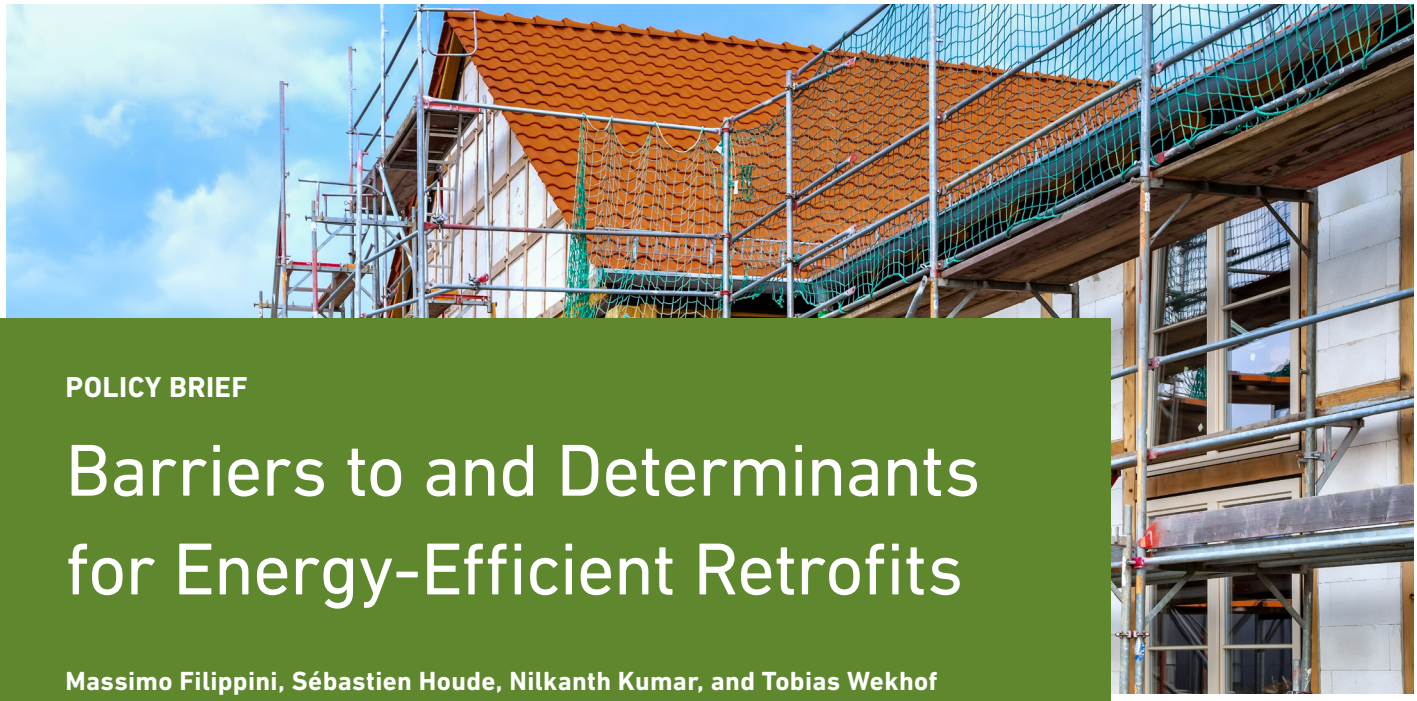

POLICY BRIEF

Barriers to and Determinants for Energy-Efficient Retrofits

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Executive Summary

- Energy-efficient retrofits are highly opportunistic investments: many homeowners wait until a building technology is broken or obsolete before investing in them.
- Financial motives are major barriers to and determinants for these investments, but they are not systematically the most important ones for all households.
- Co-benefits, such as increased comfort and contributing to a cleaner environment, rank highly as determinants of energy-efficient retrofit uptakes.
- Tax deduction policies on retrofits have a small but measurable effect on energy-efficient retrofit uptakes.
- There is strong political support for more generous subsidies.

Outline

In Switzerland, the building sector generates close to one-third of all greenhouse gas emissions (FOEN and SFOE, 2020). As a result, energy-efficient retrofits could be one of the largest reducers of the Swiss carbon footprint. Energy-efficient retrofits are, however, a hard sell for many homeowners because these retrofits are often complex and expensive projects. This policy brief reports on a research program conducted at the Centre for Energy Policy and Economics (CEPE) at ETH; its goal was to identify the behavioural barriers to and determinants of energy-efficiency investments among single-family homeowners living in Switzerland.

The Role of Cantonal Policies

In a first part of the project, we analysed a sample of 8,378 Swiss households using a dataset collected between 2015 and 2016 in collaboration with nine Swiss utilities. The sample covers retrofits for the years 2010 to 2014.[1] The goal was to identify (a) the socio-economic characteristics of the household respondents who performed energy-efficiency renovations in the past and the renovated home's building features and (b) the effects of a tax deduction policy and subsidy policy at the cantonal level.

Our results suggest the building vintage, household income, and education level are all relevant determinants of investment decisions; energy-related attitudes and policy-related variables might also play important roles. In particular, a tax deduction policy enacted during that period had a small but positive impact on households' energy-efficient retrofit uptake. The second policy variable, cantonal budget towards energy-saving mea-

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This policy brief is based on the following research paper: The Narrative of the Energy Efficiency Gap, Sébastien Houde and Tobias Wekhof
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[1] Comprehensive details of the survey and the data are provided in Blasch et al. (2018).

sures, also had a significant but smaller effect. Altogether, we found the fiscal measures and overall public resources allocated to energy-efficiency investments were one set of relevant determinants.

Barriers and Determinants

To further uncover the barriers to and determinants of energy-efficient retrofits, we conducted a second survey in February 2020 with single-family homeowners (N = 3,471) in the Canton of Zurich. The survey was designed to elicit the determinants that led certain homeowners to perform an energy-efficient retrofit (denoted as the takers, 78% of the sample) and the barriers for homeowners who did not perform such a retrofit (denoted as the non-takers, 22% of the sample).[2] To ensure all buildings in this study could have a high potential for renovation, we selected a sample of homeowners living in single-family homes constructed prior to 1990.

Between takers and non-takers, we found homeowner age is the main significant socio-economic variable that is available to use for policy targeting. In fact, apart from age, we found other socio-economic characteristics, such as income and education, are not robust predictors of past decisions in this most-recent sample. The underlying reason is once the sample consists only of old buildings, income and education have a reduced statistical significance. Moreover, general awareness of energy-efficiency policies is actually lower for takers relative to non-takers, but there are no significant differences in policy preferences between the two groups, which is discussed in the following sections. Overall, our results suggest policy makers need to move beyond building and socio-economic characteristics to target their policies and consider increasing the focus on information campaigns and reducing the bureaucratic burden.

In this survey, we also used a novel method to elicit survey respondents' personal narratives of their energy-efficiency investment decisions. Collecting narratives involves asking people what they think and letting them respond by answering open-ended questions. Recent advances in automated text analysis and artificial intelligence allowed us to turn unstructured text narratives into quantifiable metrics that serve as proxies for household preferences and market barriers.

To collect narratives, we asked survey participants two sets of questions. First, why they decided to renovate (or not). We used this question to extract barriers to and determinants of retrofits. Second, we asked respondents about government policies that should encourage energy-efficient retrofits. We used this question to understand policy preferences.

Barriers

Figure 1 shows a word cloud constructed from the open-ended question about barriers.[3] We clustered the answers into broad topics to identify different household types amenable to policy targeting based on their barriers.

For the barriers, two distinct types of homeowners emerged. First, there are owners who do not renovate because they perceive their house as being already energy efficient. They made up 50% of non-takers. Second, there are those who face financial constraints. This group accounts for 23% of all non-takers. Respondents who do not renovate because their building is perceived as being already efficient do not differ in income or age from other non-takers. The only main difference can be found in a higher educational level. Those respondents also have a high awareness of and experience with using energy- efficiency–related policies. However, we found no specific relative differences with respect to preferences for different policy options.

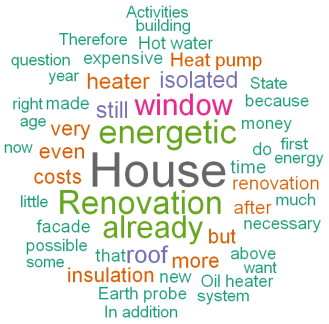

Figure 1: Word cloud with most common words used to describe barriers to energy-efficient retrofits by non-takers

Because homeowners who perceive their building as being already energy efficient do not show notable differences in socio-demographic and building information compared to other non-takers, it is thus difficult to target this group with specific energy-efficiency policies using only building characteristics. In contrast, homeowners who did not renovate due to financial constraints have a lower income; however, they also do not differ in policy awareness or policy preferences, although they have less experience using policies. These findings imply that policy awareness and preferences do not have strong explanatory power related to why particular consumers perform retrofits and others do not. Consequently, improving knowledge of existing policies might not be sufficient to overcome the barriers to energy-efficient retrofits.

Determinants

For the determinants of takers' energy-efficient retrofits, we performed a similar word cloud exercise. Figure 2 shows the

[2] This study's main aim was to analyse the major barriers to and determinants of energy-efficient retrofits. Our sampling strategy was to obtain a final sample of homeowners who have performed an energy-saving retrofit in the past or had planned to do so in the near future. Hence, the share of takers is not representative of the general population in Zurich.

[3] This word cloud is a graphical representation of the words most frequently used to describe the barriers to energy-efficient retrofits non-takers encountered.

main topics found in the narratives elicited with the takers. The determinants can be clustered into three major categories corresponding to different household types of interest for policy targeting: households that invest to replace broken or obsolete building technologies (43% of takers), households that see retrofits as profitable investments (30% of takers), and households that renovate out of ecological concerns (26% of takers).

Homeowners in the first category could be described as opportunistic energy-efficiency investors. They are relatively younger, but they live in older buildings. Even though policy awareness is low for this group, respondents do not favour having more policy information and do prefer less bureaucracy and higher subsidies. In sum, their characteristics are in line with a decision maker who performs energy-efficient retrofits out of necessity (i.e., when it is time to replace broken or obsolete building technologies).

The second homeowner group renovates to save money and is characterised by a lower education level and a lower incidence

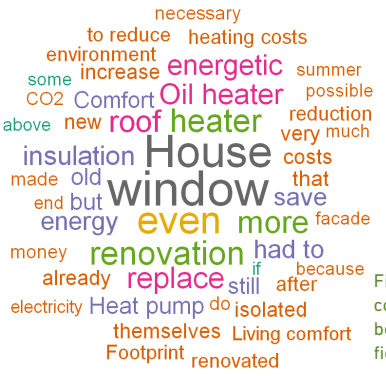

Figure 2: Word cloud with most common words used to describe determinants of energy-efficiency retrofits by takers

of donating to environmental organisations. Moreover, this group has a weakly higher income level, while controlling for education, compared to others who do not mention financial motives as important determinants. This homeowner group is inclined to use existing policies at a higher rate compared to other groups, but they have no distinguishing policy preferences. Compared to homeowners who renovate out of necessity or opportunity, respondents who renovate to save money do perceive a financial opportunity in energy-efficient investments.

Finally, the last group consists of homeowners who renovated because of environmental concerns. Those respondents have a higher income and have previously donated to environmental organisations. They consult policies more often than other groups and would strongly favour policies promoting information campaigns and environmental standards. For the purpose of policy targeting, this group offers interesting opportunities: policy makers could target this group by providing better and easier access to information related to policies and co-benefits of energy-efficient investments.

Policy Preferences

In a second set of open-ended questions, we asked all respondents (takers and non-takers) about their opinions on how policy makers should encourage energy-efficient retrofits. The most common words from the answers are depicted in the word cloud in Figure 3. These were clustered into topics that describe different policy preferences (Table 1). A wide range of topics emerged from the narratives. When asked how policies could encourage energy-efficient investments for all types of households, the top

Figure 3: Word cloud with the most common words respondents (takers and non-takers) used to describe their personal policy preferences concerning energy-efficient retrofits. Words in a larger font appear more frequently in the answers.

suggestion was more-generous subsidies. A greater focus on integrating energy-efficiency policies and policy support for solar photovoltaic (PV) technology was the second most-popular suggestion. It is interesting to note in Switzerland, energy-efficiency programs and incentives for solar PV technology are usually not combined. The remaining suggestions referred to providing more information, reducing bureaucracy, and favouring standards. Other topics with smaller response shares also emerged from the narratives. Tax-related measures were discussed, but they were not a popular topic, especially compared to subsidies. Finally, although subsidies was the most popular topic, almost 65% of respondents favoured other policy measures.

Implications and Policy Recommendations

Our results show for most of the respondents, energy-efficient investments are opportunistic endeavours. In particular, several homeowners who invested in energy efficiency did so because a particular building technology was malfunctioning and needed to be replaced. This behaviour may signal myopic attitudes with respect to retrofitting decisions (i.e., homeowners tend not to plan in advance, and this foresight would allow them to optimize their retrofitting plans). However, several non-takers perceived their house as being energy efficient enough and did not believe there was an opportunity to make such investments. For both takers and non-takers, it might, however, be possible that replacing a technology or retrofitting their home might be profitable from a private perspective; they simply do not correctly perceive these financial benefits. Altogether, this suggests information campaigns, targeted audits, and building standards could be important policy measures that influence decisions and the rate at which energy-efficient retrofits are performed.

Financial motives remain important, however. For non-takers, the high cost of investment is the second-most important barrier. Similarly, for takers, the second-most important determinant is that energy-efficiency investments are profitable. When looking at policy preferences, it is also clear financial motives are an important component of this decision. By far, the most popular policy among survey respondents was more generous subsidies. In terms of political support, a significant share of homeowners desired better information, less bureaucratic burden, and improved integration between energy efficiency and residential solar policies. These measures have strong political support, but tax policies, which influence investment decisions and could be used to fund energy-efficiency subsidies, are much less popular.

Table 1: Policy preferences

Policy Preference	All [%]	Retrofit: non-takers [%]	Retrofit: takers [%]
More subsidies	32.5	31.2	36.9
More focus on photovoltaic	16.3	15.8	17.8
More information	16.1	15.7	17.8
Less bureaucracy	15.0	14.3	17.4
Focus heating	12.9	12.8	13.5
Standards	9.3	9.2	9.5
Tax deduction	8.7	8.4	9.7
Pollution tax	6.5	6.3	7.2
Focus on new buildings	4.8	4.9	4.1
Focus insulation	3.6	3.8	2.9
Technology	3.0	3.1	2.9
Property tax	1.5	1.3	2.1
Subsidy threshold	1.1	1.1	1.0
Credit	0.5	0.6	0.2

Note: This table presents policy preferences obtained by classifying an open-ended answer. Keywords unique to each topic and responses that can be part of multiple topics were used in this classification.

Finally, whereas households are very heterogeneous in their motives whether to invest in energy efficiency and support policy preferences, few characteristics that influenced the respondents' decisions are amenable to policy targeting. In particular, homeowners' building and socio-economic characteristics do not differ widely between takers and non-takers. These results show policy makers need to move beyond these characteristics to target their policies. To that end, we propose a more granular approach by focusing on the specific barriers to and determinants for energy-efficient retrofits.

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Cover Photo

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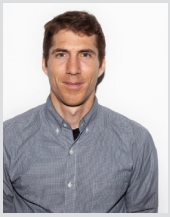

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