options they saw was to reduce the energy bill. A folder taught them about the existence of DTT’s energy coaches. The household was already considering generating their own electricity with solar panels, but they were also interested in infrared panels. After the advice, they decided to install 20 solar panels and not to opt for the infrared panels. Instead, they chose to

	purchase new radiators, which can be regulated to only provide heating when necessary.
Energy coaches	Advice of the independent energy coaches was highly appreciated by owner-occupants. The coaches provided advice on behavioral aspects (e.g. closing of internal doors), available subsidies in combination with advice on insulation, heat pumps, solar panels, LED lighting etc. This helped people to structure the available information and to draw up a concrete plan for their home. Not every energy coach was an asset. A specific coach criticized measures owner-occupants had taken in the past, which resulted in complaints.
<hr/>	
neutrals	
<hr/>	

243
244

6. Owner associations (VvE's)

245 In the period 2017-2021 thirteen owner associations (VvE's) started with drawing up an energy plan. The process
 246 always included a "do-it-yourself" survey of the residents. Themes: residential data, usability apartment building, safety
 247 and security, health and comfort, complaints and wishes of residents. These surveys were carried out together with the
 248 VvE board. The survey ensured that all residents were involved in the advice process from the start. The average
 249 response was about 70%. The survey was followed by energy advice with both a step-by-step plan and a total approach.
 250 The retrofitting processes of all thirteen VvE's are still in progress. Dissatisfiers, satisfiers, criticals and neutrals
 251 identified so far can be found in table 4.

252
253

Table 4 Dissatisfiers, satisfiers, criticals and neutrals in the perception of owner-occupants involved in VvE's.

Category of assignment	factor	Description
dissatisfiers	Low quality of work	Many maintenance solutions appeared to be of low quality, were poorly monitored during execution and as a result new repair work was required. The VvE board usually consists of volunteers with little or no technical knowledge. They expected a professional approach from their contractors but were often disappointed by the quality of the work.
satisfiers	Beautification	The residents considered the appearance of their property as very important. The option for a new façade made them feel proud, and would also have positive effects on the resale value of their apartments. A new, energy efficient façade was therefore an interesting offer for most appartement owners.
criticals	Generation of funding for retrofitting	The idea for the possible addition of an extra layer of apartments on top of the block was appealing to the owner-occupants since it would generate part of the budget needed for retrofitting. However, this brought all sorts of additional questions to the table that required additional time and effort of the board, especially regarding the feasibility of the idea. This caused mixed feelings.
neutrals	Fire-safety	Occupants were rarely aware of the importance of fire-safety. Additionally, the (aging) population of the building might require additional measures in order to be able to evacuate everyone in case of an emergency.
	Ventilation	Most ventilation systems were functioning poorly. Occupants proved not to be aware of the related health risks. In practice it was very difficult to convince residents that measures were necessary.
	Multi-year maintenance planning (MJOP)	Owners' associations are obliged to draw up a multi-year maintenance plan. These must be renewed every five years. Energy-saving measures are not a standard part of this planning.

254
255
256

8. Analysis

257 In this paragraph the combined outcomes of the three analyses are described, using the four categories: dissatisfiers,
258 satisfiers, criticals and neutrals. The outcomes of the different case studies are visualized in table 5.

259 **8.1. Dissatisfiers**

260 Four specific factors appeared in the category of dissatisfiers: communication, low quality of work, demolition of recent
261 home improvement, and lack of choice. The factor communication does not come as a surprise. This matches with
262 findings in other sectors. Another dissatisfier was the suggestion to take out a rather new tile or wooden floor to improve
263 the energy performance of the ground floor. In these cases, floor insulation was simply skipped. The quality of
264 maintenance work or how was dealt with architectural details was another factor that appeared in this category. The
265 ornaments in woodwork, additional corners, and stained-glass windows, all part of the authentic look and feel of
266 dwellings, can be devalued during a retrofit (DTT). Finally, owner-occupants seem to expect to have choice between
267 several alternatives. Within #ENEXAP several owner-occupants made explicit that one proposition only led to
268 disappointment.

269 **8.2. Satisfiers**

270 In the category of satisfiers the following factors emerged: adding an extension, future proofing, receiving an unexpected
271 subsidy, direct feedback and beautification. The residents considered the appearance of their property as very important.
272 A make-over with a new energy efficient façade in combination with an expected increase of resale value proved to be
273 an interesting offer for most apartment owners (VvE's). Some households responded very enthusiastic about the
274 possibilities of an energy efficient retrofit in combination with an extension (conservatory or kitchen), or energy reduction
275 as a package deal with future proofing. These households were strong advocates of these ideas in order to convince the
276 consortia to prepare this interesting proposition. At the moment it became clear the consortia would not come with such
277 an offer, these households lost interest. Direct feedback helped to raise awareness but turned out not to be a guarantee
278 for action (DTT).

279 **Table 5** Dissatisfiers, satisfiers, criticals and neutrals in the perception of owner-occupants.

Category of assignment	Factors in # ENEXAP	Factors in DTT	Factors in owner associations
dissatisfiers	Communication	Communication	Low quality of work
	Lack of choice	Low quality of work	
	Demolition of recent home improvement		
satisfiers	Home extension	Future proofing	Beautification
	Future proofing	Home extension	
	Direct feedback	Subsidy	
		Direct feedback	
criticals	Comfort improvement	Comfort improvement	Generation of funding for retrofitting
	Reduction of the energy bill	Reduction of the energy bill	
	Financial loan	Energy coaches	
	Performance guarantee		
neutrals	Advice report		Ventilation
	Coaching and training of the firms		Fire-safety

280

281 *8.3. Criticals*

282 Financial loans and a performance guarantee appeared in the category of criticals, as well as possible advice from energy
 283 coaches, the possibility to generate additional funding for the retrofit, comfort improvement and reduction of the energy
 284 bill. The reason to ask for a performance guarantee might be that generally expectations of the construction sector are
 285 not very high. The factors of comfort improvement and reduction of the energy bill are directly related to the arguments
 286 often used to convince people to invest in energy efficiency measures. These promises probably led to a rise of
 287 expectations owner-occupants had of the performance level, hence the fact they are considered criticals. Without
 288 presenting them as a benefit, these factors probably belonged to the category of dissatisfiers. In that situation they would
 289 only lead to complains in case of malfunction. The possibility to generate funding for the required retrofit with the
 290 creation of extra apartments, left the owner-occupants with many unanswered questions. This caused people to have
 291 both feelings of satisfaction and dissatisfaction.

292 *8.4. Neutrals*

293 Easily overlooked by owner-occupants, are the importance of ventilation, fire-safety, the possibility to combine the
 294 implementation of energy efficiency measures with maintenance and the importance of the condition of the foundation,
 295 all in the category of neutrals. Also, the training & coaching of the firms is part of this category. In the eyes of customers
 296 these factors are irrelevant and are therefore part of the neutrals section. This neutrals category, part of the theoretical
 297 framework, was deliberately framed to contain factors that are relevant for professionals, but not to owner-occupants.
 298 In practice these factors sometimes led to friction. This manifested itself most clearly in relation to ventilation. Most
 299 residents did not consider this as problematic. The residents in the Owner-Association-case presumed they could solve a
 300 lack of ventilation by opening a window. The pressing question that raises from this category of neutrals is how to create
 301 a context in energy retrofits in which professionals can address important technical issues without bothering the owner-
 302 occupants?

303

304 **9. Discussion and conclusions**

305 The hypotheses were that the framework of dissatisfiers, satisfiers, criticals and neutrals would make it possible to
 306 identify and structure the different factors in the case studies relevant from the perspective of owner-occupants, to
 307 visualize gaps between the owner-occupants' perspective and the take professionals have on specific factors, and
 308 hopefully also providing insight on how current propositions can be improved.

309 *9.1. Value of using the customer satisfaction framework*

310 The framework of satisfiers, dissatisfiers, criticals and neutrals was used in this article to analyze, identify and structure
 311 factors in the response of owner-occupants to concrete propositions in three energy efficiency case studies: #ENEXAP,
 312 DTT and the Owner-Association-case. The framework helped to reflect on the propositions in a new way, since it
 313 requested to put the factors that matter to the owner-occupant to the table simultaneously. The underlying logic of the
 314 framework helped to structure the different factors into the categories of dissatisfiers, satisfiers, criticals and neutrals
 315 with their own specific characteristics. The framework helped to structure what should have priority while improving a
 316 proposition. The current quest to weed out dissatisfiers is congruent with the insights from literature. Additionally, it can
 317 be concluded that up until now, there has been only limited attention for satisfiers, criticals or neutrals in energy
 318 retrofitting. The evaluation therefore showed that the framework can help to identify and structure factors relevant for
 319 specific retrofit propositions in general.

320 Additionally, another hypothesis emerged. The framework might also be of help to clarify the motivations and drawbacks
 321 of a specific owner-occupant as to customize a proposition. The categories would in that case be used to analyze the
 322 following:

- 323 • Dissatisfiers – Problems and fears of the owner-occupant that need addressing.
- 324 • Satisfiers – What is considered of value by the owner-occupant? What are needs, desires and expectations?
- 325 • Criticals – What are opportunities, drawbacks and risks, as perceived by the owner-occupant?
- 326 • Neutrals – What relevant blind spots of the owner-occupant need addressing?

327 By generating insights on the different factors understanding of the viewpoint of the client is created. Which, in turn,
 328 allows translating a proposition into an appealing offer and to determine how specific factors that are often overlooked
 329 by owner-occupants can be addressed. These consists not only of physical factors but also of e.g., behavioral aspects.
 330 Outcomes of two case studies (#ENEXAP; DTT) showed that tips concerning behavioral aspects can leverage the
 331 performance of the applied energy measures. The effects were often of a magnitude unexpected for owner-occupants.
 332

333 *9.2. Gaps in the perspective of professionals*

334 Professionals are very focused on getting the technical aspects right. They want to make sure owner-occupants
335 understand the relevance of specific factors that are of no interest for the average resident. Additionally, they may not
336 know how to address these matters. In case of required additional ventilation it seems impossible to first measure if
337 there is a problem, and second if there is, to convince the owner-occupant to install the equipment. From the #ENEXAP
338 and DTT case studies it became clear that professionals do not always register what has value to owner-occupants.
339 Factors that cause satisfaction, like beautification, future proofing or additional space are not always evident to an
340 executing party. Having a conversation about what is valuable can help to bypass blind spots. There seems to be a
341 tendency among most professionals to focus on the factors relevant in a rather narrow technical perspective only.
342 Finally, also here a new hypothesis emerged. The framework might be of help when developing or rewriting norms or
343 standards. It would improve the quality of norms and standards if experience and knowledge from the user perspective
344 is included in these trajectories. When new technology is being implemented new insights will emerge during
345 implementation and use. If and how the framework could be of help here would however need further research.

346
347 *9.3. Improving propositions*

348 The framework helped answering the question: can and should the proposition service different factors in order to
349 extend the appeal of the proposition to a wider audience? Standardization is on the wish list for both owner-occupants
350 and businesses. For clients it is perceived as a means to improve quality. Companies are looking for standard solutions
351 as a way to upscale their approach and to tap into a market large enough to retrieve a profit. Now the interest in
352 offering standardized retrofit solutions is receiving more and more attention among companies, insights, experiences
353 and knowledge from customer satisfaction is becoming increasingly important.

354
355 Giese and Cote (2000) noted that customer feedback in relation to dissatisfiers is stronger than that in relation to
356 satisfiers, especially when it provokes negative feelings in relation to fairness and the accuracy of information provided.
357 Dissatisfiers need to be solved urgently. Complaints from clients can therefore be seen as a valuable source of inspiration
358 for improvement of the product and/or service. One should realize that only 4% of dissatisfied customers will take the
359 effort to file a complaint (Kolky, 2015). Therefore, it might be useful to organize a periodical evaluation study. Solving a
360 dissatisfier is relatively easy, as it is usually clear what needs to be addressed. That is not to say the question is easy to
361 answer, as became clear in #ENEXAP. Predicting the final reduction on the energy bill, for example, remains tricky.

362 Lack of information, the time it takes to get certain information and/or the way information is structured are factors
363 that keep reappearing in the category of dissatisfiers in different sectors and also emerged in two of the energy
364 efficiency case studies. It is however, not new to point out that the exchange of information during the customer
365 journey is an important and difficult factor in customer relation management (Dowling, 2002). Through differences in
366 perspective of owner-occupants and professionals, not well managed customer journeys, the required information is
367 not always at the disposal of the owner-occupant when needed. It is factor that still needs improvement, while it is not
368 always clear what information is relevant. Information management is a balancing act, information overload of the
369 owner-occupants should also be prevented.

370
371 Service providers need to develop product-market combinations that fit the expectations of owner-occupants on the
372 topic of energy efficiency. Insights derived from an analysis of dissatisfiers, satisfiers, criticals and neutrals can provide
373 interesting clues to improve propositions. Most people consider global warming as an important problem (SCP, 2020),
374 however, this does not imply they will actually invest in energy efficiency measures. If we look at the satisfiers, the
375 conclusion can be drawn that the scope of solutions that are of interest to owner-occupants could be broadened. But
376 only if dissatisfiers are dealt with properly. This is compatible with research conclusions from the UK. Wilson, Crane and
377 Chryssochoidis (2015) advocate that the 'bundling' of efficiency measures into other types of home renovations should
378 be encouraged, rather than stimulating retrofits focused on energy efficiency only. They show that in the UK energy
379 efficiency measures are three times more likely to be included as part of broader retrofitting projects that have appeal
380 to the owner-occupant than when considered alone. Only one out of ten owner-occupants planning a retrofit consider
381 energy efficiency measures only (Wilson et al., 2013). Hereto specific conditions of domestic life associated with
382 renovation activity, both DIY and contractor-led, should be identified (Wilson et al., 2015). Other research also supports
383 the importance of building aesthetics or home appearance in renovation decisions (Novikova et al., 2011; Whitmarsh et
384 al., 2011). The recent increases of fossil energy prices (FT, 2021) will most likely stimulate the demand for energy
385 efficiency measures. With the expected rise in demand, the urgency for appealing market propositions increases.

386 The question is, can enough energy efficient retrofits be sold to owner-occupants while we know that only 13%
387 (Motivaction, 2020) of the population feels obliged to contribute with a green lifestyle? Focusing on secondary benefits
388 of energy efficiency measures, like is being done with comfort improvement and reduction of the energy bill, could help.
389 But then still, the focus remains on energy. In the meantime, a very fragmented and technical oriented supply chain is
390 re-organizing itself allowing the delivery of mass customized energy efficient retrofit solutions for most dwellings.
391 Additional energy services have been developed like financial arrangements, loans, subsidies, energy coaches and local
392 information desks. The retrofit packages available still require considerable investments from owner-occupants. Will
393 energy prices rise to the extend these investments become appealing? Or should we develop additional strategies?
394 Wouldn't it be better to find out what the most appealing renovation propositions are, like Wilson and colleagues are
395 suggesting, and market those with additional energy efficiency measures? And, if possible, make sure that it is obligatory
396 that these propositions contribute to energy efficiency? This would mean that energy efficiency becomes one of the
397 neutrals in the customer satisfaction framework of other retrofitting propositions. To find out if this will be a more
398 efficient strategy additional research is required into how efficiency measures could be 'bundled' into other types of
399 home renovations.
400

401 **Acknowledgments**

402 This article is based on the findings of the research executed as part of the Integrale Energietransitie Bestaande Bouw
403 (IEBB) project funded by Meerjarig Missiegedreven Innovatie Programma 3 (MMIP3) programme of Rijksdienst voor
404 Ondernemend Nederland (RVO) aiming at advancing the upscaling of industrialized retrofitting in the Netherlands. The
405 authors wish to thank everyone involved in the case studies and IEBB 7.3. Finally, we want to express our gratitude to the
406 reviewers of this article for their valuable comments and remarks. All errors and omissions remain the authors'
407 responsibility.

408 **Conflict of Interests**

409 The authors declare no conflict of interests.

410 **Supplementary Material**

411 Supplementary material for this article is available online in the format provided by the authors (unedited).

412 **References**

- 413 Bergman, N., and Foxon, T. J. (2020). Reframing policy for the energy efficiency challenge: Insights from housing retrofits
414 in the United Kingdom. *Energy Research & Social Science*, 63, 101386.
- 415 Brandt, R. D. (1988). How service marketers can identify value-enhancing service elements. *Journal of Service Marketing*
416 2 (Summer):35-41.
- 417 Brouwer, E.-J. (2019). *Climate and energy exploration 2019: Ambitious goals give energy transition momentum,*
418 *implementation appears unmanageable.*
- 419 Cadotte, E. R., and N. Turgeon (1988). Dissatisfiers and Satisfiers: Suggestions from consumer complaints and
420 compliments. *Journal of Consumer Satisfaction, Dissatisfaction, and Complaining Behavior* 1: 74-79.
- 421 DTT (2020). *Gebruik diensten Duurzaam Thuis Twente; beknopt jaarverslag 2019*, [Use of DTT's services; short year report
422 DTT 2019].
- 423 Dowling, G. R. (2002). Customer Relationship Management: In B2C Markets, Often Less Is More. *California Management*
424 *Review*, 44, 87–104.
- 425 FT (2021). The EU's electricity market and why soaring gas prices are driving bills higher. *Financial Times*, Author: Mehreen
426 Khan, October 14, 2021.
- 427 Fuller, J. and K. Matzler (2008). Customer delight and market segmentation: An application of the three-factor theory of
428 customer satisfaction on life style groups, *Tourism Management*, Vol. 29, No. 1, pp. 116-126.
- 429 Giese, J. L. and J. A. Cote (2000). *Defining Consumer Satisfaction*. *Academy of Marketing Science Review*
430 <http://www.amsreview.org/amsrev/theory/giese00-01.html>.

- 431 Gupta R., L. Barnfield, and T. Hipwood (2014). Impacts of community-led energy retrofitting of owner-occupied dwellings.
432 *Building Research & Information* 2014;42(4):446–61.
- 433 Haase, M., K. Stenerud Skeiea and R. Woods (2015). The Key Drivers For Energy Retrofitting Of European Shopping
434 Centres, 6th International Building Physics Conference, IBPC 2015, *Energy Procedia* 78 (2015) 2298 – 2303.
- 435 Heitmann, M., D. R. Lehmann, and A. Herrmann. (2007). Choice Goal Attainment and Decision and Consumption
436 Satisfaction. *Journal of Marketing Research* (JMR) 44, no. 2: 234-250.
- 437 Herzberg, F., B. Mausner, and B. Snyderman (1959). *The Motivation to Work*. New York: Wiley.
- 438 Holloway, B.B. and S.E. Beaty (2008). Satisfiers and Dissatisfiers in the Online Environment; A Critical Incident Assessment,
439 *Journal of Service Research*, Volume 10, No. 4, May 2008 347-364, Sage Publications.
- 440 Housing Europe (2021). *The state of housing in Europe*.
- 441 IEA (2017). Energy technology perspectives 2017. *Catalysing energy technology transformations*.
- 442 JCHS (2009). *The remodelling market in transition*. Joint Centre for Housing Studies, Havard University, Cambridge, MA.
- 443 JDPA (2020). *Home Improvement Retailer Satisfaction Study*, report J.D. Power.
- 444 Kahneman, D. and A. Tversky (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica* 47: 263-291.
- 445 Kano, N., N. Seraku, F. Takahashi, and S. Tsuji (1984). Attractive Quality and Must-Be Quality. Presented at the 12th
446 *Annual Meeting of the Japan Society of Quality Control*.
- 447 Klasens, E. and M. Oostra (2016). Uncovering the Real Needs of Customers, *proceedings CIB World Building Congress*
448 *2016 Intelligent Built Environment*, Volume V - Advancing Products and Services, Tampere University of Technology,
449 Department of Civil Engineering, Finland, May 30 – June 3, 2016.
- 450 Kolsky, E. (2015). Customer experience for executives; Issues, and ideas on how to do customer experiences better,
451 presentation *Callidus Customer Conference*, Las Vegas, USA, April 2015
- 452 Kotler, P. and G. Armstrong (2017). *Principles of Marketing*. 17th edition, USA: Pearson Prentice Hall.
- 453 Looijen Bader, E.M., K. Grooten and M.A.R. Oostra (2022). *State-of-the-art en geleerde lessen in Nederland; De individuele*
454 *of collectieve reis door de energietransitie van eigenaar-bewoners*. [State-of-the-art and learned lessons in the
455 Netherlands; The individual and collective journey through the energy transition of owner-occupants] IEBB report,
456 Utrecht, the Netherlands, in press.
- 457 Lucon, O., D. Üрге-Vorsatz, A. Z. Ahmed, H. Akbari, P. Bertoldi, L. F. Cabeza, et al. (2014). Buildings. Working Group III
458 contribution to the IPCC 5th assessment report, *Climate Change 2014: mitigation of climate change*. Cambridge, UK/New
459 York, NY, USA: Cambridge University Press; Chapter 9.
- 460 Maddox, N. R. (1981). Two Factor Theory and Consumer Satisfaction: Replication and Extension. *Journal of Consumer*
461 *Research* 8 (June): 97-102.
- 462 Matzler, K. and H. H. Hinterhuber (1998). How to make product development projects more successful by integrating
463 Kano’s model of customer satisfaction into Quality Function Deployment. *Technovation* 18 (1): 25-38.
- 464 Motivaction (2020) *Vijf tinten groener; Nederlanders op weg naar een groene samenleving*. [Five shades of green; The
465 Dutch on the road to a greener society]
- 466 Novikova A., F. Vieider , K. Neuhoff and H. Amecke (2011). *Drivers of thermal retrofit decisions: a survey of German single-*
467 *and two-family houses*. Berlin, Germany: Climate Policy Initiative (CPI).
- 468 Oliver, R. L. (2015). *Satisfaction; A behavioral perspective on the consumer*. 2nd edition, Routledge.
- 469 Oliver, R. L. (1995). Attribute Need Fulfillment in Product Usage Satisfaction. *Psychology and Marketing* 12 (January): 1-
470 17.
- 471 M. Oostra and L. Looijen Bader (2021). Towards Energy Neutral Neighbourhoods’. chapter in *Smart Sustainable Cities; A*
472 *handbook for applied research*. Editors: M. Rietbergen, E.J. Velzing and R. van Stigt, HU University of Applied Sciences.
- 473 Oostra, M. and L. Been (2016). An Energy Expedition; Experiences of a Dutch Collective of House Owners Aiming for
474 Energy Neutrality, *proceedings CIB World Building Congress 2016 Intelligent Built Environment*, Volume IV -

- 475 Understanding Impacts and Functioning of Different Solutions, Tampere University of Technology, Department of Civil
476 Engineering, Finland, May 30 – June 3, 2016.
- 477 PBL (2019). *The climate agreement: Effects and points of attention* (Technical report). Netherlands Environmental Agency.
- 478 Pred, A. (1981). Social Reproduction and the Time-Geography of Everyday Life, *Geografiska Annaler, Series B, Human*
479 *Geography*, v.63(1):5-22.
- 480 Raad van State (2019). *Concept Klimaatplan*, Bijlage bij Kamerstukken II 2019/20, 32813, nr. 406. [Concept Climate plan]
481 the Advisory Division of the Council of State, W18.19.0301/IV.
- 482 Reckwitz, A. (2002). Toward a Theory of Social Practices: A Development in Culturalist Theorizing. *European Journal of*
483 *Social Theory* 5 (2), 243-263.
- 484 Sandberg, N. H., J. S. Næss, H. Brattebø, I. Andresen, and A. Gustavsen (2021). Large potentials for energy saving and
485 greenhouse gas emission reductions from large-scale deployment of zero emission building technologies in a national
486 building stock. *Energy Policy*, 152, 112114.
- 487 Silvestro, R. M. and R. Johnston. (1990). The Determinants of Service Quality: Hygiene and Enhancing Factors. *Quality in*
488 *Services II: Selected Papers*. Coventry, UK: Warwick Business School: 193-210.
- 489 SKB (2021). *SKB Kopersonderzoek*. [SKB Buyers report] report Stichting Klantgericht Bouwen.
- 490 Soliman, H. M. (1970). Motivation-Hygiene Theory of Job Attitudes: An Empirical Investigation and an Attempt to
491 Reconcile Both the One- and Two-Factor Theories of Job Attitudes. *Journal of Applied Psychology* 54 (5): 452-461.
- 492 Souca, M.L. (2014). Customer dissatisfaction and delight: completely different concepts, or part of a satisfaction
493 continuum?, *Management & Marketing. Challenges for the Knowledge Society*, Vol. 9, No. 1, pp. 75-90.
- 494 SCP (2020). *Klimaatbeleid en de samenleving; Een korte samenvatting van inzichten uit het scp-onderzoek op het vlak van*
495 *duurzame samenleving*. [Climate policy and society; short summary] Report of the Netherlands Institute for Social
496 Research, authors: Y. de Kluizenaar, C. Carabain & A. Steenbekkers, The Hague.
- 497 Swan, J. E. and L. J. Combs (1976). Product performance and consumer satisfaction: A new concept. *Journal of Marketing*
498 40 (April): 25-33.
- 499 Vargo, S. L., K. Nagao, Y. He and F.W. Morgan (2007). Satisfiers, dissatisfiers, citicals, and neutrals: A review of their
500 relative effects on customer (dis)satisfaction, *Academy of Marketing Science Review*, vol. 11 no 2.
- 501 Whitmarsh L., P. Upham, W. Poortinga, C. McLachlan, A. Darnton, P. Devine-Wright, et al. (2011). *Public attitudes,*
502 *understanding, and engagement in relation to low- carbon energy: a selective review of academic and non-academic*
503 *literatures*. London, UK: Research Councils UK (RCUK).
- 504 Wilson, C., L. Crane and G. Chryssochoidis (2015). Why do homeowners renovate energy efficiently?; contrasting
505 perspectives and implications for policy, *Energy Research & Social Science*, 7 (2015) 12-22.
- 506 Wilson C., G. Chryssochoidis and H. Pettifor (2013). *Understanding homeowners' renovation decisions: findings of the*
507 *VERD project*. London, UK: UK Energy Research Centre (UKERC).
- 508 Wolf, M. G. (1970). Need Gratification Theory: A Theoretical Reformulation of Job Satisfaction/Dissatisfaction and Job
509 Motivation. *Journal of Applied Psychology* 54 (February): 87- 94.
- 510 Zhang, P. and G. M. von Dran (2000). Satisfiers and Dissatisfiers: A Two-Factor Model for Website Design and Evaluation.
511 *Journal of the American Society for Information Science* 51 (December): 1253-1268.

512

513 **About the Authors**



514

515 Nelleke Nelis, owner Making Space. A construction engineer who switches between the construction world and the
516 world of the residential consumer. I have many years of experience in informing, involving and convincing residents
517 (groups) at every moment in the customer journey. With my background in construction and housing technology, I can

518 “translate” information, and I have insight into the wishes of residents and how you can connect these to an energy-
519 saving plan.



520

521 Mieke Oostra is professor Applied Urban Energy Transition of the University of Applied Sciences Utrecht. She is chairing
522 the theme Circular and Energy Neutral Area Development of the Centre of Expertise Smart Sustainable Cities (CoE SSC).
523 She has expertise and vast experience in future proofing both buildings and districts, with a special interest in
524 addressing societal issues while meeting the needs of clients and end-users. As the chair of platform Urban Energy
525 (organization representing Dutch UAS professorships focused on the energy transition in the built environment), she is
526 member of the working committee of BTIC (Dutch Center for Building Technology Innovation).

527

528