

CLIMATE CHANGE EFFECTS ON LIVING QUALITY; AWARENESS OF HOUSING ASSOCIATIONS

MARTIN J. RODERS

OTB Research Institute for the Built Environment - TU Delft, The Netherlands
m.j.rodgers@tudelft.nl

AD STRAUB

OTB Research Institute for the Built Environment - TU Delft, The Netherlands
a.straub@tudelft.nl

HENK J. VISSCHER

OTB Research Institute for the Built Environment - TU Delft, The Netherlands
h.j.visscher@tudelft.nl

Abstract

A changing climate can have a large influence on the living quality of houses. A case study was carried out on the level of awareness of housing associations. This study forms the start of a research project on governance strategies for adaptation in residential buildings. A content analysis on climate change related topics was pursued on the policy plans and the most recent annual reports of the 25 largest Dutch housing associations. They were classified according to their level of awareness. Based on the results of the analysis it is concluded that the housing associations fall within the lowest category of awareness. In order to reach higher levels of awareness, governance strategies for adaptation have to be developed. The nature of possible strategies will depend on the level of awareness of the housing association. The definition of strategies will be studied in the future.

This research provides basic information on 'climate change awareness' that is valuable for governmental and non-governmental policymakers on the national, regional and local level, who are dealing with climate change issues.

Keywords: Awareness, Climate Change, Adaptation, Social Housing, Energy Efficiency

INTRODUCTION

There is clear scientific evidence of a changing climate on the global and the national level. The Intergovernmental Panel on Climate Change (IPCC) states that "Warming of the climate system is unequivocal". It reports that during a period of twelve years - between 1995 and 2006 - eleven rank among the warmest years since measurements started in 1850 (IPCC (2007a). The Royal Dutch Meteorological Institute (KNMI) found out that the long term mean temperature in the Netherlands has risen by 1.7°C since 1900, while the global increase was 0.8°C. In the time frame 2003-2008 three years were part of the top-10 warmest years since measurements started in 1706 (KNMI, 2008). These evidences determine that policy makers have to start facing the consequences of changing environmental circumstances. Scientists commonly agree that climate change is a fact, and they are now investigating the precise impact of it on the living quality in our cities, offices and houses, and how we can prepare for and adapt to these impacts.

In the international debate on climate change, opinions diverge. Internet forms a broad base for blogs and blog posts from adopters, who actually believe that the climate is changing (Gore, 2010) and skeptics, who don't believe that climate is changing [i, ii, iii]. The discussion even entered into the Dutch political system, when errors were discovered in the Fourth Assessment Report of the IPCC early 2010. This was a motive for the Dutch House of Representatives to ask the minister of Housing, Spatial Planning and the Environment for an evaluation of the report. This was carried out by the Netherlands Environmental Assessment Agency (PBL) which concluded that the report did not contain any significant error. It did confirm, however, that more transparency is required in the Fifth Assessment Report (due in 2013), concerning both the sustenance of the findings and the benefits of climate change (PBL, 2010). In this paper we follow the line of the PBL. We trust the work of the thousands of scientists, who have collaborated on composing the IPCC report, until there is scientific evidence that they drew the wrong conclusions. The skeptic voices have sharpened our critical attitude which will help us presenting the most realistic results and solutions for effective adaptation strategies. After all, we know that housing associations will not take all scientific evidence for granted.

With the intention to reduce the effects of climate change (mitigation), policies have been adopted on the international and the national scale. For example, the European Commission has approved Directive 2002/91/EC, known as the Energy Performance of Buildings Directive (EPBD) (EP, 2002). In the Netherlands, this EPBD is applicable on existing buildings. Moreover, for new buildings legislation on energy performance is operative. Because a building can only be built when it complies with the building code, property owners and the building industry are automatically aware of the legal mitigation measures. However, even if it is possible to stabilize greenhouse gas emission, the changing process and its corresponding effects will continue developing (IPCC, 2007). Consequently, measures have to be developed for adaptation, which is defined as "any action, either intentional or accidental taken to minimize the adverse effects of climate change or to take advantage of any beneficial effects" (Crown, 2006). Policy on this theme is being made on a regional and a national scale. The European Union has shown adaptation awareness by firstly launching a Green paper on Climate Change in 2007, which set out ideas on adaptation measures, (CEC, 2007), followed by a White Paper on climate change in 2009 (CEC, 2009), proposing legislation on the matter. On the level of national governments, adaptation strategies are ready or in progress in countries such as Denmark, Finland, France, Germany, Hungary, the Netherlands, Romania, Spain and the UK (Biesbroek et al., 2010). On a local scale, information is more diffuse, but adaptation strategies are implemented or under development in cities such as Cape Town, Durban, Quito, Tokyo, Walvis Bay and Windhoek (MIT, 2011). The conference '*Resilient Cities 2011, 2nd world congress on cities and adaptation to climate change*', will strongly contribute to awareness among all participating cities (ICLEI, 2011). The engagement of the 'Hotspots'/Stakeholder cities in the Climate Proof Cities project in the Netherlands (Knowledge for Climate, 2010) indicates that they are also aware of a changing climate. The sense of urgency for adaptation has emerged as plan development field in the new Millennium (Biesbroek, 2010). As a result, much effort is still put into the setting up of adaptation programs, which can eventually lead to legislation. As a consequence, the awareness of adaptation is not as widely spread as awareness of mitigation, especially on the level of the property owners and the building industry.

In order to find out if the awareness of adaptation has already reached the operational level of policy making, we carried out a case study among housing associations in the Netherlands. They own and manage 2.3 million dwellings, which is approximately 32% of the total Dutch housing stock (CFV, 2010). Their successful involvement in the adaptation of the built environment will not alone provide living quality for the social stock, but will certainly help

to reach a substantial part of the existing housing stock and provide tools for private owners to follow similar actions. Knowing the state of awareness of the housing associations, appropriate governance strategies for adaptation can be developed. This study on awareness is considered as a starting point for a larger research on the application of climate change adaptations in social housing.

DUTCH HOUSING ASSOCIATIONS

Housing associations have legal duties on six performance fields, being: the quality level of the dwellings, renting of the houses, tenant-participation in policy making and management, financial continuity, livability, and housing and care (BBSH, 2011). Focusing on the quality aspect, it is their task to be aware of the changes that might challenge the living quality of their tenants and to provide housing with future value, which includes climate change resilience.

Energy efficiency

Since January 1, 2008, it has been compulsory for housing associations to hand over an energy label at the transaction moment of a dwelling. This obligation follows from the implementation of the EPBD. In the Netherlands, the energy label is merely a communicative instrument because of a lack of law enforcement possibilities and/or sanctions, and because a required minimum energy performance level is missing. However, it does give an insight in the energy performance of the dwelling. As most housing associations have 'labeled' all units in their possession, they know the current energy performance status of their building stock (Tambach et al., 2010). This insight, complemented by the housing associations' statutory performance requirements on livability and its sense for Social Corporate Responsibility (SCR), has opened possibilities for the introduction of the 'energy efficiency'-theme in the strategic asset management. By implementing energy saving measures, the associations fulfill their task of providing affordable housing, as they slow down the influence of the rapidly increasing energy costs on the overall operating costs. They also improve the living quality of the building, as for example an insulated wall or window not only saves energy but usually also contributes to noise reduction; humidity decrease and cold air flow reduction (Smid and Nieboer, 2008).

However, it is not only the 'social incentive' (livability, SCR) that makes the housing associations more alert on energy saving. The Dutch government has set up energy saving goals as the consequence of the ratification of the Kyoto Protocol. In order to reach these goals they approach the housing associations as one of the key actors, since the social housing stock is considerably large, with a projected emission of 137 Mton CO₂ in the period 2009-2020 (adapted from: Rooijers et al., 2009). The so called 'Covenant Energy Saving Housing Association Sector' was set up, where housing associations and government have agreed on mutual efforts to improve the energy efficiency in the period 2008-2020. During the course of the covenant, housing associations have to invest in energy saving measures, targeting for an energy reduction of 24 PètaJoules. The measures to reach this reduction are: pursue to reach energy label B or raise 2 label steps (for instance from F to D) when performing high level renovation interventions and reduction of energy use of newly built dwellings with 25% from 2011 and 50% from 2015 (reference year 2007). In turn, the government is committed to introduce the valorization of the energy performance in the 'dwelling evaluation system' (MinVROM, 2008). This is a system used in the Netherlands to rate the quality of the dwellings in the rental sector. The height of the evaluation score determines the maximum rent a housing association is allowed to ask for the dwelling. If the

association improves the energy label, the evaluation score and maximum rent will increase accordingly. In this way, applying energy saving measures provides extra income for the housing associations.

CLIMATE CHANGE IN THE NETHERLANDS

As exemplified in the foregoing, the current national and local governance strategies focus mainly on mitigation rather than adaptation. This can be seen in the ambitions of CO₂ reduction and energy saving measures of the existing building stock. However, policies are to a large extent based on responsibilities of actors, building owners and contractors, and on market mechanisms. These last appear not to work well enough to reach the intended goals in the Netherlands (Daniels and Kruitwagen, 2010). Together with the unstoppable changing process of the climate (IPCC, 2007), adaptation measures are inevitable to withstand the upcoming effects of climate change.

Climate change adaptation

The temperature in the Netherlands has risen significantly in the last decade, as described in the introduction. Also the overall precipitation has increased with 18% over the past century and the multi-day precipitation amounts augmented, especially in winter (KNMI, 2006). Moreover, the summer rainfall values in the coastal zone (between 0 and 30 km's from sea) are higher than in any other part of the Netherlands, which is expected (but not scientifically proven) to be influenced by the rising water temperature of the North Sea (KNMI, 2008). The effects of climate change in the Netherlands are numerous. The sea level will rise (KNMI, 2006), threatening the lower parts of the Netherlands and the major rivers will have more run-off in winter (Bessembinder, 2008), threatening the areas close to this rivers. All together, the risk areas for sea and river flooding cover 55% of the surface of the Netherlands (PBL 2011). Another thread comes from intensified peak precipitation, which can cause local flooding (Bessembinder, 2008). The increase of temperature will affect the natural environment (PBL, 2009) and the climate in the cities (Salcedo Rahola et al., 2009).

In order to create a base for planning and policy making, four scenarios have been developed by the KNMI showing the prognosis of the state of the climate in 2050 (see table 1) and in 2100. Although there are some different trends in various scenarios, the average temperature is expected to rise in all scenarios, as well as sea level and peak precipitation (KNMI, 2006).

		G	G+	W	W+
Global temperature rise		+1°C	+1°C	+2°C	+2°C
Change in air circulation patterns		no	yes	no	yes
Winter ³	average temperature	+0.9°C	+1.1°C	+1.8°C	+2.3°C
	coldest winter day per year	+1.0°C	+1.5°C	+2.1°C	+2.9°C
	average precipitation amount	+4%	+7%	+7%	+14%
	number of wet days (≥ 0.1 mm)	0%	+1%	0%	+2%
	10-day precipitation sum exceeded once in 10 years	+4%	+6%	+8%	+12%
Summer ³	maximum average daily wind speed per year	0%	+2%	-1%	+4%
	average temperature	+0.9°C	+1.4°C	+1.7°C	+2.8°C
	warmest summer day per year	+1.0°C	+1.9°C	+2.1°C	+3.8°C
	average precipitation amount	+3%	-10%	+6%	-19%
	number of wet days (≥ 0.1 mm)	-2%	-10%	-3%	-19%
Sea level	daily precipitation sum exceeded once in 10 years	+13%	+5%	+27%	+10%
	potential evaporation	+3%	+8%	+7%	+15%
	absolute increase	15-25 cm	15-25 cm	20-35 cm	20-35 cm

Table 1: KNMI'06 climate scenarios for 2050 (source: KNMI 2006).

Risks affecting the social housing stock

As climate change shall inevitably threaten the well being of their clients, housing associations need to withhold climate change from decreasing the living quality of their building stock. With the current knowledge, key issues to focus on are discomfort caused by heat and consequences of flooding, as these have a direct influence on the living quality of the tenants.

Heat effects

The main heat effects are directly related to human health issues, rather than the financial damage on properties caused by natural catastrophes such as flooding. Expected effects are heat stress, summer smog, and allergies and viruses. A positive effect of a warmer climate is the reduced illness and mortality in winter (PBL, 2009).

As 62% of the social housing stock is located in urban areas (with a density > 1500 addresses per sqkm, VOIS, 2011), special attention is paid to the 'Urban Heat Island'-effect. This is the effect where the urban structure accumulates heat and consequently is warmer than the surrounding countryside. The highest temperature differences occur at the end of the day and can reach up to 10°C (Salcedo Rahola et al., 2009). The 'Urban Heat Island'-effect is caused by several factors, being absorption of sun radiation, air pollution, 'street canyons', anthropogenic heat (cars, air conditioners, industrial processes etc.), heat storing materials, decreased evaporative surfaces, and reduced wind speeds (Kleerekoper et al., in press)

Water effects

The risk of flooding caused by sea and major rivers will be tackled to a large extent if the national government executes the measures proposed by the 'Delta Commission' (Deltacommissie, 2008). The focus for housing associations will be to contribute to the reduction of flood risk caused by precipitation.

Adaptation measures

None of the above named effects of climate change can be controlled by the housing associations alone. They are dependent on co-operation with other stakeholders as water boards and municipalities etc. However, housing associations do have the possibility to

contribute to the climate robustness of the living environment of their tenants by applying adaptation measures to the houses, preferably during maintenance and renovation activities. They could for example apply light colors on their building façades in order to reflect radiation and reduce the inner-temperatures. In the case of allergies, they could be more alert on which type of vegetation they plant in the common gardens of e.g. apartment blocks. The reduction of the harmful effects of flooding caused by extreme precipitation can be established by applying adaptation measures to retain water temporarily, such as 'green roofs' or to ensure effective drainage as open pavements so that the peak load on the sewage system is topped off. Another effective measure is to use the materials that are not negatively affected by water so that the consequences are less intrusive if, despite all protective measures, flooding happens in case of extreme circumstances (Pitt, 2007).

Whatever measures will be applied on the different scales, it has to be taken in to account that collaboration and a multi-scale approach can be beneficial. For the housing associations, the local authorities and the tenants are the first stakeholders to deal with when addressing climate change adaptations. Moreover, the type of measures will bring more benefits when they focus on climate resilience than on climate robustness. For example, in the first case, flooding in extreme situations would be accepted and the extra water would temporarily be buffered in a designated natural area, which would benefit the quality of the landscape in general when not flooded; while in the second case, measures could be to simply raise the height of the dikes (Pijnappels and Sedee, 2010).

However, before measures will be taken, the actors have to be aware of the task that lies ahead. This research determines to which extent housing associations are aware of this task. Only after their level of awareness is known, effective strategies can be developed for adaptation to climate change.

RESEARCH METHODOLOGY

In order to obtain a clear view of the awareness of Dutch housing associations towards climate change and its threads, a content analysis (Bryman, 2008) was carried out, searching for climate change related topics in their policy documents.

The research question for the content analysis was: How much do housing associations express their awareness to climate change in their policy documents? The sample consisted of the 25 largest housing associations in the Netherlands. Together they own 881.000 dwellings, which is 37% of the social rented housing stock (ABF, 2008). The housing associations are divided through the Netherlands (see figure 1), but mainly in the western part, where most people live. From the sample, 24 associations had their annual reports available for analysis and 18 associations their policy plan. The reference year for the awareness is 2010.

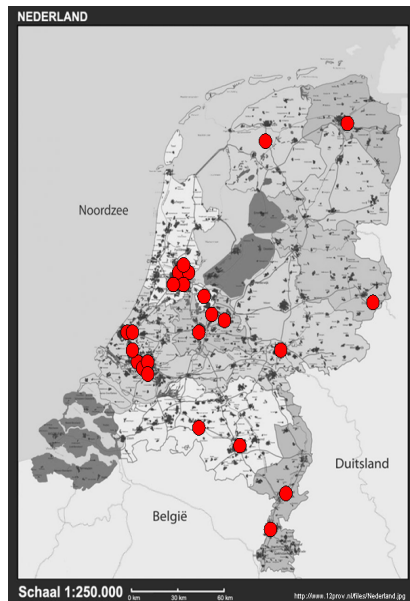


Figure 1: Distribution of the 25 housing associations

Two types of documents have been selected for this survey as they would evidence the associations' implemented projects and general strategies. The first type of documents analyzed was the annual report describing the associations' projects and activities executed during 2009. The second type was the corporate policy plan. In this document the housing associations have described their strategies for a time span of several (3-5) years. The oldest plan dates from 2006, looking forward to 2010. The newest plan dates from 2011 with a vision till 2015. Additionally, the policy plans especially addressing sustainability issues were searched. However, as many housing associations are drawing them up at the moment of writing, the number of available documents was only 6. They were, however, analyzed in order to discover if they would differ much from the general policy plans and annual reports. The topics that were searched for were divided into three groups. The first is 'Adaptation', containing the topics *Climate*, *Climate change* and *Climate change adaptation*. The second group is 'Mitigation', containing *Energy*, *CO2* and *Operating costs* (in the sense of all costs related to live in a house, i.e., rent, energy costs, local taxes etc.). The topics that literally belong to one of the two groups, but do not refer to climate change, were left out of the results presented in this paper. For example, the topic *Climate* in the sense of "inner climate" or "social climate" was excluded.

Four stages of learning

In order to define effective approaches for governance of adaptation, four awareness categories have been created, in analogy with the four stages of learning model, which describes the process of learning. See table 2. The housing associations will be attributed to one of the awareness levels.

Level	Stages of learning (Hughes, 2002)	Awareness levels of housing associations
1.	<i>Unconscious incompetence</i> One is not even aware that he or she lacks knowledge or	<i>Unaware non-adapted</i> The housing association doesn't show awareness to climate change adaptations in

	skill (that is, one lacks an awareness that certain knowledge or skill even exist)	its strategies and projects
2.	<i>Conscious incompetence</i> One is aware that he or she lacks a knowledge or skill	<i>Aware non-adapted</i> The housing association shows awareness to climate change adaptations in its strategies
3.	<i>Conscious competence</i> One acquires the missing knowledge or skill and applies it in articulated or codified ways	<i>Aware adapted</i> The housing association shows awareness to climate change adaptations in its strategies and projects
4.	<i>Unconscious competence</i> One's knowledge or skill becomes second nature, applied seemingly without thought or effort	<i>Unaware adapted</i> The housing association shows awareness to climate change adaptations in its projects

Table 2: Four levels of awareness of housing associations

RESEARCH FINDINGS

The annual reports of the 24 housing associations were analyzed, and the results are presented in Figure 2. In the reports, hardly any attention is given to the 'Adaptation'-related topics. Out of the 24 reports analyzed, 14 (58%) do not mention *Climate*, whereas only one association (4%) mentions the topic more than 10 times. Zooming in on the topic *Climate change*, this only appears twice, being mentioned only once by 2 associations. The topic *Climate change adaptations* is not mentioned at all. The 'Mitigation' topics, however, showed up far more frequently in the annual reports. *Energy* appears in all (100%) annual reports analyzed. The number of topics range from 4 to 88, with an average value of 31.0. The related topics *CO2* and *Operating costs* were also frequently mentioned, both by 19 (79%) housing associations.

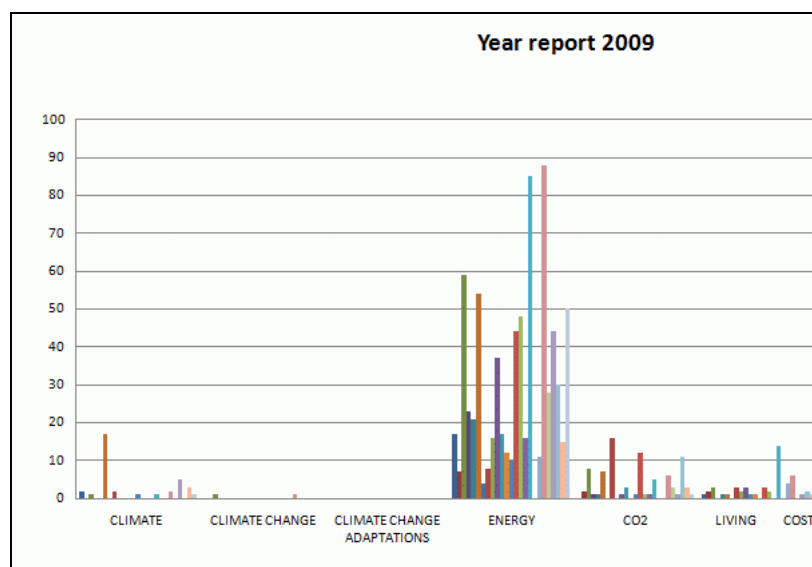


Figure 2: Content analysis results for the annual reports of 2009.

Figure 3 presents the results of the document analysis of the 18 policy plans. The ‘Adaptation’ topics appear on a very small scale. *Climate* is used in only 3 documents (17%). *Climate change* and *Climate change adaptations* appear in none (0%) of the policy documents. The ‘Mitigation’ topics appear more than the ‘Adaptation’ topics. *Energy* appears in 15 (83%) of the policy documents analyzed, whereas *CO2* and *Operating costs* appear in 8 (44%) and 13 (72%) documents, respectively

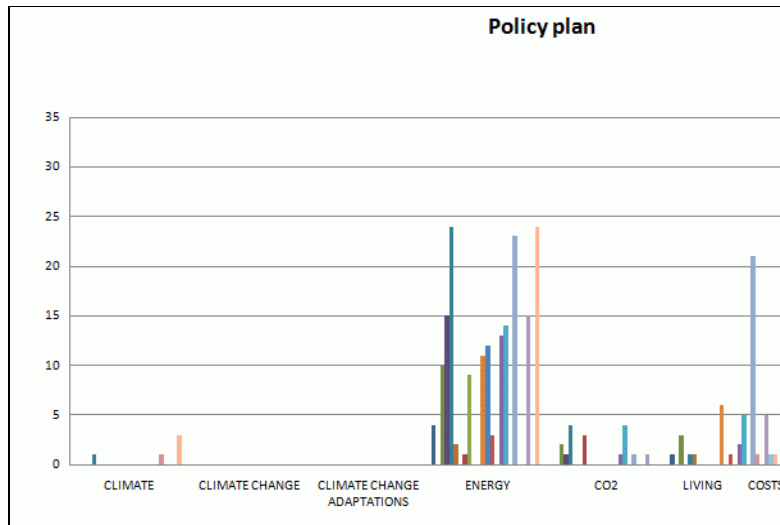


Figure 3: Content analysis results for the policy plans.

Energy

The Dutch housing associations reported on in this paper show little awareness for the threats posed by climate change. The governance on implementing mitigation measures, however, seems to have been effective judging from the fact that many housing associations show awareness of the *Energy* topic. Figure 4 demonstrates that this awareness has increased since 1 January 2008, when a new law came into force obliging the social housing sector to provide energy labels for their housing stock. The policy plans with a scope from 2009 onwards, which were drawn up in 2008, show an increase in energy attention. However, even though the action of taking energy saving measures not only serves the goal of compliance with the EPBD, but also improves living quality and provides cost savings for the tenants, it is the regulatory measure by the government that appears to have been the impetus for taking action.

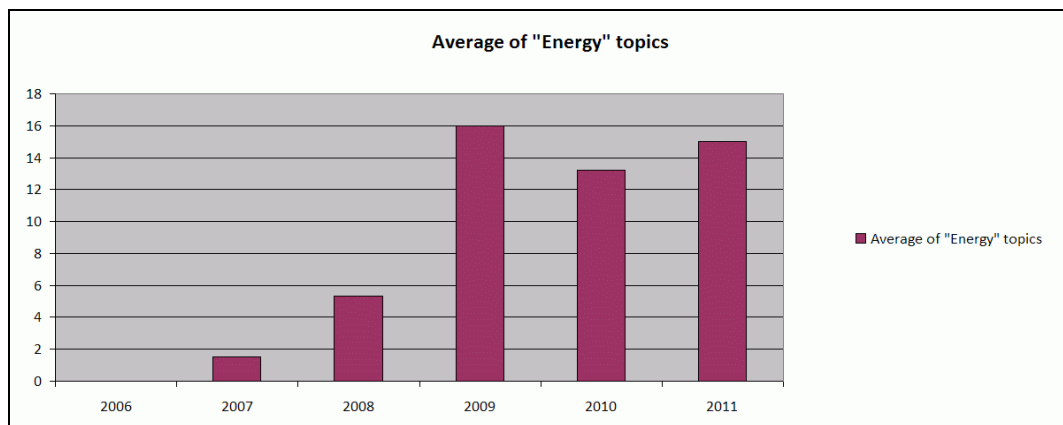


Figure 4: Development of “Energy” topic.

The attention for energy-related issues is also reflected in the energy policy documents available for analysis. The topic *Climate* is referenced in 83% of the documents, *Climate change* is referenced in one of the documents (17%), but *Climate change adaptation* is not referenced at all. The focus on energy topics becomes clear in the ‘Mitigation’ group, whose topics (*Energy*, *CO2* and *Operating cost*) are all mentioned in all documents. The highest number of *Energy* topics is 174, in one document (see Figure 5).

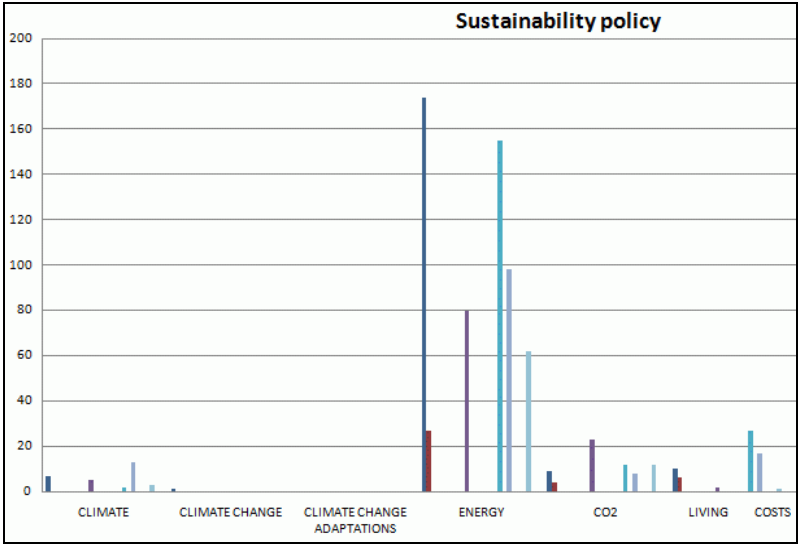


Figure 5: Content analysis results for sustainability policy.

Further proof of the attention given to energy can be found in the projects developed by the housing associations concerning energy efficiency or sustainable energy. Among the remarkable projects initiated in this area are: a geothermal heating system [iv], use of CO2-capturing materials (olivine) on roofs [v; vi] a tenant-oriented website for energy information [vii] and a ‘Green Deal’ between a housing association and an energy company [viii].

DISCUSSION AND CONCLUSION

Based on the content analysis of the two types of documents, it can be concluded that, to date, awareness of housing associations with regard to climate change adaptations is still very limited. All housing associations of the sample can be categorized into the lowest awareness level, “unaware non-adapted”. The topic *Climate change adaptations* was not mentioned, neither in their strategies nor in the projects they executed. In order to validate the results presented in this paper, we would recommend analyzing other documents, such as the strategic asset management plans, using the same topics, or analyzing the same documents using a larger number of topics related to climate change adaptation measures.

The categorization of the housing associations according to their level of awareness allows for differentiated governance strategies for adaptation. As it is expected that not all housing associations will shift to higher levels of awareness at the same time, a differentiated framework with strategies focusing on each level would seem to be more effective than one general approach. What the results of this study have made clear is that the governance strategies for adaptation need to be further studied, taking into account the impact of the

governance strategies for mitigation. They appear to be effective for awareness raising on both the strategies and the projects level.

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