Interreg North-West Europe ACE-Retrofitting

European Regional Development Fund

Financial Solutions for Condominium Retrofitting

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Prepared by Maastricht University - Deliverable D.T4.1.1

Acknowledgement

We want to thank all of the project partners that supported and kindly helped within the last months to set up this report, to detect all the different financing tools with their examples, and to develop the frameworks that are shown within this report. Not only did they help to prioritize the content, but they also helped regarding the approach and structure of the report in general to ensure that we cover all angles. We tried to incorporate all the feedback to our best abilities.

1 Executive Summary

This report is part of the ACE-Retrofitting program and covers the financial perspective of retrofits for condominiums. The target audience of this report are local authorities within the partner cities, helping them to stimulate energy efficient retrofits of condominiums by offering solutions on financing. Thus, it examines the landscape of available financial tools. The outcome is summarized in two flowcharts that guide local authorities on how to potentially support condominiums and guide owners on how to approach the financing decision. In addition, several financing tools, examples, and innovative solutions are presented, allowing local authorities to select their own solution or to study these further.

The report draws attention to the importance of the residential buildings sector to the Paris Agreement in 2015. Condominiums are an essential fraction of the buildings sector especially in urban areas. As condominiums are more complex in their decision-making to retrofit than other buildings, this report adds value by specifically tackling the issue of retrofitting condominiums.

Two analytical frameworks are developed to evaluate the different financing solutions for condominium owners: One theoretical, addressing the condominium owners' needs, and one practical, evaluating the implementation.

For the theoretical framework, the report identifies the following criteria to evaluate:

- **Investment Characteristics**
- **Scalability to a Retrofit**
- **Energy Performance Risk to Condominium Owner**
- **Transferability of obligations at Sale**
- **Support**
- **Addresses Split Incentives**

The practical criteria to judge a financing tool reflect the ease of implementation of the tool, using the following criteria:

- **Possible in Partner Countries?**
- **Transaction Costs Related to Negotiations**
- **Obligations for Owner**
- **Is Product Available in Partner Countries?**
- **Can the Municipality Assist the Program?**
- **Suitable for Residential Market?**
- **Regulatory or Legislative Issues**

As a start, all potential financial tools are collected, categorized and presented. The following options are identified: **own savings**, three types of loans (**mortgages**, **soft loans** and **collective loans**), **utility on-bill financing**, **EUA/PACE financing**, **energy performance contracting (EPC)**, **energy supply contracting (ESC)**, **leasing**, and **Add-Ons combined with renewable energy (AdoRes)**. For every category, different examples are presented.

All financing options are analyzed regarding their fit for condominiums, using the criteria of the two frameworks. According the first set of criteria, from the theoretical framework, utility-on bill financing, EUA/PACE financing, energy performance- and energy supply contracting (EPC / ESC) seem to be the best options. According to the second set, from the practical framework, own savings, mortgage-based energy efficiency financing, utility-on bill financing, energy performance contracting (EPC), energy supply contracting (ESC), soft loan and subsidy schemes are the best options.

The outcome shows the dilemma: Easy implementable financing options are not necessary the best for condominium owners´ needs. Vice versa, financing options perfectly fitting owners´ needs are not necessarily the easiest to implement.

Based on the fit in both frameworks, two flowcharts are developed, guiding owners and local authorities, respectively. Owners are guided according to their needs (what is best for them), whereas local authorities are guided according to the low-hanging fruit approach (from least effort support to highest).

In addition to the flowcharts, four innovative programs, ranking highest in both frameworks, are presented in more detail, allowing local authorities to understand what makes these programs such a good fit. These programs are **Assen Service Cost model**, **Effirenov by ENGIE**, **Energies Posit'if** and **ABRACADABRA.**

Taking the outcomes of all analyses and the detailed descriptions of the four innovative financing tools, the final section discusses in more detail what local authorities could do. In summary, local authorities can mainly engage in three different ways. They can reach out to national authorities. They can tailor standards or accelerate bureaucratic processes. And finally, they can finance projects either by supporting them or by developing own projects.

2 Introduction [1] [2] [3] [4] [5]

In 2015, 195 countries agreed on an international climate treaty, known as the Paris Agreement. This agreement can best be summarized by its overall goal, which is to keep climate change below 2 degrees Celsius (European Commission, 2018). To achieve this ambitious target, nations necessarily need to reduce emissions. However, so far, the actions undertaken are not enough to meet the goal. One major factor in the current high emissions is the building sector.

According to the Global Status Report of the United Nations (UN) (2018), buildings consume 30% of final energy. Of this 30%, 22% stems from residential buildings, which is a big share but not surprising given that people spend most of their time at home. Thus, if this would all be renewable energy this would not be a problem. However, looking at the energy related CO_2 emissions draws a similar picture. Compared to other sectors, buildings make up 28% and the residential sector alone 17%. Hence, there seems to be potential for emission reductions in this sector.

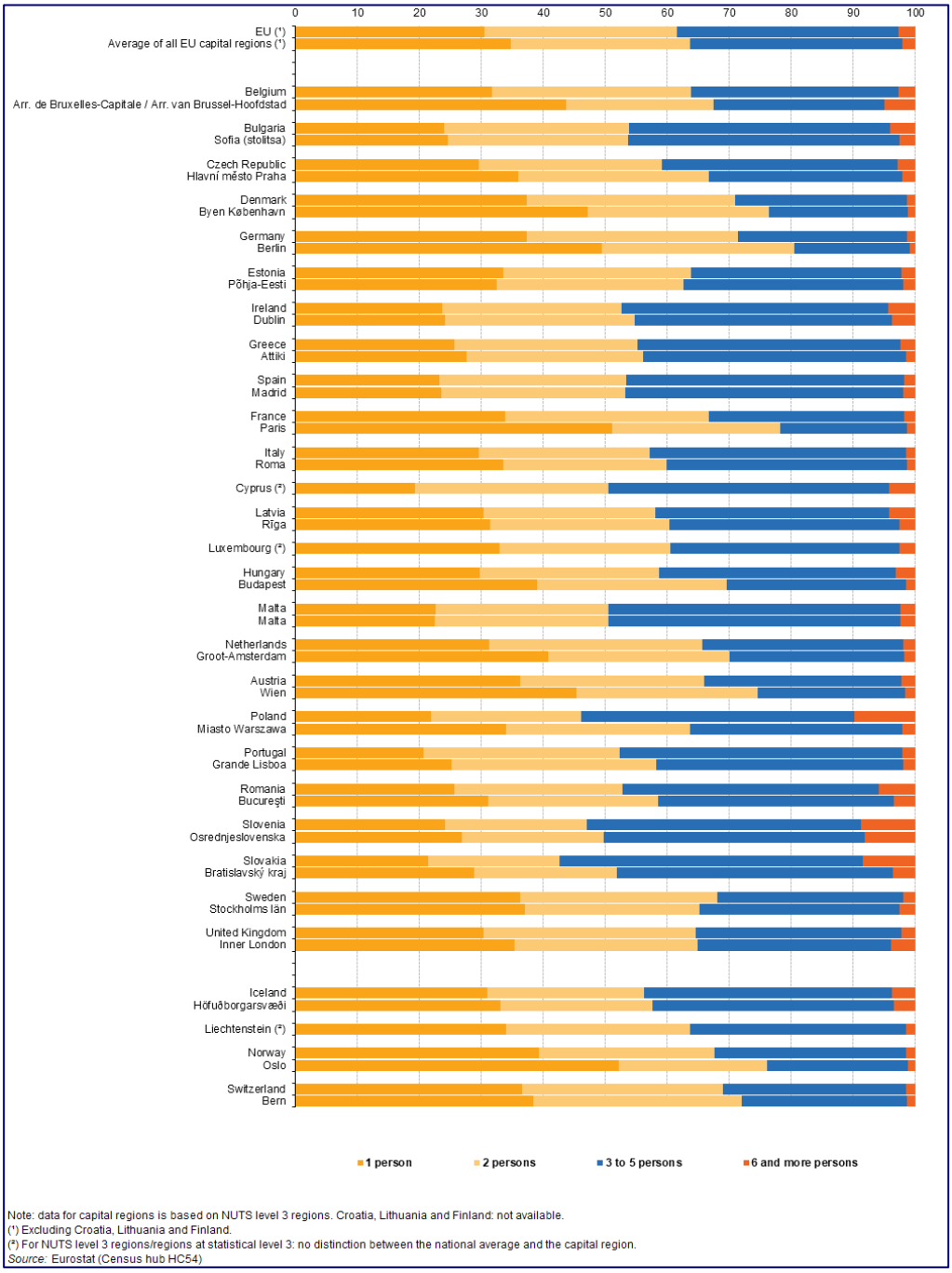
The question that arises is where the potential for these reductions is hidden. If we look at the European housing-market as analyzed by Eurostat in 2017, we see in Figure 1 that in the European Union (EU) around 40% of all people live in an apartment of a building occupied by 3 or more households. If these are owner occupied, we talk about condominiums. The sheer percentage shows how important it is to recognize these dwellings and the potential they provide to reach climate goals anchored within the EU.

New buildings immediately incorporate the requirements of energy-efficient buildings. However, new buildings only constitute a minor share of the whole building stock in Europe. Generally, the existing building stock is of far higher importance as this accounts for the biggest part of the residential building stock: annual new construction tends to be less than 2 percent of the existing stock. When we look at the percentages of the dwellings built before 1980 in Figure 2 taken from Eurostat (2017), we recognize that this makes up for more than 70 percent on average. If this is narrowed down to capital regions with bigger cities, this number increases even further to an average of around 80 percent. Such buildings did not incorporate sustainability factors back when

[1] https://ec.europa.eu/clima/policies/international/negotiations/paris_en
[2] http://www.worldgbc.org/sites/default/files/UNEP%20188_GABC_en%20%28web%29.pdf
[3] http://ec.europa.eu/eurostat/statistics-explained/images/8/82/Dwellings_by_period_of_construction%2C_national_averages_and_capital_regions%2C_2011_%28%25_share_of_all_dwellings%29_PITEU17.png
[4] https://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/a-cost-curve-for-greenhouse-gas-reduction
[5] https://www.sciencedirect.com/science/article/pii/S0095069611000337

they were built. In consequence, they are not energy efficient, which is why they also offer the opportunity to achieve high emissions savings. This can be achieved by retrofitting.

Figure 1: Dwellings by the number of occupants, national averages and capital regions, 2011



Note: data for capital regions is based on NUTS level 3 regions. Croatia, Lithuania and Finland: not available.
(*) Excluding Croatia, Lithuania and Finland.
(2) For NUTS level 3 regions/regions at statistical level 3: no distinction between the national average and the capital region.
Source: Eurostat (Census hub HC54)

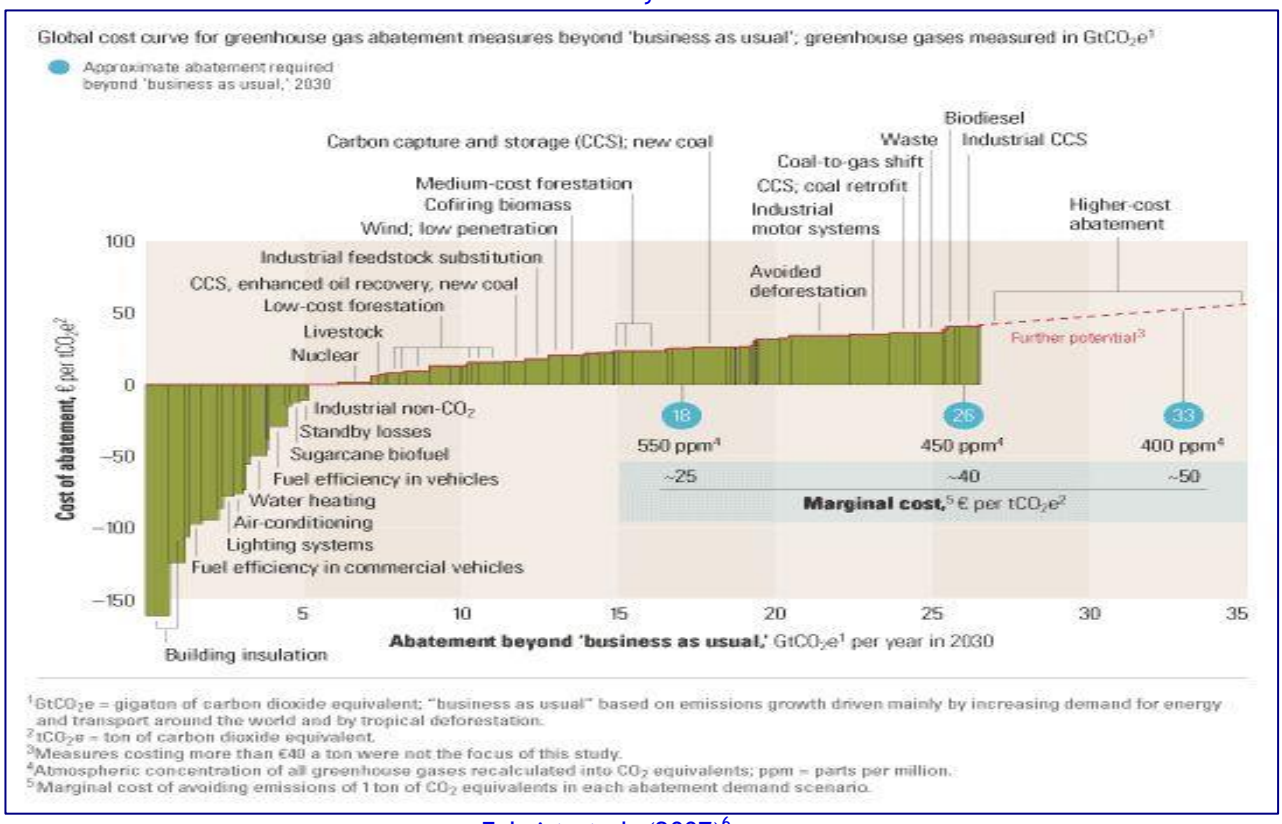
Eurostat (2017)

Figure 2: Dwellings by period of construction, national averages and capital regions, 2011 (% share of all dwellings)

	Capital region	Period of construction							
		Before 1946		1946-1980		1981-2000		2001 onwards	
		National average	Capital region	National average	Capital region	National average	Capital region	National average	Capital region
EU-28	-	22.3	-	44.1	-	22.1	-	9.8	-
Belgium	Arr. de Bruxelles-Capitale / Arr. van Brussel-Hoofdstad	37.1	51.7	38.2	37.0	16.5	7.1	8.2	4.1
Bulgaria	Sofia (stolitsa)	10.5	5.6	55.4	45.8	25.5	33.2	8.6	15.4
Czech Republic	Hlavní město Praha	19.0	29.4	37.1	30.4	20.5	20.7	7.7	7.4
Denmark	Byen København	34.1	68.1	44.6	21.8	14.0	5.7	7.2	4.4
Germany	Berlin	24.3	42.3	46.5	36.3	23.1	19.2	6.1	2.1
Estonia (¹)	Põhja-Eesti	17.0	12.0	47.1	47.3	22.8	23.2	9.4	15.2
Ireland	Dublin	13.3	13.9	22.9	30.8	20.7	20.2	22.0	18.0
Greece	Attiki	7.6	2.4	47.8	55.1	29.1	27.1	15.5	15.3
Spain	Madrid	11.1	8.0	43.0	50.3	24.7	24.2	18.5	14.9
France	Paris	28.7	59.7	37.0	26.0	23.9	11.7	10.4	2.5
Croatia	Grad Zagreb	13.6	13.7	42.5	43.3	23.6	22.3	11.0	17.0
Italy	Roma	20.7	12.3	51.4	60.1	19.8	20.4	7.9	7.1
Cyprus	Kýpros	3.0	-	24.6	-	36.1	-	34.1	-
Latvia	Rīga	22.7	23.5	46.6	48.4	24.3	21.7	5.1	6.1
Lithuania	Vilniaus apskritis	13.5	12.7	49.6	43.3	28.9	30.2	6.2	12.6
Luxembourg	Luxembourg	21.8	-	31.5	-	21.6	-	14.0	-
Hungary	Budapest	20.3	33.2	48.3	38.0	21.7	17.3	9.7	11.6
Malta	Malta	13.0	13.5	23.2	24.3	23.4	24.1	8.7	9.1
Netherlands	Groot-Amsterdam	18.9	32.7	41.9	29.7	26.4	25.0	9.5	10.1
Austria (²)	Wien	25.5	42.4	40.1	35.4	22.7	14.6	11.7	7.6
Poland	Miasto Warszawa	19.1	10.3	43.0	49.1	22.7	16.1	11.4	17.8
Portugal	Grande Lisboa	10.7	9.8	37.1	46.0	36.0	31.4	16.3	12.8
Romania	Bucureşti	11.2	7.7	59.1	60.3	19.0	23.3	8.0	5.5
Slovenia	Osrednjeslovenska	21.3	16.6	45.0	47.9	25.0	23.7	8.7	11.8
Slovakia	Bratislavský kraj	8.2	8.7	52.6	48.0	21.5	23.5	5.8	11.3
Finland	Helsinki-Uusimaa	9.6	12.1	48.7	44.3	29.7	29.8	10.7	12.8
Sweden	Stockholms län	24.3	23.8	47.7	44.1	12.3	12.4	4.6	6.8
United Kingdom (³)	Inner London (⁴)	37.8	57.7	39.7	26.6	15.6	10.4	6.9	5.3

Eurostat (2017)

Figure 3: Simplified global cost curve for estimated size and cost of feasible approaches to abatement by 2030



Enkvist et al. (2007)[6]

From a cost perspective, retrofits seem to be among the easiest ways to reduce emissions. Enkvist et al. (2007) analyzed different ways to reduce greenhouse gas abatement for McKinsey & Company. Figure 3 provides the resulting graph and shows that actions related to retrofitting like insulation, lighting, water heating and air conditioning rank superior from a cost perspective. Since then, many papers have shown that that sustainability measures indeed create value in the housing market, both in terms of rents and in terms of prices.[7][8][9] However, most of these results do not specifically look at condominiums or apartments. Brounen (2018) has studied green value effects in the Dutch condominium market, looking at the effects of energy labels on transaction price and selling period. Energy efficient retrofits would have a positive impact on the energy label. Brounen shows that even for condominiums, sustainability measures create value. A-labels decrease the selling period, which already is valuable to an owner. Looking at the effects on transaction price, it can be concluded that all A-, B- and C-labels have a positive impact on the price. Thus, energy efficiency

[6] https://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/a-cost-curve-for-greenhouse-gas-reduction

[7] Brounen, D., & Kok, N. (2011). On the economics of energy labels in the housing market. *Journal of Environmental Economics and Management*, *62*(2), 166-179.

[8] Brounen, D., Kok, N., & Menne, J. (2009). Energy Performance Certification in the Housing Market Implementation and Valuation in the European Union.

[9] Fuerst, F., McAllister, P., Nanda, A., & Wyatt, P. (2015). Does energy efficiency matter to home-buyers? An investigation of EPC ratings and transaction prices in England. *Energy Economics*, *48*, 145-156.

measures do not only create value for single-family houses, but also for condominiums. That all leaves us with the question why retrofitting in condominiums is not more common.

The reason for this is that retrofitting in a condominium situation is very complex. This is due to the number of stakeholders, but also due to the financing related to the retrofits. Retrofits can get quite expensive, especially for very old buildings, and individual owning condominium apartments face financial constraints. For single-family houses there are more financial tools available and the decision to retrofit is usually not that complex. In the condominium situation, however, there is still a lack of financing solutions in the EU and beyond to boost retrofitting of condominiums.

The ACE-Retrofitting project and this report aim to fill this gap by assessing the landscape of the complex retrofits of condominiums. We aim to provide a starting point and a guideline for actions - especially from a financial point of view – that can be undertaken by owners and municipalities in order to kick start retrofitting of condominiums within North-West Europe. We provide an overview of the state-of-the-art in available financing tools and initiatives. Hence, the report takes a step towards the execution of the Paris Agreement by addressing the financing of an important part of the housing market that has not been studied much yet.

This report provides an overview of potentially feasible financing initiatives for energy efficient retrofits of condominiums. There are lots of tools that try to finance or stimulate retrofitting of buildings in general, but we look at how well they work in the specific situation of condominiums. The aim of this report is to narrow down the possible financing options to the most promising ones. In addition, we present the most innovative financing projects for condominiums. A framework is developed to evaluate and categorize the currently available financial tools. However, the available tools do not necessarily aim to stimulate retrofitting of condominiums, so our framework specifically aims to evaluate whether tools are transferable to the condominium situation or not.

We first describe the initial condominium situation, including our assumptions and our aim. This is to make sure readers know what to expect or not to expect from this work. Next, we outline the special circumstances condominiums face in the retrofitting process to develop evaluation criteria. Especially the comparison to single-family houses and the issues of a split incentive will be discussed. This will give the reader an understanding of why retrofitting in condominiums is a challenging task. For example, the decision to retrofit is conducted by groups of owners with different financial and personal preferences. This is not the case in single-family houses. These make up the theoretical criteria. In addition, we also develop practical criteria for financial tools that address the condominium situation.

These sets of criteria are put into a theoretical as well as into a practical evaluation framework. We do this because a theoretically perfect tool might be suboptimal to implement. Both aspects are covered by one of the two frameworks. We feed these two frameworks with a set of financial tools. Specifically, we list and explain eight different financial tools, all illustrated by several examples. The first framework then evaluates financing options with respect to the theoretical condominium situation. In the second framework, we evaluate the most promising options with respect to practical aspects, focusing on the role of municipalities, transaction costs and other issues.

Based on the combined findings of the two frameworks, we finally evaluate five innovative tools, because they already address the different criteria. The outcomes of these analyses are presented in the flowcharts shown after the introduction. For condominium owners, the flowchart provides better guidance where to start and how to choose from the different financing possibilities. For municipalities or local authorities, the flowchart offers guidance on how to support retrofitting regionally.

Overall, based on our analysis, we find that some financing options and/or financing examples are more suitable for retrofitting in condominiums than others. For example, Energy Performance Contracting seems to be a promising tool for our purposes, because it guarantees (financial) energy savings and provides lots of support to the owners. Especially the demand for support has been identified as important to the owners by the focus group. Utility on-bill financing is ranked high as well, but the practical framework suggests that its scalability is questionable.

We focus on the most innovative and suitable financing ideas, presenting them in a separate section in which we evaluate them individually. These are, among others, the Assen Service Cost model, Effirenov by ENGIE, Energies Posit'if and ABRACADABRA.

Finally, based on the insights we got from the analyses of the report we project our findings to actions that municipalities or cities can take. Consequently, cities can act in different ways, as developers by creating an ESCO, as networkers by bringing commercial banks to the table, as facilitators by tailoring regulations or as financiers by providing money or by supporting projects with funds.

2.1 Assumptions

To manage expectations, it's important to describe the starting point of our analysis:

- We assume condominium owners already made a decision to retrofit, either on their own or with the help of some local initiative.
- We assume condominium owners already informed themselves on what needs to be retrofitted to reach their energy-saving or comfort goals, either by contacting energy consultants or having a master plan (which is necessary to lead to superior results).[10]
- Condominium owners are (at least slightly) aware of the total retrofitting costs.
- Condominium owners are looking for potential options on how to finance the costs.
- We do not describe the process of setting up a financial plan for condominiums. We rather assume condominium owners can set up a financial plan, either through internal knowledge or with the help of a consultant. In our practical framework, we take the complexity, costs and duration of the different financing options into consideration, but we assume that condominiums know about the implications.
- We also assume the reader to have some basic financing knowledge, at least be familiar with the concept of loans, interest rates, and duration.

2.2 Aims

- We want to point out the special situation of condominiums in retrofit financing, allowing future readers to consider potential pitfalls.
- We aim to present an extensive overview of financing tools in general and provide more detailed examples of different tools.
- We evaluate how suitable different options for condominiums are, given the identified special circumstances.
- We want to help condominiums and policy makers in their choice, by discussing practical aspects of the different options and providing flowcharts on the decision-making process.
- We highlight the most innovative financing ideas for condominiums. Making these tools available often requires additional effort from policy makers and local governments (e.g. municipalities), but the effort can be rewarding. Therefore, we dedicated a special section to these options, discussing each in more detail.

[10] More about the masterplan development can be found on the supply side of the ACE-Retrofitting program.

3 Flowcharts and Tool Overview

To help the reader navigate the complicated landscape of retrofit financing tools, we provide two conditional flowcharts. One is addressed at condominium owners (Figure 4.1) and one at municipalities (Figure 4.2). We provide these flowcharts at this point already, because they provide a good overview of what to expect of the report and can be used without having read the whole report.

The flowchart shown in figure 4.1 is aimed at condominiums and starts from the existing situation in a condominium, and directs the user through a decision process by asking questions. The direction taken in the chart depends on the answer to these questions, which finally take the user to an optimal financing tool, or a combination thereof. Looking at the flowchart for condominium owners, the reader can assess what kind of financing options are available according to his financial preferences, abilities and his financial environment. We try to concentrate on tools that have the ability to be a collective solution for all the buildings' owners. Hence, we also underlined the collective options with a color scheme. In general, this flowchart builds on the theoretical framework in section 6.1.

The flowchart for the municipalities (figure 4.2) aims at assessing how the municipalities can support retrofitting of condominiums on a regional level. As it is a flowchart, it is designed to end up at one of the boxes (ending points), which is consequently the best option to support. However, if possible for the municipality, it can also offer more than one support mechanisms. To reflect this, the dashed arrows mean that it is possible to go back and assess whether there are other options that can be applied simultaneously. With simultaneously we mean that they can be applied as two distinct projects simultaneously and that they can be combined (for example, combination of soft loan and energy performance contract)[11]. The design of the flowchart builds up on the outcomes of the practical framework in section 6.2 and section 8. In this flowchart, less ending points and tools are shown. This is because a municipality cannot actively support all kinds of tools. For example, using own savings is a decision conducted by the owner only. Mortgages on the other hand are only offered by financial institutions. Thus, this flowchart is restricted to the tools that can be affected by municipalities. We talk more in detail about the support options of municipalities in section 8.

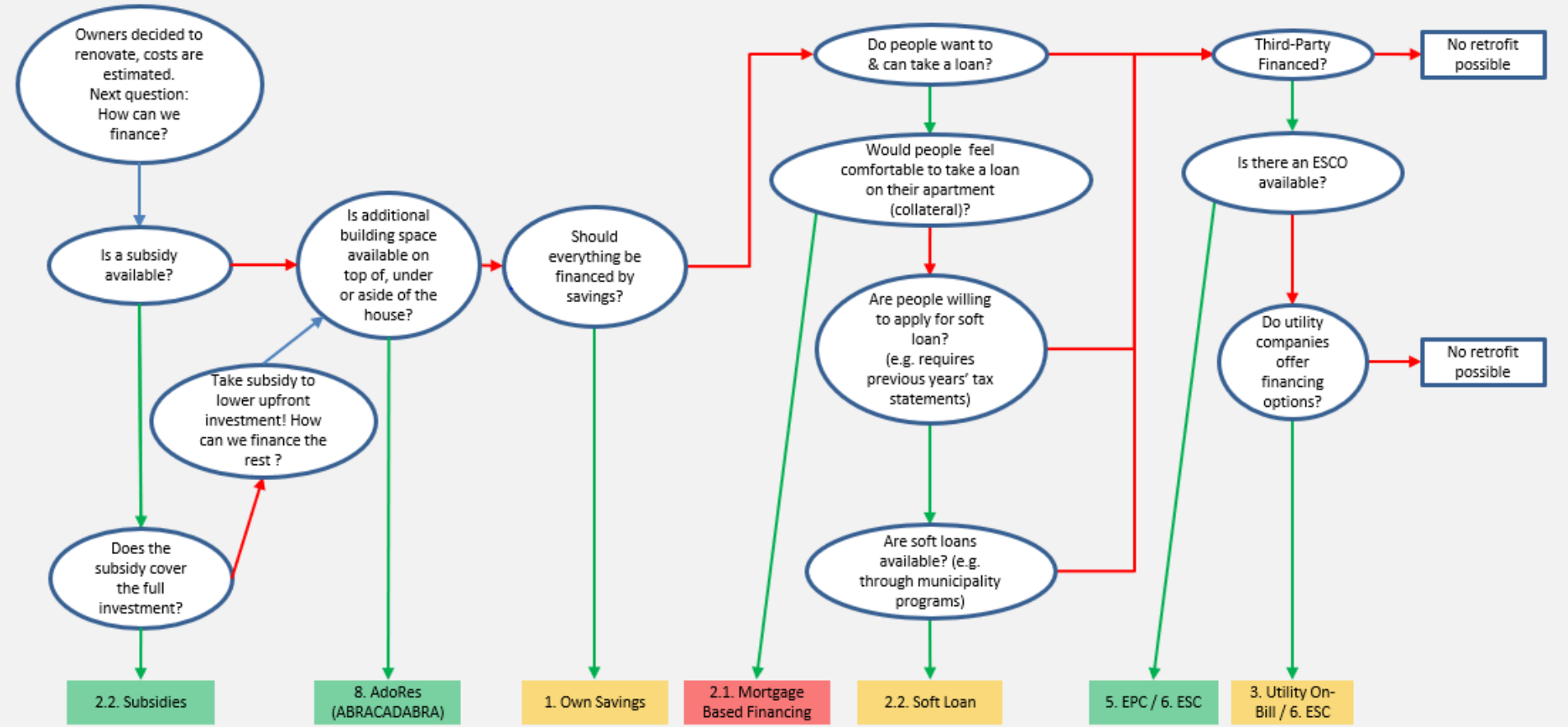
[11] **Possible scenario for clarification:** The user can end up at the ending point 5.EPC. He assesses the flowchart further and also ends up at the point 2.2 Soft loan. Thus, he has two options what to do with this outcome. He can apply one EPC scheme and one Soft loan scheme independent of each other or he can apply an EPC scheme that is combined with the soft loan scheme.

Both flowcharts follow the assumption that the user prefers low cost over higher costs. Thus, they depict a prioritization starting with the lowest cost option and ending with the highest cost option. This holds especially for the flowchart aimed at municipalities.

Both conditional flowcharts are presented on the next two pages. The starting point is given in the upper left corner for both flowcharts. The arrows represent the reader's answers or decisions. In this regard, the green arrow represents "Yes", the red arrow "No" and the blue arrow the decision to conduct a retrofit (the dashed arrow is an exception).

To further assist the user, we end this sub-section with a short explanation of all the financing tools mentioned in the flowchart (numbering according to flowchart). Detailed descriptions, analyses, and examples of each tool are given in section 5.

Figure 4.1: Conditional Flowchart for Condominium Owners[12] [13] [14]

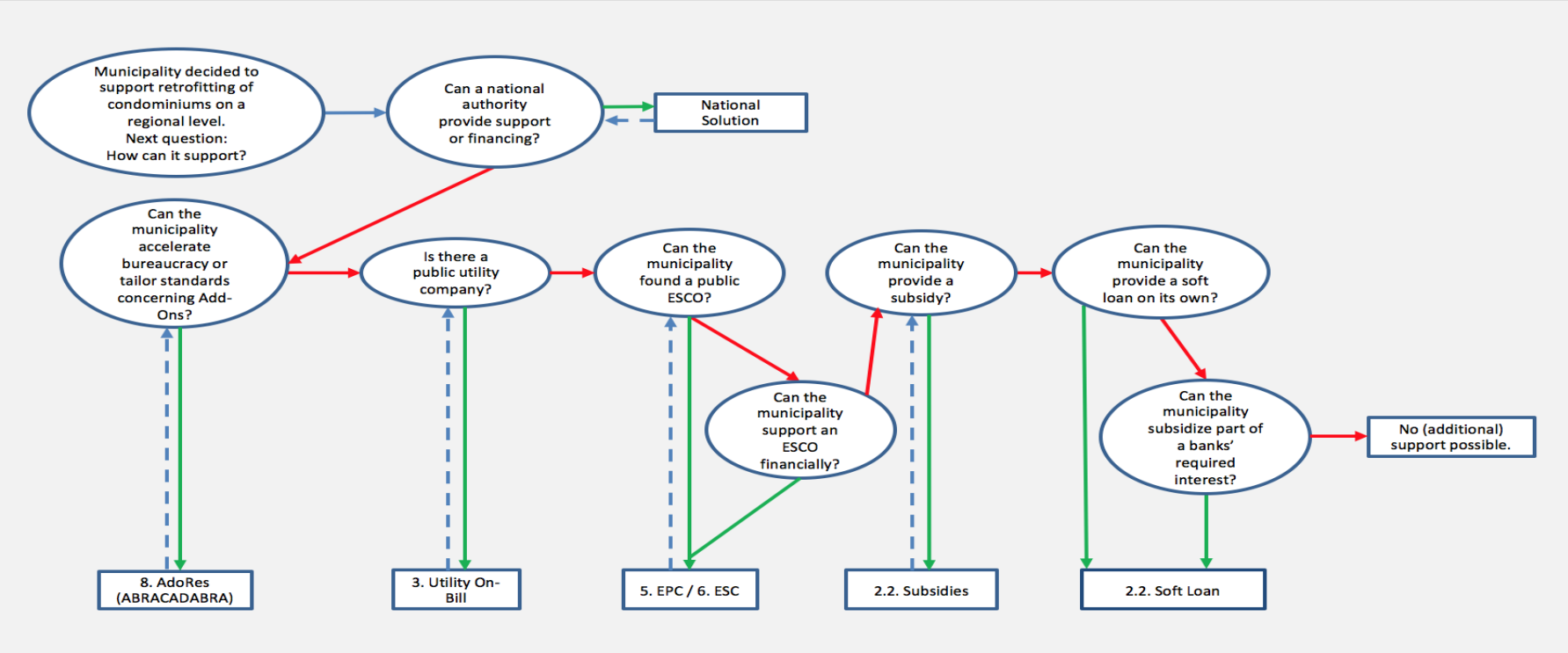


[12] Bubbles represent questions. Boxes represent ending points (Green=Collective scheme likely, Orange=Collective scheme possible, Red=Collective Scheme unlikely). Arrows represent answers (Red=No, Green=Yes, Blue=Decision).

[13] The option 4. PACE/EUA financing has been left out of the flowchart, because it is only available in the US. The option 7. Leasing has been left out due to their low outcomes in both frameworks. The option 2.3. Collective Loans has been left out as we already indicated which method provides the ability to have a collective scheme. However, these tools will still be addressed in this report. For soft loans and subsidies, the capacity might be limited by the issuer. Thus, uncertainty is present in this method.

[14] Abbreviations used: AdoRe (ADd-On combined with REnewable energy), ABRACADABRA (Assistant Buildings' addition to Retrofit, Adopt, Cure And Develop the Actual Buildings up to zeRo energy, Activating a market for deep renovation), EPC (Energy Performance Contract), ESC (Energy Supply Contract), ESCO (Energy Service Company)

Figure 4.2: Conditional Flowchart for Municipalities[15] [16] [17]



[15] Bubbles represent questions. Boxes represent ending points. Arrows represent answers (Red=No, Green=Yes, Blue=Decision, Dashed Blue=additionally take rest of the flowchart into account, as more than one support mechanism can be applied at once).

[16] The option 4. PACE/EUA financing has been left out of the flowchart, because it is only available in the US. Options 1. Own Savings, 2.1. Mortgage based energy efficiency schemes, 2.2 Collective Loans and 7. Leasing have been left out as they cannot be supported by the municipality. However, these tools will still be addressed in this report.

[17] Abbreviations used: AdoRe (ADd-On combined with REnewable energy), ABRACADABRA (Assistant Buildings' addition to Retrofit, Adopt, Cure And Develop the Actual Buildings up to zeRo energy, Activating a market for deep renovation), EPC (Energy Performance Contract), ESC (Energy Supply Contract), ESCO (Energy Service Company).

1. Own Savings

Own savings means literally that the owner uses his/her own savings or equity to finance the retrofit. This option is restricted to wealthy individuals when financing the complete retrofit with this method. However, savings are a good place to begin at when partially financing a retrofit, because they do not involve transaction costs, and not involve decision making outside the condominium.

More detailed information concerning this financing tool can be found on in section 5.1

2. Loans

We divided this tool into three different types of loans as can be seen below.

2.1 Mortgage Based Energy Efficiency Schemes

This financing tool functions like regular mortgages, but it offers favorable terms according to energy efficiency characteristics. It is a debt instrument that is mostly offered by banks, and it has a mature infrastructure in most societies. Mortgages tend to have lower interest rates than other loan types, due to the collateral quality.

Detailed information on this financing tool is given on section 5.2.1.

2.2. Soft Loans and Subsidies

Soft loans function like regular loans, but they offer favorable financing conditions, like lower interest rates, longer amortization times, or higher loan to-value ceilings. They also often include subsidies dependent on specific energy efficiency requirements. Thus, it is a hybrid between a debt instrument and a government subsidy tool. It is mostly offered by regional and national development banks. This instrument is already wide-spread throughout the partner countries.

More details regarding this financing tool is to be found in section 5.2.2.

2.3. Collective Loans

Collective Loans are loans taken collectively by the owners of the building. This is usually conducted by associations representing the owners, like the syndicate of owners or a home

owners association. The obligations of these loans are usually transferable at sale, which is the advantage of this type of loan.

More detailed information concerning this tool can be found in section 5.2.3.

3. Utility On-Bill Financing

Using this financing method, the owner's utility company plans, finances and conducts energy efficiency improvements. The investment is refinanced through an additional item on the utility bill. Thus, no upfront costs are involved for the owner. Currently, however, the scale of the energy efficiency improvements is small relative to a full condominium retrofit.

More information regarding this financing tool can be found in section 5.3.

4. EUA/PACE Financing

In this retrofit financing scheme municipalities issue low-interest bonds, and the proceeds of these are used as loan to retrofit properties, mostly homes (not on the owner). The lien stays with the property when it is sold. The loan obligations (interest, amortization) are paid with the property tax, which makes the obligations transferable as well. Until now PACE is restricted to the US, except for one pilot project in Spain.

Detailed information concerning this financing tool can be found in section 5.4.

5. Energy Savings Performance Contracting

An Energy Savings Performance Contract is much broader than just a financing tool. Under such a contract, an energy service company (ESCO) plans and conducts a retrofit, and arranges financing for it. The financing can be offered by the ESCO itself, but also by other parties. An essential characteristic of this scheme is that the ESCO guarantees the energy savings and infrastructure maintenance throughout the contract, which also guarantees stable payback of the obligations.

Detailed information concerning this financing tool can be found in section 5.5.

6. Energy Supply Contracting

This tool is similar to energy savings performance contracting. The difference is that it only addresses the supply, but not the consumption of energy.

More detailed information on this financing tool is provided in section 5.6.

7. Leasing Schemes

In leasing schemes, the landlord finances the retrofit. The tenant then pays a regular fee for the retrofit in order to be eligible to use it. However, leasing is rarely used for retrofits in a residential setting, because a retrofit cannot be removed from a house in case of default, and tenants can move away at short notice. Therefore, it is more applicable for commercial real estate, due to the long-term rental contracts in that sector. Moreover, it is only partly applicable to a condominium setting, in which many or even most occupants tend to be owners, rather than tenants.

More detailed information concerning this tool can be found in section 5.7.

8. AdoRes

AdoRes – building add-ons combined with renewable energy – aim at adding additional space, and therefore extra value, to a building. This can be done by attachments to the facade, the roof or the cellar. The additional space is usually rented to a tenant and the resulting rent is used to finance the retrofit of the whole building. This tool involves lots of planning as well as zoning permission from the local government. It also increases the upfront investment that is required. However, the advantage is that loan servicing does not depend on energy savings alone.

More detailed information on this tool can be found in section 5.8.

4 Criteria for Frameworks

In this section we will explain the criteria used in the theoretical and in the practical framework. These serve to assess the tools from different perspectives. We divide them into two categories, because a theoretically perfect tool might be suboptimal to implement, which is then reflected by the practical framework.

4.1 Criteria Theoretical Framework [18] [19] [20]

In order to get a solid understanding of the issue that is central throughout the report, we begin with a description of the specific characteristics of condominiums. Later, we use this analysis as part of a framework regarding the feasibility of financing solutions. We explain the special characteristics of condominiums specifically in comparison to single family homes.

We saw that buildings in general make up 28% of the global energy related CO_2 emissions and 17% stem from residential buildings (UN Environment, 2017). These numbers emphasize the importance of potential energy savings within this sector. Within the residential sector, condominiums play a very important role, especially in cities: When looking at floor area, condominiums represent 34% of the overall residential sector (ODYSSEE-MURE, 2015)[21]. Hence, condominiums can also play a considerable role in potential energy savings.

We look at condominiums in particular, because they pose the bigger challenge in incentivizing retrofits in comparison to single family homes. One obvious reason for this is that compared to a single-family house, condominium owners own one or a few apartments in a larger multi-unit building. Therefore, more people are involved in decisions concerning retrofitting. This is especially the case in deep renovation retrofits, because these require even more capital. Not only the people living in the building, but also the people owning the different condominiums within the building have to be considered. In a single-family house the decision of retrofitting is likely to boil down to one party, the single owner.

To make this more tangible, imagine ten households each living in ten single-family homes. If one of those households wants to retrofit, one retrofit will be accomplished. Now imagine ten households living in one multi-family house. If as in the example of the single-family house, one of those households again is willing to retrofit, very likely nothing is going to happen. This is because the majority of owners that are not willing to retrofit, and retrofitting one apartment in a larger building is hardly feasible. A consensus regarding the decision to retrofit the whole building needs to be achieved among the owners. This is hard to achieve due to several reasons, some of them financial.

[18] http://www.worldgbc.org/sites/default/files/UNEP%20188_GABC_en%20%28web%29.pdf
[19] http://sustainca.org/green_leases_toolkit/glossary
[20] https://www.sciencedirect.com/science/article/pii/S0301421512004661
[21] http://www.odyssee-mure.eu/publications/br/energy-efficiency-trends-policies-buildings.pdf

Similar results are found in the analyses of the ACE-Retrofitting's demand side focus group interviews.[22] They find that anticipated barriers were: uncertainty about financial costs mostly driven by a lack of insight in the revenues at the personal and communal level and an unfavourable weighing of expected life years and estimated time needed for a positive return on investment, lack of expertise on possible solutions, anticipating problems with mobilizing others, and the expected nuisance from installing the measures (e.g., noise, dust). At the level of condominium management, the urgency of finding a solution to an identified problem (e.g., broken heating system), new policy regulations, and having financial reserves available were the most important cues for starting the energy retrofitting process. These results can be translated into three different stages: preparation for change (i.e., help in determining needs and solutions for example through a checklist and personalized and tailored information); transformation (e.g., strengthening condominium management through ' train-the-trainer' programs and peer-to-peer learning, installing project team with in-house experts, and getting the relevant legal, financial and expert information); and ready for change (e.g., developing an action plan that includes a monitoring and communication plan, and describes a clear mandate structure and a timeline). We try to incorporate all these notions into our criteria for the theoretical framework.

Firstly, not all people are willing or able to take on debt. Retrofitting is usually an expensive deep renovation approach, and most cases or projects of such scale require a major investment. Thus, it is important how this investment is financed. This question might well be one of the most essential questions to potential customers. Of course, this is an issue that owners of multi-family rental houses face as well, but they tend to have better access to the capital market and are likely to be used to making investments at scale. Individual condominium apartment owners generally are not. On top of that, they need to attract capital in a collective way, which creates mutual dependence and more potential risk. Low liquidity can be an additional factor as well. Thus, information on the

[22] Across the six project cities, 10 focus group discussions were organized including a total of 75 participants. Each group included representatives from different stakeholders among which homeowners, condominium managers, and professionals that link supply and demand side (e.g., architect, energy coach). The transcripts of the interviews´ audio recordings, were analyzed using a directed content analysis approach (Hsieh & Shannon, 2005). In this approach, categories are derived from theory and relevant previous findings and are defined both before and during the coding of the data. An iterative process was used to make sure that both, the a priori determined, as well as the inductively arrived at categories were reliable, that is, that they were a correct representation of the content of the materials. The results of the focus group discussions were summarized at the level of home owners and tenants and the level of condominium management, respectively, and then further categorized into barriers and cues to action with respect to the decision-making process of implementing energy efficiency measures. A report is coming forward as part of the ACE-Retrofitting program

nature of the investment is essential. Hence, we need to assess whether equity, debt or third-party financing is available. Moreover, we also need to consider the investment horizon as well as the rate of return. So **"Investment Characteristics"** need to be part of our subsequent analysis of financing tools.

Looking at the investment characteristics, we recognize that one part of these bears special importance. As mentioned, especially deep renovation retrofits are costly and paying back loans used to finance them can take a significant amount of years. Hence, several owners might not have an incentive to invest in such projects. Imagine owners of around 70 years. They will very likely not experience the break-even point of their investment. This results in a low willingness to invest into such projects. Also, relatively young owners might not be willing to invest as they might not be sure whether they will still be living in the condominium at the break-even moment. As a result, they do not feel the need to invest into the long term. Therefore, obligations associated with financing should be transferable with the object. Some tools are offering such options. Therefore, we include the **"Transferability of Obligations at Sale"** to the list of criteria we need to use when evaluating financing tools.

Thirdly, the support offered by programs during planning, engineering and installation is important, because most people are not experts in energy-efficiency improvements. Therefore, the degree to which service and support is offered by programs is essential. This support involves auditing, planning, financing, and maintenance. In this regard, assessing the benefits to the different parties that live in the condominium is of interest as well. Some parties might derive relatively more benefits from a retrofit than others. For example, if the roof of an apartment building is being renovated, the owner of the apartment directly under it extracts more financial benefits due to cost savings than others in the building. Such differences need to be considered. Thus, we see **"Support"** as an issue to which we should pay attention in de analysis of financial instruments. It should express to what extent support is offered by different solutions. This especially refers to the results of the focus group.

Another important issue to consider is the performance risk that comes with retrofits. Even though energy savings are projected and calculated in theory, they will not necessarily be met in praxis. Thus, for all retrofit options, landlords as well as tenants might fear actual performance to be lower than projected. This is important, since energy savings are generally expected to be used in order to repay obligations linked to the retrofit. In a scenario where these expected savings do not match the realized savings, it will become harder to refinance the investment. Hence, we consider **"Energy Performance Risk to Condominium Owner"** as a criterion for the further analysis.

Especially in the long run, performance risk is of concern as technologies might change and systems require maintenance throughout their usage time to be efficient.

There are already lots of ideas on how energy efficiency improvements of retrofits can be financed. However, some of those ideas might only consider small-scale energy-efficiency improvements. Condominiums in multi-family settings tend to be (much) larger than projects in a single-family housing setting. Thus, we need to question whether available financing methods allow for large-scale investments like retrofits. This is because retrofits naturally require a relatively large recovery time. As a result, it might not be feasible to engage into such projects for some tools or investors. Hence, we add **"Scalability to a Retrofit"** to our judgement criteria set in order to reflect the risk that an available tool will not be feasible for relatively big projects in the condominium situation.

Finally, the condominium situation faces the issue of split incentives. This problem is well known in the field of real estate. In general, it leads landlords and tenants to have different incentives. This issue is especially present in condominiums, as very often tenants live in condominiums instead of the owner. Literature addressing the split incentive distinguishes between three different types of these. According to the California Sustainability Alliance (2011) a split incentive is a "circumstance in which the flow of investments and benefits are not properly rationed among the parties to a transaction, impairing investment decisions". Bird and Hernandez (2012) add three specific types of the split incentive. The first one is the most common split incentive and a typical principal agent problem. It arises from the contractual rental agreement between the landlord (agent) and the tenant (principal). If the landlord is not paying for utilities like gas, water and electricity, he does not have any incentive to invest in any sort of retrofit. This is because retrofits are generally attractive due to energy savings. However, if the landlord pays for the retrofit and the tenant derives the financial benefit in form of energy savings, the landlord will not be willing to retrofit. One challenge is therefore to overcome this dilemma. This can be done in two ways. Firstly, by either setting up rental contracts in which the landlord pays the utilities. Secondly, by allowing the landlord to pass on costs of the retrofit according to the realized savings to the tenant. An example of this is the Dutch "Energie Prestatie Vergoeding". This could be translated to an energy performance fee. This fee is paid by the tenant to the landlord if he improves the buildings insulation or adds solar panels. The fee is separate from the rent. Both parties can agree on a fixed fee or a variable fee dependent on the current energy price (Rijksoverheid, 2018). In either way the landlord is then able to benefit financially from the investment.

The second type of split incentive is also between the landlord and the tenant. It is called temporal split incentive. In this situation the landlord (agent) does not know whether he/she will move

and/or in consequence sell the condominium within the next years. Thus, it would not be wise to invest into a long-term investment, knowing that he/she will not derive the full benefits that come with it. Hence, the agent is again rather incentivized to not make the investment. As mentioned in the first paragraph the option to transfer the investment at a later stage would solve the problem.

The third type of split incentive, as mentioned by Bird and Hernandez (2012), has a more unconventional form. This is because in this case it is not an incentive problem between the landlord and the tenant. It rather involves utility companies. Obviously, those companies derive their turnover and profit from the amount of a commodity they sell like gas or electricity. However, in contradiction to this, they often take the role of an intermediary or a direct provider of information and solution for energy efficiency programs. Retrofits obviously aim to reduce energy consumption, so utility companies have little incentive to provide efficient solutions, as their major source of profit (selling energy) will suffer from retrofitting projects in the long run. It is interesting to assess whether the financial tools offer solutions to mitigate this sort of split incentive. Therefore, we will incorporate all three types of split incentives into the framework. The first type is salient only if an apartment is rented to a tenant. However, in most cases condominiums are owned by the person or persons that live there. Nevertheless, if only some apartments of the building are rented, the split incentive affects the overall decision. The third type might also become relevant in some tools (e.g. Utility On-Bill Financing), as some of them are offered by utility companies. Hence, when evaluating financing tools for condominium retrofits, we employ the criterion **"Addresses Split Incentive"**.

The issues discussed above illustrate that financing building retrofits in a condominium situation is a major challenge. Our report aims to help address that. Before entering into a detailed overview and evaluation of financing tools, we first give a graphic overview of different condominium situations and their consequences for the choice of financing tools.

4.2 Criteria Practical Framework

Besides the theoretical criteria, practical considerations are of importance as well. Like this, we see for example whether implementation is possible across regions within the partner countries. As in the style of the set of theoretical criteria, six different criteria are added to cover practical considerations regarding the eight tools. Thus, we now look into the different aspects that serve as criteria.

It is obvious that lots of projects in this report are rather regional than national or even international. Therefore, an important factor is whether tools or even specific projects are actually possible to implement in ACE-Retrofitting's partner countries (North-West Europe) or cities as well. Thus, we included **"Possible in Partner Countries"** in the criteria for the practical framework. This criterion serves as a final judgement and is therefore partially based on the other criteria.

Setting up financial tools and using them can be quite costly from a transaction costs perspective as well. For example, the Assen Service Cost model took almost two years of implementation, because it depended on lots of stakeholders and hence, lots of negotiations. Thus, such transaction costs can make or break a project. Especially from the perspective of the ACE-Retrofitting project, which strives for quick implementation, this could be a decisive factor. Hence, we include the criterion **"Transaction Costs Related to Negotiations?"** in the framework. This reflects the transaction costs related to the negotiations with the different stakeholders or facilitating institutions (commercial banks, municipalities, contractors, ESCOs).

Next, it is of interest which obligations or responsibilities come with the program. Such obligations can, but do not have to be of a financial nature. Is there any debt involved, which in consequence leads to interest obligations? Is there any reporting or cooperation required by the condominium owner throughout the horizon of the contract? Does the owner need to meet any specific requirements in order to participate in the program? Considerations like these are assessed within this criterion. We refer to **"Obligations for Owner"** to cover such thoughts.

We also assess whether the tools are available in the partner countries. We do this, because if availability is given, ACE-Retrofitting can likely use the knowledge achieved from such projects. Structures that are essential for such projects are likely given. In addition, it might as well be an indicator for financial viability. Thus, we add **"Product Available in Countries"**. As we provided at least one example for each tool we assume to be able to find at least one example for each country. If this is the case, we indicate "Yes" in the framework without referring to them. If not, we indicate "No." plus a short explanation.

Another practical consideration that bears special importance for the municipalities is the question how municipalities can support projects within the tools. Therefore, we add the criterion **"Can Municipality Assist the Program?"** to reflect the considerations on which actions municipalities can undertake to facilitate projects. As this is an essential question for municipalities we dedicate an additional section to this topic. However, whereas the dedicated section deals with what actions municipalities can take in general, the framework matches actions to the specific tools.

One criterion that is not covered by the first framework is the question whether the tool is suitable for residential real estate. In some cases, it is possible that only commercial real estate is targeted. If this is the case, the tool will not be applicable for this report's purposes. Therefore, we include **"Suitable for Residential Market?"**. By considering this, the framework ensures that the tool can be transferred to the targeted residential market.

Finally, the practical framework considers one of the potentially most complex issues. These issues are legal or regulatory issues that can arise during the implementation or any other phase of the specific tool. These considerations lead us to include **"Regulatory or Legislative Issues"** as the final criterion.

5 Tools and Examples[23] [24]

Chapter two already gave an overview of the broad tools of financing that exist. In this section we provide the detailed characteristics and functioning of each. We use the tools as input for our frameworks. Thus, the tools are assessed from a theoretical perspective and from a practical perspective. The practical perspective also analyzes the tools from an institutional perspective of the consortium countries (North-West Europe). We do this in a way to ascertain whether it is feasible to implement the tools in those countries. Our research starts with a report by Eichholtz and Kok (2013). They list several options from equity financing to debt financing, but also rather unconventional methods like utility on-bill financing. This report is a good starting point, but the paper by Milin and Bullier (2013) expands this list by showing even more options in a more practical way, as they look at how they currently function in practice and what might be missing. Additionally, the different project partners helped to complete the list providing regular feedback. As a result, we identify eight different tools, which are supported by more than 20 examples in total. We describe all the tools in their general functioning first and then underline them by specific project examples for each group (except for On-Balance Equity Financing) to get a better feeling of how they work. Moreover, the examples also show that within the tools, there is still space for differences. Sometimes the examples could be used for more than one tool. For example, soft loans are often combined with other tools. We mention the examples for the tools that we see as most suitable if a combination is present. Hence, the descriptions provide the general functioning only.

[23] https://www.dgbc.nl/sites/dgbc.nl/files/onderzoeken/Financing_Tools_for_A_Green_Building_Stock_-_5_juni_2013.pdf

[24] https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2013/3-local-action-and-national-examples/alternative-financing-schemes-for-energy-efficiency-in-buildings/

5.1 Own Savings[25]

Pure internal equity financing means not using external financing at all. In the case of private apartment of home owners, this method would involve only savings. According to Eichholtz and Kok (2013), this method is the easiest way to finance retrofits as there are no external parties involved, and the decision-making can stay within the boundaries of the condominium building and its owners. A drawback of this financing method is of course that it is limited to relatively wealthy individuals. However, this counts only if the retrofit is fully financed through savings, and that does not need to be the case, since savings can well be used in combination with other financing instruments. Hence, this method can be used by anyone with own savings, regardless of the quantity. That means that richer individuals might invest more and poorer individuals less. An opportunity in such a situation might be that the relatively richer owners in a building finance or invest into the retrofit of the other owners that do not have enough savings available. Maybe lower interest rates could be achieved. The wealthier owners (in this case the financiers) could then benefit from the interest and the fact that their building is fully retrofitted.

The use of savings reduces loan amounts and interest payments, and given the (currently) low interest rates on bank deposits, the opportunity costs of savings are very low. In addition, retrofitting would depend less on financial institutions like banks if savings can be mobilized, and it would reduce the risk for a financier, making external financing more feasible. Therefore, if possible, own savings should always be the starting point of a potential financing solution. The main challenge in this method is to convince the target group of the financial viability of retrofitting.

In addition to using own savings, private condominium owners could take a personal loan that is available on the market. Furthermore, they could benefit from existing national programs that focus on providing tax credits or deductions. However, as those are very common, we rather focus on the tools that are specifically aimed at retrofitting.

[25] https://www.dgbc.nl/sites/dgbc.nl/files/onderzoeken/Financing_Tools_for_A_Green_Building_Stock_-_5_juni_2013.pdf

Collective savings example 1: Fond Travaux[26] [27]

The fond travaux is a private approach financed by owners. Hence, it is a collective approach as all the owners pay their share annually as soon as they own a condominium in the building. The implementation time does not take too long, but depends on how long a legislative change can be implemented. In France since January 1, 2017, condominiums with more than ten apartments must now set up a "works fund". This "works fund" is mandatory: the syndicate of co-owners does not have to decide on the establishment of this works fund, nor on its minimum amount (since it is fixed by the law at 5% of the forecast budget). Only to expand the fund beyond this minimum amount is a collective decision of the condominium syndicate needed. The fund is financed by a compulsory annual contribution paid by the co-owners, and it is paid in the same way as the provisions of the estimated budget. The sums paid are attached to the lots. There is no refund of the trustee in case of a sale, but nothing prevents the seller and the buyer to agree to a refund. Since 1 July 2010, the syndicate of co-owners can open a collective savings account (livret A), of which the ceiling is EUR 76,500 (but the capitalization of the interest can bring the balance of the account beyond this ceiling). The decision to open an account is taken by the General Assembly. In case of a retrofit decision savings from this account could be used to finance the improvements of the common areas of the building.

5.2 Loans

This tool is divided into several subcategories as there are more than just one type of a loan. Hence, we divide this tool into mortgages, soft loans and collective loans.

5.2.1 Mortgages-Based Energy Efficiency Schemes[28] [29]

National mortgage markets often include mortgage products specifically tailored towards energy efficiency financing. The property or building serves as collateral to secure the loan. However,

[26] http://www.notaires.paris-idf.fr/actualites/copropriete-sort-du-fonds-de-travaux-en-cas-de-vente
[27] http://leparticulier.lefigaro.fr/jcms/p1_1610718/copropriete-fonds-de-travaux-cap-sur-2017
[28] We only talk about energy efficient mortgage-based financing and not regular mortgage-based financing, because regular mortgages do not necessarily take energy efficiency criteria into account and finance the building rather than a retrofit (primary mortgages). Mortgages are loans secured by the property or building as collateral. These loans are usually offered by commercial banks, government agencies or insurance companies. Mortgages are also the largest source of financing for real estate in the US with 13,5 trillion US dollars outstanding. The majority of this amount stems from residential real estate purchases. (Geltner et al., 2013). The term is usually 15-30 years. 15 years mortgages have an average interest of around 4,7% and 30 years mortgages roughly 4,1%. The interest rates depend on the credit scores of the owner and the type of mortgage, but is comparably low, because of the collateral provided.
[29] https://www.dgbc.nl/sites/dgbc.nl/files/onderzoeken/Financing_Tools_for_A_Green_Building_Stock_-_5_juni_2013.pdf

under these schemes the borrower typically receives additional borrowing capacity beyond the standard residential mortgage, favorable terms of the mortgage rate, or both. These advantageous mortgage loans tend to be linked to specific sustainability measures, and the they are often supported and incentivized by (local) governments or other public institutions. In the Netherlands, for example, the law allows buildings with the highest-rated energy label to have EUR 8.000 more debt financing relative to a standard home. As mentioned, programs that fall in this kind of tool often refer to sustainability measures like energy labels or comparable measures and then assign preferential financing terms accordingly. Thus, the regular mortgage rate will be reduced by around 0,1% when sustainability criteria are increased, like for example the energy labeling of the building. Depending on the program, this reduction can be even higher with higher sustainability or energy efficiency. We will see such a program in the example below.

Sustainable mortgage example 1: Triodos[30] [31]

This example is an individual approach and is financed by the private sector, even though Triodos is known as a development bank. Triodos was one of the first banks in the Netherlands to include and reward sustainability aspects in their mortgage underwriting process. Home mortgages originated by Triodos have a lower interest rate the more the energy efficiency of a home or building project improves. This energy efficiency is measured by the energy label of the building. The mortgage rate reduces by 0,1% for each energy label rating improvement. Thus, it provides incentives to increase energy-efficiency to a maximum. At the same time implementation is relatively short as it just adds a reduction to existing mortgage schemes. Triodos issues both residential and commercial mortgages, with amounts varying between EUR 100.000 and EUR 15.000.000, which obviously allows for large-scale projects, besides mortgages for single homes or apartments. However, while a Triodos mortgage is among the cheapest for the most sustainable homes, it definitely is not for less sustainable ones. So, a retrofit that would, for example, bring condominium apartments from a G-label to a C-label, could most likely be financed more cheaply with a conventional mortgage from another bank.

[30] https://www.triodos.co.uk/en/business/borrowing/
[31] https://www.dgbc.nl/sites/dgbc.nl/files/onderzoeken/Financing_Tools_for_A_Green_Building_Stock_-_5_juni_2013.pdf

Example 2: Bayerische Landesbank [32]

This example is an individual mortgage as well and also financed by the private sector. It is an example of banks that offer a mortgage-based energy efficiency financing in Germany is Bayerische Landesbank. The implementation of such a program does not take too long for the same reasons as the example of Triodos. Apart from mortgage financing, this bank provides support in the certification process of the building through a subsidy. Furthermore, additional support is provided when the value and risks of a building is assessed, as well as advice on potential energy-efficiency improvements. Finally, the bank offers improved terms of financing at preferential rates as soon as the criteria in regard of energy-efficiency are met. Thus, the approach of the Bayerische Landesbank not only provides favorable financing terms based on sustainability aspects, but also provides support on how to get there. However, currently this service is only offered to commercial real estate, rather than to residential real estate.

5.2.2 Soft Loans and Subsidies[33]

Soft loan schemes generally provide loans at zero or below-market interest rates. However, potential borrowers need to qualify for this type of loan. Intuitively, the qualification depends on the use of the loan, which means that its favorable financing terms only become available to energy-efficient improvements like retrofits. Terms of qualification differ from program to program. Whereas some look at the energy label accomplished with the retrofit, others look at the amount of energy improvements. The low interest rate is aimed to stimulate energy-efficiency projects as they become more affordable than through common loans. Soft loans can have a horizon of up to 30 years, which allows for large-scale projects like retrofits[34]. The amounts offered vary between programs, but usually it is enough to finance the retrofit entirely. As in the example of the Kreditanstalt für Wiederaufbau KfW, which is the most common provider in Germany for such loans, owners can take a loan of up to EUR 100.000. Usually these soft loan schemes are provided by public banks or development banks, which can afford to provide such low-interest loans through their own preferential credit rating and low financing costs. In some cases, grants are given as well to reduce upfront cost for engineering and construction supervision. Additionally, subsidies are tools that aim at reducing total costs by providing financing of specific amounts or percentages of the total price for the energy efficiency improvement. However, the subsidies and grants are more likely to just

[32] https://www.dgbc.nl/sites/dgbc.nl/files/onderzoeken/Financing_Tools_for_A_Green_Building_Stock_-_5_juni_2013.pdf

[33] https://www2.sgfgas.fr/presentation/CaracteristiquesEPZ_anglais.html

[34] https://www.kfw.de/inlandsfoerderung/Privatpersonen/Bestandsimmobilien/Finanzierungsangebote/Energieeffizient-Sanieren-Kredit-(151-152)/ SEE "+ Konditionen"

incentivize the retrofit, instead of financing it entirely. We merge them with soft loans, because they often are provided as a combination with soft loans and rarely (or even never) finance the whole retrofit. Hence, it makes sense to immediately combine them as soft loans like the ones offered by KfW also include grants and subsidies.

Additionally, it is possible for municipalities and governments to set up partnerships with (local) banks and convince them to offer soft loans to homeowners in their region. The partner bank can be asked to offer an energy-efficient soft loan. The municipality or government would pay the bank for lower interest rates (longer pay-back periods or other advantages). It could pay the banks management fees related to the loan and it could create a guarantee fund to cover the risk of non-payment by homeowners. All these options can also be applied simultaneously.

Example 1: KfW energy efficient refurbishment[35] [36]

This example is an individual approach financed with public money of the German development bank KfW. This national soft-loan example is called the KfW energy efficient refurbishment program. It supports all kinds of energy efficient refurbishments in the commercial and residential property, covering both the single-family and multi-family sectors. As this program is led by a German public bank and partially funded publicly, it can offer low interest rates. Implementation should not take too long as it just provides low interest rates, but those build up on the banks' capital and borrowing capacity. On the one hand, the program offers grants for stages of engineering, planning, consulting and installation. On the other hand, the program provides low interest loans for energy-efficiency improvements or retrofitting, which start from 0,75% interest at a maximum of EUR 100.000 (KfW, 2018). In 2016 alone, the program offered a total of EUR 4,166 billion to costumers, mainly in order to improve energy efficiency of residential dwellings (Statista, 2018).

Example 2: Eco PTZ [37] [38] [39]

The Eco PTZ (L'éco-prêt à taux zéro) loan offers individual as well as collective financing approaches for condominiums. It is partially financed by public and private money. This is because it is a zero percent loan offered by commercial partner banks. However, the state pays those partner banks

[35] https://www.kfw.de/inlandsfoerderung/Privatpersonen/Bestandsimmobilie/Förderprodukte/Förderprodukte-für-Bestandsimmobilien.html

[36] https://de.statista.com/statistik/daten/studie/70375/umfrage/kfw---co2-gebaeudesanierungsprogramm---ausgaben-seit-2001/

[37] https://www2.sgfgas.fr/presentation/CaracteristiquesEPZ_anglais.html

[38] https://www2.sgfgas.fr/presentation/Stats/EPZ/EPZ_Bilan_de_production.pdf

[39] https://www.chenbro.eu/zero-interest-loan-france/

with tax credits to provide such loans. Hence, it can be seen that this is a national program as well. Until March 2016, Eco PTZ lent a total of EUR 405 million to more than 23.000 energy efficiency projects (SGFGAS, 2018). In the Paris area for example, three banks have contracted with the state to provide this type of loan: Crédit Foncier, Caisse d'Epargne and Domofinance. Later in this study, we assess the way Effirenov in partnership with Crédit Foncier uses this loan structure. In this part the specific functioning of Eco PTZ will also be shown more closely.

Example 3: RVO and Rijksoverheid subsidies [40] [41] [42]

This example is an individual approach financed with public money on a national level. The Rijksdienst voor Ondernemend Nederland (RVO) has several subsidy programs for energy efficiency improvements. The use of these subsidies can vary from processing and advice to building improvements like isolation and new boilers. In these programs, financing of up to 75% of the total invoice can be provided by the RVO. This program has scheduled EUR 14.000.000 to be spend in total and gave out roughly EUR 3.250.000. The national government is offering a similar service for isolation by covering approximately 20% of the costs of the improvement.

Example 4: Nationaal Energie Besparingsfonds[43]

This example is an individual approach financed with public money on a national level. The Nationaal Energie Besparingfonds is offering preferential financing terms to Dutch citizens through a fund managed by the Rijksoverheid, the Rabobank and the ASN bank. It requires minimum consent of ten apartments within a house and provides a minimum of EUR 25.000 up to a maximum of EUR 5.000.000. Thus, it should be able to finance large scale retrofits as well. The maturity of the loan ranges between 10 and 15 years.

5.2.3 Collective Loans

Collective loans are one of the tools that can be combined with other tools as well. For example, a soft loan can be combined with a collective loan, which we see in the first example of this section, but also with Energies Posit'if in section 5.5. However, we thought it would be necessary to make it a loan-subcategory as there are also collective loans that are not necessarily a soft loan (as shown in example 1). They are a certain type of loan that tackles the condominium situation specifically.

[40] https://www.rvo.nl/subsidies-regelingen/subsidie-energiebesparing-eigen-huis/vereniging-van-eigenaren/voorwaarden-vve/energieadvies-en-procesbegeleiding
[41] https://www.rvo.nl/subsidies-regelingen/subsidie-energiebesparing-eigen-huis
[42] https://www.rijksoverheid.nl/onderwerpen/duurzaam-bouwen-en-verbouwen/vraag-en-antwoord/subsidie-isolatie-huis
[43] https://www.energiebespaarlening.nl/vve/

This is because the owners take a loan collectively rather than individually. This happens through the condominium association such as a home owners association. Until today such options are rarely offered by banks as the procedures associated with it are very complex[44]. The advantage in collective loans can be that transferability at sale can be transferred between owners. In principle, French law states that all the obligations have to be paid upon sale, but if the lender agrees and he syndicate of co-owners is informed, the buyer can take the place of the seller[45]. However, collective loans are only aimed to be used for common areas. The report of Credit Foncier (2015) states on page 84 that collective loans are meant "to provide financing for energy efficiency work on common areas and facilities or on private areas deemed to be of collective interest" [46]. Hence, when using collective loans, it might be hard to apply it to individual non-common areas.

Example 1: Credit Foncier Copro 1 and Copro 100[47]

Credit Foncier offer this collective approach on a national level without public money being involved. They offer two models for a collective loan. Both "finance the share of each co-owner. In fact, this à la carte collective loan not subject to age restrictions finances a personalised amount specific to each co-owner based on the energy efficiency updating work approved by the general assembly of co-owners" (Credit Foncier, 2015, p. 84)[48]. The minimum borrowing amount for both loans is EUR 15.000 with a duration between 3 and 20 years. The difference between the two loans are the terms of payment. The Copro 100 involves multipayers whereas the Copro 1 involves a single payer. For a single bank the implementation can go quite fast, however as we see later with the Assen Service Cost model in section 7, some banks are reluctant to offer such loans. All works that are conducted in common areas require voting. Both can also be combined with the Eco PTZ described earlier, but in this case public money would be involved. Furthermore, Credit Foncier also offer support in receiving collective subsidies.

[44] https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2013/5b-cutting-the-energy-use-of-buildings-policy-and-programmes/energy-renovations-of-eu-multifamily-buildings-do-current-policies-target-the-real-problems/2013/5B-235-13_Matschoss.pdf/

[45] http://leparticulier.lefigaro.fr/jcms/p1_1555586/recourir-a-lemprunt-collectif-pour-les-travaux-pas-si-simple

[46] https://creditfoncier.com/wp-content/uploads/2015-financial-report-1.pdf

[47] https://www.creditfoncier.fr/pret-travaux-coproprietes/

[48] https://creditfoncier.com/wp-content/uploads/2015-financial-report-1.pdf

Example 2: Assen Service Cost[49] [50]

Assen Service Cost model is a project in an early phase. It is a regional example of the province of Drenthe. The loan is taken by the home owners association (HOA) of a building. Thus, it is a collective loan. The project is financed with private money. However, a guarantee fund is set up to back this private money, which in consequence means that public money is involved as well. When the HOA has taken the loan, the home owners pay their obligations back by paying a so-called service cost to the HOA. With this scheme home owners can also transfer their obligations at sale, as these obligations are tied to the property rather than to an individual. A drawback of this method is the relatively long time it took to be implemented, as it took more than two years.

We have a detailed look at this example in section 7.

5.3 Utility On-Bill Financing[51] [52]

Utility on-bill financing is an option to provide retrofitting by including a utility company into the process. Compared to classical debt financing options the utility company provides the initial investment instead of the owner or the landlord. The utility company then recovers the investment costs by billing the customer additionally on their monthly utility bill. Thus, the customer derives financial benefits through cost savings in his energy consumption, but gets billed additionally by the utility company until the initial costs (including financing costs) are fully paid back. Usually this is achieved by favorable financing terms that go as low as 0% or even grants provided by the utility company. These favorable financing terms are offered as people tend to pay their utility bills at a relatively high rate, since non-payment is reduced by the threat of disconnection. This reduces the financing risk for the utility company. Another – similar – option is the on-bill repayment. The difference is that the utility company is only the repayment vehicle and a third party provides/pays the upfront costs. Hence, several types of investors can participate in such an on-bill program, which might offer additional opportunities to fund such programs in the future. Finally, a tariffed on-bill is possible as well.

[49] https://www.youtube.com/watch?v=PjbHgQp9zMA
[50] http://www.nweurope.eu/projects/project-search/e-0-desirable-warm-affordable-homes-for-life/news/innovative-new-financial-model-to-enable-private-apartment-blocks-to-retrofit-to-net-zero-energy/
[51] http://aceee.org/sector/state-policy/toolkit/on-bill-financing
[52] https://www4.eere.energy.gov/seeaction/system/files/documents/onbill_financing.pdf

This option does not add the repayment costs to the existing tariff's utility bill. Rather it sets up a completely new tariff than the old one. This new tariff directly includes the cost recovery charge and is thus, similar to the other options as well. Hence, the difference is just a formal difference, whereas payments are the same. However, given the third split incentive, utility companies should not be interested to reduce energy consumption. Thus, on first sight it seems odd that such services are offered. The reason for the offer is that utility companies can leverage their existing relation with the customer. Furthermore, governments prescribe such actions to utility companies, so it could partially be a logical reaction to such initiatives. Finally, it can also stem from a simple financial perspective. Building additional power plants to supply customers can be more expensive than just to reduce the total consumption by efficiency initiatives.

In the US on-bill financing is already well used in order to provide energy efficiency improvements. According to the 2014 report of the State & Local Energy Efficiency Action Network (SEEAction), the US had a total of thirty active on-bill programs. However, if the scope is narrowed down to the condominium situation, only five programs are left, because most of them aim at either non-residential real estate or at single-family homes only. Still, five active programs remain that allow for condominiums, and two of these are for condominiums only. One of the two programs is the "PSE&G Residential Multi-family housing program". PSE&G is a gas and electricity provider in the New Jersey area and set up a utility on-bill program for condominiums. We present this program in the examples. The other one is called "MPower Oregon", but is rather a facilitator than an own program.

Example 1: PSE&G Residential Multifamily Housing Program[53] [54]

This example is a collective approach as the obligations will always stay with the utility bill. It is financed by the private sector. PSE&G is a utility company active in the US. The PSE&G Residential Multifamily Housing Program covers households for which PSE&G provides gas or electricity in the area of New Jersey, which also makes the program a regional one[55]. In the first step, the company provides a cost-free energy audit to the building owner. Step two involves an engineering analysis of the retrofit project based on the audit report. Afterwards, a bidding process for potential contractors starts, which is followed by installation of the improvements. During installation, quality control is provided by PSE&G after 50% of the process is completed and again after overall completion. The program provides several other incentives to engage in energy-efficiency

[53] http://www.puc.state.pa.us/Electric/pdf/Act129/OBF-PSEG_Paper.pdf
[54] https://rpsc.energy.gov/sites/default/files/reports/c-1187_PSEG%20Multifamily%20Housing%20Program.pdf
[55] http://www.prezcat.org/catalog/pseg-residential-multifamily-housing-efficiency-program-new-jersey

improvements. PSE&G covers the initial project costs and finances energy-efficiency upgrades. Project costs are partly covered by PSE&G grants, whereas the rest is paid back by an on-bill scheme at an interest rate of 0%, which provides a strong incentive for retrofitting to potential customers/condominium owners. Repayment is allowed to take up to ten years, but if the condominium is sold within this period, the remaining balance needs to be paid upon sale. Until now only master-metered houses or condominiums have been using the project, which is important as the split incentive is not an issue in these cases. The program realized 42-45 projects with an investment amount of USD 39 million. This offered to retrofit more than 10K units and 280 buildings (Fredericks, 2018).

Example 2: The Green Deal UK[56] [57] [58] [59] [60]

This example is a collective approach and financed by the public sector. The Green Deal UK is a British example of a national utility on-bill program that ties its obligations to the property. Thus, when the owner changes, the bill remains with the property (and so goes to the new owner). Implementation time was quite long as planning started with the 2011 energy act, but the program only went live in March 2013. Single family homes as well as multi-family homes can participate in the program, which therefore addresses the condominium situation. However, no other specific characteristics do purposely address condominiums. First, a registered assessor conducts an energy audit and finds potential improvements. Only when the projected energy savings outweigh the additional costs on the utility bill is it possible to implement the energy efficiency improvements. The payment is then done through the energy bill and thus, is transferable at sale. One drawback however, is the limit of 10.000 pounds of financing per dwelling, which reduces the instrument's ability to finance a deep renovation retrofit. The British government planned to invest a total of 125 million (BBC,2013). However, as the British people did not adapt to the model as desired, it currently not being financed anymore. Only 15.000 projects had been taken out, which was far below expectations.

[56] http://www.greendealinitiative.co.uk/#
[57] http://www.greendealinitiative.co.uk/about-the-green-deal/the-green-deal-for-homes/index.html
[58] https://www.theguardian.com/environment/2015/jul/23/uk-ceases-financing-of-green-deal
[59] https://www.bbc.com/news/uk-21226042
[60] http://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN05763

5.4 EUA/PACE Financing - Schemes[61] [62] [63] [64] [65]

The Property Assessed Clean Energy program (PACE) is a US-invented financing tool. It covers 100% of the hard and soft costs of a retrofit and can have financing terms of up to 30 years. In a typical PACE project, the state authorizes municipalities to provide tailored PACE solutions for their local district needs. This is then called "land secured financing district" Usually, the municipalities serve a lien on the property. If home-owners are legislatively eligible to receive PACE-financing they can apply for the assessment and eventually get accepted. From a project perspective, eligibility depends on the type of building and the type of improvements that are planned. However, this varies between programs. As there are commercial PACE programs, residential buildings will not be eligible and vice versa. Improvements eligible have a wide range from insulation, roof and lighting to solar panels, heating and water pumps. From a participant perspective, it is important to mention that the eligibility criteria do not depend on credit scores, but just on the worth of the house. Therefore, PACE offers an alternative to regular loans for homeowners that might not have the best credit scores. Regular loans would only offer less favorable interest rates to such homeowners.

After the acceptance, the energy-efficiency upgrades are financed through bonds issued by the local government of the PACE district. As soon as the project is completed, the repayment period starts. However, the special characteristic of PACE financing is that the bonds are paid back through the property tax bill. This can be advantageous, because the property tax is due only once or twice a year. Like this, participants can first benefit from the cost savings and then pay their property tax. In most cases energy savings exceed the annual payments. In addition, the generated positive cashflows might even be tax deductible as well. Furthermore, PACE financing can be transferred easily when the object is sold, because the obligations are tied to the property rather than to the individual. Hence, improvements can be conducted even when the owner plans to sell the affected apartment within the near future.

[61] http://pacenation.us/what-is-pace/
[62] http://pacenation.us/wp-content/uploads/2013/06/Annual-report-6.18.13.pdf
[63] http://pacenation.us/pace-market-data/#residential
[64] https://cordis.europa.eu/result/rcn/176594_en.html
[65] http://www.trustepc.eu/es/wp-content/uploads/sites/16/2017/07/8_GNE-Finance-EuroPACE-i.pdf

Figure 5: Four steps within PACE financing (bond structure)

Office of Energy Efficiency and Renewable Energy (2018)[66]

The money for the investment can be provided by several sources. Usually the local government issues bonds through the "land secured financing district" to offer investors the chance to invest in PACE projects. In open market models however, this is not necessarily the case. Thus, funds, retrofit funds or any type of lenders can be a source of financing as well, which means that multiple financing options (also for the provider) do exist. Which possibilities to finance or invest exist, depends on the legislation of the specific PACE district. Hence, in some districts only governments offer financing through bonds and in other districts an open market is existing.

Until now the United States (US) has mainly been successful in commercial rather than residential PACE programs. According to the PACENation report (2013) this is mainly due to legislative reasons in the residential field. Thus, only 14 programs are currently present in only four US states. However, the same report underlines that those residential PACE programs that have been launched succeeded in their mission to improve energy efficiency while being financially viable for the participants as well. According to PACENation (2018) a total of 220.000 homes have been upgraded by PACE schemes until the end of 2017. This accounts for investments of roughly USD 4,6 billion. Furthermore, the same set of data claims to offer 58% energy savings per dollar invested.

The only other country in which a PACE-like structure exists is Australia. Environmental Upgrade Agreement (EUA) it is called. It works in the same way, but it is mainly (but not exclusively) restricted to the Melbourne area. There are some differences on details. For example, debt service payments are made quarterly instead of annually. What is important to acknowledge and to underline is that in EUA financing schemes the property charge to repay the financing can be passed to the tenant by the landlord, in case the condominium is not owner occupied. This is an essential

[66] https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs

characteristic as the program can address a potential split incentive in that way. Like this, the owner has the incentive to retrofit as he can pass some of the costs to his tenant. The tenant would thus have to pay his share when he is the one that benefits financially from the energy cost savings. For owner occupied condominiums, this will not be an issue.

PACE/EUA financing schemes are not yet operational in the EU and it's not sure it will be feasible. What speaks against an implementation is reflected by a statement of an according EU study. It compares US and EU markets concerning PACE and finds that "Europe faces different challenges compared to US. In particular, the fragmentation of the building sector, that is differences in building types and construction periods, and the mortgage market along with high transaction costs may discourage lenders from offering loans for energy efficiency investments to individual households" (CORDIS, 2016). What speaks for an implementation of PACE in Europe is that all European countries except for Monaco and Malta have a property tax anchored in their tax system. Furthermore, the same EU study as mentioned above concludes the following: "For instance, countries such as Germany and Italy have been reducing supporting schemes for solar panels. In this respect, the PACE loan program is a novel mechanism, likely to be less of a burden for public budgets and a viable solution for the long-term financial sustainable growth". Thus, the study explicitly states how PACE could be important by reducing the burden of subsidies. Nevertheless, an EU project in Madrid is starting now to assess opportunities, but also risks (GNE Finance, 2017).

Example 1: HERO [67] [68] [69] [70] [71]

This is an example of a collective approach, because the obligation is tied to the property. It uses private money, but the municipality serves as a lien, which thus makes it partially public and regional of nature as well. The largest American residential PACE provider is the Home Energy Renovation Opportunity (HERO) program. It already helped over one-hundred-thousand homes in Florida and Missouri to improve their energy efficiency and financed over USD 2 billion of improvements. This underlines that such a program is also accepted by home owners. Those improvements contain small-scale projects as well as large-scale projects like retrofits. Eligibility to participate in the program depends on home equity and payment history rather than credit ratings, which makes it a viable alternative to traditional financing methods that are predominantly based on credit ratings. HERO helps the customer (the home owner) to find a contractor via a search tool

[67] https://www.renovateamerica.com/financing/hero
[68] https://www.prnewswire.com/news-releases/renovate-america-completes-284-million-pace-infrastructure-securitization-300379067.html
[69] https://news.energysage.com/hero-loan-program-interest-rates-terms/
[70] http://www.publiccounsel.org/tools/assets/files/0993.pdf
[71] The time of implementation is not known. However, the project launched in 2015

in the region of the customer. The contractor then starts the installation process and is only getting paid as soon as the customer ensures that he is satisfied with the improvements. The term length of the repayment period can range from 5 to 25 years depending on the scale of the project and the customer's payment abilities. The interest rates move accordingly from 2,99% at five years term length to a maximum of 8,99% at 25 years term length. The loan amount ranges from a minimum of USD 7.000 to a maximum of USD 237.000 (Energy Sage, 2017).

Example 2: Spruce Finance [72] [73] [74] [75] [76]

This is an example of a collective approach, because the obligation is tied to the property. It uses private money, but the municipality serves as a lien, which thus makes it partially public as well. Spruce finance is another project aimed at residential energy-efficiency improvements. It is mainly focused on solar panel installation and offers traditional financing schemes that involve a loan, but also PACE financing schemes to home owners who need alternative financing schemes. The total amount financed by Spruce Finance (not exclusively through PACE) has been two billion until 2016 for nearly 70.000 projects. The program also offers low payment options, which again increases the potential market that it can serve. To be eligible, the program requires the customer to have a minimum of 10% equity in the property, which means that mortgage-related debt is required to be below 90% of the property value. Payment history of bills and obligations relating to the building is also important as no more than one 30-day mortgage late payment in the past 12 months is allowed and no more than one late property tax payment in the past 3 years. If all requirements are met, Spruce Finance provides the upfront cost in partnership with the local municipality and the repayment period starts with installation of the improvements. The program offers payback periods of up to 30 years. A ten-year term comes with an interest rate of 7,49%, 20-year terms with 8,25% and 30-year terms with 8,49%. However, besides the interest payment, an origination fee of 4,99% comes with all the different loan terms (Spruce Finance, 2017).

[72] https://www.prnewswire.com/news-releases/spruce-finance-becomes-first-home-energy-efficiency-finance-company-with-full-product-suite-on-one-platform-300515232.html
[73] The exact number of total investments financed exclusively through PACE schemes is not available.
[74] https://sprucefinance.com/financing/pace/
[75] http://energyservicepartners.com/wp-content/uploads/2017/06/PACE_Solar_Spec_Sheet_02.06.17.pdf
[76] The time of implementation is not known.

Example 3 EUA-Financing: Sustainable Melbourne Fund[77] [78] [79] [80]

The Sustainable Melbourne Fund is one example of a regional EUA financing scheme. It is a collective approach, financed projects for roughly AUD 19 million up to 2016 and plans to expand its operations (C40 cities, 2016). This program offers financing to energy-efficiency upgrades to commercial buildings mainly in Melbourne, but also in the Victoria area. The program offers support in helping tenants engage in such a scheme with the owners and vice versa. To be eligible for the program the investment amount has to be at least AUD 15.000. The upfront costs are carried up to 100% by the program. The invoice for the payback amount is called "government issued rates notice". The obligations have to be met quarterly. The vehicle through which the repayment is done is called "council rates". If the charges during the repayment period are passed to the tenant and the tenant fails to make these payments accordingly, the owner becomes liable of making these payments. The transferability of the financing is also given as the loan can be transferred between owners at sale as well as between tenants.

5.5 Energy (Savings) Performance Contracting[81] [82]

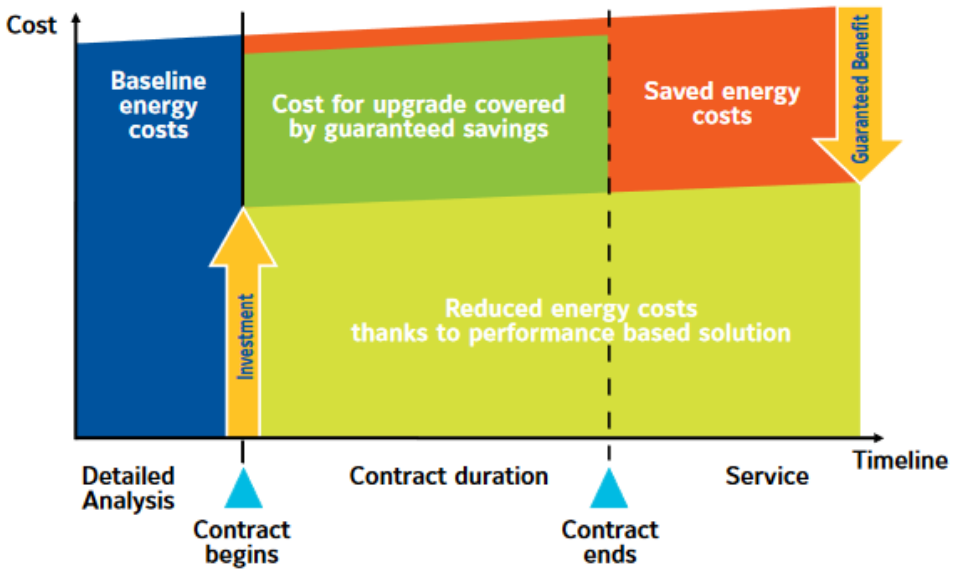
Energy Savings Performance Contracting (EPC) differs from utility on bill-schemes. This is because an EPC involves an Energy Service Company (ESCO). ESCOs are companies that offer energy services as their main business. Thus, their main product is energy efficiency. Utility companies on the other side offer energy rather than energy efficiency. In an EPC the ESCO also provides a guarantee for the customers' energy savings. Utility on-bill programs do not provide such a guarantee. Therefore, EPCs are not a utility on-bill approach, because the provider of the service is an ESCO and they provide a savings guarantee. EPCs can be a budget-neutral approach to finance retrofits as well as energy-efficiency improvements. Thus, upfront costs are not necessarily involved. Besides the provision of the financing and the guarantee, the ESCO also provides the service and implementation. This includes energy audits, consultation and contracting. The contract can be signed for different horizons. Hence, it can run five years, but also up to 20 years depending on the program. In general, it is most common that the contract runs as long as required to repay any investments. Following this logic, the downward risk is relatively low throughout the contract time.

[77] https://www.c40.org/case_studies/c40-good-practice-guides-melbourne-sustainable-melbourne-fund
[78] http://sustainablemelbournefund.com.au/finance/
[79] http://sustainablemelbournefund.com.au/apply-solar-finance/
[80] The time of implementation is not known.
[81] https://www.energy.gov/sites/prod/files/2017/05/f34/2015_savings_espcs_0.pdf
[82] http://www.buildup.eu/sites/default/files/content/Institute%20BE%20-%20Energy%20Performance%20Contracting%20in%20the%20European%20Union.pdf

However, as the ESCO guarantees for the savings, closer cooperation and monitoring is necessary as well in order to ensure proper functioning of the retrofit. In some programs the ESCO also receives bonusses for savings above the expectations. In such cases, the upward potential for the participant is also limited.

The funding, however, is not necessarily the responsibility of the ESCO as third-party capital providers or the building owner itself can fund the project as well. The creditor-borrower relationship is always between the financier and the owner of the retrofitted building. The investment is refinanced through the energy savings, which are typically higher than the monthly payment. Since the ESCO guarantees those savings, there are no performance risks carried by the owner or the financier, but they would be exposed if the ESCO would default. In some contracts the duration of the EPC even exceeds the repayment time, which guarantees additional savings. Figure 6 depicts a typical timeline and how the costs are split up throughout the different phases of an EPC.

Figure 6: EPC Cost Timeline



Institute of building efficiency (2010)[83]

At this moment EPCs are mainly used in the US to finance large-scale projects in the public sector. However, according to the report of Bob Slattery (2013) for the US Department of Energy, EPCs helped federal agencies to accomplish 344 projects and install more than USD 4 billion worth of energy improvements since 1998. In, addition USD 207,7 million of cost savings had been achieved in the current reporting year, which gives an indication of the potential EPCs could have in the non-public sector. In the residential sector and in Europe energy supply contracting faces some barriers as explained by the Institute for building efficiency. It is mentioned that Europe widely lacks awareness of such contracts, there is low political support, owners do not have the technical capacity to find a qualified ESCO (Institute for building efficiency, 2010). On the other hand, as in the case of Germany, it can also be a question of complexity of the contracts, lack of trust in these kind of financing models, high transaction cost (each project has to be individually legally designed) and the problem of lacking a continuous energy usage of residential buildings. Thus, it seems as if the EPCs seem to be very complex, which decreases common adoption especially in the private sector.

Example 1: NORESCO[84] [85]

It is financed with private money. As one of the largest ESCOs in the US NORESCO offers energy performance contracting solutions to all types of buildings. NORESCO guaranteed roughly USD 3 billion in energy and cost savings spread over 7,000 facilities worldwide (Electric Energy Online, 2017). The company customizes solutions for each contract according to the building's characteristics. They first start by identifying potential cost saving opportunities, and then implement these solutions in the form of energy-efficiency improvements. They fund them with the generated energy savings. If those energy savings are below the contracted savings NORESCO pays the difference. Thus, the performance risk of the energy-efficient improvements is carried by NORESCO rather than the landlord. There are multiple financing options available ranging from tax-exempt bonds or non-recourse private placement project debt to a combination of customer financing and a NORESCO equity investment.. Additionally, NORESCO even offers the possibility to provide PACE financing solutions to its customers. Thus, this solution offers a touching point between a range of the tools presented.

[83] http://www.buildup.eu/sites/default/files/content/Institute%20BE%20-%20Energy%20Performance%20Contracting%20in%20the%20European%20Union.pdf
[84] http://www.electricenergyonline.com/detail_news.php?ID=614863
[85] http://www.noresco.com/energy-services/en/us/solutions/Energy-Efficiency-Retrofits-Modernization/Performance-Contracting/

Example 2: The guarantEE project[86] [87] [88]

The guarantEE project facilitates energy performance contracting by developing EPC models with different partners and stakeholders. Thus, it cannot be assessed like the other examples and does not really need implementation time. Rather than providing one actual EPC program, it helps to develop several programs within the EU. Thus, it operates internationally. The project is funded by the EU and is planned until 2020. GuarantEE aims at the public and the private sector, knowing that especially the residential private sector is more complicated to serve. Nevertheless, one of the project's goals is to develop and test solutions for rented facilities by applying EPC solutions. Their partners to facilitate such projects are spread in Europe, which underlines that they are not restricted to one specific area. Rather than being or providing one financial instrument, this project pioneers in the field of EPCs by research and implementations with its partner network. Especially for ACE-Retrofitting purposes this project could be supportive in assessing whether EPC solutions might be feasible in condominium situations. However, until today a specific case in the project's best practices section was not available, which casts some doubt on its practical applicability.

Example 3: Energies POSIT'IF[89] [90] [91]

This example can be both an individual and collective approach and involves public as well as private money. Energies POSIT'IF is a regional example of an EPC in the European residential sector exclusively aimed at deep renovation of condominiums. Energies POSIT'IF is a French program that focuses on the region Ile-de-France, which consists of Paris and its surroundings. It took one year to implement from planning till the first contract. The project has a public-private ownership structure. According to the CityInvest report (2013), over 2500 apartments have been part of the project. It is planned that 10.000 apartments are retrofitted until 2020 at a total investment amount of 250 million. The model seems to work reasonably well in France, and it will be of interest whether it can be applied to other EU regions as well.

Section 7.2 presents are more detailed overview of this program.

[86] http://guarantee-project.eu/
[87] http://guarantee-project.eu/about-guarantee/
[88] http://guarantee-project.eu/consortium/
[89] http://citynvest.eu/sites/default/files/library-documents/Model%2011_Energies%20POSIT%27IF_final_0.pdf
[90] http://www.energiespositif.fr/?page_id=2515
[91] https://www.dropbox.com/s/zvur7n3bdwe7aw3/Energie%27Positif_FR.pdf?dl=0

Example 4: RenoWatt[92] [93] [94]

This project is an individual approach for public entities. Thus, it involves public money. RenoWatt is an EU-funded project that is currently being piloted in the region of Liège. Hence, it is a regional approach. Even though it is a project aimed at the public sector, its one stop characteristic and the fact that it won the "Best energy project 2017" price, makes it worth to mention in this report. It took 16 months to be implemented, followed by another 17 to 21 months of tendering processes. It aims at retrofitting public buildings within this area, but it may be transferable to private and residential projects as well. RenoWatt provides retrofit assistance throughout several stages, ranging from project identification and profitability analysis to financing and procurement. Either one provider or a consortium of providers takes the full responsibility if these tasks, which can be divided into design, production, and operation. When the retrofit is conducted, savings are guaranteed by the ESCOs that conduct the retrofit. In the case of missing the savings target, which is typically 34%, the ESCO needs to pay penalties. However, when performance is higher than predicted, bonuses are paid out to the provider, which gives a strong incentive to conduct the retrofit at a high level. Especially the upward potential is an interesting characteristic of RenoWatt, as this constitutes additional incentives and opportunities for ESCOs to engage into the project (given they can provide proper improvements). The advantages listed by RenoWatt itself also seem convincing. They offer help regarding the support by subsidies, negotiations as well as legal support and financial arrangements. Thus, it is a one-stop solution as it overcomes the complexity burden through a collective approach that bundles several complex factors into one project. The project states that it engaged in more than 130 projects at a total investment amount of EUR 59 million (GRE Liege, 2018). The only disadvantage at this early stage is that the project is oriented towards public buildings, thus making it questionable whether it can be transferred to the condominium situation in a feasible way.

Example 5: Picardie Pass Renovation[95] [96]

The region of Picardie created this project together with the Public Service for Energy Efficiency (PSEE). Hence, it is a regional initiative. It offers two options to the owners. Technincal support only or Technical and financial support. With technical support only, it conducts an energy audit, proposes specific efficiency measures and helps to find contractors (682 companies in the current network). In the other option financing is added to the technical support. For a EUR 10.000 loan

[92] http://www.gre-liege.be/renowatt/25/renowatt.html
[93] http://www.gre-liege.be/renowatt/25/renowatt.html
[94] https://www.klimabuendnis.org/fileadmin/Inhalte/7_Downloads/CITYnvest_guide_One_stop_shop_2015_EN.pdf
[95] https://www.pass-renovation.picardie.fr/laccompagnement-du-service-public/
[96] https://www.pass-renovation.picardie.fr/project-funded-by-europe/

that is being repaid within 25 years, an owner has to pay 2,5% interest each month. However, on average a loan of EUR 44.000 is provided. The project is financed by three different: sources EUR 1.800.000 from the ELENA subsidy, EUR 8.000.000 from the Picardie region and EUR 23.500.000 from a loan of the European Investment Bank. Thus, during the test phase, EUR 60.000.000 have been financed. However, as can be seen in figure 7, Picardie Pass Renovation is a project that took quite long to be implemented. Thus, it is questionable whether such a project could be undertaken within the ACE-Retrofitting network timely.

Figure 7: Timeline Picardie Pass Renovation

Picardie Pass Renovation (2018)[97]

Example 6: SUNShINE[98] [99]

This project is a collective approach through the home owners' association. It uses private money, but the forfaiting fund is public. The SUNShINE (Save your bUildiNg by SavINg Energy) project is a project that specifically aims at retrofitting multifamily apartments. It aims at low-quality buildings in Latvia. The financial target of the project is to finance EUR 50 million in order to retrofit a minimum of 200.000 square-meters (roughly 80 buildings). The projects conducted by the ESCO RenEsco uses the European regional development fund, which reduces the payback time significantly. Even though the payback time is generally around ten years, the EPC contract runs 20 years. Thus, savings are guaranteed beyond the payback time. This allows participants to derive guaranteed benefits even throughout the payback time. Like this they are even more incentivized to participate in the program. On the other hand, this puts more pressure on the ESCO as it guarantees savings without receiving money during this period.

[97] https://www.pass-renovation.picardie.fr/project-funded-by-europe/
[98] https://energy-cities.adobeconnect.com/p4zqnjm06tlh/
[99] http://citynvest.eu/sites/default/files/library-documents/Model%2020_SUNShINE_final.pdf

The EPC scheme of this program works as follows. First, an energy performance contract that runs 20 years is signed with the Home Owner Association. Next, the ESCO takes on a loan at a financial institution (not known at which institution in particular) and renovates the building. Usually 45% – 65% of savings are achieved. Then the House Maintenance Company (HMC) collects the same amount as prior to the retrofit from the owners. Thus, it has additional money left after paying the new, low energy bill, which is then used to repay the ESCO.

However, the special characteristic about this project is the support of a forfaiting fund. The fund is called LABEEF (Latvian Building Energy Efficiency Fund). Its purpose is to buy the future receivables of the ESCO. This is necessary in order to relax the ESCO's balance sheet, because it carries too many receivables and liabilities due to the financing of retrofits, which would preclude it from getting additional loans after a while. Therefore, the forfaiting fund makes sure the ESCO can keep on accepting new projects. Hence, implementation time will be relatively long as the fund needs to be established and negotiations between private and public stakeholders need to be conducted. For in depth information about the financing and contracting mechanism interested readers can watch the webinar accordingly.

5.6 Energy Supply Contracts[100] [101] [102] [103]

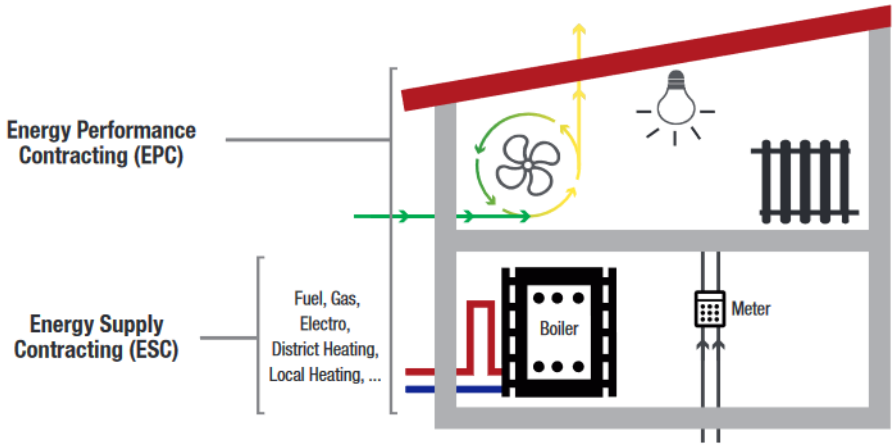
Energy supply contracting (ESP) or energy delivery contracting is closely comparable to energy performance contracting. In both approaches the service is accomplished by ESCOs or utility companies. However, whereas energy performance contracting aims mainly at savings at the consumption side, energy supply contracting rather aims at the supply side. Accordingly, the subject of the contract is the utility value (like volumes of heat) instead of the energy value. The EUSCO explains the difference between ESC and EPC accordingly: "The principal difference is that EPC goes beyond ESC. Whereas ESC is based on a business model that guarantees energy supply; EPC is a business model for energy savings. The goal is to avoid wasting energy and to invest the savings in energy efficiency" (EUSCO, 2018). This difference is also visualized in figure 8. This results in the incentive for the ESCO to make energy supply as efficient as possible, which in most cases goes hand in hand with retrofitting. Thus, the ESCO or utility company concentrates on the supply of energy through provision and investment into new power stations that generate and supply the targeted

[100] http://euesco.org/cms/upload/downloads/brochures/101006_euesco_ContractingFlyer_A4_final_low.pdf
[101] https://www.euesco.org/cms/upload/downloads/brochures/101006_euesco_ContractingFlyer_A4_final_low.pdf
[102] https://www.engie-deutschland.de/en/solutions/energy/contracting/energy-supply-contracting/
[103] https://www.engie-deutschland.de/en/solutions/energy/contracting/

object with energy. However, power stations only make sense for industry purposes due to the large scale. Besides this provision, energy supply contracting operates the station, takes care of the raw materials needed as well as providing maintenance if needed. It is mostly used in industrial or commercial sectors, because it gives clients the opportunity to focus on their core business instead of energy supply issues. Nevertheless, there is still the opportunity for the residential sector to become a part of the ESC business as for example through district heating schemes. The contract duration can also vary significantly. ESCs in the industry usually run long-term. The investment needed is usually smaller than in energy performance contracts as the consumption side can be ignored.

A visualization of the difference and the characteristics of energy supply- and energy performance contracting is shown in figure 8 and 9. The basic difference is that ESP is mainly restricted to the sheer supply of energy, whereas EPC can focus on the supply and on the use and thus, the savings. Hence, EPCs seem better as they go all the way when efficiency is considered.

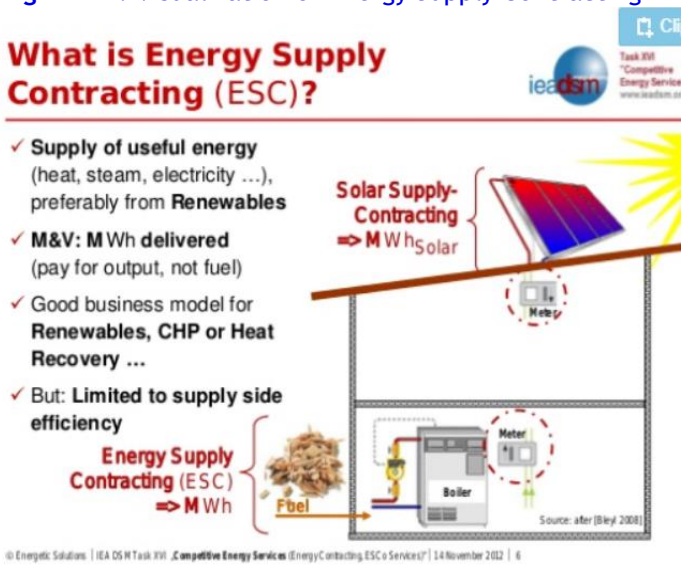
Figure 9: Difference between ESCO Business Models



EUSCO (2018)[104]

[104] http://euesco.org/cms/upload/downloads/brochures/101006_euesco_ContractingFlyer_A4_final_low.pdf

Figure 10: Visualization of Energy Supply Contracting



Energetic Solutions (2014)[105]

Example 1: ENGIE energy supply contracting[106] [107] [108]

This national example uses an individual approach and finances its projects with private money. An example for energy supply contracting is the model offered by ENGIE. They offer technical and commercial analysis tailored to the customer's needs. Afterwards, they offer implementation and financing, as well as maintenance service for their customers. As the contract is an energy supply contract, ENGIE also takes responsibility of buying primary energy for the customer in order to run the plant. The main benefit for the customer is high effectiveness in regard of energy use without the need of handling that part of the business on its own. As example for the program's success they provide the case of a company heavily relying on steam and hot water but also general heating. ENGIE planned and constructed a system accordingly to meet energy efficiency and

[105] https://www.slideshare.net/ceciliabengtson/esco-market-development-business-models-innovations-and-lessons-learned-presented-by-rob-kool-in-the-abscense-of-jan-w-bleyl-androschin-energetic-solutions-austria
[106] https://www.engie-deutschland.de/en/references/details/Saxonia-chooses-ENGIE-Deutschland/
[107] ENGIE does not provide specific numbers of the total investmented amount until today
[108] Time of implementation is not known.

environmental standards. From 1993 until today, ENGIE and the company remain in this contract, which gives an indication of the benefits that can be derived. As this is mainly used for businesses rather than for condominiums, a possible transfer could only be adapted to the provision of heating schemes, but also solar panels as depicted in Figure 9. For example, having an ESC for a heating system only that serves a building or a district.

Example 2: Stuttgart's care-free energy renovation[109] [110]

The city of Stuttgart has developed a program aimed mainly at condominium owners: the care-free energy renovation program. It is a regional program and applicable for retrofits of the heating system and/or the building envelope. Planning, construction, operation, maintenance, as well as financing, the guarantee is covered by the program. The private company Rahm+ is the general contractor. It coordinates the whole energy retrofit and implements energy efficiency measures on the building envelope given that the homeowners pay the investment. Moreover, it offers an energy supply contract to homeowners who wish to replace their heating system but either cannot take out a loan, do not want to do this (e.g. due to their age or creditworthiness), or don't want to spend their savings. Instead of a loan, they pay a fixed monthly fee to the ESCO which owns the heating system (Cicmanova et al., 2017).

5.7 Leasing[111]

Another method that can be used as an alternative financing tool for energy efficient retrofitting is leasing. Leasing contracts are common in sectors where the user of an object does not own it. To be eligible to use it, he pays a regular fee to the owner of the object. Bullier and Milin (2013) mention that in energy efficiency projects or even retrofits this financing scheme seems odd as the financed object cannot be removed in case the fee is not being payed anymore. Nevertheless, it is possible, which will be shown in the examples below.

Example 1: New York City Green Lease[112] [113] [114] [115]

At least one example exists of a leasing scheme for retrofits in the commercial property sector. New York City launched the project called "New York City Green Lease" regionally to encourage lease

[109] www.energy-cities.eu/IMG/pdf/guidebook_softloans_web.pdf
[110] Time of implementation is not known.
[111] https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2013/3-local-action-and-national-examples/alternative-financing-schemes-for-energy-efficiency-in-buildings/
[112] https://aceee.org/files/proceedings/2012/data/papers/0193-000214.pdf
[113] http://www.nyc.gov/html/planyc2030/downloads/pdf/energy_aligned_lease_official_packet.pdf
[114] http://www.the-esa.org/news/articles/-/first-green-lease-for-new-york-city
[115] Time of implementaion is not known.

models, as owners did not feel incentivized to retrofit. This low encouragement to retrofit also stemmed from the long investment horizon of retrofits. The project suggests options in which the building owner leases the energy-efficiency improvements to the tenant. Thus, the owner finances the retrofit and the tenant leases it in addition to the regular rent. The project develops contract terms that can easily be implemented into a contract without setting up a completely new contract. Hence, it aims to facilitate contracting. Thus, reduced transaction costs when negotiating a new lease agreement should be achieved. Apart from this, the project suggests specific payback schemes of 80% of expected energy savings in order to recover the costs, which leaves the tenant a cushion in case of below expectation savings. Until now the general idea has not been transferred to the residential sector, but it worked for commercial large-scale real estate projects in New York for 210.000 square-feet of office space (Energy Saving Association, 2011). Maybe a similar method could be transferable to residential projects as well, which nevertheless would pose a major challenge, due to the scale.

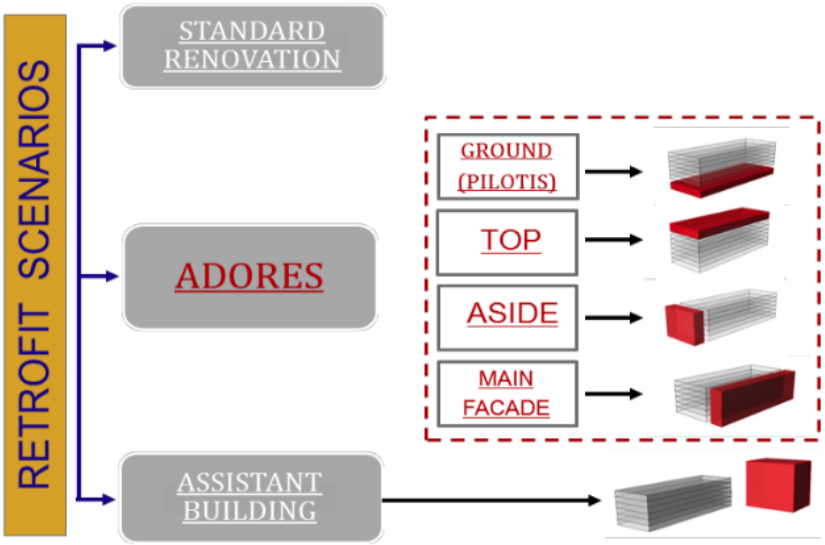
5.8 AdoRes[116]

Another rather unconventional method of financing a retrofit is to finance it through the extension of the targeted building by creating new space either on top, besides or under an existing building. These so-called add-ons increase the value of the object extensively, and create potential rental income. When these add-ons are combined with renewable energy, as in the case of retrofits, they are referred to as “AdoRes” (Ado comes from Add-On and Re from Renewable energy).

This has several advantages. First, energy savings are achieved, similar to the tools mentioned above. But here, additional benefits are derived by renting or selling the add-ons, so creating additional income or sales proceeds that can cover costs related to retrofitting. Therefore, the major difference towards the other tools identified so far is that in this approach financial benefits are not only derived from energy savings, but also from non-energy related benefits like rent or sale. With this method costs can be refinanced more quickly, which could in the end make this sort of investment more attractive to non-public financiers like commercial banks as well. The key role of the local government in this type of tool is to give the zoning permission to enlarge the building, and to make that permission strictly conditional on the investment in the buildings energy efficiency improvement. This can create substantial value for the condominium owners, at almost zero cost for the local government. We will look more closely at the only known program within this tool

[116] http://www.buildup.eu/en/news/overview-increasing-real-estate-value-existing-buildings-counterbalance-energy-retrofit-0

Figure 11: AdoRes Positioning in Retrofit Scenarios



UIPI (2018)[117]

Example 1: ABRACADABRA[118]

The pioneer in this innovative tool is a European project based in Italy called ABRACADABRA program (Assistant Buildings' addition to Retrofit, Adopt, Cure And Develop the Actual Buildings up to zeRo energy, Activating a market for deep renovation). It is EU funded and involves several partners ranging from consultancies to universities, unions and municipalities. Even though it is based in Italy it offers its services internationally. As central goal the project defines "an important reduction of the payback time of the interventions, a strengthening of the key investors' confidence, increasing quality and attractiveness of the existing buildings' stock and, finally, reaching a concrete market acceleration towards the Nearly Zero Energy Buildings target" (ABRACADABRA, 2018). These goals have already been achieved in several projects of the program. We look more closely at this program in section 7.4 of the report.

[117] https://www.uipi.com/a-new-beginning-for-energy-and-architectural-transformation/
[118] http://www.abracadabra-project.eu/project/

5.9 Further Considerations[119]

Of course, the tools' example section could be expanded further, but we try to concentrate on examples that represent the different approaches within the respective tool and can potentially be related to the condominium situation. Hence, in some cases we do not include projects solely focused on public buildings or other non-residential properties. A suitable overview of such financing tools is provided in the Citynvest (2015) report "Increasing capacities in Cities for innovating financing in energy efficiency - A review of local authority innovative large scale retrofit financing and operational models", which covers different operational and financing frameworks in depth.

Two tools that are on the edge of inclusion into the tools are energy efficiency obligations (also known as white certificates) and green bonds. Energy efficiency obligations are a legislative approach to incentivize energy savings by obligated parties. It requires such parties to achieve a quantitative amount of energy savings during a certain period by the end user. However, we concluded that condominium owners cannot influence the decision of obligated parties to finance a retrofit. Hence, it is not really a financing tool, but more pure chance to benefit from it. The issue with green bonds follows a similar reasoning. Building owners cannot issue such a bond on their own. If such a bond exists, it is still rarely the case that this bond exclusively and directly finances retrofits. It would rather be the case that a green bond finances a project such as the examples provided. Therefore, these two tools would need public support and help, for example from a municipality to channel the financing to retrofits. Additionally, these "tools" would require to be combined with another financing tool described here to work properly, otherwise they do help to overcome any of the identified hurdles (section 4.1). As we see that these tools can still be beneficial to condominium owners, we provide a description in the appendix.

One additional way of lowering the initial investment amount that we did not discuss in detail is scaffold advertising. We did not include this, because it is not really a financial tool. However, depending on the location of the building being retrofitted, it can also add financially to the project. In some cases, scaffold sheets are required anyways during the building phase. In such cases advertisement according to the cities regulations on this would be easy to conduct.

[119] http://citynvest.eu/sites/default/files/library-documents/20151202_WP2_Final_Report-V1.5.PDF

6 Frameworks

After presenting a wide inventory of the financing tools currently available for energy improvements, we evaluate these tools based on the criteria introduced in the first section to reflect the specific condominium situation. In Table 1 we show this evaluation framework. It incorporates all the parts discussed so far. Therefore, the framework contains all the tools presented on the y-axis and the condominium criteria on the x-axis. The tools in red are likely not a feasible solution for the condominium situation. The tools in orange are not a feasible solution on their own for ACE-Retrofitting's purposes but might well be helpful in combination with other tools. The tools in green show characteristics particularly important for the condominium situation. They might be the solution or at least a good starting point to come up with a solution. Later we shortly describe why this is the case.

Our second framework looks more closely at the tools from a practical point of view, considering users´ and policy makers´ concerns. To accomplish this, a list of practical aspects is provided that is partially based on findings from different financial tools. The purpose of this is to find solutions that also can be transferred to the countries or cities of ACE-Retrofitting's partners. For example, a theoretically perfect tool might need two years of implementation. For some authorities or municipalities this might be too long. Considerations similar to this one are implemented in the practical framework.

The partners of the project helped to complete the frameworks with their feedback. We discuss the most important findings, offering insights in the differences between the tools and in what is lacking in the different solutions. Remember, the tools are not exclusively aimed at condominiums and might not even target the residential market only. Thus, after a first look, we categorize the tools even further with the color scheme described above to see how they succeed in condominium situations. In consequence, it is possible to look more closely at the best and most innovative options. Maybe, a combination of the different tools is advisable.

6.1 Evaluation Theoretical Framework

First, we look at the theoretical framework (Table 1. Thus, non-feasible solutions are detected. Partially feasible solutions are highlighted to be kept in mind and the potentially feasible solutions will be underlined. This is done to come up with a suggestion on how a financial instrument can meet the needs of the condominium situation. Later we look at some of the more promising examples. Looking at current approaches of financial tools, it becomes obvious that there are lots of different options available to the government, condominium owners, utility companies and

ESCOs. However, the question is which solution works best for the condominium situation. Hence, which solution can account for more than one decision maker, because a condominium involves more than four parties? Which solution offers a financing scheme that fits parties even though they might not be able/willing to take on excessive debt? Are obligations transferable when the owner changes and most importantly is the solution addressing the split incentive? If the split incentive is not addressed the potential solution is always restricted to fully owner-occupied apartments and condominiums, which reduces the impact, since this is only part of the market. Knowing this, it is easy to narrow our further analysis down to some solutions by just looking at the framework (Table 1) that evolved so far. Paying retrofits from own savings (tool 1) is an option, however it is not innovative, and this method is currently already available to all condominium owners in the world. Hence, it can be a solution, but is restricted to wealthy individuals. Similar reasoning goes for the mortgage-based energy efficiency financing (tool 2.1), as this in the end boils down to debt. Finally, this also holds for soft loans and subsidies (tool 2.2). These financial tools might work for single family houses as only one party decides to retrofit or not, however, for condominiums soft loans and subsidies are hard to see as a mutual solution. It does not account for the split incentive and even if the split incentive was not an issue, a soft loan is still a debt financing instrument, which lots of condominium owners are not willing or able to take on. In addition, condominium owners will also face the performance risk of the retrofit. On the other side subsidies (or grants) are of limited use, as these tools only provide a minor part of the total costs of a retrofit and are not sustainable in the long run. Conclusively, it is possible to say that the mentioned tools above are available and widespread in lots of countries, but do not seem to solve the problem on their own. Nevertheless, it is important to keep in mind that even if those tools on their own might not be a solution to the problem, they still bear the ability to be applied in combination with other instruments. Thus, we colored these tools in orange. Leasing Schemes (tool 7) still seem too abstract at this point for the residential sector in the condominium situation. Too many unknown variables that are essential like legislative issues and practical issues (a deep renovation retrofit cannot be simply removed if the leasing contract will not be extended) remain. Therefore, we decided to put this tool in red.

Thus, the most promising tools (green) from this theoretical framework are collective loans, On-bill financing, EUA/PACE, EPCs, and ESCs, as they address the split incentive and are generally favorable towards the owner. This is because in EPCs and ESCs performance risk is carried by the ESCO, which enables pay back. Furthermore, the initial investment is mostly covered by the ESCO itself, which erodes the split incentive.

Table 1: Financing tools and the theoretical condominium criteria[120]

Tools	Investment Characteristics	Scalability to a Retrofit	Energy Performance Risk to Condominium Owner	Transferability of Obligations at Sale	Support	Addresses Split Incentives
1. Own Savings	Company/Individual uses own equity/savings	Yes	Yes	Not applicable	No	No
2.1 Mortgage Based Energy Efficiency Financing	Mortgage at favorable financing terms	Yes	Yes	No	Partially – not all programs offer support	No
2.2. Soft Loan and Subsidy Schemes	Loan at favorable financing terms or subsidy	Yes	Yes	No	Yes	No
2.3. Collective Loans	Loan taken by syndicate of owners.	Yes	Yes	Yes	Partially – not all programs offer support	No
3. Utility-On Bill Financing	Utility Company pays upfront costs and bills customer on utility bill	Questionable	Yes	Yes	Yes	Yes
4. EUA/PACE Financing	Can be financed by all kinds of investors; municipality used as a lien	Yes	Yes	Yes, as the obligations are tied to the property.	Yes	Yes
5. Energy Performance Contracting	ESCO, Third-Party or Owner can finance the project	Yes	No, risk is carried by ESCO	No	Yes - Extensive support even after implementation	Yes
6. Energy Supply Contracting	ESCO, Third-Party or Owner can finance the project	Yes	No, risk is carried by ESCO	No	Yes - Extensive support even after implementation	Yes
7. Leasing Schemes	Owner usually leases to tenant	Only large-scale projects accomplished	Yes	No	No	Yes
8. AdoRes	Owners have to take care of financing.	Yes.	Yes, if not combined with EPC or ESC	n.a.	Yes	No

[120] Colour of the Tool represents the degree to what extent the tool is a solution on its own: Red: The tool will not be feasible at all, Orange: The tool will not be feasible on its own, but may be valuable in combination, Green: The tool may be a solution (no guarantee).

Table 2: Framework based on practical criteria[121]

Tools	Possible in Partner Countries?	Transaction Costs Related to Negotiations	Obligations for Owner	Is Product Available in Partner Countries?	Can the Municipality Assist the Program?	Suitable for Residential Market?	Regulatory or Legislative Issues
1. Own Savings	Yes	None	No	Yes	No	Yes	No
2.1. Mortgage Based Energy Efficiency Financing	Yes	With bank.	Payback + Interest Provide Collateral	Yes	Yes. Create link between originator and borrower	Yes	No
2.2. Soft Loan and Subsidy Schemes	Yes	With provider for loan terms and requirements	Meet Requirements Payback + Interest	Yes	Yes. Can subsidize part of interest	Yes	Supply is finite.
2.3. Collective Loans	Yes	With bank and syndicate of owners	(Meet Requirements) Payback + Interest	Yes, but rare.	Yes. Convince banks to offer such loans.	Yes	Yes. Only possible for common areas.
3. Utility-On Bill Financing	Yes	With utility company	Payback through utility bill	Yes	No	Yes	Can utility company take client from network at default?
4. EUA/PACE Financing	Not yet. Test started in EU	Municipality with government	Payback through property tax.	No. Only in US and one pilot in Spain.	Yes. Can serve as a lien	Yes, but mostly commercial.	Challenge for residential sector
5. Energy Performance Contracting	Yes	High between ESCO and owners (maybe financiers) due to individual contracting	Payback (+ Interest) Regular Information regarding performance	Yes (Exception in Belgium)	Yes. Create public ESCO or set up forfaiting fund.	Yes	No
6. Energy Supply Contracting	Yes	With ESCO and potential financier	Payback Regular Information regarding performance	Yes (Exception in Belgium)	Yes. Create public ESCO or set up forfaiting fund.	Yes, but mostly used in industrial sector.	No
7. Leasing Schemes	Yes	Set up contract between lessee and lessor (difficult)	Regular Fees	No. Examples not in the residential sector.	No	No	Yes. Retrofit cannot be removed.
8. AdoRes	Yes	Very high due to number of stakeholders	Payback + Interest Extensive Planning	Yes	Yes. Create network to connect stakeholders. Accelerate bureaucracy.	Yes	Yes. Increased bureaucracy.

[121] Colour of the tool represents the implementation's degree of difficulty. Red: It is unlikely that the tool can be implemented quickly in a feasible way. Orange: The tool will need considerable involvement to be implemented. Green: The tool can be implemented quickly or is already widespread.

6.2 Evaluation Practical Framework

The second framework (Table 2) shows which tools are feasible from a practical perspective. As we link the results of the second framework to the results of the first framework, we provide a direct comparison of the final results in Table 3 for the convenience of the reader. This practical framework also provides an analysis from an institutional point of view as it addresses the question whether it is feasible for the consortium countries to implement the tools accordingly. Looking at the tools colored red, we see which tools are likely too difficult to implement. Leasing seems to be too difficult to be implemented, as it is rarely used, which is also reflected by the number of examples of this tool. It represents a rather exotic approach that is only suitable in special circumstances not relevant for the condominium situation. EUA/PACE financing is also colored red, not because it would not be practically feasible in principle, but more because it has just not been applied at all in Europe. There is one pilot in Madrid, but this is not enough to rank it higher, as this tool would need to start almost from scratch. ACE-Retrofitting is aimed at speed, and EUA/PACE implementation seems to be an impossible exercise within the given ACE-Retrofitting timeframe. This is also the reason why we exclude this tool from the flowchart given at the beginning. AdoRes are presented in orange. They require relatively more involvement as compared to the green tools. Still, they can likely be implemented. AdoRes are not colored green as they involve relatively more planning than the other tools. As it is not only the retrofit, but also physical additions of space that need to be conducted, the whole project turns more complex. Thus, there are high transaction costs as the number of stakeholders increases. As we conclude by the first framework AdoRes do not offer financing for the retrofit, but only reduce the payback time and energy savings dependence. Hence, additional transaction costs arise from searching financing opportunities. Furthermore, legislative issues can arise as space addition to the existing building might not be legally allowed due to urban planning, construction laws, or monument status.

Looking at the tools which are green and thus are likely to be implemented quickly, we see that mostly the rather traditional approaches seem to be in that group. Own Savings, Mortgage-Based Energy Efficiency Financing and Soft Loans and Subsidies look suitable from a practical perspective. This is because they are in the market for a long time and build up on structures of traditional financing instruments like mortgages or regular loans. A low number of stakeholders is involved, which keeps transaction costs low and no legislative issues need to be considered as they are already widespread in the market. However, those three tools do not seem to be perfectly suited when looking at the theoretical framework (Table1). Utility On-Bill Financing, seems to be the only tool that is green in both frameworks. However, the only point that is disadvantageous is the question whether such financing methods can be scaled up to a proper retrofit.

EPCs and ESCs are good from the owner's point of view as in such schemes the ESCO usually takes care of everything. The degree of involvement by the owner of course depends on the exact program, but we look at some options in the next section. EPCs might require closer cooperation with the ESCO throughout the contract regarding the retrofit. However, in Table 1 we see that performance is guaranteed, which seems to be a good trade-off. Energy Supply Contracting shows similar results in both frameworks as they are essentially the same except for the saving's scope. Hence, in general we would always prefer EPC over ESC as the degree of energy efficiency is always higher (investment might be higher as well). The only reason why EPCs are not ranked in the best bin is the complexity of contracting and the related high transaction costs. However, it will not be surprising that still some of the innovative tools that we describe in the next section in general follow an EPC structure.

Table 3: Comparison of Results of Both Frameworks

Theoretical	Practical
1. Own Savings	1. Own Savings
2.1 Mortgage Based Energy Efficiency Financing	2.1 Mortgage Based Energy Efficiency Financing
2.2 Soft Loan and Subsidy Schemes	2.2 Soft Loan and Subsidy Schemes
2.3 Collective Loans	2.3 Collective Loans
3. Utility-On Bill Financing	3. Utility-On Bill Financing
4. EUA/PACE Financing	4. EUA/PACE Financing
5. Energy Performance Contracting	5. Energy Performance Contracting
6. Energy Supply Contracting	6. Energy Supply Contracting
7. Leasing Schemes	7. Leasing Schemes
8. AdoRes	8. AdoRes

6.3 Pros and Cons

As the previous frameworks offered lots of information and explanations, we provide a more condensed form of the advantages and disadvantages of the different tools in Table 4. This table lists the main pros and cons in order to get a feeling on why tools are in the market, but also why they might not be the perfect solution. Thus, the table is meant to consolidate the most important characteristics explained in the previous sections into a more compact and easy to understand format.

Table 4: Pros and Cons of tools

Tool	Pro	Contra
1. Own Savings	- Easy (no financier) - Cheap (no transaction costs)	- No willingness to invest - No savings available - Solution would be available, but is not adapted
2.1 Mortgage Based Energy Efficiency Financing	- Supply is available	- Debt based financing - Need of collateral - complicated in condominium situation (multiple owners for one loan)
2.2 Soft Loan and Subsidy Schemes	- Favorable financing terms	- Debt-based financing - complicated in condominium situation (multiple owners for one loan)
2.3 Collective Loans	- Transferable between owners	- Likely only available for common areas
3. Utility On-Bill Financing	- No upfront cost for owner ➔ Charges on utility bill	- Not feasible for large-scale projects yet
4. EUA/PACE Financing	- No upfront costs ➔ Transferable between owners	- Not yet available in Europe
5. Energy Performance Contracting	- No performance risk - More security for owners	- Only few projects in the residential sector till now
6. Energy Supply Contracting	- No performance risk regarding supply - More security for owners	- Does not look at energy consumption
7. Leasing Schemes	- No/less upfront costs	Not suitable for real estate market
8. AdoRes	- Generates additional space - Generates income in addition to energy savings	- Does not take care of financin - Regulatory barriers

7 Innovative Financing Tools

Considering the previous sections, we see that some tools show the highest potential to focus on the overall issue. We call them innovative tools as they all have quite different approaches and characteristics compared to the common traditional tools like loans. This is because they already address lots of issues specific to the condominium situation and thus, also rank high in both, the theoretical and the practical framework. However, in most cases these tools tend to be more complex relative to the traditional instruments. Nevertheless, they seem to be the best solutions due to the general complexity of the condominium situation. We do not limit the following analysis to tools that ranked high in both frameworks. We rather put more weight on the theoretical framework as this will be more important when addressing the condominium situation. Like this an example of AdoRes will be assessed even though it only made the medium rank in the practical framework. Moreover, they are often limited to a specific area, as they are tested before they might launch in larger markets. Thus, transferred to larger markets they likely become viable solutions. In this section we look closer at four of the tools already presented, which follow a high potential innovative approach to tackle the condominium situation and an additional idea generated. We look at the advantages, but also at the risks and complexities related to the different programs. This analysis will focus on the Assen Service Cost Model, Energies Posit'if, Effirenov by ENGIE and ABRACADABRA and Crowd Funding-Schemes. We chose to analyze these tools in particular, because they represent the different approaches that retrofit programs can take. Furthermore, they are either tailored to the condominium situation or address the issues in a particular way. For example, the Assen Service Cost model allows easy transferability. ABRACADABRA on the other side is one of the tools that might not be a solution on its own but offers an unconventional approach to reduce payback times by adding space to the property. Thus, even within this group it is highly innovative as it reduces the dependence on energy savings to finance the retrofit. It is important to mention that some of these examples combine characteristics of different tools like for example a soft loan scheme paired with EPCs. Hence, they are not necessarily clear cut.

7.1 Assen Service Cost Model (Collective Loan)[122] [123] [124] [125] [126]

The Dutch municipality of Assen, in cooperation with the Province of Drenthe and The Netherlands Investment Agency (NIA), set up this model specifically aimed at retrofitting of condominiums. Until the end of 2017 only 28 apartments in one building had been renovated. However, this is because this building served as the pilot for the program.

The model is an innovative form of financing that allows owner-occupied condominiums to be renovated towards zero-on-the-meter without using personal loans. It is based on "object based-funding" instead of person-based funding. Individual apartment owners pay a regular fee to the HOA, and as the HOA pays for the renovation of the complex. The fee paid by the apartment owners is called service costs and increases. However, this increase is balanced by a decrease in energy costs. The selected consortium of builders who realize the renovation of the apartment complex will guarantee an agreed-upon energy performance of the building for a period as long as the payback time. This consortium is responsible for the renovation itself, and also for maintenance and management of the building. The property owner thus exchanges the energy costs for service costs.

Thus, the Assen Service Cost model has several characteristics that are beneficial to become a solution for condominium owners. This is because it already combines several characteristics of tools that have been identified in the first analyses. Firstly, the program can be financed through a loan by banks without the need for individual condominium owners to take on debt. This may sound counterintuitive, but it works by steering the loan through the home-owners association (HOA), which takes on the bank loan. This loan is additionally secured by the respective municipality with a guarantee fund rather than collateral. The loan is then paid by the service costs paid by the condominium owners (with a maximum horizon of 30 years). Instead of paying to a utility company they now pay the service costs into the savings account of the home owners association, which is used to pay back the loan. In consequence, compared to mortgages the loan is object- rather than personal-based, enabling the owners to transfer the obligations when they move out. Obviously, a major concern is thus solved, which is transferability. This feature looks like the advantageous

[122] http://www.nweurope.eu/projects/project-search/e-0-desirable-warm-affordable-homes-for-life/news/innovative-new-financial-model-to-enable-private-apartment-blocks-to-retrofit-to-net-zero-energy/
[123] https://www.youtube.com/watch?v=PjbHgQp9zMA
[124] http://www.dvhn.nl/drenthe/Landelijk-fonds-met-Asser-energie-besparingsproject-als-voorbeeld-22550560.html
[125] https://energievanassen.nl/portfolio/asser-servicekostenmodel/
[126] http://www.dvhn.nl/drenthe/Flat-Assen-energieneutraal-door-nieuw-financieringsmodel-21340688.html

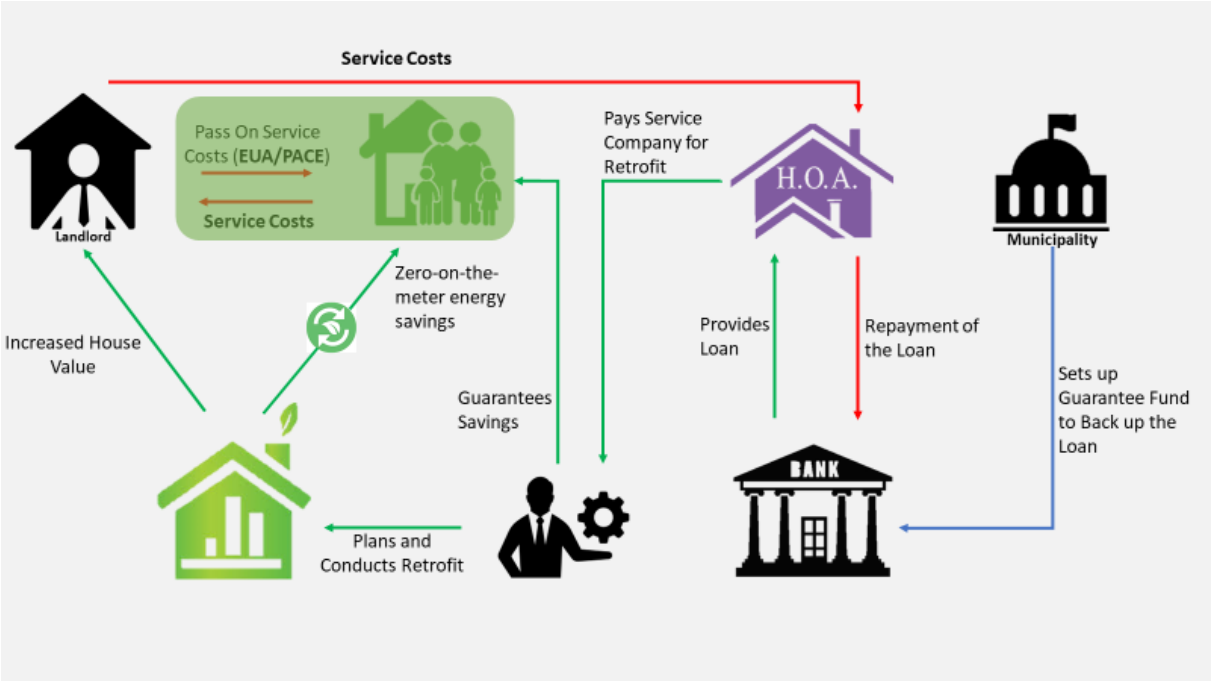
aspect of EUA/PACE financing schemes (Tool 4): to have the obligation tied to the property/object rather than an individual.

On top of that, the program provides security regarding the energy savings, because the contractors enter into an energy performance contract with the condominium owner. Consequently, characteristics of EPC schemes (Tool 5) are present as well, as the contractors which plan and implement the efficiency improvements, bears performance risk and maintenance responsibilities.

This all sounds very promising as lots of challenges already have been overcome. However, till now only owner-occupied condominiums can be tackled by the program without being opposed to the split incentive. This is because the HOA collects the service costs from the home owners and not the tenants. Therefore, if the condominium is rented to a tenant who is paying utility bills, again the owner does not have any incentive to improve energy efficiency, because he would pay the service costs while the tenant saves money on bills. To overcome this burden, it is important to investigate (from a legal perspective) whether a model can be developed according to the functioning of EUA schemes. Recall that some of those schemes allowed the owner to pass on charges to the tenant as he realizes the cost savings as well. In this regard, charges should not be fully transferred to the tenant, but should be in relation to their energy consumption and savings. Hence, the owner should also pay a share. If this can be achieved for a scheme similar to the ASC model, a bigger audience could be reached. From a logical perspective this seems achievable, because the tenant would pay no more than before as the savings are guaranteed by the contractors and zero on the meter. Therefore, the tenant will face no downward risk if the service costs are passed on him. The owner on the other side would benefit from the increased property value.

This combination is schematically shown in Figure 11. It can be seen that the loan is provided by the bank to the HOA. The HOA pays the Service Company or a Contractor to plan and conduct the retrofit and also to guarantee the energy savings. When the retrofit has been finished the parties living in the apartments (tenant- or owner-occupied) derive their zero-on-the-meter cost savings from it. On the other hand, the owner will benefit from the increased value of the house/apartment. These flows are represented by the green arrows in Figure 11. The red ones represent the flows used to pay back the loan. Service Costs are paid by the landlord to the HOA. If the owner however is not living in the apartment as well, he/she is also able to pass on these service costs to his/her tenants. They then transfer the money to the landlord and this will pay the HOA. The HOA will then of course pay the bank in order to refinance the loan. The municipality only backs this loan with a guarantee fund to ensure that the bank will get back its money.

Figure 12: Assen Service Cost Model plus addition of service cost sharing



[a] The green arrows represent the flows coming from the bank to finance the retrofit
[b] The red arrows represent the flows to pay back the loan
[c] The blue arrow represents the guarantee fund that backs up the HOA
[d] The transparent green box shows the process added by service cost sharing between owner and tenant

Even though the idea seems feasible, it is necessary to assess the risks. The idea comes with different kinds of risk. Thus, policy makers as well as any other stakeholders of the concept should thoroughly assess these.

First of all, there is of course a default risk. If homeowners default, the HOA is obviously also at risk to not be able to pay back the loan anymore as the money they pay comes from the service costs. However, banks do not bear this risk as the local government (in the example of the original Assen Service Cost model the Province of Drenthe) sets up a guarantee fund that carries the associated default risk. This creates a risk for the Province, but it is also a chance to include commercial banks into the financing of condo retrofits, which is an area they have not been active in hitherto. They have much needed capital available, but have been reluctant to participate in such programs as either the risk was too high, the investment horizon too long, or the complications of the condominium setting too daunting.

Secondly, initial transaction costs are very high in this model. In general transaction costs are high in EPC models, but in this case, extensive negotiations between the different parties took very long, because banks were reluctant to engage. As a result, the city of Assen took two years in total to get the project going. Furthermore, no ESCO is involved, but different contractors like roofers. If an ESCO or even a city itself could be included as a contractor, the project might be accelerated. Nevertheless, a long implementation phase needs to be considered when desiring to apply a similar program. Hence, setting it up in the short run will very likely be impossible even with the knowledge and experience that can be gleaned from the Assen case.

Another consideration would be to try to allow for energy supply contracting as well. This might be easier to implement as the extent of energy efficiency is smaller than in energy performance contracts. In addition, in energy supply contracting one contractor should be enough to realize the retrofit.

What is essential as well are the national rules and regulations concerning HOAs. Are these associations mandatory? Do they have a required amount of capital? What is their legal structure (i.e. can they take on a loan?)? These characteristics are essential to the functioning of the whole idea, but they might differ between countries. In the Netherlands the rules are beneficial for the idea, because the project is currently piloting in a Dutch province, but regulations differ between countries. As an example, loans for common areas in Belgium are about all collective things. That means the façade is commonly owned, but windows are privately owned. Consequently, a mix of instruments is always necessary for private and HOA retrofits. Otherwise HOA would finance private renovations, or the retrofit would not be complete, which in any case will not be desirable. Therefore, the necessary mix of instruments will add additional complexity to the program.

Finally, the passing on of some of the obligations through the service costs is also important to be considered. It is unclear whether the owner is allowed to pass on the service costs to the tenant. As already said in the previous section, there is no downward risk for the tenant so in no scenario the tenant will pay more than before. Based on this security it might be relatively easy to develop an argument. However, this legal aspect should definitely be considered to ensure that the split incentive can be overcome as well.

7.2 Energies Posit'if (EPC and Collective Loan)[127] [128] [129]

Energies POSIT'IF is an example of an EPC in the European residential sector exclusively aimed at deep renovation of condominiums. Energies POSIT'IF is a French program that focuses on the region Ile-de-France, which consists of Paris and its surroundings. The project has a public-private ownership structure. It was initiated regionally by 14 local Ile-de-France regions and two financial institutions. It receives EU financing. In general, the program offers customers technical design, implementation and operations, as well as financing and insurance services.

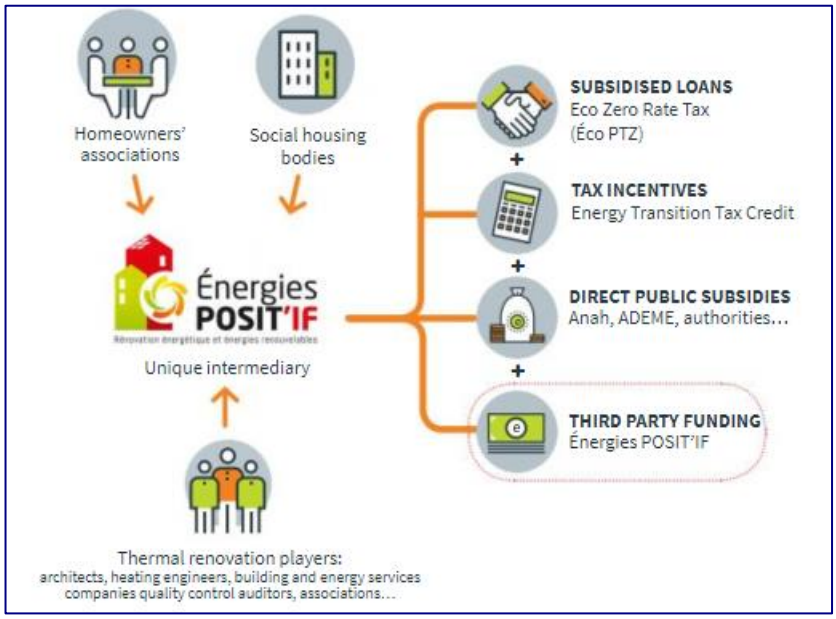
According to the Citynvest report (2013), over 2500 apartments have been part of the project. It is planned that only 10.000 apartments will be retrofitted until 2020 at a total investment amount of 250 million. The model seems to work reasonably well in France.

In the case of the Assen Service Cost Model, we saw that transaction costs can be challenging. Energies Posit'if tries to reduce transaction costs significantly by acting as a public-private ESCO. Thus, it serves many tasks. The project aims to refinance investments through energy savings. However, Energies Posit'if also offers strong help in setting up a financial plan that does not only rely on loans. Moreover, they help to get access to soft loans, subsidies or even white certificates and third-party financing.

general process up until financing is straightforward. First, an energy audit is conducted in order to assess the condominium's potential in terms of performance and savings. Then, the program claims to support the negotiations between the different owners, as the decision to retrofit is made by all owners. Thus, consensus is established. After the contractual agreement is being made, the other parties being involved are included (architects, engineers, ESCOs). Depending on the options chosen within the contract, the condominiums and their owners make use of follow-ups, maintenance, performance guarantees and third-party financing.

[127] http://citynvest.eu/sites/default/files/library-documents/Model%2011_Energies%20POSIT%27IF_final_0.pdf
[128] http://www.energiespositif.fr/?page_id=2515
[129] http://www.eib.org/infocentre/videotheque/efsi-video-energies-positif.htm

Figure 13: Energies Posit'if general approach



Energies Posit'if (2018)[130]

Concerning the financing, Energies Posit'if offers two general models. Firstly, Energies Posit'if develops a financial plan for each owner depending on her or his preferences and financial abilities. Thus, several sources of financing can be applied. Own savings can be used if available, grants and subsidies can be utilized or bank loans can be used. Another possibility for the home owners is a collective loan. Obviously, in this scheme Energies Posit'if does not provide any financing on its own. Essentially, it does function as an intermediary between the condominium owners and the different technical stakeholders. Hence, condominium owners have to pay their loan obligations (if financed by loans), the retrofit (paid through Energies Posit'if as an intermediary) as well as service fees for Energies Posit'if.

The second financing option involves Energies Posit'if actively in loan seeking and provision as well. The project itself can finance retrofits as it received considerable funding by the European Investment Bank of EUR 100 million, which has to be paid back within 22 years (EIB, 2018). This enables the project itself to invest into retrofits and not simply facilitating them. Thus, in comparison to the first option, condominium owners are only in contact to Energies Posit'if instead of banks and Energies Posit'if. Hence, owners pay monthly fees to Energies Posit'if only, as they

[130] http://www.energiespositif.fr/?page_id=2515

take care of the financing and the retrofit itself. This option is more or less a one stop solution, because there is almost no responsibility left at the owner level.

In either case, savings are taken into account to pay back the investments. Additionally, EPCs are an option for the owners to additionally ensure savings. The payback period can also be varied, allowing owners to pay higher fees in order to reduce payback period for example. Finally, the project also provides support to get eligible for tax advantages or subsidies due to the retrofit, which in the end can increase profitability further.

One major risk when trying to transfer the project to a different region or country is the loan that currently backs the project. Getting a loan of around EUR 100 million will be very hard, especially in the case of ACE-Retrofitting's timeline.

7.3 Effirenov by ENGIE (EPC and Soft loan)[131] [132] [133]

"Effirenov" is another example for an EPC. It includes a complete energy efficiency audit of the building. Financing solutions are available as well in form of grants through Eco-PTZ. In order to be eligible for the EPC scheme buildings have to bear four characteristics. They have to comprise more than twenty apartments, need to have a collective heating room, have been constructed between 1948 and 1980 and should have a necessity of renovation.

In general, Effirenov is carried out by a partnership between ENGIE and Credit Foncier, a French national mortgage bank. ENGIE is a French ESCO and is responsible for the energy performance contracting. Credit Foncier is responsible for the financing part through the Eco-PTZ loan. The project specifically focusses on the retrofitting of condominiums, which makes it suitable to have a closer look at it.

The project basically combines an energy performance contract with a soft loan financing scheme. First of all, different proposals and the related benefits are presented to the user/users of the program. Experts then recommend specific energy efficient improvements. If the decision is made to conduct the retrofit, a financing plan is developed by Credit Foncier. With the financing the retrofit can be conducted. Design and implementation of the retrofit are carried out by the program. Additionally, savings are guaranteed through an energy performance contract. Finally,

[131] https://www.engie-cofely.fr/solutions-innovantes-engie-cofely/offres-globales/effirenov/
[132] https://creditfoncier.com/wp-content/uploads/2015-financial-report-1.pdf
[133] https://www2.sgfgas.fr/presentation/CaracteristiquesEPZ_anglais.html

Effirenov takes care of maintenance as well throughout the time of the energy performance contract.

Looking more closely at the financing, we see that it basically looks like a loan. However, the loan is provided by Credit Foncier and is part of the Eco PTZ program. This is a zero percent eco loan created to finance renovation work of old buildings. The lender still receives interest even if it is a zero-interest loan. This is because the government pays the interest to the lending institution by providing tax credits accordingly. Hence, we see an advantageous part of the Effirenov, because we often see soft loans with low interest, but preferential zero-interest loans are rarely offered. The loan cannot only be taken on by individuals, but also by a collective body like a home-owners association. This allows to take on an individual loan to finance a personal share of the retrofit and to be part of a collective loan as well to finance retrofitting of the common areas. To be eligible to get the loan ENGIE (2018) states that the building should have more than 20 apartments, a collective boiler, should be constructed between 1948 and 1980 and should face the need of renovation. If this is given Credit Foncier can set up a financing plan. The maximum loan amount of Eco PTZ is EUR 30.000 per individual depending on the degree of renovation. The payments are done on a monthly basis and the payback period is usually 120 months. Depending on the degree of renovation, it can also be up to 180 months. The time can also be reduced if the bank agrees to the request. In any case it cannot be less than 36 months (SGFGAS, 2018). Thus, the project offers very favorable financing terms to owners of condominiums by utilizing the governmental Eco-PTZ program and additionally guarantees savings through the application of an energy performance contract.

Concerning risks, the projects financing heavily depends on the Eco PTZ loan. Credit Foncier is not a governmental institution. Thus, they need to make profits at the end of the day. Consequently, if the Eco-PTZ program would not exist Credit Foncier would not have any incentive to provide a zero-interest loan. Thus, if the project would be aimed to be transferred to another region, it is necessary that a similar governmental incentive structure is existing as well. Otherwise, the financial incentive to retrofit would be less for the owner, because he would need to pay interest for a regular loan.

Furthermore, transferability might be an issue as the owners most likely take on an individual loan. Nevertheless, if a collective loan is arranged it might be possible to transfer the stake one of the owners has in it.

7.4 ABRACADBRA (AdoRe)[134] [135] [136] [137] [138]

We saw in earlier sections that a rather long payback period tends to hinder private players from entering the market for retrofits. The ABRACADABRA project tries to overcome this with the idea of building additional space of commercial property. Hence, additional income to energy savings will be generated, which in consequence reduces the payback period. The pioneer in the innovative AdoRe-Tool is a European project based in Italy. As said, t is EU funded and involves several different stakeholders. In this section, we have a closer look at the technical, the financial and the regulatory aspects of the program.

From a technical perspective, the project offers and has expertise in AdoRes covering additional ground, top, side and main façade attachments. In addition, ABRACADABRA offers a toolkit that helps stakeholders to compare the different options to common retrofits and even to assistant buildings. They are currently validating this toolkit to not have more than 10-15% discrepancies compared to national systems (ABRACADABRA, 2016).

Concerning the regulatory perspective, the project has already assessed the national frameworks in order to account for any regulation that can influence the project. Thus, they analyzed Bulgaria, Greece, Italy, Latvia, Norway, Romania, Spain, and the Netherlands. However, the exact details of this analysis would go beyond the scope of this report. Interested readers can find the according report in the reference list. In general, the major regulatory obstacles are defined as property rights, tenancy and condominium law and local and urban planning rules. According to the specific characteristics within each country ABRACADABRA can select the best option of add-ons to meet regulatory standard as well.

Looking at the financial side of the project, we see that it provides a tool to assess the costs. In this cost-assessment a pessimistic, neutral and optimistic scenario are analyzed. In this toolkit, energy prices, inflation rate, interest rate of loans, construction costs as well as the average value are taken into account. They are adjusted for each scenario and according to the respective country. Then the users must provide some information as well like additionally created space, estimated

[134] http://www.abracadabra-project.eu/wp-content/uploads/2017/01/D2.2-Tool-Kit-Technical-preliminary-report.pdf
[135] http://www.abracadabra-project.eu/wp-content/uploads/2017/01/D2.3-Toolkit-Regulatory-preliminary-report_final.pdf
[136] http://www.abracadabra-project.eu/wp-content/uploads/2017/12/D2.4_Tool-kit-Financing_-preliminary-report.pdf
[137] http://www.abracadabra-project.eu/wp-content/uploads/2017/01/D2.1-Challanges-and-Opportunities.pdf
[138] http://www.buildup.eu/en/news/overview-increasing-real-estate-value-existing-buildings-counterbalance-energy-retrofit-0

costs and the replacement period for the retrofit`s interventions. Costs for the retrofit however, can be obtained by using the above mentioned technical toolkit. Hence, the project provides guidance to the users. Finally, the toolkit provides three outcomes: The new value of the building, the payback time based on energy savings, the payback time based on potential energy savings and income generated through the add-on. As means of financing of the retrofit, the toolkit offers own savings, subsidies and loans. Additionally, a reduced online version runs its beta that allows to type in information by answering a questionnaire. Like this the project is easier to approach for regular owners.

If we now look at the risks and considerations, we already saw that the financing is more or less left to the owner/user. That means whereas ABRACADABRA has the main plan as well as lots of helpful tools, the owner has to find the means of how to finance the related costs. In the financial report that has been referenced in the previous paragraph, it is mentioned that there are lots of tools to finance the project (also innovative tools from covered in this report are being mentioned). However, the project does not seem to provide specific help by assessing which one is the best or by providing own financing opportunities. This has two implications. Firstly, the ABRACADABRA program is more of a supporting program for a general program that takes care of the initial financing. This is not necessarily a negative point. However, this needs to be considered. We already made this relation visible in the flowchart. Secondly, the true transaction costs will be higher than expected. This is because the related transaction costs of the ABRACADABRA program are taken into account, but there are also additional costs related to obtaining a loan or making use of any other innovative financing project.

Another point to consider is that the initial upfront investment costs are higher as well compared to a rather traditional retrofit. Additional space is built, which will of course require more investment than just conducting a retrofit. Linked to this additional space, one of the case studies in Italy identified additional depreciation due to a loss in aesthetic value as a risk.

Furthermore, the project assumes that demand for housing or commercial property to be high. Otherwise, owners run the risk of either not being able to sell or to rent the newly created space. This is important to consider, because it strongly influences the financial viability of the project. Nevertheless, especially cities which face high demand are likely not seeing this as a risk.

Finally, we want to refer to the regulatory and legal risks again. These risks are relatively high during the planning phase as laws differ between regions and might prohibit an add-on. Hence, it is essential to be aware of the fact that not each house is eligible to run a project like this.

7.5 Crowd Investment – Schemes[139] [140] [141]

Finally, we want to present an unconventional method. We do not want to compare it to the other tools as it is untested and would therefore look bad relative to the other tools. Thus, it is more an idea on how to adopt it. The instrument of interest is crowd investment. Crowd investment schemes in general seem abstract at this point, but they are as well a possible solution to finance and facilitate energy efficient retrofits of condominiums. Even though crowd investment schemes are still not tested on the condominium situation, one example showed to be feasible for public buildings like schools. In these schemes regular citizens become investors and provide money for an energy efficient project. When realized, they get paid back with interest. Usually an institution manages the money that has been contributed by the citizens.

An example is Énergie Partagée. It is aimed at energy efficiency and embodies inter-community action in the scope of a large civic project. To achieve this, private actors like associations, citizens, and businesses cooperate with public authorities. It works by forming a group of interest that establishes a fund which raises private money to finance a certain energy efficiency project. The group then underwrites shares according to the amount funded by the individual (investor). The investment horizon is typically aimed at around ten years with an objected interest of 4% (Énergie Partagée, 2018). Énergie Partagée is an association that invests into these groups, it collects and manages contributions, but also facilitates cooperation between project administrators and energy activists. Till now the project focussed on public buildings, as the citizens investing are rather willing to engage in investments that is at least partially beneficial for them (for example putting solar panels on schools). However, the project might bear opportunities for the private residential market, as it already showed proved ability to raise money even in this rather unconventional way. According to Énergie Partagée (2018) it raised around 14 million by more than 5.000 citizens. Thus, people generally seem to be willing to provide funding for energy efficiency projects.

This example does not have to reflect how crowd funding in general should work, but just shows that it can work. We would rather recommend an approach in which in which the cities or municipalities take a more active role. By that we mean that the city could function as an intermediary that channels, organizes and distributes the money that private individuals (the crowd) want to invest. Like this crowd investment projects would be more efficient as they are more organized. They can find better ways to match investors with the owners or borrowers. Maybe

[139] https://energie-partagee.org/devenir-actionnaire/souscrire/
[140] https://energie-partagee.org/
[141] http://www.goethe.de/ins/cz/prj/fup/en14217644.htm

owners of one apartment in a house can invest into the other condominium of the exact same house. There is no such project yet, but it is worth to consider such ideas in the future as an option.

8 Role of the Authorities

As this report is mainly addressed to municipalities, we will mention the exact options that municipalities have in supporting retrofitting. The flowchart depicted in figure 4.2, already provided the general idea of what municipalities can do. The flow of options represents a prioritization. This prioritization builds up on how costly the approaches are to municipalities. Thus, the cheaper the option, the better for the municipality. Depending on how the municipality sets it priorities this flow could change. However, we follow this low cost preference assumption. In this section we will expand this rather basic model, with the ideas based on the analyses and examples generated throughout this report. The options provided are not mutually exclusive. Hence, a municipality can also support retrofitting by applying more than one option.

8.1 Reach Out to National or International Level

What we see in figure 4.2 is that the regional municipalities should always consider reaching out to national authorities as a first step. This is based on the idea that regional municipalities are rather limited in their financial means. National authorities might be able to support municipalities financially. Besides the financial aspect, national authorities might likely have additional and valuable expertise. What is important to mention is however, that reaching out to national or even international authorities can also add significant length to the project in general (for example through negotiations or additional communication). Nevertheless, it offers opportunities to municipalities.

We saw in section 5.2 that most loan schemes are initiated on a national level. Hence, authorities can refer to such programs for example. Moreover, we saw that some tools use the possibilities offered by the EIB and the European Fund for Strategic Investment (ESFI). This is something that should be considered as well. Following the European Commission (2018) “The EFSI is an EU-budget guarantee providing the EIB Group with a first loss protection. This means that the EIB Group is able to provide financing to higher-risk projects than they normally would. An independent Investment Committee uses strict criteria to decide whether a project is eligible for EFSI support. There are no quotas – by sector or by country. Financing is purely demand-driven.” Therefore, this is an opportunity for regional and even national authorities to receive funding under this program (popularly called “the Juncker Funds”) especially offered to projects such as retrofitting. The

European Committee of the Regions (2016) offers an overview of how to use the EFSI – Juncker Funds - as a municipality for regional projects. It is mentioned that the aims of the fund are to explore new markets, develop new financial projects and to design new forms of cooperation. Loans are provided to regional and municipal authorities as well as financial intermediaries. This all sounds promising when considering retrofit projects of all kinds. Especially because of the fact that commercial financial intermediaries can be attracted through the guarantee scheme and thus, triggering the multiplier effect. Therefore, when we advise to reach out to national or international authorities and programs, we want municipalities to consider the chances offered by the EIB and the EFSI – Juncker Funds as well. The cited source above also provides guidance on how to contact the EIB or initiate such projects.

One important point that has been missing throughout the whole report is the importance of proper marketing. This report rather focused more on the financial side and the functioning of the different options and tools. However, it is important to mention that even the best program will need to create awareness. If condominium owners do not know about the existence of potentially beneficial programs, how can they participate in such? General knowledge about financing options might be lacking at the demand side. Whereas lots of owners might know about the tools described in sections 5.1 and 5.2, the other tools covered by this report might not be that well known. This is where cities could step in. They should try to ensure proper awareness by condominium owners, because if owners do not know about a product, they will not be able to use it. Hence, a city can facilitate the overall goal by engaging in the creation of awareness.

8.2 Tailor Standards

Referring back to figure 4.2 again, it can be seen that if national support is not an option, the second option proposed was tailoring of standards. This is because tailoring standards is a relatively inexpensive way to facilitate retrofitting. In section 5.8 and additionally in section 7.4, we saw that for example AdoRes and with that the ABRACADABRA program are interesting ways to address the general issue. However, in the practical framework in table 2 it can be seen that high bureaucracy like zoning laws, building restrictions or any other kind of regulations can slow down such programs or reduce its practicality. Municipalities have the ability to tailor regulations that stand in the way of programs like the ABRACADABRA. If nothing needs to be changed, municipalities might as well accelerate processes related to retrofits (building permissions or similar). In that way they can again facilitate retrofitting without investing extensive amounts of money.

Another approach would be to address or create standards that are currently perceived as too complex regarding ESCOs and EPCs. The transaction costs are very high relative to the invested

amount. As an idea to address this, authorities could try to find and support standards that reduce investment costs. On the one hand this could be done on the contracting level by providing standardized contracts that accelerate negotiations. On the other hand, this could be done by connecting multiple buildings and their owners to form one party that become one project for an ESCO. Like this scale advantages could be gained, which lower the transaction costs.

8.3 Provide Financing

If national support is not an option, standards cannot be tailored, or a municipality wants to extend the support even further, it can initiate financial support. Therefore, we assess in which ways municipalities can support retrofitting. We consider this as the last step due to the mentioned restricted capital available.

As has been evaluated in section 5.4 so far, it is not uncommon to have ESCOs as a stakeholder and facilitator within projects. Thus, the city itself can become a developer by creating a public or a private ESCO. In such case, the city could provide equity, which can even be financed through public funds partially. Admittedly, this could turn out to be harder than it sounds as there are also legislative and political factors that have to be considered. However, as also mentioned in this report there are examples (like Energies Posit'if) that overcame this initial barrier and now can be considered as viable solutions to the overall problem tackled by this report. If there are already ESCOs in the regional market or ESCOs that can take projects nationally, a municipality can as well support this existing ESCO. An example of how authorities can support ESCOs is the fund LABEEF (Latvian Building Energy Efficiency Fund). As outlined in the example of SUNShINE in section 5.5 this fund helped the project being able to finance more retrofits by buying their receivables. This is because, similar to municipalities, ESCOs are also restricted in capital, which sometimes hinders them on taking new projects. This is where, municipalities might be able to step in without being forced to form a public ESCO.

Besides the creation or the support of ESCOs, municipalities can provide services known from the banking sector like soft loans or even subsidies. Especially subsidies should be more of a last resort for municipalities. Subsidies will not be recovered by the issuer. Consequently, they are not sustainable in the long run. On the loan side, municipalities can either provide loans by themselves by setting up a revolving fund to finance soft loan or they can try to create partnerships with banks. In the latter case, the city can approach development banks or commercial banks that are also interested in projects that aim at sustainability as well as financial profitability. Partnerships with development banks like KfW or Triodos might not be too hard to achieve, as their mission generally builds up on the thought of fostering development, which in consequence is very likely to be

connected to aspects of sustainability. However, getting commercial banks into the boat would offer lots of new opportunities. More capital would become available through such stakeholders and the financial feasibility of connected projects would be proven as otherwise commercial banks would not engage into them. Therefore, cities could try to specifically try to connect with such commercial bank. A good example of such a bank would be ING Netherlands, which specifically focusses more and more on sustainability aspects and even tries to pioneer the sector in sustainability aspects of their real estate branch. However, in the example of the Eco-PTZ soft loan for example in section 5.2.2 we see that the French government paid the banks for lower interest (through tax credits).

A better more feasible approach might be guarantee funds that assure against losses by banks which provide loans to certain projects or homeowners. Like this, risks are reduced on the bank-side and as a result cheaper loans can be provided. Moreover, commercial banks can be encouraged to participate. The Assen Service Cost model showed such an approach as we describe in section 7.1.

Finally, the city can mobilize private start-ups or cooperatives on its territory. For example, the city could launch a public tender in order to select a company that will develop a financial model for home renovation programs on behalf of the city. In return the city provides some subsidies to overcome the rather difficult starting phase while the company funds a sustainable business model.

8.4 Measurement

As the previous sections already talked about the role that cities or municipalities can take, this section aims to expand the role of the authorities. This is because if a city or municipality decides to adapt a program, it is also necessary to measure and assess potential success. As most projects in relation to retrofitting have a long-term approach, the actual success can only be measured in the long run as well. Profitability, default rates, general satisfaction etc. will be more meaningful after a projects full execution.

In the short term however, one meaningful indicator of how well a project is functioning or adopted is reflected by the pickup rate (how many people participate in the project in total and how many participate from those who received marketing). Condominium owners will be able to assess new programs (given they will be aware of the programs existence, which is the bigger challenge in the first place) and will be able to compare them to existing ones. Thus, it would make sense to look at the retrofits conducted within the desired region through the program that has been newly implemented. However, another important factor to take into account might also be the percentage made up by the program of the total amount of retrofits at the condominium level being conducted.

However, this might only be possible to measure in a perfect scenario (perfect information about retrofits given).

Of course, these suggestions might only serve as a starting point, but they reflect the general idea of the city to facilitate retrofitting of condominiums either directly or indirectly. Especially linking potential stakeholders can be valuable, because cities might have more information and expertise than other stakeholders. At the end, even if the city might not be involved directly into the potential program (by providing a soft loan or similar), they will be the party that is able to derive value from externalities, which gives one more incentive to engage actively in the process.

9 Conclusion

This report tried to provide guidance for municipalities on how to support retrofitting of condominiums, as this is currently a global issue rarely addressed in current literature. Municipalities are not completely aware of where and how to support, which is why we tried to shed a light on this. Even though we mainly addressed municipalities, we still provided guidance for owners as well, because they are the ones who decide on investments.

In this report eight different tools aimed at stimulating retrofitting of condominiums have been identified. Own savings, three types of loans, utility on bill financing, energy performance contracts, energy supply contracts, leasing schemes and AdoRes have been described in detail. Some of them could be used as a solution on their own, some only as support to reduce the total investment amount. For each, several examples have been provided to the reader, which underline that even within those tools, examples and projects can still differ and thus, show different characteristics important in the condominium situation.

To evaluate whether these tools suit the condominium situation, a theoretical framework has been developed. This framework reflects points that already dew attention in literature covering condominium situations or retrofits. During this especially the split incentive and bounded rationality have been focused as they represent barriers especially in the multifamily buildings sector. In addition, a practical framework has been developed as well to reflect the constraints faced by municipalities. The results of both frameworks have been mixed due to the different criteria. Nevertheless, some tools stood out positively. Utility on bill-financing, energy performance contracting- and energy supply contracting schemes are promising regarding the challenges we address. This is especially because they offer several ways of financing, extensive support throughout all phases of the retrofit and in the case of EPCs a guarantee for the projected savings.

However, utility on-bill remains questionable due to its unsolved scale issues and EPC due to its high complexity and transaction costs, as they require individual contracting. If that issue could be solved by developing an EPC system that offers fast contracting, less dependent individual contracting ESCOs and EPCs would offer very high potential.

Thus, the frameworks led us to look more closely at the rather innovative approaches of tackling the overall issue. This is because we saw that no tool is the perfect answer to the overall issue. Innovative approaches already combine several characteristics of the different tools in order to specifically tackle the condominium situation. In this regard we saw different advantages, but also different risks that have to be considered prior to an implementation. The section provided a sort of lessons learned during the implementation of the different projects.

Finally, we provided a useful overview for the cities of what they can contribute to support the overall target. They should always reach out to national bodies as a first step due to their restricted capital. In that regard we would emphasize once more that the European Investment bank could be an important partner especially in cases where national authorities might not be supportive. In such regards, cities could also function as channels of financing that is not immediately available to individual owners. By this we mean tools like green bonds, EEOs and as described in section 7.5 crowd investment schemes. They can also tailor standards to accelerate programs or processes. Finally, they can consider financing of specific projects or even develop projects on their own. Only as a last step in this category, municipalities can provide subsidies or soft loans, because these are not sustainable. As side note it is also important to create awareness of the different options, even if this point does not relate immediately to financial considerations. All these opportunities are provided in a condensed form in the two flowcharts that reflect owners' concerns and municipalities' options. In both cases, we designed the flowchart assuming preferences for low cost approaches. This means that municipalities and owners will always prefer the low-cost approach over higher cost. The layout of these flowchart could change if this assumption changes.

10 References

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11 Appendix

In the tools we do not include Energy Efficiency Obligations (EEO) and green bonds. This is because these tools cannot be applied by the owner on its own. An owner cannot set up a green bond nor can he use EEOs without another parties' initiative. This reasoning may also hold for the other tools, however for EEOs and Green bonds share a variable of luck. By this we mean that the purpose of green bonds and EEOs is not necessarily and exclusively the financing of retrofits. For the tools in the main part of the report, we see retrofitting as the sole purpose of the tools. For EEOs, it is rarely the case that obligated parties engage in the financing of retrofits. Green bonds finance a variety of energy efficiency measures, but rarely finance retrofits directly. They are more of an option to finance projects (such as our examples). As we see that these tools can still be beneficial for the financing of a retrofit, we do explain them in the Appendix.

11.1 Energy Efficiency Obligations (White Certificates)[142] [143]

Energy Efficiency Obligations, which are also called "White Certificates" are a legislative approach to incentivize energy savings by obligated parties. It requires obligated parties to achieve a quantitative amount of energy savings during a certain period by the end user. This is aimed to be ensured through financial penalties if the obligated party does not fulfil its obligations. However, white certificates can also be bought or sold to other parties that are obligated to the mentioned obligations.

EEOs have been established in several countries like the US, Canada and predominantly by member states of the EU. The implementation of EEOs can differ per state as their essential characteristic is the obligated energy reduction. In the EU for example this energy reduction is set at 1,5% of annual sales to the final consumer according to article 7 of the European Energy Efficiency Directive (EED). In most cases the obligation is placed on regulated distribution utilities or on competitive energy retailers. However, simply raising money from distribution companies in order to set up a fund is also a possibility of how to implement EEOs.

This tool is not really one financial instrument, but rather a legislative approach. However, it still is of interest for our purposes as it provides an incentive for energy suppliers to engage into retrofitting issues as a potential source of achieving the obligated energy reductions. Furthermore, it is mentioned that barriers to improved energy efficiency can be and have been overcome through

[142] https://ec.europa.eu/energy/en/topics/energy-efficiency-directive/obligation-schemes-and-alternative-measures
[143] http://www.raponline.org/document/download/id/8029

well-designed EEOs. Additionally, Lees and Bayer underline the use in the residential sector of EEOs to overcome several issues like the "Lack of personalized advice on the most effective measures that end-users can undertake limited technical knowledge of the end-user, lack of finance on affordable terms, high transaction costs, split incentives, such as between a landlord and tenant or a product manufacturer and end-user, lack of confidence in the quality of available options, hassle in researching unfamiliar trades and often the need for more than one trade (heating and insulation) to be addressed"(Lees and Bayer, 2016, pp.14).

Example1: Energy Efficiency Obligation Scheme (Ireland)[144] [145]

In Ireland the Sustainable Energy Authority of Ireland (SEAI) administered the EEOs within the countr. The project to facilitate meeting national and European climate goals started in 2014 and is aimed to end in 2020. Obligated parties can facilitate energy savings/reductions via two ways, which is technical (provision of certified energy practitioner to carry out energy audits, implementation of energy management systems, identifying energy efficiency opportunities, measuring and verifying savings once opportunities have been realised), financial support (direct monetary support of projects, facilitation of low interest loans, negotiation of discounts on materials, reduced energy prices or tariffs) or even both. In the residential sector the SEAI provides energy credits to obligated parties for each unit saved. After each implementation that results in energy savings, the costumer provides written consent to SEAI that energy credits are provided accordingly. On top of that the obligated party needs to provide evidence that the savings would not have been realized at all, as quickly, or to the same degree as without the help of the provider. Moreover, the SEAI audits 5%-10% of the energy efficiency measures to ensure validity of the credits even further.

11.2 Green Bonds[146] [147]

Green bonds can also be used to finance retrofitting. However, the issue is that building owners cannot set up a green bond on their own but would rather need the help of their municipality or similar. The Green Bond Principles (2018) define green bonds as "any type of bond instrument where the proceeds will be exclusively applied to finance or re-finance, in part or in full, new and/or existing eligible Green Projects and which are aligned with the four core components of the

[144] https://www.seai.ie/resources/publications/EEOS-Guidance-Document.pdf
[145] https://www.seai.ie/energy-in-business/energy-efficiency-obligation-scheme/
[146] https://www.icmagroup.org/green-social-and-sustainability-bonds/green-bond-principles-gbp/
[147] https://www.investopedia.com/terms/g/green-bond.asp

GBP". Thus, they are bonds that are specifically used to finance projects regarding environmental and climate change. In 2017 USD 157 billion of green bonds have been issued on the green bond market and are projected to reach up to USD 300 billion in 2018 (Climate Bonds Initiative, 2018)[148]. From a transaction cost perspective, green bonds tend to be more expensive than traditional bonds as the use of the proceeds have to be monitored and reported. However, they often offer tax exemptions or tax credits. The GRESB green bond guidelines for the real estate sector states that retrofits meet the guidelines for green bonds as they definitely serve the aspect of energy efficiency and might even be able to apply the aspect of renewable energy (GRESB, 2016)[149]. Hence, they can be used for retrofits, but only when the municipality actively supports and creates a green bond.

[148] https://www.climatebonds.net/market/explaining-green-bonds
[149] https://gresb.com/wp-content/uploads/2017/07/Green-Bond-Guidelines-for-the-Real-Estate-Sector.pdf

Table 4: Funding and Subsidies by Country

	Direct subsidies/ funding	Advantages through taxation	Attractive financing	Other funding
Austria	From federal state and partly from the nine provinces	None	Public low cost loans, annuity grants	Specific grants for demonstration projects within R&D programs
France	From the state agencies (ANAH, ADEME), regions and municipalities.	Lower VAT rate when the building is older than 2 years.	Zero interest loans for individual owners and groups of owners.	"White certificate" paid by energy supplier to customers who save energy. Third party financing.
Germany	On city level: X €/m^2	None	KfW: reduced loans	Market incentive programmes (solar thermal, CHP etc.), roof renting for PV, contracting for heat delivery.
Hungary	The financial frame this year was ca. 3 million €, enough for 15-20 buildings.	None	"Green" credits from some banks for refurbish-ments. It's a very small part of the credit market.	Saving account for housing. Clients save small amounts regularly for min. 4 years and get subsidy. The money has to be spent on housing and/or energy saving.
Sweden	Max. 35% of the investment cost for installation of PV.	Tax reduction of ca 5 800 € on repair works on buildings (not only energy efficiency measures).	None	None
England	Energy Companies Obligation: supplier offers subsidies to reduce energy usage/fuel bills. Feed in tariff: a financial incentive for the generation of electricity. Renewable Heat Incentive: a financial incentive for the generation of heat from a renewable source.	None	The Green Deal: the cost of energy improvements is recovered from future electricity bills, by using the financial savings from the measures.	Locally based schemes or offers available through independent organisations or councils and local authorities.
Scotland	HEEPS:ABS, ECO, Energy Assistance Scheme (EAS)	Landlords Energy Saving Allowance (LESA)	Green Deal (loans), Feed-in Tariffs, Renewable Heat Incentive will be available 2014.	There may be other local funding sources available.