WELLBASED

D5.1 Analysis of existing and alternative ways of financing urban health interventions aimed to tackle energy poverty

WP5 – Policy recommendations, scale-up & transferability

Deliverable Lead and Editor: MUTK

Contributors: KVC, TNO, LNV

17/12/2024

Funded by the Horizon 2020 Framework Programme of the European Union

WELLBASED has been funded by the European Union's Horizon 2020 Programme under the Grant Agreement GA 945097. The contents of this publication are the sole responsibility of MUTK and do not necessarily reflect the opinion of the European Union.

WP No.: 5

Deliverable No.: 5.1

Lead researcher: Gabor Balás (MUTK)

Authors:

- Andras Varro, Luca Koltai, Gábor Balás, Barnabás Körmöndi (MUTK)
- Rebeca Lucas, Belén Costa (KVC)
- Joram Nauta, Bartje M. Alewijnse (TNO)

Level of Dissemination: Internal

Revision History

Versions:

Version No.	Person in charge	Partner (acronym)	Date	Specifications
1 - TOC	B. Körmöndi	MUTK	30/11/2022	
2 – 1st content draft	B. Körmöndi, R. Lucas, B. Costa J. Nauta, B.M. Alewijnse	MUTK, KVC, TNO	31/05/2023	
3- Revised first content draft	Varro, L. Koltai, G. Balás	MUTK	31/01/2024	
4 – 2nd content draft	Varro, L. Koltai, G. Balás R. Lucas, M. Ferrando, B. Costa J. Nauta, B.M. Alewijnse	MUTK, KVC, TNO	02/04/2024	
5 – Final draft	Varro, L. Koltai, G. Balás	MUTK, KVC, TNO	15/11/2024	

	R. Lucas, M. Ferrando, B. Costa J. Nauta, B.M. Alewijnse			
6 – Peer review	Hardy D., Blackburn S. Pilar J.	LCC, VCE		
7- Final version	Varro, L. Koltai, G. Balás R. Lucas, M. Ferrando, B. Costa J. Nauta, B.M. Alewijnse	MUTK, KVC, TNO	12/06/2024	
8- Final review	Garcia, N.	VIC	10/12/2024	

Statement of originality

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation, or both.

Table of contents

List of figures

List of tables

List of acronyms

- EP – Energy Poverty
- ESCO – Energy Service Company
- H2020 – Horizon 2020
- MS – Member States
- SIB – Social Impact Bond
- UFM – Urban Financial Metabolism
- WP – WorkPackage
- WUP – WELLBASED Urban Programme

1 Executive summary

Introduction

Work Package 5 is focused on the translation of Wellbased outcomes into policy recommendations. This deliverable centres on the analysis of applied financial mechanisms in other European projects, besides searching for alternative ways of financing health interventions in the field of energy poverty.

Background and history of financial models

In the **Background and history of financial models** chapter the relationship between energy poverty and health is introduced. Available data and literature show that winter and summer energy poverty have serious consequences on people's health and cause high costs for the citizens and state budgets.

The Commission Recommendation on energy poverty emphasises that households affected by energy poverty **have limited access to commercial loans, they face barriers access finance for investments, therefore these households need public financial support.** This support can take the form of a direct upfront subsidy, a direct payment of the energy efficiency or renovation works, a public loan that allows households to pay back the public investment as they save on energy bills, zero-to-low interest loans or any other innovative way of financing to help them finance energy renovation works.

Introduction of selected models

In the chapter "Introduction of selected financial models" we are introducing 7 financial instruments which aim to alleviate energy poverty and its negative effects. The selected models are a) applied in Europe, b) include a targeting of low-income households, c) include direct financial assistance either for consumers or social service providers, d) take health, wellbeing and social aspects into consideration in some form.

Social Impact Bond

A full chapter is dedicated for the **Social Impact Bond (SIB)** which is a novel tool to finance innovative social projects. It is a new approach to address social issues that relies on result-based or pay-for-success financing. SIBs have emerged as one of the most innovative financial instruments designed to support the social service sector in the delivery of innovative social programs, but has never been applied in the field of energy poverty before.

A case study of the Social Impact Bond (SIB) has been applied to the challenge of reducing energy poverty within the framework of the Valencia pilot in the WELLBASED project. Valencia´s intervention, deployed during the first year, aimed to increase energy efficiency and combat energy poverty by offering citizens energy audits at home, energy efficiency kits, bill optimisation advice, and coaching.

In the scenario analysed, the investment necessary to deploy a WELLBASED intervention using a SIB is recovered from year 6 (where savings for the public administration (SSD) are already present), and from year 7 onwards, savings for the public administration - who no longer needs to pay for electricity bills - and families will continue. Thus, SIBs could be considered as an alternative new instrument at the disposal of local authorities and policy makers to scale up and finance interventions that combat energy poverty and

increase the wellbeing of citizens. However, a word of caution is necessary. Due to their nature and complexity, SIBs call for simple and straightforward indicators and metrics to measure the success of the intervention, on the basis of which, investors will be paid back. With this exercise, our attempt has been to investigate the feasibility of SIBs using a single and straightforward indicator, identifying a specific government department (the Social Security Department) that will achieve savings as a result of the intervention. The field is open for further research in the direction of testing other indicators (e.g. health indicators) alone or in combination that reflect the complexity of the energy poverty problem.

Urban Financial Metabolism

The goal of Urban Financial Metabolism (UFM) methodology is to facilitate policy makers and private partners with qualitative and quantitative insights in the (collaborative) costs and benefits of interventions that help to avert energy poverty. The model analyses cash flows that run in, out, and through a neighbourhood and helps to identify indirect impacts or costs and benefits as a result of doing nothing or investing in certain interventions ans is able to compare them.

The UFM model has been applied before in the City of Groningen (The Netherlands) in a H2020 Lighthouse project called Making City in a neighbourhood consists of a residential area with a relatively high share of low income households.

Preliminary results show that some cash flows stay in the neighbourhood, and others leave it or even the city and/or municipality of Groningen in the form of taxes for example. In contrast with intervention scenarios, more money is leaving the municipality than coming in or being spent internally. This indicates that the **cost of doing nothing harms the local economy.**

The UFM model can be replicated and applied in new cities or neighbourhoods when a data gathering protocol is in place and the required data is available and local knowledge on policies, regulations, and housing is already in place.

Conclusions and recommendations

It is increasingly recognized in more and more places that energy poverty must be tackled. The Member States of the EU are allocating increasing amounts of money, but data show that the renovation of public buildings is still the priority which means that houses with lower incomes still often lack access to finance and most of the measures which are in place are low cost type interventions.

The models introduced briefly or in a more detailed way were typically implemented on a pilot basis and have their limitations and the implementers are aware of this and working on overcoming them. The precise targeting of these models and tools requires stakeholders who are aware of local needs and target groups, therefore the transnational replication of models seems challenging.

2 Introduction

2.1 Objectives and scope of the deliverable

The overall objective of this deliverable is to review and analyse the financing models that are being applied to tackle energy poverty, primarily in the European Union and its partner countries, but also looking for good practices beyond these borders. The main focus is on those models where health aspects were also considered.

The already existing models are analysed to identify how they operate in the given economic and social environment, what kind of barriers and/or limitations decrease their effectiveness, and also the facilitators which support their functioning. Finally, the conclusions are summed up, to see what kind of lessons can we learn from these models and how they can be improved.

In recent years, however, the need to efficiently tackle energy poverty has grown dramatically as a consequence of a series of events (COVID-19 and economic and energy crisis as consequences of Russian-Ukraine war) which could potentially cause millions of people to be pushed into extreme poverty[1]. These issues have placed major pressure on policy makers to find solutions that can alleviate the crisis which requires new ways of thinking and involve more actors into finding a solution.It is already recognised that simple solutions cannot make long-lasting changes and improvements in society therefore alternative financing solutions will also be examined where more complex financial mechanisms with multiple stakeholders involved are modelled and their impact can be beneficial for much broader parts of society than only those in energy poverty. Two alternative models are analysed in this deliverable: Social Impact Bonds (SIBs) and the Urban Financial Metabolism concept (UFM).

The SIBs are a new financing instrument in the field of Energy Poverty, an outcome-based form of social impact investment that makes use of private capital to achieve social goals. Social impact bonds have the potential to tap large capital markets to launch new social services.

While the UFM is also an innovative urban governance methodology that analyses the different investments that converge on a city (or in a neighbourhood) to ensure that they in parallel serve different goals and give insights on how and where investments create benefits by creating bankable investment solutions.

To sum up, through this deliverable we give a detailed insight for our pilots in Wellbased and other interested stakeholders about existing and alternative financial models, their pros and cons and the lessons already learnt.

[1] Guan, Y., Yan, J., Shan, Y. *et al.* Burden of the global energy price crisis on households. *Nat Energy* **8**, 304–316 (2023). https://doi.org/10.1038/s41560-023-01209-8

2.2 Relation to other WPs and deliverables

This deliverable makes a baseline analysis of financial models applied to tackle energy poverty with health aspects, therefore it connects to all the work packages carrying out activities. WP2 examined in general the energy poverty related policies in Europe (T2.3 and D2.1), now the focus is on their financial background. WP3 is focusing on the pilot sites and the adaptation of their Urban Programme which also can utilize the comprehensive analysis and the conclusions of financial models. The applicability of the alternative ways in the pilots are also examined. WP4 carries out the actual research and data collection which is essential for the policy recommendations in WP5. Data can be useful for the further development and applicability of alternative financing models. In WP5 the results of this task can fuel Task 5.2 both by improving the knowledge of how existing models work and how they could be improved as well as finding alternative ways of financing energy poverty interventions by SIBs and UFM, which can contribute to enhance the scalability and replication potential in other cities. The findings and lessons learnt from this deliverable can be built into the dissemination of Wellbased results in WP6, where the potential improvements of SIBs and UFM can also be introduced.

2.3 Structure of the Deliverable

This deliverable contains information about the financial models behind the energy poverty related policies and programmes on different level in the EU and partner states. These will be analysed, highlighting the framework of the programmes, the barriers/boundaries and facilitators and the learned lessons. Then the alternative ways of financing are examined, SIBs and UFM and their theoretic applicability into the pilots' Urban Programme. The synergies between SIBs and UFM will be explored as well.

The structure of this deliverable is divided in three parts:

- In **Chapter 3 the Background and history of financial models and** few already existing and applied financing models are introduced**.**
- In **Chapter 4** the Social Impact Bonds is analysed to evaluate its applicability in the field of energy poverty.
- In **Chapter 5** the Urban Financial Metabolism concept is evaluated and described.
- In **Chapter 6** the synergies between SIBs and UFM are presented.
- Finally, in **Chapter 7** the findings and conclusions are assessed.

Although all sections of this deliverable are connected and one enriches each other, they have been prepared to be read individually.

2.4 Methodology

The deliverable mixes different kinds of methodological tools.

Desk research/literature review was carried out in order to introduce the theoritical and policy background of financial models and SIBs. Professional partners were also involved in the search for best practices, as

one of the WELLBASED events within WP5 was used to ask participants to recommend good practices which are worth to be introduced in our deliverable.

A **case study of the Social Impact Bond (SIB)** has been applied to the challenge of reducing energy poverty within the framework of the WELLBASED project. To do this, we have carried out a **pre-feasibility analysis** and **have estimated the costs and savings in case the intervention to combat energy poverty was to be scaled up to serve 1.000 beneficiaries**. To this purpose we use real data from the specific pilot intervention (WUP[2]) implemented in Valencia (Spain).

The UFM calculations are based on the **data collected within the framework of an H2020 Lighthouse project called Making City**. This project focuses on one neighbourhood called the Positive Energy District (PED) North.

Two public events (one session of the "End of Energy Forum!" and a capacity-building) have been realized within WELLBASED on the topic of Financial Models for Energy Poverty, obtaining valuable inputs from the public and the advisory board.

[2] WUP: Wellbased Urban Programme

3 Introduction of existing financial models

3.1 The need of financing: Interactions between energy poverty and health

Energy poverty negatively affects the quality of human life in many ways. As WELLBASED is focusing on the health aspect of energy poverty, in what follows we will briefly introduce the interactions between energy poverty and health based on the available literature and empirical statistics.

According to the Communication of the European Commission,[3] inefficient buildings often have both energy poverty and social problems simultaneously. This often means that people with low incomes have little control over their energy expenditure, causing a vicious circle of high energy bills, arrears, and problems with well-being and health. (European Commission, 2020). The WHO states that in climate zones with a cold season, efficient and safe thermal insulation should be installed in new housing and retrofitted in existing housing. Indoor housing temperatures should be high enough to protect residents from the harmful health effects of the cold. For countries with temperate or colder climates, 18 ˚C has been proposed as a safe and well-balanced indoor temperature to protect the health of general populations during cold seasons.[4] During the summer, a suggested range for temperature is 23-25.5 ˚C.[5]

Health shocks or risks related to household energy consumption are one of the most serious health threats worldwide.[6] The quality of our home and the equipment we use in it have a significant impact on our well-being and are even a pre-requisite for our health. Energy poverty is associated with several health risks, which are amplified by the so-called poverty trap - low-income households are more likely to live in poor-quality housing, use solid fuel, and have less access to health services on their low incomes.[7]

Inadequate comfort and sanitary conditions in housing and work environments, such as inadequate indoor temperatures, deficient air quality, and exposure to harmful chemicals and materials, contribute to lower

[3] European Commission (2020) A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives. Downloaded: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0662#footnote69

[4] World Health Organization (2018) Housing and health guidelines. Downloaded: https://ghhin.org/wp-content/uploads/Bookshelf_NBK535293.pdf

[5] Burroughs, H. E.; Hansen, Shirley (2011). Managing Indoor Air Quality. Fairmont Press. pp. 149–151. ISBN 9780881736618. Archived from the original on 20 September 2014. Retrieved 25 December 2014.

[6] Huan Liu, Tiantian Hu (2023) Energy poverty alleviation and its implications for household energy consumption and health. Environment, Development and Sustainability. v. 25., i. 3. pp. 1–21.

[7] Habitat for Humanity (2020) Éves jelentés a lakhatási szegénységről 2020. Downloaded: https://habitat.hu/sites/lakhatasi-jelentes-2020/wp-content/uploads/sites/9/2020/10/hfhh_lakhatasi_jelentes_2020.pdf

productivity, health problems, and higher mortality and morbidity.[8] The WHO estimates that the economic damage of air pollution can account for up to 19% of a country's GDP, mainly due to reduced labour productivity and healthcare costs. Good health is therefore crucial as household livelihoods rely on the health of family members. Being ill as a result of indoor smoke or having to care for sick children reduces earnings and leads to additional expenses for health care and medication.[9]

3.1.1 Winter energy poverty and health issues

The WHO states that cold air inflames the lungs and inhibits circulation, increasing the risk of respiratory conditions, such as asthma attacks or symptoms, the worsening of chronic obstructive pulmonary disease (COPD), and infection. Cold also induces vasoconstriction, which causes stress to the circulatory system that can lead to cardiovascular effects, including ischaemic heart disease, coronary heart disease, strokes, subarachnoid haemorrhage, and death. One cross-sectional study[10] in adults with COPD found better results for those who spent longer periods in an environment with an indoor temperature above 21 °C. A dose-response trend was observed for number of days with bedroom temperatures of 18 °C and above for at least 9 hours. Similarly, modelling based on the results of a randomized trial involving children with asthma found that every 1 °C increase in room temperature below the threshold of 9 °C, was associated with a small but significant increase in lung function. Bedroom exposure was shown to have a stronger association with asthmatic children's lung function than living room exposure.[11]

Studies reported significant associations between air pollution from household use of highly polluting fuels and increased weight loss and malnutrition, cough and dyspnea in adults, lung cancer, hypertension, and blindness. As elderly people are more vulnerable, the impact of inequal energy consumption on the rural elderly population was found to be more pronounced.[12] Respiratory and vascular diseases caused by fine particulate matter have been estimated to reduce life expectancy in the EU by more than eight months.[13]

In addition to air pollution, damp, mouldy living spaces also increase the risk of respiratory diseases such as asthma. Mould is caused by waterlogged walls and leaky roofs on the one hand, and unevenly cooled

[8] European Commission (2020) A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives. Downloaded: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0662#footnote69
[9] World Health Organization (2006) Fuel for life: household energy and health. Downloaded: https://iris.who.int/bitstream/handle/10665/43421/9241563168_eng.pdf?sequence=1
[10,] World Health Organization (2018) Housing and health guidelines. Downloaded: https://ghhin.org/wp-content/uploads/Bookshelf_NBK535293.pdf

[12] Huan Liu, Tiantian Hu (2023) Energy poverty alleviation and its implications for household energy consumption and health. Environment, Development and Sustainability. v. 25., i. 3. pp. 1–21.
[13] European Environment Agency (2023) Air pollution. Downloaded: https://www.eea.europa.eu/themes/air/intro

rooms and lack of ventilation on the other. Finally, mental health can be affected by poor housing conditions and the worry and anxiety associated with paying/delaying bills.[14]

The above-mentioned study of Liu and Hu (2023) empirically explored the linear and nonlinear relationships among energy use, poverty, and health at the household level. Their main finding is that the use of cleaner energy could effectively mitigate the health impact risk, and income levels were found to play an important role in regulation.

3.1.2 Energy poverty issues during summer

Researchers on the Complex Urban Systems for Sustainability and Health project state the definition of energy poverty should be changed to address the ability of a households to maintain safe indoor temperatures and consider cooling needs and overheating risks. This is an increasing concern in cities where human activity and building density cause an urban heat island effect. Urban heat islands have higher temperatures than the surrounding rural areas. Night-time temperatures remain higher, putting the most vulnerable residents at risk. The researchers explored the links between heat exposure, housing characteristics, vulnerable populations, and the risk of summer energy poverty.[15]

Households with lower income tend to be exposed to the highest temperatures during both daytime and nighttime and have lower thermal performance. Their residents are both more vulnerable to heat and less able to afford to mitigate the risks. According to the research led by Sánchez-Guevara and the co-authors (2019) in Madrid, a higher proportion of older people were at risk of heat exposure. These people are more vulnerable and at greater risk of negative health impacts. In London and Madrid, there were clear areas of overlap between vulnerable populations and heat exposure which need to be addressed as temperatures continue to increase in order to reduce the risk of summer energy poverty and negative health impacts.[16]

This increase in temperature also affects northern European countries and the indoor conditions of residential buildings during the summer which impacts the health of the inhabitants, especially in buildings without mechanical cooling. Therefore, it is crucial to study the impact of climate change on the risk of overheating and energy requirements in residential buildings, and to evaluate the effectiveness of various

[14] Habitat for Humanity (2020) Éves jelentés a lakhatási szegénységről 2020. Downloaded: https://habitat.hu/sites/lakhatasi-jelentes-2020/wp-content/uploads/sites/9/2020/10/hfhh_lakhatasi_jelentes_2020.pdf

[15] Carmen Sanchez-Guevara, Miguel Núñez, Peiró, Jonathon Taylor, Anna Mavrogianni, Javier Neila González (2019) Assessing population vulnerability towards summer energy poverty: Case studies of Madrid and London. Energy and Buildings, 190, 132-143.

[16] Carmen Sanchez-Guevara, Miguel Núñez, Peiró, Jonathon Taylor, Anna Mavrogianni, Javier Neila González (2019) Assessing population vulnerability towards summer energy poverty: Case studies of Madrid and London. Energy and Buildings, 190, 132-143.

strategies to mitigate overheating.[17] In the research of Velashjerdi Farahani et al. (2021), they conducted dynamic energy and indoor condition simulations in a new and an old apartment buildings using two climate scenarios for southern Finland in 2020 - one representing average weather conditions and the other representing extreme weather conditions.

The strategies evaluated to combat overheating included different building orientations, the use of blinds, site shading, varying window properties, the use of opening windows, a split cooling unit, and enhanced ventilation cooling and ventilation boost. The results showed a high risk of overheating in both buildings under current and projected average climate conditions, and particularly during exceptionally hot summers. These conditions could occasionally be harmful to the health of the occupants.[18]

The use of opening windows and enhanced ventilation cooling with a ventilation boost were found to be effective in improving indoor conditions under both current and future average and extreme weather conditions. However, the only solution that was able to completely prevent overheating in all spaces, with a relatively small increase in energy usage, was the installation of a split cooling unit in the living room.[19]

3.1.3 The cost of energy poverty-related health issues

Achieving a healthy interior thermal environment in a cold region requires a mix of thermal insulation and heat delivery. Constructing a well-ventilated and thermally insulated house is more technologically sophisticated and costly compared to constructing a house without insulation. However, it is probable that it Will bring health and other benefits, with some studies[20] suggesting that the cost-benefit ratio can reach as high as six. The WHO highlighted that on a macro-level, improving the energy efficiency of dwellings was found to lead to cost savings and in some countries, the clear co-benefits of retrofitted insulation on health and energy efficiency mean that these retrofits are already subsidized by governments. For example, it is estimated that improvements in occupants' health by improving housing in the United Kingdom, including

[17] Velashjerdi Farahani, A., Jokisalo, J., Korhonen, N., Jylhä, K., Ruosteenoja, K., & Kosonen, R. (2021). Overheating Risk and Energy Demand of Nordic Old and New Apartment Buildings during Average and Extreme Weather Conditions under a Changing Climate. *Applied Sciences*, *11*(9), Article 9. https://doi.org/10.3390/app11093972

[18] Velashjerdi Farahani et al. (2021)

[20] Preval, N., Keall, M., Telfar Barnard, L., Grimes, A., & Howden-Chapman, P. (2017). Impact of improved insulation and heating on mortality risk of older cohort members with prior cardiovascular or respiratory hospitalisations. *BMJ Open*, *7*, e018079. https://doi.org/10.1136/bmjopen-2017-018079

through increasing warmth in bedrooms, would save the United Kingdom health services £1.4 billion in the first year in treatment costs alone.[21]

According to the Communication of the European Commission's plan by 2030, the buildings of Europe will be less energy-consuming, more liveable, and healthier for everybody. The Commission presented a Recommendation on Energy poverty, using renovation as a lever to address energy poverty and access to healthy housing for all households, including for persons with disabilities and for older people. Moreover, as a part of the Commission's renovation wave strategy, the Affordable Housing Initiative was announced for 100 lighthouse projects that examine whether and how the EU budget resources alongside EU Emissions Trading System revenues could be used to fund national energy efficiency and savings schemes targeting lower-income populations.[22]

Recently, different tools have been designed to calculate the effect of energy efficiency measures, such as MICATool, which can support decision-makers in conducting analysis for different data and policy scenarios.[23]

3.2 Background and history of financial models

3.2.1 Energy poverty and financing

The background of energy poverty in Europe is well described in other deliverables (D2.1), therefore here the focus is on the financial aspects behind the policies and programmes.

The identification of energy poverty as an EU wide issue was first mentioned in 2009, in the third energy package[24] where Member States were called to develop national action plans or other appropriate frameworks to tackle energy poverty. Although, the first mention of energy poverty in Europe came from the UK, (1991), where it was fully equal with fuel poverty[25]. Various programmes and strategies were developed and carried out in the UK to tackle fuel poverty and until 2004 a significant success was reached, as the number of households living in fuel poverty decreased from 5 million to 1,2 million[26]. As data from 2021

[21] World Health Organization (2018) Housing and health guidelines. Downloaded: https://ghhin.org/wp-content/uploads/Bookshelf_NBK535293.pdf
[22] European Commission (2020) A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives. Downloaded: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0662#footnote69
[23] https://build-up.ec.europa.eu/en/resources-and-tools/tools/micatool-support-decision-making-calculating-energy-efficiency-measures
[24] Electricity Directive (2009/72/EC) and the Gas Directive (2009/73/EC)
[25] Schuessler, Rudolf (2014) : Energy poverty indicators: Conceptual issues. Part I: The ten-percent-rule and double median/mean indicators, ZEW Discussion Papers, No. 14-037, Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim, https://nbn-resolving.de/urn:nbn:de:bsz:180-madoc-368880
[26] Helen Stockton and Ron Campbell (2011): Time to reconsider UK energy and fuel poverty policies?, National Energy Action.

shows that the recent energy crisis has had a serious impact, as the rate of Europeans unable to keep their home adequately warm in winter increased to 9.3% after 6.9%[27]

According to the 2023 Commission Recommendation (EU) 2023/2407[28] on energy poverty, 40 million Europeans across Member States representing 9.3% of the Union population were unable to keep their home adequately warm in 2022, which indicates a sharp increase when compared to the figure for 2021, and the share has more than doubled for those people in the lower income categories. In 2023, the "Fit for 55!" package presents a first Union wide definition of energy poverty in Directive (EU) 2023/1791 (Energy Efficiency Directive, EDD)[29] of the European Parliament and of the Council coupled with provisions for the prioritisation of energy efficiency and building renovation measures among energy-poor groups and other vulnerable groups. According to the reviewed EED, energy poverty means *"a household's lack of access to essential energy services, where such services provide basic levels and decent standards of living and health including adequate heating, hot water, cooling, lighting, and energy to power appliances, in the relevant national context, existing national social policy and other relevant national policies, caused by a combination of factors, including at least non-affordability, insufficient disposable income, high energy expenditure and poor energy efficiency of homes."* However, the detailed content of the definition remains a matter for the Member States.[30]

The Commission Recommendation of energy poverty emphasizes that households affected by energy poverty have limited access to commercial loans, they face barriers to access finance for investments, therefore these households need public financial support. This support can take the form of a direct upfront subsidy, a direct payment of the energy efficiency or renovation works, a public loan that allows households to pay back the public investment as they save on energy bills, zero-to-low interest loans or any other innovative way of financing to help them finance energy renovation works. It also recommends that Member States put measures in place to prevent disconnections of consumers affected by energy poverty and vulnerable consumers through targeted financial support schemes and actions such as payment plans and energy efficiency advice, alternative supply contracts or assistance from social services and civil society organisations.[31]

In 2020, the European Commission published the "Renovation Wave for Europe" strategy[32], along with an action plan and a document with available EU fundings. This document aims to at least double the annual energy renovation rate by 2030. The strategy identifies 3 focus areas:

- tackling energy poverty and the worst performing buildings;
- renovation of public buildings;
- decarbonisation of heating and cooling.

[27] https://energy.ec.europa.eu/topics/markets-and-consumers/energy-consumer-rights/energy-poverty_en
[28] COMMISSION RECOMMENDATION (EU) 2023/2407: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302407
[29] https://eur-lex.europa.eu/legal-content/HU/TXT/PDF/?uri=CELEX:32023L1791&qid=1706181731338
[30] Magyar Energiahatékonysági Intézet (2023): A Fit for 55 és az energiaszegénység, https://mehi.hu/wp-content/uploads/2023/01/mehi-fit-for-55-es-energiaszegenyseg-2023.pdf
[31] COMMISSION RECOMMENDATION (EU) 2023/2407
[32] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

The “Renovation Wave” mobilizes renovation strategies and wishes to use them as mechanisms to handle energy poverty and improving housing conditions for all households. It also gave prominence to related bodies such as Building Stock Observatory, Horizon Europe Mission and EU Covenant of Mayors office by increasing the focus on housing improvement in EU energy poverty policy in its approach.[33]

In 2023, the Social Climate Fund (SCF) was established together with the ETS 2 to help the adverse effects of ETS2 introduction. The initiative would allocate specific financial resources to Member States to directly assist the most impacted vulnerable groups, including those suffering from energy or transport poverty, ensuring they are not neglected during the transition to a more sustainable economy. In order to fund these initiatives and investments aimed at assisting the most disadvantaged populations, the SCF will combine the income from the sale of allowances from the ETS 2 with 50 million allowances from the current EU ETS. In addition to the required 25% contribution from Member States to their Social Climate Plans, the SCF is expected to generate a minimum of €86.7 billion between 2026 and 2032.[34]

Meanwhile, the EU4Health programme, with a budget of €5.3 billion for the 2021-27 term, provides unprecedented financial support from the EU in the field of health. It recognises health as an investment. EU4Health is a definitive statement that the European Union places great importance on public health and considers it a key tool in establishing a European Health Union. Although it is not directly focusing on energy poverty related health issues, the EU4Health programme was implemented in reaction to the COVID-19 pandemic and to enhance the EU's preparedness for crises. The pandemic exposed the vulnerability of domestic healthcare systems. The EU4Health programme aims to enhance long-term health systems by fostering their strength, resilience, and accessibility.[35]

A recent study[36] states that in the current 2021-2027 funding period, EU Member States have allocated more money for renovation and energy efficiency than ever before, and unprecedented quantities of public funding are being made available. Three quarters of the €20bn of EU funds will go to projects subject to minimum energy savings criteria. Member states are prioritizing public sector investment in their planning, as they attract the highest share of funding (53%), while renovation of housing stock attracts 32%. According to the study, EU funding is expected to lead to 723.000 dwellings being renovated across the EU and 33 million m^2 of renovated floor area of public infrastructure.

Most of funding for renovation and energy efficiency within the framework of Cohesion Policy is planned under ERDF (82%), while the shares of Cohesion Fund and Just Transition Fund are 14% and 3%. Member States have provided more funding for energy renovation through the Recovery and Resilience Facility

[33] Bosseboeuf, D. et al.: Tackling energy poverty: learning from the experience in 10 European countries, IEECP, November 2021.

[34] Directive (EU) 2023/1791 of the European Parliament and of the Council (13 September 2023) on energy efficiency and amending Regulation (EU) 2023/955 (recast)

[35] EU4Health programme 2021-2027 – a vision for a healthier European Union (2021) European Commission, https://health.ec.europa.eu/funding/eu4health-programme-2021-2027-vision-healthier-european-union_en

[36] Renovate Europe (2023): 2021-2027 Cohesion Policy Support for Energy Efficiency and Building Renovation, https://www.renovate-europe.eu/wp-content/uploads/2023/04/23-04-24_MFF_21-27_Report.pdf

(RRF). Investments of RRF are concentrated in the residential sector (€23 bn, 58% of overall funding).[37] The study of Renovate Europe (2023) also calls on the Member States to carefully coordinate the public funding, to encourages private finance into the sector through programme design and support an ambitious regulatory framework both for the renovation and the financial sector.

In the EPAH good practices collection[38] the health and wellbeing aspects of energy poverty were emphasised as a growing part of local and international initiatives. Although, as the exact measurement of health conditions and quality of life of participants living in energy poverty is extremely difficult, in most cases only general conclusions were drawn through the interventions. Overall, it makes sense that improved homes and living conditions improve health conditions. However, most of the policies still lack the long-term vision regarding how best to mitigate energy poverty permanently.

EPAH also provides a guide on how to plan energy poverty mitigation actions. This suggests that while planning such actions, evaluating options, economic and social factors should be taken into consideration, alongside policy, legal, technological and environmental ones.[39]

A recent study analysed the policy measures of European countries[40] how they tried to cope with the impact of the economic and energy crisis, which severely affected millions of households across Europe. Those solutions can be the most promising and provide a comprehensive solution to vulnerable households. It can be stated that the spreading of one-stop-shops underlines their effective operation and usefulness for local citizens.

Research carried out within the EU LIFE project, RENOVERTY findings state that most of the existing policies focus on comparably low-cost activities such as subsidizing energy costs, offering consultation of improving the efficiency of appliances. This leads us to the consensus that financing support needs to be higher than than it is currently.[41]

Another study which assessed how different countries tackle energy poverty which took place in 10 selected European countries also came to the conclusion that most actions do not apply comprehensive approach regarding energy poverty. They found that most of the policies are income or direct aids to help cover energy expenses and renovation policies are beyond the reach of the most vulnerable households. This proves that the targeting of renovation programmes are less developed than targeting the aids for energy expenses.

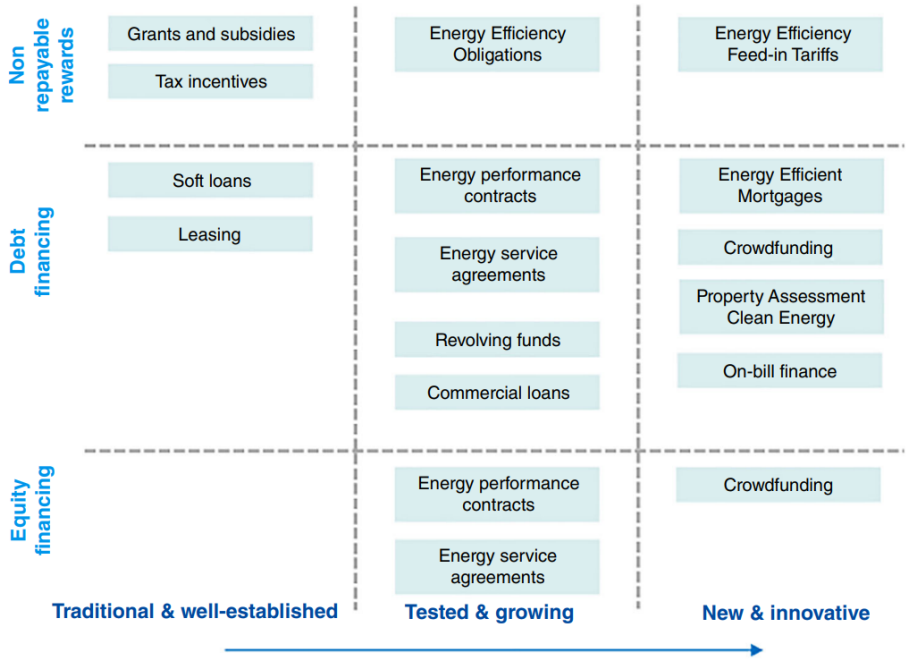
3.2.2 An overview of the operation of financial models

Financial mechanisms for energy efficiency renovations may be structured as either debt or equity funding. Within the EU, these typically range from traditional tools like subsidized loans to novel or appearing models

[37] Renovate Europe (2023).
[38] EPAH, 2021. Tackling energy poverty through local actions – Inspiring cases from across Europe.
[39] EPAH Handbook 2: A Guide to Planning Energy Poverty Mitigation Actions, April 2024.
[40] Caroline van O., Anika B., Nam C. N., Koen S. (2023). Energy Poverty: A Science and Policy State of Play. TNO
[41] RENOVERTY: Overview of policy mechanisms and financial mechanisms for renovation roadmap development (Deliverable 4.2.), 2024.

in the European market, such as mortgages specifically for energy efficiency, crowdfunding, dedicated savings accounts for renovations, and more. These can be categorized based on their type (grants that do not require repayment, debt financing, or equity financing) and their degree of market penetration (conventional/well-established, tried and emerging, or new and innovative).[42]

1. Figure: Overview of current financial instruments supporting energy renovations in the EU[43]



There are essential distinctions in the practical operation of financial tools. The diverse aspects of their design and execution encompass capital sources, mechanisms for repayment, and kinds of improvements, among others. While debt financing is usually associated with conventional amortisation plans, the unique characteristics of energy efficiency investments can open up more creative channels for repayment, such as property taxes, utility bills, etc.[44] In their design, another crucial factor to take into account is the capital framework. This could originate from either public or private resources and encompass investments in venture capital and equity, as well as mezzanine financing. Subordinated debt finance, often known as mezzanine financing is a more cost-effective option for sustainable energy project developers compared to

[42] Bertoldi, P., Economidou, M., Palermo, V., Boza-Kiss, B., & Todeschi, V. (2021). How to finance energy renovation of residential buildings: Review of current and emerging financing instruments in the EU. WIREs Energy and Environment, 10(1), e384. https://doi.org/10.1002/wene.384
[43] Bertoldi et al., 2021
[44] Bertoldi et al., 2021

equity market financing. It typically does not require giving up control of the company and enables companies to raise enough capital to meet the debt-equity requirements of senior lenders.[45]

In the case of debt financing, collateral options might encompass the property itself for mortgages, utility bills for on-bill models, property tax, or occasionally, special government guarantees. These guarantees are established to mitigate the perceived risks of financial institutions, especially concerning client defaults or late payments. Within public-private partnerships, governments have the option to subsidize interest rates, enabling banks to provide preferential interest rates in their loan financing products to their customers. Banks may also consider reducing interest rates as it becomes increasingly clear that these energy efficiency investments boost consumer purchasing power by raising disposable income due to decreased energy bills.

Tax credits and deductions for the purchase/installation of energy-efficient products, building components, or comprehensive renovations can also be provided as independent incentives or combined features alongside other financial products. Additional enhancements encompass extended underwriting criteria, subsidized transaction costs, etc. Lastly, these tools can be linked to other instruments, including revolving funds, where loan funds are recycled and re-lent for further energy efficiency investments.[46] Governments can impose energy efficiency obligations on energy firms, which take the form of distinct energy conservation goals. An example of this is the mandate for energy savings equivalent to 1.5% of yearly sales to end consumers, as outlined in Article 7 of Directive 2012/27/EU.[47] Energy firms utilize their technical expertise to achieve or secure energy savings for their clientele, thereby contributing to some financing.[48]

According to another categorisation, three options for financing energy efficiency improvements can be identified:[49]

1. ESCO Financing: financing with internal funds of the ESCO and may involve own capital or equipment lease;
2. Energy-user/customer financing: usually involves financing with internal funds of the user/customer backed by an energy savings guarantee provided by the ESCO
3. Third-party financing (TPF): it refers solely to debt financing. In this case project financing comes from a third party, e.g. a finance institution, and not from internal funds of the ESCO or of the customer.

[45] Bertoldi, P., & Rezessy, S. (2010). Financing energy efficiency: forging the link between financing and project implementation. Ispra: Joint Research Centre of the European Commission. https://build-up.ec.europa.eu/sites/default/files/content/financing_energy_efficiency.pdf

[46] Bertoldi et al., 2021

[47] Fawcett, T., Rosenow, J., & Bertoldi, P. (2019). Energy efficiency obligation schemes: Their future in the EU. Energy Efficiency, 12(1), 57–71. https://doi.org/10.1007/s12053-018-9657-1

[48] Bertoldi et al., 2021

[49] ESCO Financing options:https://e3p.jrc.ec.europa.eu/articles/esco-financing-options

Concerning the stakeholders involved in financing actions against energy poverty, in case of financial instruments like grants and subsidies, the buildings or households best suited are vulnerable or low-income households and hard to reach properties (e.g., rented properties). In terms of preferential loans, households with sufficiently high credit score are best suited. While, in case of revolving funds it depends on the financial product supported by fund what kind of buildings and households are best suited. Moreover, in terms of energy performance contracts and energy service agreements large condominiums are the best suited. In case of energy efficient mortgages creditworthy homeowners are the best suited. In terms of property assessment clean energy the best suited are only the property owners. Meanwhile, in case of on-bill finance the rented properties are the best suited. In addition, the crowd-funding is the best suited for communal projects. Last but not least, the financial instruments that are the most suitable for all kinds of buildings and households are the energy efficiency obligations and the tax incentives.[50]

There is no universal solution to tackle energy poverty. Recognising energy poverty either as social or energy-related issue is a key determinant of the type of policy measures that are put in place[51]. If financial aids are provided as part of social policy, competition is less distortive, and most vulnerable households will be affected, but they rely heavily on public expenditure. On the other hand, mechanisms within energy policy (such as grants for energy-efficiency improvements, tax reductions for energy-saving investments) might have a more positive effect on environmental and health costs attributed to inappropriate housing conditions.[52]

Different solutions can be identified according their time-orientation (past, present or future problem-solving) as well. Income-based financial aids make households able to cover their energy bills, but do not take the root of their problem (e.g. the inefficiency of the building stock and obsolete heating systems) into consideration, thus preventive policies are equally important. Recognising the different paths enables greater flexibility in choosing the appropriate policies.[53]

3.2.3 The three degrees of market penetration of financial models

In terms of **(1) traditional and well-established financial instruments**, they are already operational and used across numerous EU countries, can help in the creation of an emerging market by offering liquidity and

[50] Bertoldi et al. 2021
[51] Primc, K. – Slabe-Erker, R.: Social policy or energy policy? Time to reconsider energy poverty policies, in: Energy for Sustainable Development 55 (2020), 32-36.
[52] Bollino, C. A., & Botti, F. (2017). Energy poverty in Europe: A multidimensional approach. PSL Quarterly Review, 70(283), 473–507.
[53] Primc, K. – Slabe-Erker, R, 2020.

immediate capital access. The conventional mechanisms such as grants, subsidies, tax incentives, and loans can be utilised to facilitate the creation of a new market during its early phases and offer financial resources and direct access to capital. While they can be custom-made to offer support to people who are at risk and can be utilised with other methods, they often prioritise individual interventions and small-scale initiatives. Under certain circumstances, when the instrument's intensity is high, it can facilitate major refurbishments.[54]

In EU Member States, several (2) financing tools are currently under trial and expansion. These include Energy Efficiency Obligations (EEOs), Energy Service Companies and Energy Performance Contracts (ESCO and EPCs), as well as Energy Service Agreements (ESAs). Moreover, (3) the 'innovative' strategies are designed to address some of the primary obstacles related to financing energy efficiency in the EU. These 'innovative' strategies could be based on funding models that allow a loan to be repaid from energy savings, similar to Energy Performance Contracts, but through different participants (for example, utilities or local authorities), thereby eliminating the need for initial capital. They can manifest as property assessment clean energy or on-bill financing. Since debt financing usually needs to be in line with limitations related to existing mortgages, energy mortgages can also present a viable alternative. Energy mortgages can be classified into two categories: Energy Efficient Mortgages (EEMs) and Energy Improvement Mortgages (EIMs). An Energy Efficient Mortgage (EEM) is a type of loan that offers a lower interest rate and incorporates the energy efficiency improvements of a building into the mortgage. This allows consumers to boost their purchasing power when buying a home and ensures that the energy savings are taken into account during the property evaluation process. In the United States, EEMs are commonly utilised to finance the acquisition of a new home that is already designed to be energy efficient, such as a property that meets the Energy Star qualification.[55] The success of these financing tools is influenced by factors such as the capital cost, the simplification of processes, and the potential to also facilitate non-energy initiatives, like general enhancement projects.[56]

3.2.4 Barriers to financial models

Numerous thoroughly examined obstacles for homeowners contribute to the less-than-ideal level of renovation procedures. These include

- tenant-owner dilemma
- insufficient or poor information regarding costs and associated benefits

[54] Bertoldi et al., 2021
[55] Bertoldi et al., 2021
[56] Brown, D., Sorrell, S., & Kivimaa, P. (2019). Worth the risk? An evaluation of alternative finance mechanisms for residential retrofit. Energy Policy, 128, 418–430. https://doi.org/10.1016/j.enpol.2018.12.033

- substantial initial investment costs
- the decision-making process[57],
- limited access to financing[58] and
- a shortage of accessible private capital.[59]

From the perspective of financial institutions, several obstacles are frequently mentioned, including

- high transaction expenses,
- small-scale projects,
- perceived risks linked to credit or projected energy savings[60].
- the financing duration may not align with the lengthy payback period of energy renovation projects in buildings.

Furthermore, the limited practice of underwriting energy-efficiency loans and the absence of standardized methods for measuring and verifying energy savings are significant deterrents[61]. The elevated interest rates typically associated with financial products for energy efficiency can be partially attributed to the scarcity of liquidity and exit strategies for investors in secondary markets.[62]

Another difficulty which should be mentioned is the targeting of the subsidies. As IEECP concludes in its study, if renovation programmes are provided in a non-targeted manner, energy efficiency subsidies tend to be taken up by households that do not fall in the lowest income groups. The requirement for co-financing and/or upfront financing and complex administrative procedures may also prevent such households accessing this funding. Therefore, the IEECP study suggests that in order to include low-income groups in

[57] van Oorschot, J., Hofman, E., & Halman, J. (2016). Upscaling Large Scale Deep Renovation in the Dutch Residential Sector: A Case Study. Energy Procedia, 96, 386–403. https://doi.org/10.1016/j.egypro.2016.09.165

[58] Bertone, E., Sahin, O., Stewart, R. A., Zou, P. X. W., Alam, M., Hampson, K., & Blair, E. (2018). Role of financial mechanisms for accelerating the rate of water and energy efficiency retrofits in Australian public buildings: Hybrid Bayesian Network and System Dynamics modelling approach. Applied Energy, 210(C), 409–419.

[59] Vogel, J. A., Lundqvist, P., & Arias, J. (2015). Categorizing Barriers to Energy Efficiency in Buildings. Energy Procedia, 75, 2839–2845. https://doi.org/10.1016/j.egypro.2015.07.568

[60] Cooremans, C., & Schönenberger, A. (2019). Energy management: A key driver of energy-efficiency investment? Journal of Cleaner Production, 230, 264–275. https://doi.org/10.1016/j.jclepro.2019.04.333

[61] Bertoldi, P., & Kromer, S. (2006, November 20). Risk Assessment in Efficiency Valuation—Concepts and Practice. JRC Publications Repository. https://publications.jrc.ec.europa.eu/repository/handle/JRC33581

[62] Zabaloy, M. F., Recalde, M. Y., & Guzowski, C. (2019). Are energy efficiency policies for household context dependent? A comparative study of Brazil, Chile, Colombia and Uruguay. Energy Research & Social Science, 52, 41–54. https://doi.org/10.1016/j.erss.2019.01.015

financing, 95-100% of the investment should be covered.[63] Additionally, if the available amount is not high enough, it may reduce the amount of renovations, and force households to apply low-cost measures.[64]

The research of Horizon 2020 project, ComAct notes that unclear national definitions of energy poverty hinder "the development of accessible financing, because current policy efforts still largely revolve around the applicable concept of vulnerability".[65]

The RENOVERTY study confirms that financial barriers are the most common ones for the households, but additional difficulties were identified as well:[66]

- awareness and access barriers: lack of technical knowledge and information about energy efficiency;
- geographical barriers: people in rural areas have difficulty in accessing professional advice for planning and financing
- regulation barriers: unsupportive and inconsistent policy setting plus regulators who prioritize bigger cities in improving energy efficiency.

The process of energy retrofitting in apartment buildings requires a collective decision-making approach. This complexity is often seen as a significant obstacle to the implementation of retrofitting initiatives. The diverse characteristics of the residents, such as age, educational background, income, and occupancy status, along with their differing interests and viewpoints, can pose challenges in uniting them for a shared objective.[67]

The study *Creating an enabling environment for accelerating condominium energy retrofitting: case studies in Grenoble (FR) and Brussels (BE)*[68] shares insights on apartment renovation projects. These case studies delve into the factors necessary to foster an environment that encourages the rapid implementation of energy retrofitting in apartment buildings. These studies were conducted as part of the Interreg NWE "ACE Retrofitting" project.

[63] IEECP. (2022). A Socially-Just EU Renovation Wave. Amsterdam: Institute for European Energy and Climate Policy.
[64] RENOVERTY, D4.2., 2024.
[65] ComAct. (2024). Financing models adapted to the needs of energy-poor households & policy recommendations., p. 2., Sofia: Center for Energy Efficiency EnEffect
[66] RENOVERTY, D4.2., 2024.

[67] Monfils, S., & Zeijl-Rozema, A. van. (2021). Creating an enabling environment for accelerating condominium energy retrofitting: Case studies in Grenoble (FR) and Brussels (BE). *IOP Conference Series: Earth and Environmental Science*, *855*(1), 012020. https://doi.org/10.1088/1755-1315/855/1/012020

The case studies reveal that the success of a retrofitting project depends on more than just facilitating the process or providing a financial plan. One of the key factors to consider is social acceptance, which plays a central role in the decision-making process for retrofitting projects. It involves a mix of committed co-owners, a proactive building manager, patient and outgoing building professionals, process facilitation, local, regional, and national policies or laws, appropriate financing mechanisms, subsidies, communication, and in this instance, previous examples.[69]

Researchers face difficulties while studying policies and measures. In many cases, data about budget, number of beneficiaries or participants, outputs and impacts are not available, therefore evaluations will likely remain rare, which creates limitations for sharing experiences, identifying success and failures and supporting policy improvements.[70] We also encountered this problem while looking for good practices, as it will be presented in the next chapter.

The study of Monfils and Zeijl-Rozema (2021) suggests that the organisational level is of immense importance. However, without the right legislation (acting as both a deterrent and an incentive) or financial incentives, the organisational level may not be very effective. Additionally, the interpersonal and individual levels must be open and well-organised to allow for free information flow between the various levels.

Establishing a conducive environment for retrofitting takes time. Moreover, the type of environment that encourages retrofitting varies across different regions in Europe, underscoring the need for increased focus on apartment buildings at local, regional, national, and European levels.[71]

3.2.5 Financial models popular in specific countries

RENOVERTY research found that despite a common European framework existing, there are differences in terms of adequate funding among the different regions of Europe (in this case, the pilot areas): in certain regions 100% financing was available while there were pilot areas where in practice no funding was available. As the research concludes, the adoption of national policies on alleviating energy poverty is not universal, and in some of the pilot areas, very limited funding was available.[72] Other research[73] also states that there is a disconnection between what happens at EU level and in the regions of the 10 countries under the scope of their investigation.

[69] Monfils, S., & Zeijl-Rozema, A. van., 2021.
[70] Bosseboeuf, D. et al, 2021.
[71] Monfils, S., & Zeijl-Rozema, A. van., 2021.
[72] RENOVERTY: Overview of policy mechanisms and financial mechanisms for renovation roadmap development (Deliverable 4.2.)
[73] Bosseboeuf, D. et al, 2021.

Various elements influence the choice and implementation of financial tools at a national scale, such as past experiences, political approval, involvement of stakeholders, societal views, and the state of the economy, among others. It is common for nations to opt for a mix of diverse instruments to boost the appeal and effectiveness of a particular tool, while also serving a broad spectrum of buildings, users, and requirements. This fusion could take the shape of loan guarantees, subsidies paired with energy performance contracts, and more.[74]

Debt financing, particularly through loans, has been an effective method for amplifying investments in energy efficiency by providing enhanced liquidity and direct capital access. Several EU Member States have introduced new credit facilities specifically designed for energy efficiency enhancements, such as the 'Residential Energy Efficiency Credit Line' in Bulgaria, 'Public financing' in Estonia, and the 'Zero-rated eco loan' in France, indicating their growing appeal in the area. Favourable loans, like those managed by Germany's KfW bank, aid in the realization of more comprehensive renovations while offering competitive interest rates and extended repayment durations.[75]

Tax benefits, either as independent policies or as supplementary features with debt financing, are viewed as a key tool in backing energy efficiency investments in several EU nations, including Italy, France, Belgium, and Denmark. These incentives, which are generally less expensive than grants and subsidies, can facilitate the adoption of energy renovations by decreasing their cost via tax reductions for households and businesses. The Ecobonus tax benefit in Italy, which can now be passed on to the service provider in return for a discount, thereby promoting broader usage, has made a substantial difference in the Italian market. Moreover, energy performance contracts have seen an increase in acceptance across numerous EU countries in recent years, despite their application being limited to a small portion of residential structures (specifically, large multifamily or social housing units).[76]

Concerning the stakeholders involved in the above mentioned financing actions, they do not focus exclusively on energy poverty or vulnerable households and homeowners. In terms of energy performance contracts, large condominiums are the best suited. Moreover, the financial instruments that are Best suited for all kinds of buildings and households are the tax incentives.

[74] Bertoldi et al., 2021
[75] Bertoldi, P., Economidou, M., Palermo, V., Boza-Kiss, B., & Todeschi, V. (2021). How to finance energy renovation of residential buildings: Review of current and emerging financing instruments in the EU. WIREs Energy and Environment, 10(1), e384. https://doi.org/10.1002/wene.384
[76] Bertoldi, P., Economidou, M., Palermo, V., Boza-Kiss, B., & Todeschi, V. (2021). How to finance energy renovation of residential buildings: Review of current and emerging financing instruments in the EU. WIREs Energy and Environment, 10(1), e384. https://doi.org/10.1002/wene.384

4 Introduction of selected models

4.1 Scope of the solutions under investigation

In this chapter we are introducing a couple of financial instruments that aim to alleviate energy poverty and its negative effects. The selected models meet the following criteria:

- they are applied in Europe and cover the widest possible range of the countries
- they include a targeting of low-income households
- they include direct financial assistance either for consumers or social service providers
- health, wellbeing and social aspects are emphasized besides energy efficiency

Our selection is based on desk research and we also used one of our events (End Energy Poverty! Forum) to collect best practices (e.g. participants were asked to recommend best practices during a breakout room session and we have them the opportunity to send us these in writing at a later date).

Our goal was to collect existing practices which are innovative, target groups are well defined, and multiple stakeholders are involved. The selected cases are introduced in same format. For the assessment of the selected means we used materials which are freely distributed.The list is not comprehensive, and it was selected on a subjective basis. The quantity of the publicly availabe information on the models presented is not homogenous, therefore their description cannot be consistent either. Programme evaluations are not prepared or publicly available for all examples presented, so in some cases information on barriers and/or on conclusions and recommendations is missing from the presentation.

4.2 Warm Home Prescription Programme[77]

4.2.1 Short description

The Warm Home Prescription (hereafter: WHP) is a novel initiative launched by Energy Systems Catapult, currently under testing in England and Scotland. It is designed to assist individuals who find it challenging to meet their energy needs and suffer from severe health issues exacerbated by cold conditions. The service enables these individuals to maintain a warm and healthy environment at home during the winter months, thereby avoiding hospitalization, while also reducing their home's energy usage and carbon footprint.

4.2.2 Objectives

The objective of this trial is to evaluate the impact of providing a low-carbon, warm home on improving individuals' health and decreasing their reliance on healthcare services. This could result in substantial savings for the National Health Service (hereafter: NHS) and alleviate the burden on its frontline staff. As

[77] Sources: Warm Home Prescription (2024); Kizilcec et al. (2023)

transition towards a smart, flexible, Net Zero energy system, the concept of a warm and healthy home should be at the heart of any consumer-focused vision for altering home energy usage.[78]

4.2.3 Target group(s) and scope

The UK is struggling with the immense task of ensuring its energy system caters to all consumers, both present and future. The ongoing cost-of-living crisis and escalating domestic energy costs have underscored the need for products and services tailored to consumers in vulnerable circumstances. Millions of individuals with health conditions, such as respiratory and cardiovascular diseases, are at heightened risk due to living in cold homes. It is estimated that in 2020, cold homes were the cause of death for 10,000 people.

The so-called Fair Futures team of the Energy Systems Catapult, comprised of experts, recognized the need for a more effective support solution. Drawing from past research and studies focused on aiding individuals whose health conditions are exacerbated by the cold, they proposed an innovative question: What if a low-carbon warm home could be prescribed by the health service to households in need?

Purchasing the energy that the most vulnerable individuals require but cannot afford could enable them to maintain a warm and healthy home environment, preventing illness and the associated costly care. Collaboration with the NHS, who have insights into the population's health and the costs related to living in a cold home, could significantly enhance targeting efforts.

4.2.4 Outcomes & Impact on health

The service is designed to provide swift and effective assistance:

- Teams from the NHS, which include social prescribers and complex care teams associated with GP practices, pinpoint patients who qualify for the service.
- These patients are then contacted by the NHS and presented with a "warm home prescription" that is facilitated by local energy advisors, who then credit the patients' energy accounts.
- This allows patients to promptly begin heating their homes to a healthy temperature.
- Where feasible, additional enhancements to home energy are organised.

After the successful pilot of the WHP project in Gloucestershire, which involved 28 homes in 2021/22, Energy Systems Catapult expanded the initiative. In collaboration with local NHS partners and local energy advice organizations, they conducted the largest trial of its kind in 2022/23. This trial supported 823 individuals in Aberdeen, Middlesbrough, Gloucestershire, and London who were in vulnerable situations or had low incomes.

The results from the 2022/23 trial strongly endorsed the positive impact of the WHP project. Both recipients of the WHP and healthcare professionals reported beneficial outcomes. The trial demonstrated the significant value of the WHP project to vulnerable and low-income individuals, with over 80% of recipients

able to heat their homes to higher temperatures than in previous years. Furthermore, 51% of WHP recipients were able to heat their homes to temperatures at least 2 degrees warmer than before.[79]

The trial also showed substantial improvements in the health and well-being of individuals due to a warmer home:

- 79% of recipients reported a positive impact on their physical health,
- 70% stated that it improved their mental health. In total, 98% of WHP recipients expressed a willingness to participate in the project again, with 93% emphasizing the importance of maintaining warmth in their homes.

The project's delivery staff were pleased with their experience, with 94% of healthcare professionals and 77% of energy advisors expressing satisfaction. Overall, 93% of delivery staff expressed a desire to see the WHP project offered again during the winter. The benefits highlighted include:

- Easing the financial burden on the NHS and freeing up hospital beds,
- Actively assisting vulnerable individuals through the winter,
- Reducing financial pressures for vulnerable and low-income households,
- Helping individuals feel sufficiently warm and comfortable in their homes.

4.2.5 Limitations/barriers

No information available.

4.2.6 Conclusions and recommendations

The task force for the WHP has formulated four primary suggestions to ensure that the findings from the 2022/23 WHP trial across England and Scotland continue to influence the collaboration between the health and energy sectors, enabling individuals to maintain warmth and wellness at home.

These suggestions are based on insights into how the WHP service affected individuals' health, well-being, and utilisation of health services. They have been developed through the WHP taskforce's discussions and the research and feedback that Energy Systems Catapult has received on the WHP service.

- Determine the number of individuals at risk and their locations.
- Enhance the exchange of knowledge regarding collaborations between the energy and health sectors.
- Shape future domestic energy assistance to enable households to maintain a warm, healthy home.
- Allocate funding for innovation to ensure the development of future products and services that can provide households at risk from the cold with a warm, healthy home.

4.2.7 More information

https://es.catapult.org.uk/project/warm-home-prescription/

4.3 Dampoort KnapT OP![80]

4.3.1 Short description

This is an experimental initiative led by OCMW Ghent (the Public Centre for Social Welfare of the city), in partnership with the non-profit organization CLTGent (a community land trust). The initiative offers a renovation fund that the homeowner or occupants are only required to pay back upon the sale of the property or any other form of property transfer. Emergency purchasers possess their residences, even though they are in a poor condition, and they do not have the necessary funding required to undertake refurbishment works. Through the provision of upfront financing and group-oriented renovation advice, Dampoort KnapT OP! provides an opportunity for ten emergency purchasers in Ghent's Dampoort area to upgrade their homes in a manner that is both high-quality and energy-efficient. CLTGent contributes by offering advice and recommendations for the renovation strategies.

The technical partner involved in the construction offers support for renovations (relief). The allocation of the available budget is a joint decision made by the participants and the supervisor. The guidance provided is tailored to the needs of the participants and balances the focus on improving living conditions and reducing energy consumption. Potential premiums can slightly increase the budget. The supervisor is responsible for obtaining quotes, conducting regular site visits, closely overseeing the work, assisting with the application for premiums, etc. After verifying the invoices, the OCMW makes direct payments to the contractor.

Residents who are unable to stay in their homes while the renovation works take place, have the option to temporarily relocate to a transition home provided by the City of Ghent (a co-partner).

Participants are offered individual social guidance as needed. A variety of prerequisites can be addressed through direct support or specific referrals (such as debts, family issues, activation, etc.). The ten participants gather monthly in a residents' group, which fosters solidarity among the participants. The residents' group plays an active role in the community by undertaking viable projects.

4.3.2 Objectives

The refurbishment agreement stipulates that by 2050, all residences will be energy efficient. However, homeowners at the lower end of the housing market lack the means to accomplish this independently. The goals cannot be met without external investments. This financial structure (grant retention/revolving fund) benefits emergency purchasers and ensures that the government (or another financier) will eventually recoup the investments.

4.3.3 Target group(s) and scope

Homeowners, Local Authorities, Residential Neighbourhoods.

[80] Sources: Ghent Climate Plan 2014-2019 (no date), Dekeyeser (no date)

- Participants are chosen based on a well-defined 'criteria framework' (encompassing both construction technical and social aspects). The project also outlines a specific construction segment.
- For each of these households, a revolving fund, established by OCMW Ghent, allocates a budget of €30,000 for energy-efficient and high-quality home renovations. Participants receive the grant by an agreement with OCMW Ghent. To mitigate risk, OCMW secures a mortgage (typically of second rank) on the property.
- The grant serves as upfront financing. Participants are required to repay it if the property is transferred (through sale, inheritance, etc.). The profit is then split between OCMW and the participant (based on a pre and post-renovation appraisal). The participant is not liable for index increases, and OCMW recoups the investment along with a minor increase (as per a previously agreed calculation method).
- This is neither a subsidy nor a loan; it pertains to a 'grant retention' system. If the money is repaid, it will be reused in the same manner.

4.3.4 Outcomes & Impact on health

The financial structure, which relies on upfront financing and deferred repayment, serves a social stratum that would typically be unable to undertake renovation projects. Dampoort KnapT OP! guarantees housing stability, improved living conditions, and energy conservation for a group that would otherwise be systematically overlooked. The assistance provided is tailored to the needs of the recipients and merges a focus on enhancing living standards with energy reduction. This approach is crucial for this particular group. Dampoort KnapT OP! is officially listed in the Flemish Energy Poverty Plan under Article 31.

4.3.5 Limitations/Barriers

- The allocation of €30,000 for each residence presents a significant challenge for local authorities to adopt this model as a standard policy. Consequently, the scope of this innovative project is somewhat restricted (Ten participants).
- Comprehensive guidance for renovation, social support, and teamwork contribute to higher operational expenses (although this leads to minimal failures and reduced risk).
- Considering the scale and structure (property), the revolving fund progresses at a slow pace.

4.3.6 Conclusions and recommendations

- Partnering with private investors opens up more possibilities for efficient financial operations. If the government establishes the structure and mitigates risks, private entities can contribute funding.

- Given appropriate project planning, this model could be adapted for the private rental sector. A comparable incentive could assist landlords with at-risk tenants, a social stratum that outnumbers the 'emergency buyers'.
- By implementing 'inclusive community refurbishments', Flemish and local governments could leverage this model as a tool for urban revitalization and poverty alleviation. Establishing a stable community presence and ensuring housing security prevents social displacement and diminishes poverty risk.

4.3.7 More information

https://www.cltgent.be/sites/default/files/Brochure_Dampoort_knapT_OP.pdf

4.4 REELIH[81]

4.4.1 Short description

The REELIH project, which stands for Residential Energy Efficiency for Low Income Households, was initiated by Habitat for Humanity and USAID in 2012 and is currently being implemented in Armenia and Bosnia and Herzegovina. The REELIH project is among numerous aid initiatives backed by the citizens of the United States via the United States Agency for International Development (USAID). (From 1992 onwards, USAID, representing the American people, has facilitated a wide array of developmental programs in countries like Armenia, Macedonia, and Bosnia and Herzegovina. The focus of these programs has evolved, transitioning from primarily humanitarian aid to support for economic, political, and social transformation.

4.4.2 Objectives

The primary goals of the REELIH project include:

- Encouraging all involved parties to aid in enhancing the living standards of low-income families.
- Establishing a sustainable framework for implementing energy efficiency in residential structures.
- Cutting down on energy expenditures.
- Diminishing air pollution and mitigating the impacts of climate change.

With financial backing from USAID, the REELIH project aims to showcase that consolidated endeavours in this field, both at the regional and national scale, by addressing market, capacity, and knowledge deficiencies, can lead to substantial enhancements in the living conditions of low-income families in the

[81] Sources: Residential Energy Efficiency for Low-income Households – REELIH – About is. 2022; Residential Energy Efficiency for Low-Income Households - REELIH - How to improve residential energy efficiency in South Eastern Europe and CIS -policy brief by HFHI, 2022

Eurasian region. This would also result in reduced energy expenses, lower carbon emissions, and overall, contribute to the ongoing discussions and reform processes with measurable changes.

4.4.3 Target group(s) and scope

The REELIH's primary focus is to cultivate regional initiatives, resources, and networks to mitigate the effects of escalating energy costs on communal housing. The REELIH project encompasses the participation of all relevant parties who advocate for, establish, fund, and directly execute projects aimed at energy efficiency.

4.4.4 Outcomes & Impact on health

The advantages of enhancing indoor climate conditions are numerous and include:

- Enhancement of individual well-being, for instance, a decrease in sickness and stress reduction
- Overall enhancements in life quality, such as heightened comfort within the home
- Decrease in mortality rates
- Reduction in the number of workdays lost due to illnesses associated with sub-par indoor environmental conditions
- A decrease in hospital admissions
- Lowered healthcare expenditure related to these kinds of illnesses
- Increased productivity and learning capabilities
- Reduced contact with harmful chemicals used in the treatment of persistent mould.

4.4.5 Limitations/Barriers

No available information.

4.4.6 Conclusions and recommendations

Drawing from comprehensive regional efforts in the energy sector, supported by USAID via the REELIH project, Habitat for Humanity suggests modifications in six policy domains to advance energy efficiency in housing and ensure more individuals in the region have access to suitable living conditions:

- Management and Maintenance of Residential Buildings: A system with well-defined responsibilities for managing and maintaining housing that incorporates energy efficiency into its operational procedures is essential. Enhancing or even professionalizing housing management is a necessary institutional step.
- Financial Mechanisms: It is crucial to devise and implement a financing mechanism that is accessible and affordable for residents and carries an acceptable risk for the banking sector. Government intervention through targeted subsidies or by providing loan guarantees is necessary.

- Facilitating the Ecosystem of Stakeholders: Support for planning and executing the renovation process is vital for the successful large-scale renovation of the housing stock, as homeowners' associations lack the appropriate skills for conducting efficient renovations.
- Reduction of Energy Poverty: It is important to connect housing and social policies aimed at improving energy efficiency in housing. Adequate measures should be implemented to ensure affordable access to energy, reduce energy poverty, alleviate social inequality, and generally improve social well-being.
- Raising Awareness: Information tools positively influence energy efficiency by promoting informed decisions. If potential residents receive reliable, verifiable, and controllable information about their future operating costs, they will make more informed decisions, and the market will adjust accordingly.
- International Cooperation and Knowledge Exchange: Effective policy-making in any country greatly benefits from international experiences and best practices. Therefore, it is crucial to establish and create opportunities for knowledge exchange and sharing of experiences in the housing sector.

Moreover, it's essential to recognize that homeowners should be at the heart of energy efficiency renovations as without the homeowners, nothing will happen. Our experience and research have shown that energy saving is not the primary motivation for homeowners. Instead, they are more interested in the increased level of comfort and "beautification" of their building. Therefore, the power of following patterns turned out to be extremely important, as the visible signs of renovations in one multi-unit building triggered a wave of renovations in neighbouring buildings.

4.4.7 More information

https://getwarmhomes.org/

4.5 Énergie Solidaire[82]

4.5.1 Short description

Énergie Solidaire is an endowment fund that gathers contributions to aid organisations combating energy poverty. Specifically, Énergie Solidaire gathers contributions in the form of donations or micro-donations that hinge on energy consumption. These donations, referred to as energy donations, are received from individuals or businesses who share and endorse our goal of a fair and equitable shift towards sustainable energy. Énergie Solidaire directs its grants towards locally-based organisations of broad interest that assist the most disadvantaged households in overcoming long-term energy poverty. Énergie Solidaire provides funding to organisations that are acknowledged for their exemplary engagement and in-depth understanding of their local area, mostly through yearly project tenders. The endowment fund precisely chooses the

[82] Source: Énergie Solidaire (no date). Available at: https://www.energie-solidaire.org/qui-sommes-nous/ (Accessed: 21 March 2024

organisations it provides funding to by subjecting them to evaluation by its so-called Engagement Committee. Subsequent tracking of the assisted activities is conducted.

The mechanism behind its functioning is the following: The donors have the option to choose between donating 1 or 2 cents for every kilowatt-hour of energy used. In order to accomplish this, Enercoop electricity provider determines the monthly fee the donor will be billed by Énergie Solidaire, depending on the donor's yearly electricity consumption. The monthly amount remains constant and may be eligible for a tax deduction of up to 66%, or 60% for professionals. Subsequently, the donor will receive its tax receipt in a reasonable amount of time prior to the income tax reporting period.

4.5.2 Objectives

Énergie Solidaire aims to facilitate the participation and action of all parties involved in order to unite local communities and enhance the ability of associations to decrease the prevalence of energy poverty among households.

4.5.3 Target group(s) and scope

Énergie Solidaire targets individuals and businesses engaged in the energy transition, including producers, suppliers, consumers, and communities. Its purpose is to empower them to:

- aid in combating energy poverty within their region;
- enhance their dedication to a participatory and all-encompassing transition towards sustainable energy.

4.5.4 Outcomes & Impact on health

Énergie Solidaire have already gained the trust of 4,300 micro-donors. Since its establishment in 2017, the fund has provided financial support to 27 initiatives.

4.5.5 Limitations and barriers

At the moment, the only option for making small charity payments based on energy consumption is through Enercoop, a cooperative and sustainable electricity provider.

4.5.6 Conclusions and recommendations

No information available.

4.6 Les 7 Vents Cooperative[83]

4.6.1 Short description

Les 7 Vents du Cotentin was set up in 1998 as an association, it gradually developed its activities and became more structured. Since 2002, Les 7 Vents has been approved by ADEME (Environment and Energy Management Agency) to be the FAIRE/Info-Energy Space of the Manche department - a mission that has been carried out ever since. “Espace France Renov’” is a free and independent public service which advises and guides individuals in their home energy improvement projects: insulation, heating, energy production and savings. Les 7 Vents provide answer to many questions of houseowners, such as available financial aids for the renovation, available technical solutions or where to find a craftsman.

The structure of Les 7 Vents, is that of an SME, a Collective Interest Cooperative Society that operates under limited profit and democratic control, as outlined in their statutes. They are strongly dedicated to upholding the values of the Social and Solidarity Economy (ESS). Every day, they demonstrate the feasibility of harmonising unwavering adherence to these principles with economic effectiveness and a high level of proficiency. They frequently coordinate activities aimed at engaging the public in a tangible, efficient, and pleasant manner on the battle against greenhouse gas emissions and limiting residential energy usage.

4.6.2 Objectives

Their mission is to provide individuals with technical and financial advice throughout their renovation or construction project in terms of energy savings, budget, choice of insulation and heating systems, use of materials, standards to be met, air quality, renewable energies, financial assistance available and eco-friendly practices. Moreover, to direct these individuals to the appropriate organizations and services according to their needs concerning housing law, taxation, consumer protection, fighting against unhealthy housing and energy poverty, sanitation, home care, mobility and waste problems. Furthermore, the SME’s mission is providing communication and events to raise public awareness by information stands, thematic exhibitions, conferences, thermographic walks, film debates, renovation visits and educational workshops. Last but not least, the SME’s mission covers a range of complementary services to suit the needs of individuals, such as 2D and 3D plans, training courses, administrative mandates, "humidity in the building" visits, electrical consumption diagnosis, town planning applications and equipment rental.

The organization's primary goal is to create social utility by directly or indirectly contributing to the maintenance and strengthening of territorial cohesion and participating in the local economic development. Additionally, the company aims to contribute to sustainable development and the transition towards a more energy-efficient, economically prosperous, socially inclusive, and environmentally friendly society via its activities.[84]

[83] Source: ‘Les 7 Vents’ (no date). Available at: https://www.7vents.fr/qui-sommes-nous/ (Accessed: 23 March 2024).

4.6.3 Target group(s) and scope

The cooperative's statutory purpose is to promote the development of sustainable and renewable energies, with a focus on the Normandy and Channel Islands regions, as well as on a national, European, and international level. Additionally, the cooperative aims to contribute to environmental protection and support future generations by advocating for energy control and the advancement of bio-energies. Furthermore, the cooperative strives to expedite the transition towards sustainable systems, particularly in the energy and ecological sectors.[85]

In 2005, the association Les 7 Vents du Cotentin became a Cooperative Society of Collective Interest (SCIC). Now it is a not-for-profit SME, this transformation confirmed the association's determination to bring together its public, private, physical and moral members, and to act as a "catalyst for projects" that are available to everyone, with the aim of achieving an energy transition and sustainable development. For a long time the organisation was the only SCIC-type structure in Lower Normandie. This new status has enabled Les 7 Vents to gradually evolve towards a advisory role through building and renewable energy consultancy, and an "Innovation and European projects" centre designed mainly to meet the needs of local authorities and businesses. The building and renewable energy design office-team provides design, engineering and consultancy services to help houseowners design and implement low-energy and energy-efficient buildings at all levels, from design and construction to use and ultimate deconstruction. The team also provides support for renewable energy production projects during the technical and financial feasibility studies and implementation monitoring phases.[86]

4.6.4 Outcomes & Impact on health

Les 7 Vents has provided advice to 200 enterprises and communities in their efforts towards energy transition and sustainable living.[87]

4.6.5 Limitations/barriers

The company gives advice about financial aid opportunities, but it is not providing monetary assistance.

4.6.6 Conclusions and recommendations

No available information.

4.7 Energent[88]

4.7.1 Short description

Energent, established in 2013, is an energy cooperative that is deeply committed to sustainable energy and community engagement. Energent has implemented their "Collective purchasing renovation" initiative in East-Flanders, Belgium. The project takes the lead in promoting sustainable house renovations through its citizen-led approach and incorporates cutting-edge automation capabilities. This enables them to provide flexibility in remodelling measures according to individual preferences and budgets, as well as digitising building improvements. Energent offers a range of services to people, including PV installation, collective purchasing of technology, and refurbishment services. Energent will enhance its remodelling services as part of its support services for citizen-led renovation.

4.7.2 Objectives

As a cooperative of citizens from East Flanders focused on renewable energy, their daily efforts are dedicated to enhancing global energy efficiency and achieving climate neutrality. Energent's objective is to expand its scope and in intends to encompass the entire province in the future. The energy community's activities are built on four essential pillars: a) innovative projects, b) investment projects, c) voluntary and member participation, and d) services provided to citizens.

4.7.3 Target group(s) and scope

Energent's unique cooperative ownership structure, which involves more than 2,000 residents, places a higher emphasis on making a positive impact rather than maximising profits. This reflects the movement's dedication to ideals driven by the community. Energent's strategic utilisation of technology is remarkable, enabling them to efficiently handle solar panel calculations and advice reports, in addition to their cooperative business model. These enhancements boost the efficiency and professionalisation of energy-efficient and significant house renovations.

The organisation functions with a staff of 13 employees, supplemented by the assistance of 9 volunteers, and also backed by a membership of 2148 individuals. Energent is presently operational in 31 municipalities and villages, encompassing 61% of the East Flanders region in Belgium.

4.7.4 Outcomes & Impact on health

The programme has effectively attracted 900 clients each year, addressing a wide range of incentives, including the desire to enhance resilience to climate change, improve energy efficiency, or for financial purposes.

[88] Source: REVOLVE, 2023; Energent (Belgium), European Commission, 2023.

4.7.5 Limitations/barriers

No available information.

4.7.6 Conclusions and recommendations

Energent has looked for a support service for Citizen-led refurbishment to enhance its growth, expand its reach to more residents, and enhance the professionalism of its actions. Energent receives support from the European Commission in the form of communication, engagement, and ecosystem development efforts. From now until November 2024, Energent will get support from:

- Assessing and enhancing the communication material to effectively inform and involve citizens
- Enhancement of social media visibility with the objective of expanding outreach to broader demographics
- Providing training to technical staff who conduct energy audits and analyse necessary renovations for homeowners in order to enhance their methods of engagement
- Conducting market analysis to gain a deeper understanding of citizens' needs and identify opportunities for offering improved or new services to increase the rate of renovation and citizen involvement

1. Table: Summary of the briefly introduced programmes in Chapter 4

Project name	Location (Country, city)	Implementation timeframe	Geographical scope	Leading stakeholder	Health aspect	Focus of Implementation	Link
Warm Home Prescription	UK (Aberdeen, Middlesbrough, Gloucestershire, London)	2022/23	Municipality level	NGO	Mental and physical health conditions	Financial assistance to keep homes warm and home energy improvements	https://es.catapult.org.uk/project/warm-home-prescription/
Dampoort KnapT OP!	Belgium, Gent	2014-2016	Municipality level	Municipality	Healthier and more comfortable homes (less damp and CO)	Renovation of homes	https://www.cltgent.be/sites/default/files/Brochure_Dampoort_knapT_OP.pdf
REELIH	Armenia, Bosnia-Herzegovina and North-Macedonia	2012-2022	Country-level	NGO	Healthier homes for the low-income households	Renovation of homes and the elaboration of a scheme	https://getwarmhomes.org/
Energie Solidaire	France	2017-	Country-level	NGO	Healthier and more comfortable homes	Supporting the most vulnerable households to	https://www.energie-solidaire.org/agi

						help them escape energy poverty in the long term	ssez-a-nos-cotes/
Les 7 Vents Cooperative	France	1998-	International scale	non-profit SME	Healthier and more comfortable homes	Free advices and guides from a public service for individuals concerning their home energy improvement projects.	https://www.7vents.fr/
Collective purchasing renovation	Belgium	2013-	East Flanders	cooperative	Healthier and more sustainable homes	Sustainable home renovations with a citizen-led approach.	https://revolve.media/features/citizens-building-renovation https://energent.be/

Based on the introduced models, we created a typology that categorises different financial instruments along two dimensions: the focus of implementation and the type of funding. This has enabled us to identify nine different types of financial instrument. The typology may be extended with future dimensions such as the leading stakeholder (central or regional government, municipality, nonprofit SME) or geographical scope (nationwide, regional, municipal/local).

2. Table: Possible classification of financial models aiming to alleviate energy poverty

Focus of implementation	**Funding**		
	Public	Private	Public+private
Renovation	1	2	3
Financial assistance for energy costs	4	5	6
Financial assistance to cover health expenditures emerged as a consequence of energy poverty	7	8	9

5 Social Impact Bonds – new instruments to finance energy poverty interventions

5.1 Description of the SIB instruments

5.1.1 What is a Social Impact Bond?

Governments worldwide are facing growing demands to respond to increasing social needs while simultaneously facing fiscal demands which emphasize the reduction of social budgets. In this context, Outcomes Based Commissioning (OBC) has been suggested as one way in which "more" social services can be provided for "less" public resources. These forms of public sector contracting are linked with a new financing tool for social services referred to as **Social Impact Bonds.** [89]

In a nutshell, a **Social Impact Bond (SIB) is a novel tool to finance innovative social projects.** It is a new approach to address social issues that relies on result/outcomes-based or pay-for-success financing. Social impact bonds (SIBs) have emerged as one of the most innovative financial instruments designed to support the social service sector in the delivery of innovative social programs.

Social Impact Bonds have received different names in different countries. They are called "*Social Impact Bonds"* in UK and Ireland, *"Pay-for-Success projects (or bonds)"* in the US, or *"Social Benefit (or Pay-for-Benefits) Bonds"* in Australia. Likewise, there are also several definitions of Social Impact Bonds in the literature. For the sake of clarity and simplicity we will follow the definition reported by Social Finance, the non-profit organization responsible for the launch of the first SIB in the UK[90]:

> "A Social Impact Bond is an innovative financing mechanism in which governments or commissioners enter into agreements with social service providers, such as social enterprises or non-profit organizations and investors to pay for the delivery of pre-defined social outcomes" (Social Finance, 2011[91]).

In Social Impact Bonds, private investors provide capital to launch or expand innovative social services that provide a public good. If the expected social benefits are achieved at the end of a given period, investors receive back their capital plus a rate of return (negotiated with public authorities and varying with the level of results achieved). Unlike traditional contracts, the commissioner (usually a public authority) only pays for the service if the expected results are achieved.

Social Impact Bonds entail a different form of cooperation between financial actors (investors, investment funds, banks, charities), the public sector (central government or local authorities) and social service providers (NGOs, social businesses, private companies).

---

[89] Olson H, Painter G, Albertson K, Fox C, O'leary C. Are Social Impact Bonds an Innovation in Finance or Do They Help Finance Social Innovation? Journal of Social Policy. 2024;53(2):407-431. doi:10.1017/S0047279422000356

[90] Social Finance. https://www.socialfinance.org.uk/what-we-do/social-impact-bonds.

[91] Social Finance (2011), A Technical Guide to Developing Social Impact Bonds, http://www.socialfinance.org.uk/wp-content/uploads/2014/07/Technical-Guide-to-CommissioningSocial-Impact-Bonds.pdf

It is important to mention that the use of the term "bond" is misleading since Social Impact Bonds are **not bonds** in the conventional sense, they are not strictly speaking bonds (debt instruments) but rather a class of Outcome Based Commissioning (OBC) contracts; they are future **contracts on social outcomes**[92] [93].

Although the concept of Social Impact Bonds is a relatively recent phenomenon - they were first introduced in the United Kingdom in 2010 in the context of prison recidivism programs-, they have stimulated research and discussion amongst scholars and generated a number of academic papers in the intervening period. As a matter of fact, despite the still limited empirical evidence and data available, academics have extensively studied and described SIBs mechanisms, characteristics, merits and limitations since their logic and organization although debatable are, at the same time, attractive and above all, **innovative**.

"Social Impact Bonds are designed to overcome the challenges governments have in investing in prevention and early intervention. They mitigate the risks of failure and bring in impact investors, who want to test innovation and scale successful programs (…). Investors provide flexible funding to programs that are designed to be responsive to the needs of vulnerable groups to improve their lives. *Social Finance*[94]:

"Social Impact Bonds provide investment to address social problems and look to fund preventative interventions. They link financial success to the delivery of measured social outcomes. If, and only if, the social outcome improves, the outcome payor repays the investors for their initial investment plus a return for the financial risks they took[95] [96]". Thus, when programs/interventions do not meet their targeted outcomes, the SIB will be interrupted, with investors losing their investment (or part of it). In this way, SIBs have been characterised a win–win option for governments, enabling them to experiment with the introduction or scale-up of programs without risking financial loss[97].

Therefore, Social impact bonds introduce an experimental strategy for cities navigating the politics of fiscal constraint. With limited political willpower and public funding, SIBs can be used to leverage new support for social programs. These emerging financing mechanisms represent an appealing possibility: increased investment in social programs via private finance.[98]

[92] Olson H, Painter G, Albertson K, Fox C, O'leary C. Are Social Impact Bonds an Innovation in Finance or Do They Help Finance Social Innovation? Journal of Social Policy. 2024;53(2):407-431. doi:10.1017/S0047279422000356, OECD (2015), "Social Impact Bonds-Promises and Pitfalls", Summary Report of the OECD Experts Seminar, Paris, 15 April 2015, France, http://www.oecd.org/cfe/leed/SIBsExpertSeminar-SummaryReport-FINAL.pdf

[93] Gustafsson-Wright, E., Gardiner, S. and V. Putcha (2015), Potential and Limitations of Impact Bonds: Lessons from the First Five Years of Experience Worldwide, Global Economy and Development Program, Brookings Institution, http://www.brookings.edu/~/media/Research/Files/Reports/2015/07/social-impact-bonds-potentiallimitations/Impact-Bondsweb.pdf?la=en

[94] Social Finance. https://www.socialfinance.org.uk/what-we-do/social-impact-bonds.

[95] Social Finance. https://www.socialfinance.org.uk/what-we-do/social-impact-bonds.

[96] Although in theory investors lose their investment if outcomes are not met, in practice some SIBs involve at least partial guarantees against loss of principal. Arena M, Bengo I, Calderini M, Chiodo V. Social impact bonds: blockbuster or flash in a pan? Int J Public Admin. 2016;39(12):927–939.

[97] Pettus A. Social Impact Bonds. Available at: http://harvardmagazine. com/2013/07/social-impact-bonds.

[98] Tse, A. E., & Warner, M. E. (2018). The razor's edge: Social impact bonds and the financialization of early childhood services. Journal of Urban Affairs, 42(6), 816–832. https://doi.org/10.1080/07352166.2018.1465347

5.2 Objectives

The objective of Social Impact Bonds is to offer an alternative way to finance pressing social problems by introducing private capital that will be anticipated by investors to finance social interventions aimed at addressing the problem. The capital (plus an interest rate) will be returned to the investors if and only if the intervention is successful, thus the risk is transferred from the government (public administration) to the private investors.

They are designed to overcome the challenges governments have in investing in prevention and early intervention. They mitigate the risks of failure and bring in impact investors, who want to test innovation and scale successful programs. Investors provide flexible funding for programs that are designed to be responsive to the needs of vulnerable groups to improve their lives[99].

5.3 Target groups and scope

There are several stakeholders that participate in a Social Impact Bond (OECD 2015).:

The government (or public administration at national/regional/local level), who is usually **the commissioner** of the Social Impact Bonds and the payer for results.

Private investor(s), who provide funding for the intervention, which is used as working capital for a **service provider** that is responsible for the social services delivery, the attainment of agreed outcomes and potentially for the provision of data related to them.

An **external independent evaluator** will assess the agreed outcomes and their impact The measurement of the outcomes, carried out by the **evaluator**, is crucial since the payment to the investor(s) (the principal plus an agreed interest rate) will be done by the government or the commissioner upon the achievement of pre-determined outcomes.

An intermediary might also be involved in Social Impact Bonds with a twofold role. First, it can act as convener of all stakeholders involved in the SIB mechanism in order to strike an agreement regarding the transaction process. Second, it can be responsible for raising capital and structuring the deal.

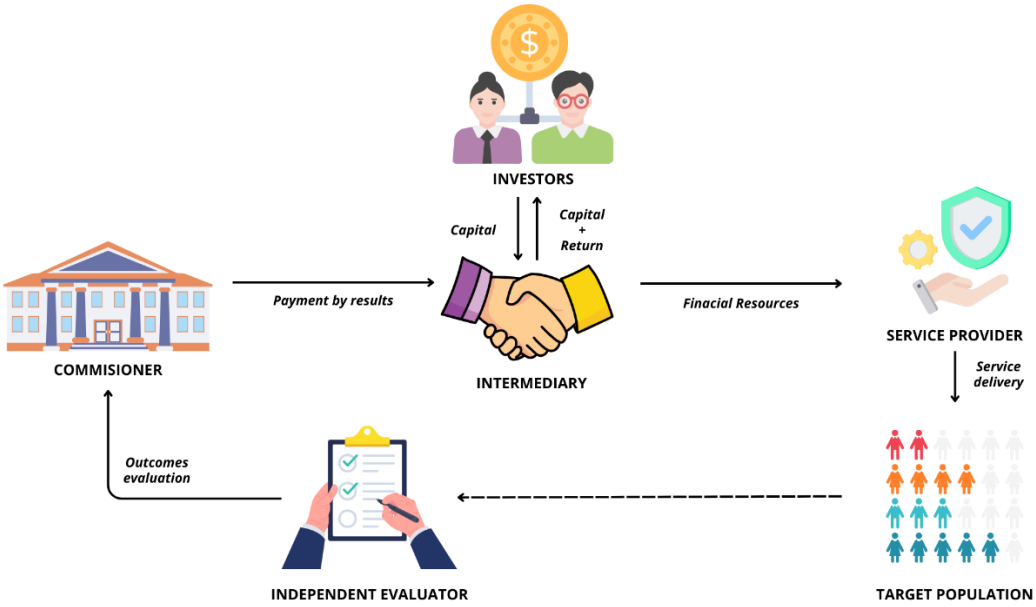
Finally, **the beneficiaries** from a SIBs intervention, who are the population in need and recipients of the intervention[100].

---

[99] https://www.socialfinance.org.uk/what-we-do/social-impact-bonds

[100] As mentioned in the OECD (2015) working paper there may be additional actors apart from the principal stakeholders that may participate in the mechanism, depending on the structure of the SIB. These include subordinate investors, guarantors, grant makers, technical assistance providers, legal advisors, and researchers. It has to be noted that the roles of the stakeholders and of additional actors may vary according to the SIB structure as well as the specific terms appropriate to each deal. For instance, researchers can act as independent evaluators assessing whether the agreed outcomes are achieved. Another example is that services providers can also be investors. In the same spirit, intermediaries can also be investors, senior investors can also be subordinate investors, intermediaries can also be evaluators, and intermediaries can also be technical assistance providers.

2. Figure: Actors in a Social Impact Bond



Source: Adapted from: Carè, R.; Rania, F.; De Lisa, R. Critical Success Factors, Motivations, and Risks in Social Impact Bonds. Sustainability 2020, 12, 7291. https://doi.org/10.3390/su12187291

There is no single model of Social Impact Bond as they have been taken up in different countries, for different issues and interventions, with different models of financing, outcomes definition, and measurement. Social Impact Bonds have emerged as a 'family' of outcomes-based models, which share similar values and features[101]:

- Social Impact Bonds are funding mechanisms to deliver meaningful outcomes for vulnerable individuals and societies
- They establish a partnership between service providers, governments, investors, and intermediaries. The pooling of resources, experience and insights should bring out the best in social service delivery
- Their design allows for greater flexibility and responsiveness to the need they serve. The focus is on how to drive greater impact by improving performance and adaptability
- Investment brings an additional layer of rigour and scrutiny to social programs
- With its focus on outcomes, Social Impact Bonds help establish what works through data collection and measurement
- Social Impact Bonds drive funding toward preventative programs and upstream interventions[102].

[101] https://socialfinance.org/wp-content/uploads/2020/08/SIBs-Early-Years_Social-Finance_2016_Final.pdf
[102] Upstream interventions focus on the social factors that contribute to health and prevent illness such as housing, employment, education.

5.3.1 Areas of application

When can Social Impact Bonds be used for?

The Social Impact Bond model cannot be used for every project or policy area[103]. Although Social Impact Bonds might provide an opportunity to address problems where existing public policy interventions are not achieving the desired social outcomes, there are important preconditions that have to be met in order to consider Social Impact Bonds as a suitable instrument, such as: the potential for meaningful cost savings; the availability of clear and measurable outcomes; and contracts that correctly reflect the responsibilities of multiple stakeholders (including investors, public entities, and service providers)[104] . The potential scope for Social Impact Bonds depends on the structure of a country's welfare state, civil society, and private sector.

According to Social Finance[105], since the objective of Social Impact Bonds is to fund services tailored to complex needs, they should be worth considering when:

- ✓ Identifiable populations with complex, cross-agency needs, who require tailored interventions, are not being served
- ✓ Current spending has poor or undetermined outcomes
- ✓ There are high financial/political costs to society and government in not addressing the social issue
- ✓ There is a benefit to using external investment to provide risk capital and assume innovation and implementation risk for new or evidenced-based programs
- ✓ There are social sector partners who can deliver effective, evidence-based successful services.

Likewise, The European Parliament Briefing[106] states that Social Impact Bonds seem more appropriate for policy areas in which there are target groups that can be easily identified, when there are measurable outcomes, and when investors are familiar with non–profits, social enterprises and social policies.

According to the Young Foundation[107], the following are critical success factors for a new model of social investment, including Social Impact Bonds:

[103] https://golab.bsg.ox.ac.uk/
[104] https://golab.bsg.ox.ac.uk/
[105] Social Impact Bonds – The early years, Social Finance (2016). https://socialfinance.org/insight/social-impact-bonds-the-early-years/
[106] https://www.europarl.europa.eu/EPRS/538223-Social-impact-bonds-FINAL.pdf
[107] https://www.youngfoundation.org/our-work/publications/social-impact-investment-the-opportunity-and-challenge-of-social-impact-bonds/

1. Preventive intervention – The intervention is preventive in nature and sufficient funding for the intervention is currently unavailable;

2. Improves wellbeing in an area of high social need – The intervention improves social wellbeing and prevents or improves a poor outcome;

3. Evidence of efficacy - The intervention is supported by evidence of its efficacy and impact, giving funders confidence in the scheme's likelihood of success;

4. Measurable impact – Whether it is possible to measure the impact of the intervention accurately enough to give all parties confidence of the intervention's effect, including a sufficiently large sample size, appropriate timescales and impacts that are closely related to the savings and relatively easy to measure;

5. Aligns incentives - A specific government stakeholder achieves savings or lower costs as a result of actions undertaken by others. These savings need to be cash releasing and provide an actual saving to government stakeholders;

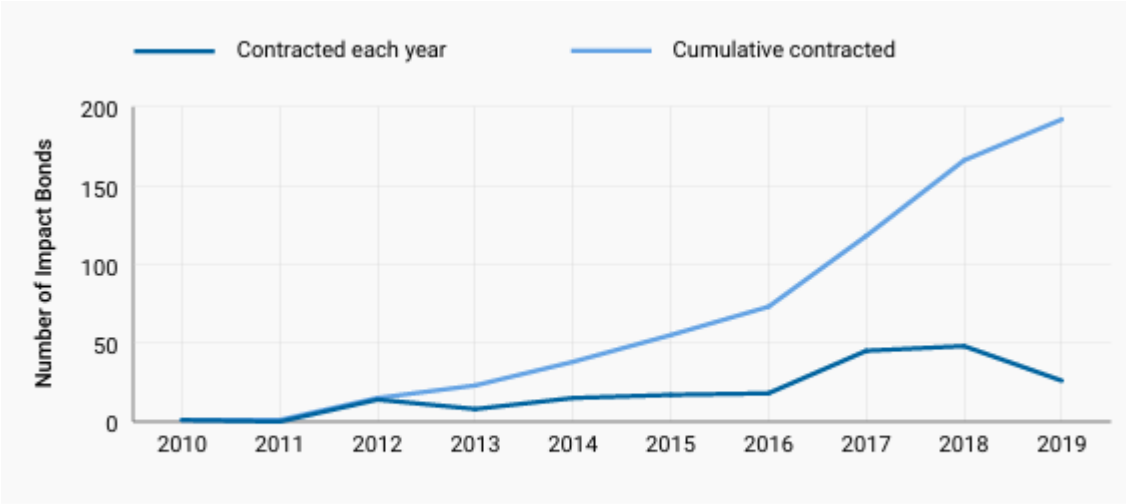
6. Savings greater than costs - The savings for the specific government stakeholder are relatively immediate and much greater than the cost of the intervention and transaction costs. This provides investors with enough return to absorb the inherent risks that are part of the scheme, and can provide significant funds for social investment; and

7. Government preference for a Social Impact Bond - Government policy for the specific agenda is keen on or at least open to the use of a Social Impact Bond.

Since the implementation of the first Social Impact Bond in the UK in 2010 in the area of criminal justice, (recidivism), Social Impact Bonds have rapidly expanded and their implementation has spanned across other policy areas, such as social welfare, homelessness, education, job training, employment and health care.

The overall number of impact bonds has increased steadily over time, although the number contracted each year has been more unpredictable. After the first SIB was contracted in 2010, no new deals occurred in 2011 and then in 2012 the number of contracts raised to 14, to fall again in 2013. Between 2013 and 2016, the number contracted each year rose only slightly, before more than doubling in 2017 to 45 impact bonds and rising again in 2018 to reach a peak of 48.

3. Figure: Impact Bond growth over time[108]



Source: Brookings Institution Global Impact Bond Database, July 2020

In the last years, data from the Brookings Institution Global Impact Bond database show that the total number of SIB contracted has steadily grown to reach a total of 240 contracts in 2024 (See below Brooking´s snapshot).

[108] https://www.brookings.edu/wp-content/uploads/2020/09/Impact_Bonds-Brief_1-FINAL.pdf

4. Figure: SIBs contracted globally[109]

Citation: Brookings Institution Global Impact Bond Database, October 1, 2024

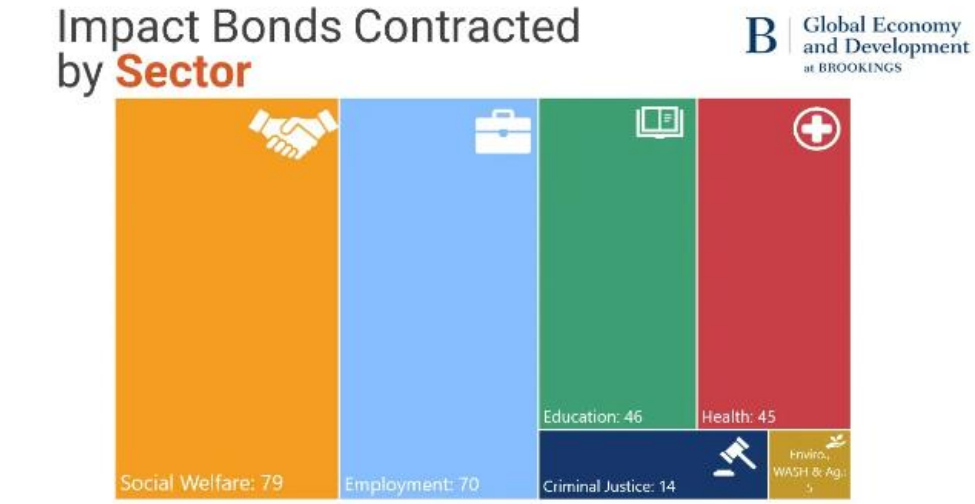
Although the concept of Social Impact Bond has been generating significant interest in multiple countries and SIB initiatives are flourishing around the world, they have been mostly restricted to Anglo-Saxon countries (i.e., UK, US, Australia) which make up two thirds of the total number of SIBs.

In the EU, since social services are almost exclusively provided by the government and as the reluctance towards private sector involvement in the provision of social services is usually stronger, the attention paid to Social Impact Bonds has been limited110. In the EU, SIBs have been launched in the Netherlands, Belgium Portugal, France, Germany and Spain. The majority of Social Impact Bonds contracted finance projects in the social welfare and employment sectors, which are the most popular since their creation, followed by education. The figure below shows the latest figures available from the Brookings database.

[109] https://www.brookings.edu/articles/social-and-development-impact-bonds-by-the-numbers/

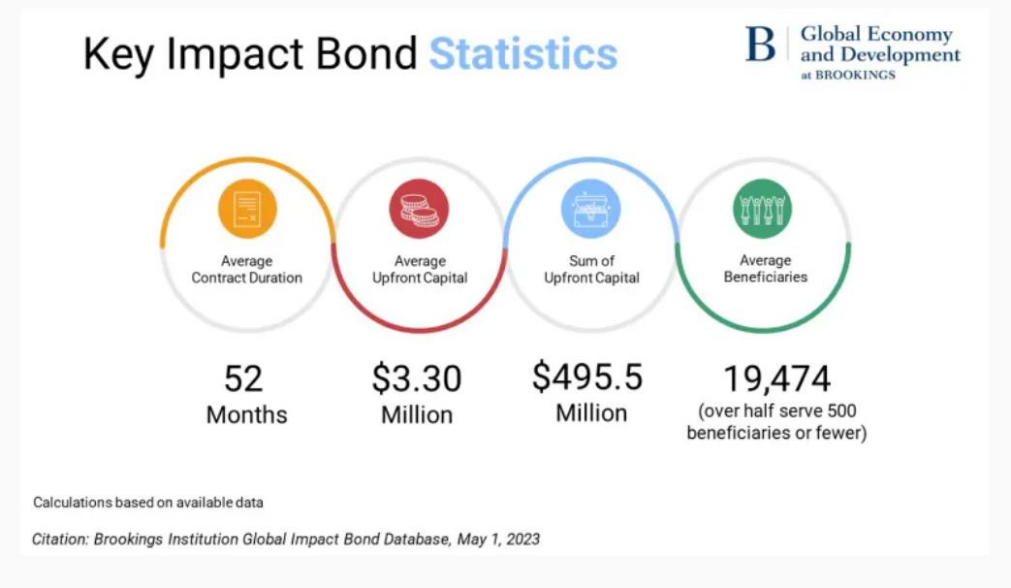
[110] Dermine, T. (2014) Establishing Social Impact Bonds in Continental Europe. M-RCBG Associate Working Paper Series No. 26 https://www.hks.harvard.edu/sites/default/files/centers/mrcbg/files/dermine_final.pdf

5. Figure: Social Impact Bonds by sector



In terms of upfront capital commitment, the SIB market has seen 524 million US dollars invested to date (over fourteen years), serving almost 28,000 beneficiaries.

6. Figure: Social Impact Bonds, key figures



5.4 Outcomes & Impact on health

Advocates of Social Impact Bonds argue that SIBs have the capacity to fund innovative social programs while generating profits for investors and savings for governments[111][112].

Social Impact Bonds transfer the risk of financial losses incurred in the implementation of ineffective projects from the public to the private sector[113]. They enable governments to transfer the risk of social innovation to private-sector interests with greater flexibility and resources in exchange for the opportunity to realize a profit while engaged in an altruistic activity. A number of private-sector organizations view SIBs as a new win-win instrument.

Another significant benefit to the public sector bodies is the opportunity to explore innovative solutions to what has been called "intractable social problems"[114]. Innovation poses both great risks and great rewards. However, government entities with limited budgets cannot afford such risks.

Moreover, it is worth noting that one of the niche features of Social Impact Bonds is that they bring together a wide range of stakeholders, including governments, non-profit organizations, impact investors, and philanthropic institutions. This makes Social Impact Bonds different from other types of funding schemes because they offer new opportunities for forms of multi-party collaborations and the development of collaborative relationships.

Finally, Social Impact Bonds improve performance and reduce costs. A focus on prevention rather than remedial interventions is more efficient, resulting in more effective outcomes and higher-quality services. In addition, the strict feasibility analysis and step-by-step monitoring of a Social Impact Bond project facilitates the achievement of specified outcomes while controlling costs, as well as enabling rapid adjustments to adapt to new or unforeseen circumstances.

5.5 Limitations/barriers

The model of Social Impact Bonds is not without its critics. Despite the significant potential benefits of Social Impact Bonds, there are also challenges that need to be worked through. A common issue found in the literature is that Social Impact Bonds are an unnecessarily complex way of financing better social programs. Since government's costs of capital are significantly cheaper than markets, they should be providing finance.

---

[111] https://www.oecd.org/cfe/leed/UnderstandingSIBsLux-WorkingPaper.pdf

[112] Amy S. Katz, MA, Benjamin Brisbois, PhD, Suzanne Zerger, PhD, and Stephen W. Hwang, MD, MPH: Social Impact Bonds as a Funding Method for Health and Social Programs: Potential Areas of Concern. AJPH February 2018, Vol 108, No. 2. doi: 10.2105/AJPH.2017.304157

[113] Foroogh Nazari Chamakia, Glenn Paul Jenkinsb,c, and Majid Hashemid (2019) Social Impact Bonds: Implementation, Evaluation, and Monitoring. International Journal of Public Administration https://doi.org/10.1080/01900692.2018.1433206

[114] Intractable problems is a term used to highlight deeply engrained and long-entrenched problems, psychologies, difficulties, and conflicts that relate to class struggles, economic disparities, social disorders, and national/international conflicts.
Pettus A. Social Impact Bonds. Available at: http://harvardmagazine. com/2013/07/social-impact-bonds.

Some philanthropists worry that Social Impact Bonds risk diverting charitable funds to make up for public spending, essentially locking philanthropic money into government agendas.

The lack of precedent in Social Impact Bonds development and implementation has been the main challenge for the stakeholders. Deciding on technical aspects without previous experience and adopting a learning-by-doing approach is a time-consuming endeavor, which may also entail financial costs. For example, structuring the Social Impact Bond deal legally and examining whether the regulatory framework will not block any part of this complex mechanism throughout its implementation can be quite challenging.

Social Impact Bonds are very much at the path-finder stage, without tried and tested routes to follow. They also involve the management of negotiations between three parties on what can be quite complex issues. The challenges can be managed and avoided if carefully considered when Social Impact Bonds are being developed, and it is important to take a phased approach to their development.

Social Impact Bonds have been criticized as a process by which public responsibility for the welfare of society as a whole is replaced by private interests working to achieve specific, narrowly defined outcomes. By making a simple link between intervention and payout, SIBs may narrow the scope of social investment to low-cost programs with short-term returns, when more comprehensive approaches are needed. They can also be indicative of the "financialisation" or "marketisation" of social services115 116.

However, the pressures of contracting economies and restricted public finances, combined with ever increasing demand for social services, have led many European governments to accept Social Impact Bonds as an opportunity to maintain a high standard of social services. In such cases, governments have tended to overcome initial political resistance and legal hurdles by promoting Social Impact Bonds as an essential source of seed capital in efforts to develop innovative social programs.

Despite the growing interest generated by these "conveyors" of private resources into welfare expenses, their novelty and downfalls identified impede the growth of a strong market117. Thus, with evidence that both supports and detracts from their use, Social Impact Bonds still need further experimentation with new interventions to generate more evidence and evaluation.

---

[115] Williams, J. W. (2018). Surveying the SIB economy: Social impact bonds, "local" challenges, and shifting markets in urban social problems. Journal of Urban Affairs, 42(6), 907–919. https://doi.org/10.1080/07352166.2018.1511796

[116] Sinclair, S., McHugh, N., & Roy, M. J. (2019). Social innovation, financialisation and commodification: a critique of social impact bonds. Journal of Economic Policy Reform, 24(1), 11–27. https://doi.org/10.1080/17487870.2019.1571415

[117] Proietti, G. (2020). Profitable Impact Bonds: Introducing Risk-Sharing Mechanisms for a More Balanced Version of Social Impact Bonds. In: La Torre, M., Chiappini, H. (eds) Contemporary Issues in Sustainable Finance. Palgrave Studies in Impact Finance. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-40248-8_4

5.6 Social Impact Bonds and energy poverty

As mentioned in the previous section, Social Impact Bonds have been implemented in several policy areas, like social welfare, homelessness, education, job training, employment, and health care. However, to our knowledge, no Social Impact Bond has been yet implemented in the area of energy poverty.[118]

Energy poverty has become a major issue in Europe affecting many families and citizens. The question is whether the Social Impact Bond model could be used to finance interventions that aim to reduce energy poverty.

Social Impact Bonds could be used to finance innovative interventions that have been proven to be successful and deliver positive outcomes to people in energy poverty and also to scale up evidence-based interventions and move from pilot projects to broader interventions, thus increasing the number of people in need who receive support. Social Impact Bonds could be the first step in a strategy to continue scaling the intervention. Once its validity has been tested, it can be included in the public service portfolio.

WELLBASED aims to fight energy poverty and increase the wellbeing of vulnerable people by designing and implementing targeted actions to reduce energy poverty in 6 European cities. We would like to "test" whether the Social Impact Bond model could be suitable for financing these interventions so that they can be scaled up in these cities in the future or implemented in other cities using the Social Impact Bond model.

We thus aim to carry out a pre-feasibility study on the use of the Social Impact Bond model to finance energy poverty interventions.

5.6.1 Energy poverty and its implications on the health and wellbeing of people

Since the beginning of the economic crisis in 2007, in many EU countries the cases of families that no longer have access to adequate energy consumption have become increasingly visible. It has been estimated that in 2016 in the EU, energy poverty affected more than 50 million people who had difficulty paying energy bills or had limited access to energy due to low incomes, poorly insulated homes, poor performing appliances (heating, cooking or hot water) or high energy costs (European Covenant of Mayors)[119].

[118] An exploratory study on the feasibility and desirability of a social impact bond (SIB) as a funding instrument for energy poverty alleviation activities was carried out in 2013 for the EAGA Charitable Trust by the Centre for Sustainable Energy. The study explored the required technical, financial and institutional arrangements and mapped the landscape for a SIB. It also mentioned that further evidence on the impacts of interventions and the costs of measures was needed as well as a full economic appraisal of the health benefits associated with energy poverty based interventions. Preston I. et al (2013): Fuel Poverty Social Impact Bonds: Their potential role and associated challenges https://www.fuelpovertylibrary.info/content/fuel-poverty-social-impact-bonds-their-potential-role-and-associated-challenges-2. (We are unaware if a pilot was developed to test the implementation of the SIB).

[119] Both estimating the current level of energy poverty in European municipalities and the impacts on citizens' life are not easy tasks. It is estimated that 1 out of 10 citizens is affected by energy poverty. Figures show that in Europe: 57 million people cannot keep their homes warm during the wintertime; 104 million people cannot keep their homes comfortable during the summertime and 52 million people face delays in paying their energy bills.

Energy poverty is a complex issue and a multidimensional phenomenon with diverse manifestations. The European Commission, Citizens' Energy Forum[120] has defined energy poverty as "a situation where a household or an individual is unable to afford basic energy services (heating, cooling, lighting, mobility and power) to guarantee a decent standard of living due to a combination of low-income, high-energy expenditure and low energy efficiency of their homes[121]". In practical terms this means that vulnerable citizens either do not have access to energy services or that by using these energy services their access to other basic services is reduced.

Energy poverty has severe implications on health, wellbeing, social inclusion and quality of life. Energy poor households experience inadequate levels of some essential energy services, e.g., lighting, heating/cooling, use of appliances, transport, and many others. For this reason, energy poverty has to be taken into account in many policy areas - including social, economic as well as climate and environment policies.

3. Table: Effects and consequences of energy poverty [122]

1. Risks and consequences on physical health – Respiratory, circulatory, and even hypothermia problems. – Problems derived from the use of auxiliary energy sources with the risk of accident, fire or poisoning due to carbon monoxide. – Increase in the additional winter mortality rate (TMAH). 2. Risks and incidence on mental health – Anxiety, loss of self-esteem. – Isolation and social exclusion. – Poor student performance. 3. Risks and economic consequences – Accumulation of excessive debt (paying high energy supply bills limits being able to pay for other needs such as food and transportation). 4. Environmental risks and consequences such as CO2 emissions – In the absence of resources, households may resort to inefficient heating systems that can be cheaper and / or more polluting.

[120] European Commission, Citizens' Energy Forum 2016 in https://www.eumayors.eu/support/energy-poverty.html

[121] It is striking that energy poverty is less of an issue in various colder countries than in warmer ones. Apart from differences in relative income and socio-economic situations, an additional explanation can be found in the fact that a colder climate means that energy efficient dwellings become much more of a necessity, with progressively tougher building standards introduced over the years as technologies develop. https://www.eumayors.eu/support/energy-poverty.html

[122] Adapted from: https://doi.org/10.1016/j.erss.2021.102456; https://energiajusta.org/consecuencias-pobreza-energetica/; https://acisenergia.com/blog/pobreza-energetica-que-es-consecuencias/; https://www2.cruzroja.es/web/ahora/-/pobreza-energetica

- The current appliances used may be defective or outdated, which may lead to higher pollution/CO2 emissions.

Energy poverty is a real problem/challenge that tends to affect already vulnerable populations and efficient interventions to reduce it are thus urgently needed.

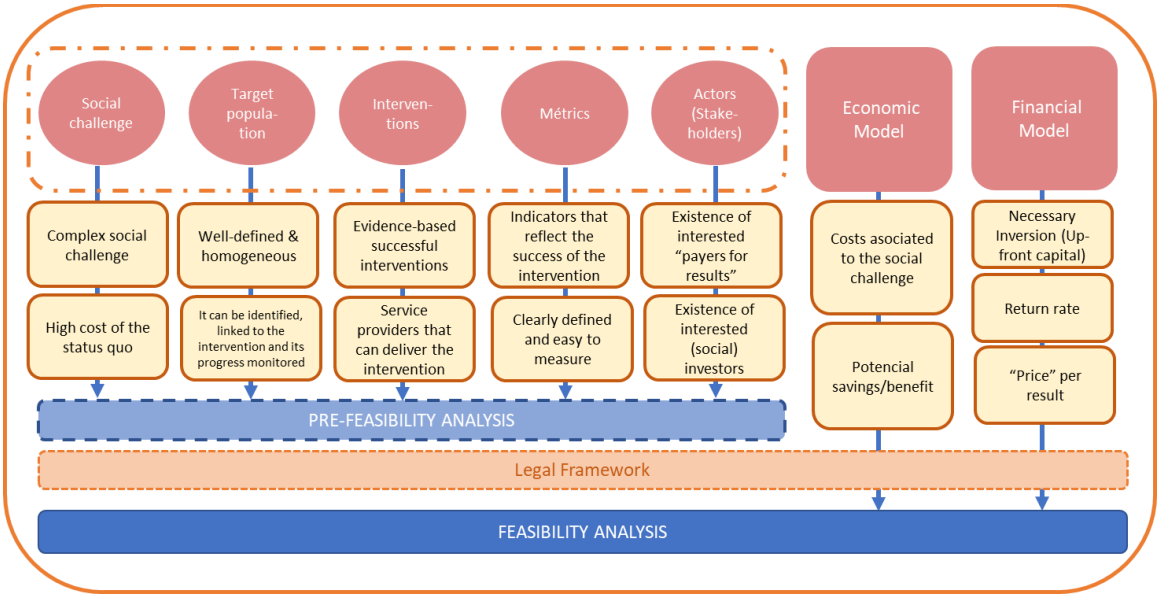
5.6.2 Can the challenge of energy poverty be met through a Social Impact Bond?

Energy poverty is unique in the field of Social Impact Bonds as to our knowledge, it does not exist. To date, no Social Impact Bond has been successfully implemented in this area. Usually, the issue of energy poverty has been addressed through subsidies and legislation, therefore, the application of a Social Impact Bond to solve the problem of energy poverty in disadvantaged households represents a novelty in the use of these instruments. In this case, in addition, the Social Impact Bond not only faces a social problem but also an environmental and energy efficiency problem.

As mentioned in the previous section, not all social problems can be addressed through the Social Impact Bond instrument. Then, it needs to be checked if the challenge of reducing energy poverty meets the necessary characteristics so that a Social Impact Bond can be implemented for its resolution.

Pre-feasibility analysis for the application of Social Impact Bonds to finance interventions aimed at reducing energy poverty

7. Figure: Aspects that determine the feasibility of applying a Social Impact Bond to solve key societal challenges.



Source: Kveloce I+D+i inspired by Codespa y Social Finance UK

The financing of interventions to combat energy poverty through the implementation of a Social Impact Bond would offer several benefits:

- The public administration can invest in prevention, avoiding energy poverty from becoming a more serious and chronic problem.
- It can tap into private sector funds at a time when public resources are scarce, and are faced with multiple competing demands following recent issues such as the Covid-19 pandemic.
- In addition, the risk of the intervention and the risk of scaling up is transferred to the investor. So, if it goes well, the public administration pays for the outcomes, starts developing policy based on evidence and can decide whether to include it in its social service portfolio.
- It allows public organizations and institutions to experiment with new innovations and so privatise the risk of failure. There is an aversion in public administration to experimenting with public money when trying to improve or solve a social problem. This aversion to risk is limiting the capacity of public administrations to innovate and develop public policy based on evidence. So a Social Impact Bond privatises the risk of the experiment going wrong. If it goes wrong, the public administration does not invest or waste money. The money is lost by the investors. If it goes well, the public administration pays for the outcomes and starts developing policy based on evidence[123].
- Social Impact Bonds would offer investors who are committed to being socially responsible investing an opportunity to make an impact.
- The use of independent evaluators to monitor the performance of the intervention would help projects keep on track and encourage transparency and accountability through objective data collection, measurement, and reporting. The independent monitoring and evaluation of Social Impact Bonds' impacts and outcomes is critical, promoting accountability and helping to keep projects on track. Close monitoring and regular evaluation also provide a mechanism by which projects can be halted owing to cost overruns and facilitate the learning process in the context of future implementation of Social Impact Bonds projects.
- Close monitoring and regular evaluation also provides a mechanism by which projects can be adjusted/modified or halted due to cost overruns. It also facilitates the learning process in the context of future implementation of Social Impact Bonds projects.

Another benefit is that Social Impact Bonds align every actor around key outcomes, and not just a key activity, and so focusing on activities and doing things. A social impact bond focuses all the actors on achieving specific objectives that are results.

5.6.3 Application in WELLBASED

In this section we develop the **case study of the Social Impact Bond (SIB)** applied to the challenge of reducing energy poverty within the framework of the WELLBASED project. To do this, we have carried out a **pre-feasibility analysis** and **have estimated the costs and savings in case the intervention to combat energy poverty was to be scaled up to serve 1.000 beneficiaries**. To this purpose we use real data from the specific pilot intervention (WUP[124]) implemented in Valencia (Spain).

[123] https://dobetter.esade.edu/en/podcast-social-impact-bonds

[124] WUP: Wellbased Urban Programme

Valencia´s intervention, deployed during year 1of the Wellbased Project, aimed to increase energy efficiency and combat energy poverty by offering citizens energy audits at home, energy efficiency kits, bill optimisation advice, and coaching.

1.Compliance check/conformity test for the implementation of a SIB to combat energy poverty in Valencia (Spain)

The pilot in Valencia complies with the necessary conditions to implement a SIB to finance interventions aimed at fighting energy poverty.

Compliance ("conformity test") for a SIB to combat energy poverty in Valencia	YES	NO
The energy poverty problem is well-defined	✓	
Its resolution is a priority for the Public Administration of the city	✓	
The costs currently incurred by the P.A. (Social Services Department) due to the problem can be quantified.	✓	
The costs that will be avoided / the future savings for the P.A. (Social Services Department) if the energy poverty problem is solved can be quantified.	✓	
The beneficiaries (citizens experiencing energy poverty) can be identified and delimited	✓	
There is empirical evidence on the impact of the intervention. Proven (evidence-based) intervention with positive results	✓*	
The results of the intervention are clear and measurable	✓	
Possibility of external validation of the results	✓	
The results are achievable in an acceptable time (interventions with very long-term results will not be attractive to investors)	✓	
There is an ecosystem of agents that can carry out the implementation of the SIB	✓	

*There is empirical evidence on the impact of energy efficiency interventions similar to the ones carried out the Valencia pilot (i.e. consisting on energy audits, delivery of energy efficiency kits and/or energy advice or a combination of them) in terms of savings in the energy bills of households (some examples include: REACH Project, GreenDoctors, ESP Nuremberg, Ni un hogar sin energia, Atlas of Energy Poverty Initiatives in Europe (ACHIEVE, REACH-Slovenia, Run4energy, CAF ACCIO). In the region of Valencia, there is also evidence of successful interventions with positive results in several municipalities (e.g. interventions carried out by AEIOLUZ[125] an Energy Services Cooperative, in Valencia city and in the municipalities of Alzira, Torrent and Lliria during 2017-2019).

[125] https://aeioluz.com/

Data from the WELLBASED project in the city of Valencia (Spain) finds empirical evidence on the reduction of energy (electricity) bills one year after the intervention. However, results are non-significative when compared with a (non-randomised) control group.

2.Costs and savings of the application of SIBs (Business case)

Costs of the energy poverty problem (incurred by the public administration)

The costs incurred by the public administration (the Social Services Department (SSD) of the city of Valencia) due to the energy poverty problem can be quantified. In 2022, the Social Services Department spent €348.000 in terms of payments for electricity bills to people in energy poverty (equivalent to circa 320€/beneficiary[126]).

In a situation with no intervention in energy poverty, the Social Services Department (SSD) will have to pay for the energy bills of people in energy poverty that cannot pay their bills. Assuming a conservative situation, with constant spending of 320€ per beneficiary, after 6 years, for 1.000 people in energy poverty the SSD would have spent €1.920.000.

Costs /payments for electricity bills by SSD (€)	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	Total
Cost for the SSD	320.000	320.000	320.000	320.000	320.000	320.000	1.920.000

Savings in energy (electricity) bills

The WELLBASED intervention in Valencia, deployed over 1 year, consisted of energy audits at home, energy efficiency kits, bill optimization advice, and coaching.

In the intervention group (with N=73 and energy expenditure (electricity bills) >30€/month[127]), the resulting average savings in the electricity bill was 38,5€/month.

The table below shows average annual savings in electricity bills considering a loss of good habits (5% the first year and 2% the following years) calculated for the scenario of 1.000 individuals in energy poverty receiving WELLBASED intervention. The savings in electricity bills after 6 years would amount to €2.570.458.

Average savings in electricity bills (€/year)	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	Total savings
Average savings	462.000	438.900	430.122	421.520	413.089	404.827	2.570.458

Costs of the intervention to reduce energy poverty (costs for the public administration)

The cost of the WELLBASED intervention to combat energy poverty in Valencia amounted to 1.155€/beneficiary. The table below shows the cost of financing the same intervention for 1.000 beneficiaries with a SIB. It includes the cost of the intervention plus the cost of the SIB structure (20% of the total costs),

[126] Amount spent in electricity bills payments: €347.988 for 1.090 beneficiaries (data for 2022).
[127] Observations showing an expenditure in electricity bills lower than 30€/month have been disregarded since this is already a low expenditure where there is no much room for savings.

monitoring/auditing costs and the return on investment paid to social investors (annual interest rate of 4%). The total cost would amount to €1.731.000.

Cost of the intervention with SIB (in €)	**Total**
Average cost of the WELLBASED intervention	1.154.973
Costs of the SIB structure (20% of the cost of the intervention)	230.995
Monitoring & evaluation costs	10.000
SUB- TOTAL	1.395.968
Return on Investment	335.032
TOTAL	1.731.000

In the case of the WELLBASED pilot for Valencia, in year 1, we would have: (a) the total cost of the intervention financed via SIB (€1.731.000) and (b) the cost for the social service department in terms of payments for electricity bills (what the SSD would have to pay without the intervention (€320.000) minus the savings in electricity bills thanks to the intervention (€462.000). Since the savings in electricity bills are greater than the amount paid by the social service department, this amount is "negative" for the social service department and we consider that the cost for the SSD is zero while the remaining amount is the real saving in terms of electricity bills for the families (€142.000), The same applies for the following years (years 2 to 6), totalling €650.458 savings in electricity bills for families after 6 years (as shown in the table below).

Actual costs & savings	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	**Total**
Cost for SSD	320.000	320.000	320.000	320.000	320.000	320.000	1.920.000
Average savings	462.000	438.900	430.122	421.520	413.089	404.827	2.570.458
Difference	-142.000	-118.900	-110.122	-101.520	-93.089	-84.827	-650.458
Actual cost for the SSD	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Actual savings for families	*142.000*	*118.900*	*110.122*	*101.520*	*93.089*	*84.827*	*650.458*

Thus, considering the cost of the intervention with SIB in the first year and the fact that there are no more costs for the SSD since families can now pay for their own bills, **after six years,** the intervention with SIB is paid and there is a remaining saving for the SSD of €189.000 (€1.920.000-1.731.000) which will be of the total amount of €320.000 from year 7 onwards.

Costs for electricity bills made by the Social Services Department (SSD)							
NO SIB	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	Total
Cost for the SSD	320.000	320.000	320.000	320.000	320.000	320.000	1.920.000
SIB	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	Total
SIB Cost	1.731.000	0	0	0	0	0	1.731.000
Actual cost for the SSD	0	0	0	0	0	0	

TOTAL COSTS	1.731.000	0	0	0	0	0	1.731.000
Savings for the SSD							189.000

Thus, using the data obtained in the Valencia pilot, the WELLBASED intervention could be scaled up (e.g. to 1.000 beneficiaries) using a SIB instrument, creating: (a) savings for families (in terms of reduced energy bills thanks to the intervention (optimizing bills, good energy efficiency habits)); (b) savings for the public administration (in terms of public money spent by the social services department (SSD) on paying citizens' energy bills); and (c) the cost of the intervention would be covered after 6 years .

Conclusion, limitations and future research

In the scenario analysed, the investment necessary to deploy a WELLBASED intervention using a SIB is recovered from year 6 (where savings for the public administration (SSD) are already present), and from year 7 onwards, savings for the public administration- who no longer needs to pay for electricity bills- and families will continue. Thus, in principle, SIBs could be considered as an alternative new instrument at disposal of local authorities and policy makers to scale up and finance interventions that combat energy poverty and increase the wellbeing of citizens. However, a word of caution is necessary. Due to their nature and complexity, SIBs call for simple and straightforward indicators and metrics to measure the success of the intervention, on the basis of which, investors will be paid back. In the case of energy poverty this is challenging, since energy poverty is a multidimensional problem and interventions will have an impact in several fields. In addition, although we understand energy "savings" as energy "efficiency", current approaches in energy poverty go in the direction of stop seeking energy savings, thus our indicator to measure the success of the intervention might rise some critics. With this exercise, our attempt has been to investigate the feasibility of SIBs using a single and straightforward indicator, identifying a specific government department (the Social Security Department) that will achieve savings as a result of the intervention. The field is open for further research in the direction of testing other indicators (e.g. health indicators) alone or in combination that reflect the complexity of the energy poverty problem.

6 Urban Financial Metabolism (UFM) as a Tool to Address Energy Poverty

6.1 Description

Energy poverty can negatively affect a household's physical and mental well-being, social participation, and cost of living. This may also influence the local economy and public health[128].

Interventions by local authorities such as investment, a policy change, or a technical improvement can mitigate the risks of (residential) energy poverty. However, it is difficult to have a (quantitative) overview of the societal and financial impact of these interventions. Correspondingly, the cost of doing nothing cannot be identified. Without this type of insight it can be challenging or discouraging for decision makers to implement interventions to tackle energy poverty. In addition, interventions in the urban environment are targeted at specific challenges and problems, without recognition of potential collaborative values. Translating collaborative visions and/or goals across domains (e.g. health, economics, mobility, energy, housing) into integrated measures often fails due to institutional and stakeholder complexities. Generally, goals are set but financial budgets can limit the effectiveness of the intervention. Or the other way around: budgets are provided for a given project (e.g. to overcome symptoms such as social participation), but an overall integrated vision across domains is lacking. Creating insight of collective costs and benefits could help and stimulate policy makers and private partners when deciding on implementing interventions.

As a result, the goal of the UFM methodology is to facilitate policy makers and private partners with qualitative and quantitative insights in the (collaborative) costs and benefits of interventions that help to avert energy poverty.

The Urban Financial Metabolism (UFM) model can be used as a tool to achieve this goal. The model analyses cash that flows in to, out of, and through a neighbourhood. This analysis helps to identify indirect impacts or costs and benefits as a result of doing nothing or investing in certain interventions. This also includes the second and third order impact in other domains. In other words, the model can be utilised to answer the question: what is the (indirect) return on investment of different interventions? Correspondingly, policy makers and private partners can make well-argued decisions on interventions and collaborate across various domains.

6.2 Objectives

As mentioned before, the Urban Financial Metabolism (UFM) model[129] can be used to map different cash flows that run through an urban area, e.g. a neighbourhood. This can be targeted at a specific budget, or a

[128] Mulder, Peter, Francesco Dalla Longa, and Koen Straver. "Energy poverty in the Netherlands at the national and local level: A multi-dimensional spatial analysis." *Energy Research & Social Science* 96 (2023): 102892

[129] URBAN FINANCIAL METABOLISM, Climate-KIC: 4.1.2 Flagship: SSD_UFL_Guidelines and Final Report (2018)

particular policy aim. The model provides insight in how these cash flows change in multiple domains. Not only by quantifying them, but also by describing, characterising, and analysing them to define which goals or domains they serve and what the related costs and benefits are.

To be more precise, the model can help to create insight into:

- The quantity and size of cash flows.
- The way in which several cash flows serve the same (policy) goal, or the other way around in which there is a lack of cash flows.
- What cash flows mean for 'generic individuals' by describing, characterising, and analysing them as costs and benefits.
- Where business cases are looped, and where there is only a one-way cash flow.
- Cash flows that currently run out of the neighbourhood but have the potential of staying in the neighbourhood itself.

This facilitates policy makers and private partners to better align, combine, and rearrange cash flows and collaboratively seek to create multiple values. The idea behind this multiple value creation is that a single intervention not only solves a specific polity or urban problem, but also creates value for other actors or domains. If well-orchestrated, interventions in a certain domain can evoke other investments or contribute to solving other (higher) goals. This is useful for two main reasons:

- It legitimizes specific interventions, as the multiple added value (win-win) improves the business case or bankability of urban interventions.
- Because a single intervention creates multiple benefits, it creates the opportunity for those domains and actors that co-benefit to share and save investments costs and/or help optimize the design or investment together.

Using the UFM model, the 'cost of doing nothing' can be compared to potential intervention scenarios by providing insight in the related cash flows using a dashboard. This can serve as a broker between the strategic and operational or financial level of urban governance and urban innovations. It invites partners to rethink interventions, incentives and engage in dialogues regarding collaborative investments. In addition, the model can be utilized to shed light on ways to decentralize cash flows and keep them in a neighbourhood. As a result, sustainable urban interventions that solve given problems, can be stimulated.

6.3 Target group(s) and scope

The output of the UFM methodology gives insight into the (societal) costs and benefits of energy poverty solutions in different domains. This can help and stimulate parties to make decisions concerning energy poverty related investments, policies, and collaborations. They can compare the 'as is' scenario or the cost of doing nothing with the effect of possible interventions.

Often, interventions initiated by governments (e.g. subsidies or investments) to tackle energy poverty might be considered 'lost' as a one-way cash flow. This can demotivate governmental institutions (e.g. municipalities), with a limited budget, from investing in energy poverty related interventions. However, as

the UFM methodology creates a more complete overview of the second and third order costs and benefits in multiple domains, this gives room for reconsideration. Also, these cross-domain effects can help partners to co-invest, as the intervention serves the same goal(s). This may align cash flows and saves budgets. For instance, municipalities might have a health budget and an energy poverty budget. If it can be proven that a given intervention contributes to solving both issues, these budgets can be combined. Furthermore, the cost of doing nothing can motivate partners to invest from a risk management perspective.

When looking back at the problem, these abovementioned reasons show how decisions regarding interventions solving energy poverty and parallel problems in other domains can be supported and stimulated using the insights of the UFM model.

6.4 Outcomes & impact on health

6.4.1 Application in the Making City project

The UFM model has been applied before in the City of Groningen (The Netherlands) in a H2020 Lighthouse project called Making City. This project focuses on one neighbourhood called the Positive Energy District (PED) North. This neighbourhood consists of a residential area Paddepoel and the University Campus Area Zernike. It has a relatively high share of low-income households, houses with an energy label that could be substantially improved, and a fair share of (private) homeowners. Here, TNO, the New Energy Coalition (NEC), and University of Groningen (RUG) are working together with the municipality of Groningen to address energy poverty in this area, using the UFM model.

The model was used to identify the cash flows that go in- and out of the PED North neighbourhood and are influenced by energy poverty. Based on the presence of energy poverty in this specific area and expected changes in energy costs over time, research has been undertaken to establish the (future) cost to society of doing nothing and to compare this with Making City scenarios in which technical interventions are implemented today to avoid citizens getting caught in the energy poverty trap. This societal cost-benefit analysis is being made on two levels: PED North and the municipality of Groningen. The timeline covers 2020-2035, as most (technical) interventions are expected to have a lifetime of approximately 15 years.

The Making City project achieved this by taking several steps:

1. Identify the number of houses and thereby households at risk of energy poverty.
2. Make a future prognosis to analyse the development of households living in energy poverty for the next x number of years.
3. Map the financial effects of energy poverty on a local, regional, and national level. Also include the future costs of society (when energy poverty increases) as the cost of doing nothing.
4. Analyse how the required interventions (to reduce the number of households at risk of energy poverty) can be collected using the UFM model.
5. Determine whether these interventions outweigh the cost of doing nothing and thus should be stimulated.

The societal impact of energy poverty was quantified using the following KPIs:

- Spendable household income.
- Money spent in local economy.
- Money leaving the municipality.

6.4.2 Outcomes and lessons learned

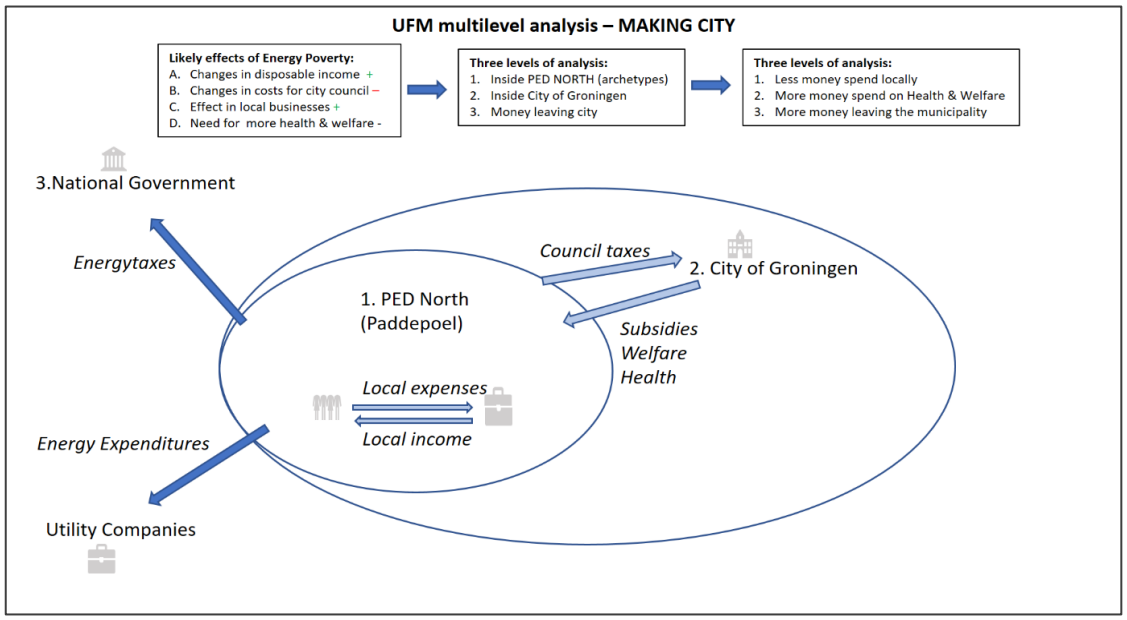
The Making City project is still ongoing, so no end results or related recommendations are available yet. However, the UFM model has already provided the city of Groningen with useful insights. Figure 8 visualises the multilevel analysis that the UFM model tried to create for the Making City project. It shows that some cash flows stay into PED North, and other leaves the neighbourhood or even the city and/or the municipality of Groningen in the form of taxes for example. In contrast with intervention scenarios, more money is leaving the municipality then coming in or being spent internally. This indicates that the cost of doing nothing harms the local economy. Figure 9 zooms into the cash flows at a household level, which further defines which exact cash flows are leaving the municipality, e.g. energy bills.

In the different Making City intervention scenarios these cash flows will change. Similar overviews (including quantification) can show the related costs and benefits. As investments are needed, these costs will increase. However, at a later stage this might save or decrease other costs. For example, offering a subsidy to isolate houses and improve energy ratings will help decrease the energy bills of these households. Consequently, the tenants or homeowners can afford to spend more money in the local economy (e.g. by shopping more at local stores) or on their health (e.g. by subscribing to a sports club, which also contributes to the local economy). Correspondingly, these benefits might outweigh the costs. These insights can serve as a starting point for policy makers and private partners to decide to initiate and even combine investments, as they serve multiple goals.

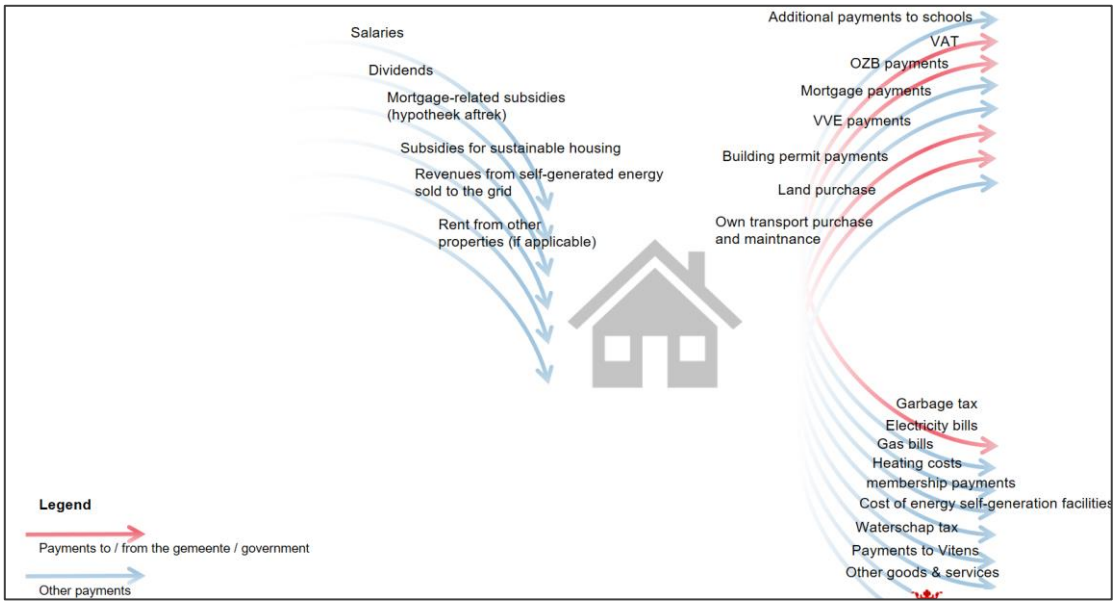
A concrete example with dummy data is given in Figure 10. It shows the costs of several interventions in different demo houses. These investment costs are too high for a household with a low income and/or savings, which means they cannot participate in the energy transition activities. However, if societal costs and benefits are included using the UFM model, it becomes clear that it is beneficial for the municipality (Gemeente Groningen) to invest in the interventions. It outweighs the cost of doing nothing with a payback time of 19 years.

Based on workshops held in March 2021 five out of fourteen programmes of the municipal budget were identified to possibly be affected by the increase of energy poverty. To verify these results, interviews were carried out with Policy Officers and Programme Coordinators of the municipality of Groningen. The aim was to indicate the policy and financial impact caused by rising energy poverty at municipal level per policy programme in 2030, and to gain insight in the distribution of money from municipal budget to district budgets, specifically the aforementioned PED North. The obtained information can be used as input for a more detailed cash flow and cost benefit analysis using the UFM model.

8. Figure: The multilevel analysis that the UFM model tries to create



9. Figure: Cash flows on a household level.



10. Figure: Example of possible UFM dashboard (using dummy data)

Research Question

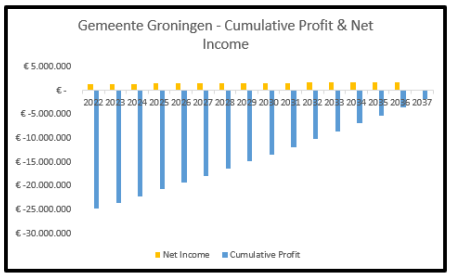
Under which conditions does investment in reducing energy bill outweigh the costs of doing nothing? Focus of analysis:

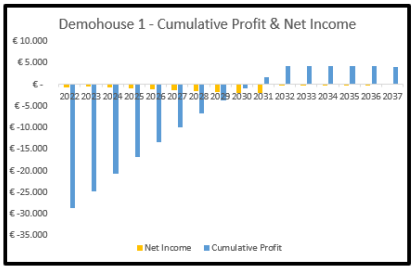
Costs of doing nothing
Energy prices
Different types of subsidies
Nr. of energy poor households

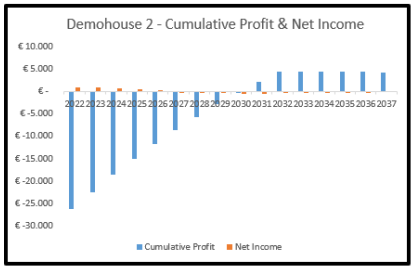
Main variables

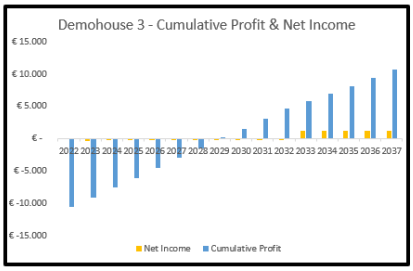
Costs of doing nothing	€ 571,94	euros per household
Electricity price	1	euro/ kWh
Gas price	0,2	euro/ kWh
	0,6	euro/m3
	12	kWh/m3
Total investment of the city	24.974.894	euros
Payback for the City	19	years

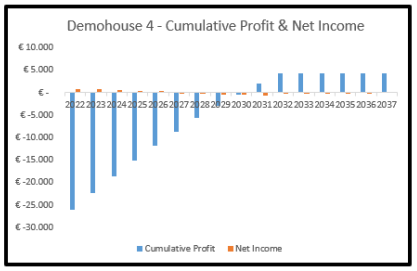
Types of houses	Intervention	Cost of intervention	Financial support by the city pe	Nr. of houses	Yearly energy saving in € per ho	Costs for the City
Demohuis 1 Vrijstaand met schuin dak N Bouwjaar: 2006	Bifcial PV Heatpump WTW	€ 46.109,93	17.363,87	1000	€ 235,24	€ 17.363.873,83
Demohuis 2 2-onder-1 kap Bouwjaar: 1975	26x oost-westopstelling, pv 360 Wp Full Back Binnen & buiten warmtepomp Inductie	€ 29.899,52	3.730,51	2000	€ 235,24	€ 7.461.020,00
Demohuis 3 Rijtjeswoning Bouwjaar: 2008	Fictive data: Heatpump PV panels	€ 18.036,40	7.500,00	10	€ 988,64	€ 75.000,00
Demohuis 4 **Rijtjeswoning** **Bouwjaar: 1966**	Fictive: Pv & Heatpump but house from 1966. so higher energy consumption	€ 18.036,40	7.500,00	100	€ 938,38	€ 75.000,00
Appartments	25% **energy bill reduction**	€ 1.475,00	€ 1.475,00	25	€ 1.475,00	€ 36.875,00











For the Making City project we have used causal chains to discover, find and interpret relations between energy poverty and related domains by exploring causal chains. Input for these causal chains were derived from literature, data and workshops; we successfully connected these by identifying underlying drivers of

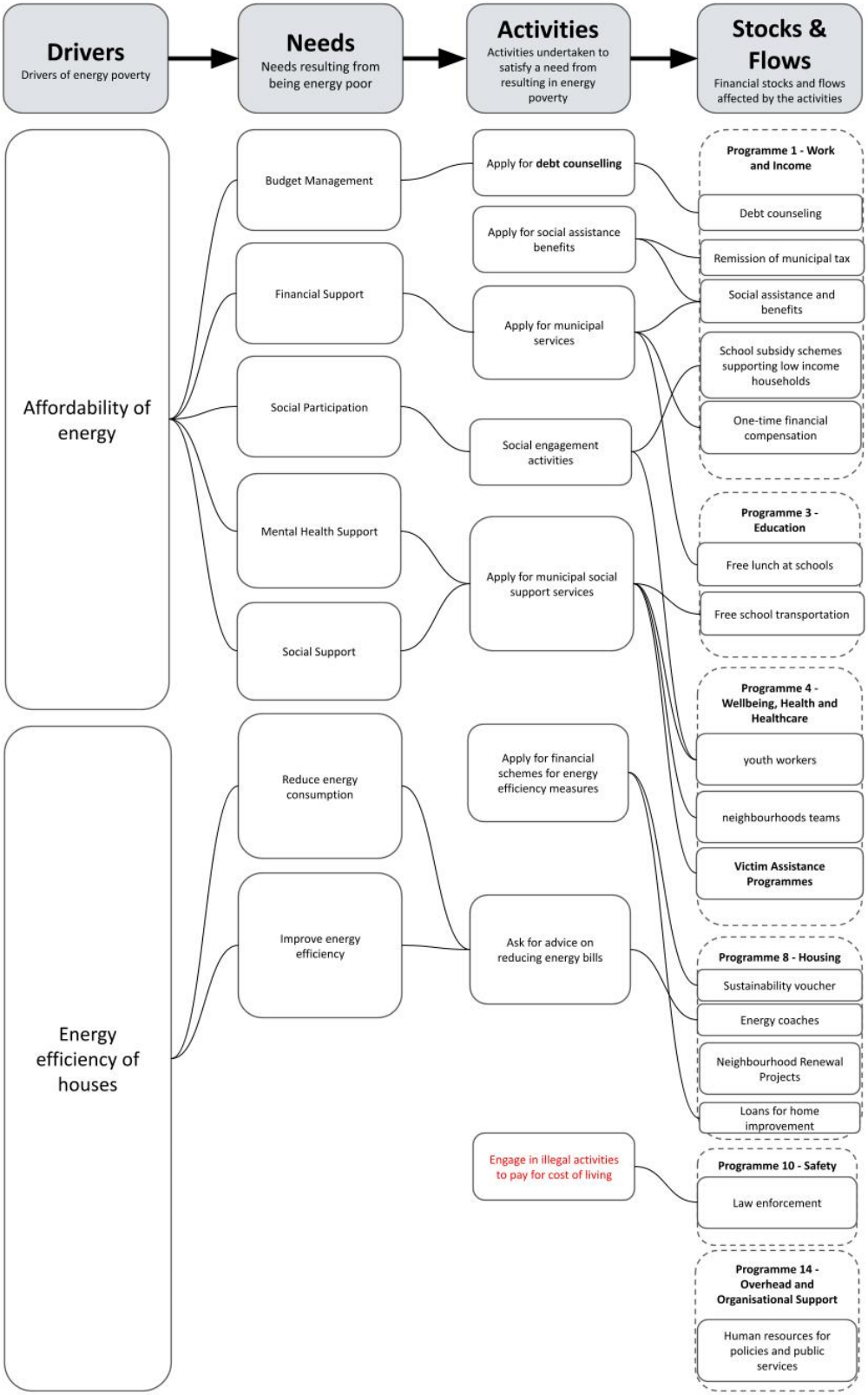
observed financial metabolism within the specific context of our in-depth case study. Connecting needs in our case study led to drivers and activities that were identified from municipal actors and helped us to understand which financial flows and stocks in the form of municipal; programmes are affected. An overview of the results is given in Figure 11.

We discovered that a variety of municipal programmes is affected through energy poverty and the resulting inaction on behalf of the municipal stakeholders in the cost of doing nothing scenario. We could not establish a trustworthy quantification about the monetary impact as the participants and interviewees did not have enough insight to make a valuable/quantifiable judgement. However they did conclude that our reasoning is probably, bringing us to our next conclusion. Municipal programmes are directed to alleviate symptoms but are lacking to understand the deeper cause that result in these programmes; using causal chains reveal, based on needs and drivers, which activities are required and therefore help policy makers to understand root causes; this insight has been helpful in creating a wider understanding and creating better base for investing in interventions in the energy transition; one investment today helps to alleviate future needs that require funding from municipalities.

One interesting finding is that the projected diminished number of inhabitants affected by energy poverty as a result of investment today also reduces the need for control systems and justification into spending of these programmes. This is also an example of co-benefits.

Although we could not establish a quantifiable return on investment for our scenario in our case study, we did show that practitioners and programme managers can expect that energy poverty has a wider than previously expected effect on the municipal programme.

11. Figure: Causal chains between energy poverty and related domains



6.5 Limitations and barriers

Using the UFM model has the following barriers or limitations:

- It can be difficult to collect all cash flow data since not all necessary sources might be available or public, especially as some private partners are often not willing to share data. This means that the data might be incomplete, or that assumptions need to be included.
- Besides data, additional system information is required in order to make the analysis. For example information regarding policies and regulations that affect energy poverty, household archetypes, and the range of energy labels. Corresponding knowledge is essential.
- It is too complex to include all elements (i.e. cash flows and system information). A sufficient level of detail and scope need to be determined.
- The insights that the model provides solely serve as a tool or input for decision making. The next, essential step is the orchestration of actual (collaborative) intervention decisions, partnerships, and solutions.

6.6 Application in WELLBASED

The UFM model can be used as a tool to analyse different intervention scenarios to tackle energy poverty, including the cost of doing nothing. It creates insight in the costs and benefits or return on investment of different interventions such as investments or policies. Not only in the domain of energy poverty, but also in other urban domains.

First, an overview of the risks of energy poverty in a given area is needed:

- Determine scope or level of territory (city/municipality, neighbourhood).
- Create an overview of key characteristics of houses at risk of energy poverty in this area using (public) data.
- Identify key determinants that help to calculate the number of households at risk of falling into the energy poverty trap.
- Group all households together that have been identified as being likely to be at risk of becoming energy poor into energy poverty risk profiles (high, medium, low, no).
- Identify the future development of these risk profiles over the next x years.

Next, being the core topic of Wellbased, the effects of energy poverty and related intervention scenarios can be identified:

1. Identify the effects of energy poverty and how they can affect certain cash flows that go in and out of the area.
2. Determine which interventions could tackle these effects of energy poverty. This includes desk research and an interview phase to investigate intervention opportunities.

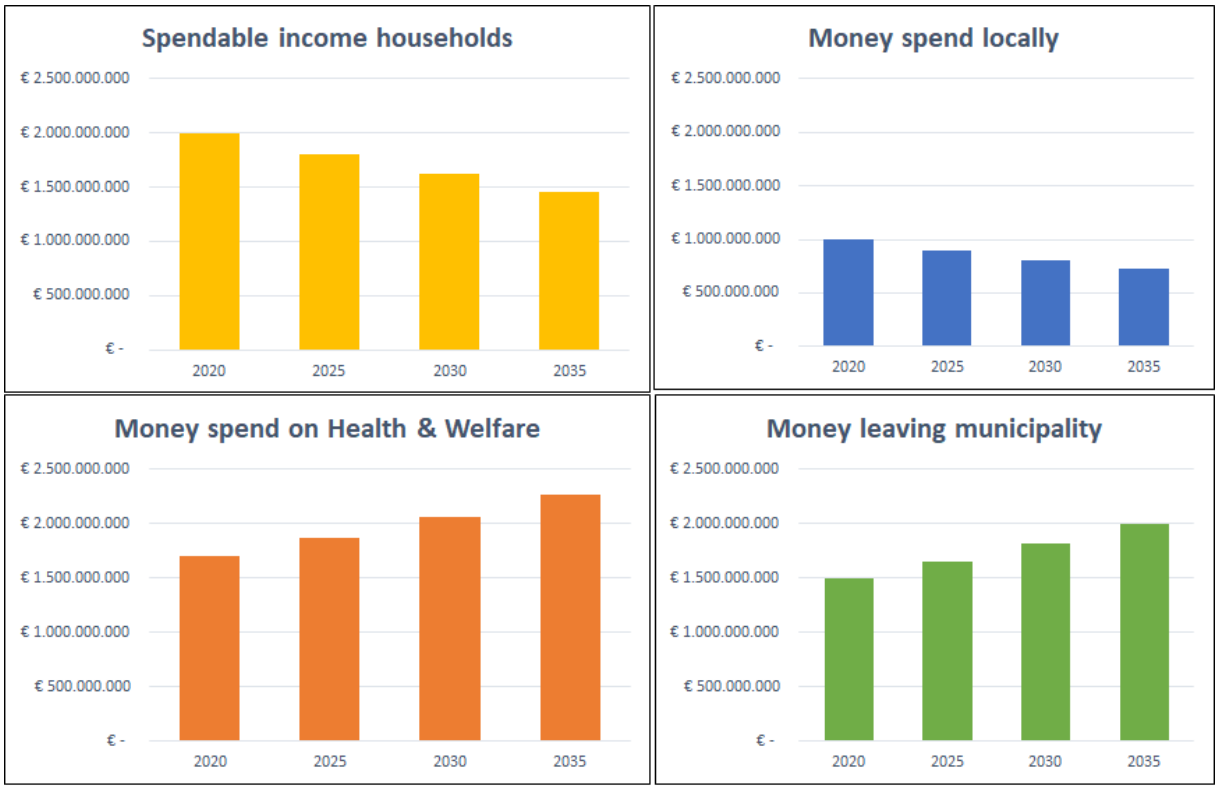
3. Calculate the required investments to finance interventions needed in a specific area. This corresponds with the idea of Social Impact Bonds (SIB), as it matches desired (social) outcomes with required investments.

Thereafter, the UFM model can be used to create insight in the costs and benefits of intervention scenarios:

1. Decide on the level of detail and map energy cash flows, including a label stating its purpose and description.
2. Decide on the level of detail and map other cash flows, including a label stating its purpose and description.
3. Map the strategic governance of the stakeholders.
4. Clarify the required deliverables with stakeholders and adjust approach.
5. Finalise full list of cash flows.
6. Collect data.
7. Plug the data in and perform as-is (cost of doing nothing) and to-be analysis of the costs and benefits that correspond with the cash flows. KPIs should be determined for this analysis.

As was mentioned before, the analysis could be performed using a dashboard that shows the outcomes for every scenario and KPI. In addition to the one given in Figure 12, another example of this dashboard for a hypothetical intervention scenario (using dummy data) is shown in Figure 11. The relevant KPIs can differ per region or scenario and can be adapted or expanded.

12. Figure: Example of dashboard (using dummy data)



6.7 Conclusions and recommendations

As explained in this chapter, the UFM model can be used as a tool to analyse different intervention scenarios to tackle energy poverty, including the cost of doing nothing. It creates insight in the costs and benefits or return on investment of different interventions such as investments or policies. Not only in the domain of energy poverty, but also in other urban domains. This can be applied in projects similar to WELLBASED to investigate the effect of investments. This can help to incentivise more targeted, joint investments to together solve more problems across domains.

The UFM model is applicable on different scales. Currently, this ranges from a district or neighbourhood to a municipality. If desired, the applicability of the model on a bigger scale could be investigated. The level of detail needs to be adapted accordingly.

The UFM model can be replicated and applied in new cities or neighbourhoods when a data gathering protocol is in place and the needed data is available. Also, local knowledge on policies, regulations, and housing should be in place. It is unknown to what extent this information is accessible outside the Netherlands. A successful implementation of the model is highly dependent on data and information concerning the quality of houses, household types, income categories, energy poverty risk evaluation, how available budgets are divided over districts, costs of the consequences of energy poverty, etc.

7 Possible synergies between SIBs and UFM

As it was presented above, SIB and UFM are different kinds of tools, but both can support the fight against energy poverty in their own right.

SIB is a contract on social outcomes, therefore it is a product of trust. The commissioner wants to make sure that the contract will pay off and it won't be ruined financially (even if it is most often a publicly funded organisation), while the client is also interested in the return of the investment.

UFM is a decision-support tool that calculates the return of investment of different interventions.

This leads us to the connection between the two different tools: The UFM, by calculating the costs and the expected return makes the issue procedure transparent, therefore makes fundraising easier and more attractive for the SIB. If the clients are aware of the financial and other benefits of a contract, they will be more willing to invest in the product.

Even though the link between the two instruments seems obvious, the exploitation of the possible cooperation between them requires further data collection and research work.

8 Conclusions and recommendations

In this document we presented why it is necessary and what are the existing and possible ways to finance the fight against energy poverty. Energy poverty has serious consequences on people's health and wellbeing and it also has serious budgetary implications, not to mention the environmental impacts.

It is increasingly recognized in more and more places that energy poverty must be tackled. Member States of the EU spend an increasing amount of money, but data shows that the renovation of public buildings is still prioritized and houses with lower income still often lack of the access to finance. The EU has recognized this barrier, according to Article 8 of the Energy-efficiency Directive, EU Member States *"shall establish and achieve a share of the required amount of cumulative end-use energy savings among people affected by energy poverty, vulnerable customers, people in low-income households and, where applicable, people living in social housing."*[130] The amount of allocated funding in the EU has never been higher, and examples show that the rate of private finance available is increasing as well.

The models introduced briefly or in a more detailed way were typically implemented on a pilot basis and have their limitations and the implementers are aware of these and working on overcoming them. The existing models are predominantly energy and cost focused while health impacts appear only marginally in the evaluations. The precise targeting of these models and tools requires stakeholders who are aware of local needs and target groups, therefore the transnational replication of models seems difficult.

Policy makers are invited to consider the two innovative tools (Urban Financial Metabolism and Social Impact Bonds) presented in Deliverable 5.1.

The pilot calculation of UFM on the example of the City of Groningen shows that the cost of doing nothing is harmful for the local economy, while the pilot calculation of the SIBs on the example of Valencia WELLBASED pilot shows that the cost of investment would return after a few years as a result of savings for the public administration. These results show that, in addition to the social aspects, it can also make financial sense to tackle energy poverty.

It is true that our calculation has barriers. As within the WELBASED project one single indicator was chosen to investigate the feasibility of SIBs, the field is open for further research in the direction of testing other indicators (e.g. health indicators) alone or in combination that reflects the complexity of the energy poverty.

The same applies for the possible cooperation between UFM and SIBs. The UFM, by calculating the costs and the expected return makes the issue procedure transparent, therefore makes fundraising easier and more attractive for the SIB. If the clients are aware of the financial and other benefits of a contract, they will be more willing to invest in the product. However, the exploitation of this possible cooperation require further data collection and research work.

[130] Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast): https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ%3AJOL_2023_231_R_0001&qid=1695186598766

Policy makers are encouraged to consider the health impact of energy poverty reduction programmes when designing and evaluating them. By taking these aspects into account, a more accurate picture can be obtained when carrying out cost-benefit (or other type of) analyses of individual interventions.

We would also like to emphasize that local stakeholders who are aware of local needs and target groups have to be involved in the replication of different good practices, otherwise, one of the most important conditions for success - accurate targeting - will not be fulfilled.

After or meanwhile adopting good practices in the fight against energy poverty and identifying the most effective measures that directly support energy poverty, another crucial step is to identify other policy measures that offset and decrease potential benefits of measures to address or eradicate energy poverty.

9 References

- Bertoldi, P., & Kromer, S. (2006, November 20). Risk Assessment in Efficiency Valuation—Concepts and Practice. JRC Publications Repository. https://publications.jrc.ec.europa.eu/repository/handle/JRC33581
- Bertoldi, P., & Rezessy, S. (2010). Financing energy efficiency: forging the link between financing and project implementation. Ispra: Joint Research Centre of the European Commission. https://build-up.ec.europa.eu/sites/default/files/content/financing_energy_efficiency.pdf
- Bertoldi, P., Economidou, M., Palermo, V., Boza-Kiss, B., & Todeschi, V. (2021). How to finance energy renovation of residential buildings: Review of current and emerging financing instruments in the EU. WIREs Energy and Environment, 10(1), e384. https://doi.org/10.1002/wene.384
- Bertone, E., Sahin, O., Stewart, R. A., Zou, P. X. W., Alam, M., Hampson, K., & Blair, E. (2018). Role of financial mechanisms for accelerating the rate of water and energy efficiency retrofits in Australian public buildings: Hybrid Bayesian Network and System Dynamics modelling approach. Applied Energy, 210(C), 409–419.
- Boardman, B. (1991). Fuel poverty: from cold homes to affordable warmth. London, United Kingdom: Belhaven Press.
- Bollino, C. A., & Botti, F. (2017). Energy poverty in Europe: A multidimensional approach. PSL Quarterly Review, 70(283), 473–507.
- Bosseboeuf, D. et al.: Tackling energy poverty: learning from the experience in 10 European countries, IEECP, November 2021.
- Bouzarovski, S., Petrova S. (2015): A global perspective on domestic energy deprivation: Overcoming the energy poverty–fuel poverty binary, Energy Research and Social Science Vol. 10, 31-40.
- Blanco L (2019): Entendiendo el universo de bonos de impacto social para ver su utilidad. Compromiso Empresarial. https://www.compromisoempresarial.com/innovacion_social/2019/01/entendiendo-el-universo-de-bonos-de-impacto-social-para-ver-su-utilidad/
- Broccardo, E, Mazzuca M, Frigotto M.L. (2019) Social impact bonds: The evolution of research and a review of the academic literature. https://doi.org/10.1002/csr.1886
- Brown, D., Sorrell, S., & Kivimaa, P. (2019). Worth the risk? An evaluation of alternative finance mechanisms for residential retrofit. Energy Policy, 128, 418–430. https://doi.org/10.1016/j.enpol.2018.12.033

- Buffa, V., Tira, M., & Pendeven, B. L. (2023). New development: From social impact bonds to impact bonds—an outcomes-based framework. Public Money & Management, 44(1), 80–84. https://doi.org/10.1080/09540962.2023.2206047
- Burroughs, H. E.; Hansen, Shirley (2011). Managing Indoor Air Quality. Fairmont Press. pp. 149–151. ISBN 9780881736618. Archived from the original on 20 September 2014. Retrieved 25 December 2014
- Cabinet Office of the United Kingdom (2013), "Ministry of Justice: Offenders released from Peterborough Prison.", Centre for Social Impact Bonds.
- Cabinet Office of the United Kingdom (2013), "Reoffending in Rikers Island.", Centre for Social Impact Bonds, 2013.
- Carè, Rosella & Rania, Francesco & De Lisa, Riccardo. (2020). Critical Success Factors, Motivations, and Risks in Social Impact Bonds. Sustainability. 12. 10.3390/su12187291.
- Carmen Sanchez-Guevara, Miguel Núñez, Peiró, Jonathon Taylor, Anna Mavrogianni, Javier Neila González (2019) Assessing population vulnerability towards summer energy poverty: Case studies of Madrid and London. Energy and Buildings, 190, 132-143.
- Caroline van O., Anika B., Nam C. N., Koen S. (2023). Energy Poverty: A Science and Policy State of Play. TNO
- CODESPA (2018): Notas técnicas para el desarrollo. 9 razones para desarrollar un Bono de Impacto Social y 3 para no hacerlo: https://www.codespa.org/aprende/notas-tecnicas/9-razones-para-desarrollar-un-bono-de-impacto-social-y-3-para-no-hacerlo/
- ComAct. (2024). Financing models adapted to the needs of energy-poor households & policy recommendations., p. 2., Sofia: Center for Energy Efficiency EnEffect
- COMMISSION RECOMMENDATION (EU) 2023/2407: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_202302407
- Consejo Económico y Social Europeo (2013): Dictamen sobre el tema Por una acción europea coordinada para prevenir y combatir la pobreza energética (2013/C 341/05). https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:341:0021:0026:ES:PDF
- Cuatrecasas (2020): Estudio jurídico monográfico: Viabilidad y encaje Jurídico de los Contratos de Impacto Social (CIS) en la normativa de Contratación Pública de España. https://spainnab.org/toolkitCIS/Informe_Juridico_CIS.pdf.
- Cooremans, C., & Schönenberger, A. (2019). Energy management: A key driver of energy-efficiency investment? Journal of Cleaner Production, 230, 264–275. https://doi.org/10.1016/j.jclepro.2019.04.333
- De la Cuesta, M (2017): La Inversión de impacto, en "La inversión de Impacto". Dossiers EsF no.27, Otoño 2017, pag 4.

- Dermine, T. (2014) Establishing Social Impact Bonds in Continental Europe. M-RCBG Associate Working Paper Series No. 26 https://www.hks.harvard.edu/sites/default/files/centers/mrcbg/files/dermine_final.pdf
- Directive (EU) 2023/1791 of the European Parliament and of the Council (13 September 2023) on energy efficiency and amending Regulation (EU) 2023/955 (recast)
- Electricity Directive (2009/72/EC) and the Gas Directive (2009/73/EC)
- (*Energy Poverty*, n.d.)*Energy poverty*. (n.d.). Retrieved 27 March 2024, from https://energy.ec.europa.eu/topics/markets-and-consumers/energy-consumer-rights/energy-poverty_en
- EPAH, 2021. Tackling energy poverty through local actions – Inspiring cases from across Europe.
- EPAH Handbook 2: A Guide to Planning Energy Poverty Mitigation Actions, April 2024.
- EPEE: European Fuel Poverty and Energy Efficiency Project (2009). Diagnosis of causes and consequences of fuel poverty in Belgium, France, Italy, Spain and United Kingdom. WP2 - Deliverable 5.
- ESCO Financing options:https://e3p.jrc.ec.europa.eu/articles/esco-financing-options
- EU Parliament – Briefing (2014): Social impact bonds Private finance that generates social returns
- EU4Health programme 2021-2027 – a vision for a healthier European Union (2021) European Commission, https://health.ec.europa.eu/funding/eu4health-programme-2021-2027-vision-healthier-european-union_en
- European Commission (2020) A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives. Downloaded: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0662#footnote69
- European Environment Agency (2023) Air pollution. Downloaded: https://www.eea.europa.eu/themes/air/intro
- Fawcett, T., Rosenow, J., & Bertoldi, P. (2019). Energy efficiency obligation schemes: Their future in the EU. Energy Efficiency, 12(1), 57–71. https://doi.org/10.1007/s12053-018-9657-1
- Habitat for Humanity (2020) Éves jelentés a lakhatási szegénységről 2020. Downloaded: https://habitat.hu/sites/lakhatasi-jelentes-2020/wp-content/uploads/sites/9/2020/10/hfhh_lakhatasi_jelentes_2020.pdf
- Gatica S (2015): Bonos de Impacto Social- El Contexto en Chile. Fondo Multilateral de Inversiones (FOMIN, 2015).
- Guan, Y., Yan, J., Shan, Y. *et al.* Burden of the global energy price crisis on households. *Nat Energy* **8**, 304–316 (2023). https://doi.org/10.1038/s41560-023-01209-8

- Gustafsson-Wright E. et al (2015): The Potential and Limitations of Impact Bonds. Lessons from the first five years of experience worldwide. Brookings Institution. https://www.brookings.edu/wp-content/uploads/2016/07/impact-bondsweb.pdf
- Gustafsson-Wright, E.; Gardiner S. (2016): "Recomendaciones normativas para las aplicaciones de los bonos de impacto: Un resumen de las lecciones aprendidas en los cinco primeros años de experiencia a nivel mundial"; Global Economy and Development Program
- Gustafsson-Wright E, Boggild-Jones I. (2018) Paying for social outcomes: A review of the global impact bond market in 2017.
- Gustafsson-Wright, E. (2020): What is the size and scope of the impact bonds market? Measuring the success of impact bonds. Global Economy and Development at Brookings. https://www.brookings.edu/wp-content/uploads/2020/09/Impact_Bonds-Brief_1-FINAL.pdf
- Habitat for Humanity (2020) Éves jelentés a lakhatási szegénységről 2020. Downloaded: https://habitat.hu/sites/lakhatasi-jelentes-2020/wp-content/uploads/sites/9/2020/10/hfhh_lakhatasi_jelentes_2020.pdf
- Helen Stockton and Ron Campbell (2011): Time to reconsider UK energy and fuel poverty policies?, National Energy Action.
- Huan Liu, Tiantian Hu (2023) Energy poverty alleviation and its implications for household energy consumption and health. Environment, Development and Sustainability. v. 25., i. 3. pp. 1–21.
- IEECP. (2022). A Socially-Just EU Renovation Wave. Amsterdam: Institute for European Energy and Climate Policy.
- Magyar Energiahatékonysági Intézet (2023): A Fit for 55 és az energiaszegénység, https://mehi.hu/wp-content/uploads/2023/01/mehi-fit-for-55-es-energiaszegenyseg-2023.pdf
- MICATool project: https://build-up.ec.europa.eu/en/resources-and-tools/tools/micatool-support-decision-making-calculating-energy-efficiency-measures
- Monfils, S., & Zeijl-Rozema, A. van. (2021). Creating an enabling environment for accelerating condominium energy retrofitting: Case studies in Grenoble (FR) and Brussels (BE). IOP Conference Series: Earth and Environmental Science, 855(1), 012020. https://doi.org/10.1088/1755-1315/855/1/012020
- Mulgan, G, Reeder, N., Aylott M, & Bo'sher L. (2011). Social Impact Investment: the challenge and opportunity of Social Impact Bonds. The Young Foundation.
- OECD (2015): Social Impact Investment: Building the Evidence Base.
- OECD (2016) Understanding Social Impact Bonds
- Olson H, Painter G, Albertson K, Fox C, O'leary C. Are Social Impact Bonds an Innovation in Finance or Do They Help Finance Social Innovation? Journal of Social Policy. 2024;53(2):407-431. doi:10.1017/S0047279422000356

- Pasi, G. (2013): “Challenges for European Welfare Systems - a Research Agenda on Social Impact Bonds.” Review of Applied Socio-Economic Research.
- Pellicer, M. (2016) Reconceptualizando la pobreza energética desde el Desarrollo Humano: hacia una definición más inclusiva y transformadora.: https://www.researchgate.net/profile/Victoria_Pellicer-Sifres/publication/313846905
- Policy Brief IVALUA (2018): “La pobresa energètica a Catalunya, una problemàtica que afecta com a mínim el 7.5% de les llars catalanes”.
- Preston I. et al (2013): Fuel Poverty Social Impact Bonds: Their potential role and associated challenges. https://www.fuelpovertylibrary.info/content/fuel-poverty-social-impact-bonds-their-potential-role-and-associated-challenges-2
- Preval, N., Keall, M., Telfar Barnard, L., Grimes, A., & Howden-Chapman, P. (2017). Impact of improved insulation and heating on mortality risk of older cohort members with prior cardiovascular or respiratory hospitalisations. *BMJ Open*, *7*, e018079. https://doi.org/10.1136/bmjopen-2017-018079
- Primc, K. – Slabe-Erker, R.: Social policy or energy policy? Time to reconsider energy poverty policies, in: Energy for Sustainable Development 55 (2020), 32-36.
- Proietti, G. (2020). Profitable Impact Bonds: Introducing Risk-Sharing Mechanisms for a More Balanced Version of Social Impact Bonds. In: La Torre, M., Chiappini, H. (eds) Contemporary Issues in Sustainable Finance. Palgrave Studies in Impact Finance. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-40248-8_4
- Renovate Europe (2023): 2021-2027 Cohesion Policy Support for Energy Efficiency and Building Renovation, https://www.renovate-europe.eu/wp-content/uploads/2023/04/23-04-24_MFF_21-27_Report.pdf
- (*Renovation Wave*, n.d.)*Renovation wave*. (2020). Retrieved 27 March 2024, from https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_enre
- RENOVERTY: Overview of policy mechanisms and financial mechanisms for renovation roadmap development (Deliverable 4.2.), 2024.
- Riopérez, I (2015): Bonos de impacto social- Análisis sobre el verdadero impacto en la sociedad. Universidad Pontificia de Comillas, Madrid.
- Schuessler, Rudolf (2014) : Energy poverty indicators: Conceptual issues. Part I: The ten-percent-rule and double median/mean indicators, ZEW Discussion Papers, No. 14-037, Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim, https://nbn-resolving.de/urn:nbn:de:bsz:180-madoc-368880

- Sánchez Suárez. C. (2018): De la vulnerabilidad energética al derecho a la energía. Ecologistas en Acción. https://es.scribd.com/document/400092369/Informe-Pobreza-Energetica-2018#from_embed
- Sian Jones (2016): "Social causes and consequences of energy poverty", en Katalin CSIBA (Editor), Energy Poverty Handbook. European Parliament. http://meszerics.eu/pdf/energypovertyhandbook-online.pdf
- Sinclair, S., McHugh, N., & Roy, M. J. (2019). Social innovation, financialisation and commodification: a critique of social impact bonds. Journal of Economic Policy Reform, 24(1), 11–27. https://doi.org/10.1080/17487870.2019.1571415
- Social Finance. SIB Feasibility Studies. http://www.social-finance.org.il/category/SIB-Feasibility-Studies
- Social Finance (2013): A Technical Guide to Developing Social Impact Bonds
- Social Finance (2016). Social Impact Bonds- The early years, https://www.socialfinance.org.uk/sites/default/files/publications/sibs-early-years_social_finance_2016_final.pdf
- Social Impact Investment Taskforce (2014): Impact Investment: The Invisible Heart of Markets. https://impactinvestingaustralia.com/wp-content/uploads/Social-Impact-Investment-Taskforce-Report-FINAL.pdf
- SpainNAB y COTEC (2020): Toolkit para el desarrollo de Contratos de Impacto Social, CIS. https://spainnab.org/toolkitCIS/Toolkit_CIS.pdf
- Tse, A. E., & Warner, M. E. (2018). The razor's edge: Social impact bonds and the financialization of early childhood services. Journal of Urban Affairs, 42(6), 816–832. https://doi.org/10.1080/07352166.2018.1465347
- van Oorschot, J., Hofman, E., & Halman, J. (2016). Upscaling Large Scale Deep Renovation in the Dutch Residential Sector: A Case Study. Energy Procedia, 96, 386–403. https://doi.org/10.1016/j.egypro.2016.09.165
- Vogel, J. A., Lundqvist, P., & Arias, J. (2015). Categorizing Barriers to Energy Efficiency in Buildings. Energy Procedia, 75, 2839–2845. https://doi.org/10.1016/j.egypro.2015.07.568
- Williams, J. W. (2018). Surveying the SIB economy: Social impact bonds, "local" challenges, and shifting markets in urban social problems. Journal of Urban Affairs, 42(6), 907–919. https://doi.org/10.1080/07352166.2018.1511796
- World Health Organization (2006) Fuel for life: household energy and health. Downloaded: https://iris.who.int/bitstream/handle/10665/43421/9241563168_eng.pdf?sequence=1
- World Health Organization (2018) Housing and health guidelines. Downloaded: https://ghhin.org/wp-content/uploads/Bookshelf_NBK535293.pdf

- Zabaloy, M. F., Recalde, M. Y., & Guzowski, C. (2019). Are energy efficiency policies for household

References used for the introduction of selected models (Chapter 4)

- 'Ghent Climate Plan 2014-2019' (no date). Available at: https://mycovenant.eumayors.eu/docs/seap/13697_1424439474.pdf (Accessed: 8 February 2024).
- 'Les 7 Vents' (no date). Available at: https://www.7vents.fr/qui-sommes-nous/ (Accessed: 23 March 2024).
- 'Warm Home Prescription' (2024) Energy Systems Catapult. Available at: https://es.catapult.org.uk/project/warm-home-prescription/ (Accessed: 6 February 2024).
- Dekeyser, L. (no date) 'Dampoort KnapT OP!', Kennisplatform Renovatie. Available at: https://www.kennisplatform-renovatie.be/goedepraktijken/dampoort-knapt-op/ (Accessed: 8 February 2024).
- Energent (Belgium) - European Commission (2023). Available at: https://citizen-led-renovation.ec.europa.eu/pilots/energent-belgium_en (Accessed: 26 March 2024).
- Energent (no date) Energent - Coöperatieve vennootschap die burgers verenigt in hun streven naar een duurzame en klimaatneutrale samenleving. Available at: https://energent.be/ (Accessed: 26 March 2024).
- Énergie Solidaire (no date). Available at: https://www.energie-solidaire.org/qui-sommes-nous/ (Accessed: 21 March 2024).
- Energy Systems Catapult (2024) 'Warm Home Prescription Taskforce recommendations'. Available at: https://esc-production-2021.s3.eu-west-2.amazonaws.com/wp-content/uploads/2022/11/07095558/Final-WHP-taskforce-recommendations.pdf.
- Kizilcec, V. et al. (2023) Report: Warm Home Prescription - Impact on Health and Wellbeing and Attitudes to Heat. Energy Systems Catapult Limited.
- Residential Energy Efficiency for Low-Income Households - REELIH - About us (2022) Reelih Regional. Available at: https://getwarmhomes.org/about-us/ (Accessed: 8 February 2024).
- Residential Energy Efficiency for Low-Income Households - REELIH - How to improve residential energy efficiency in South Eastern Europe and CIS -policy brief by HFHI (2022) Reelih Regional.

Available at: https://getwarmhomes.org/resource/how-to-improve-residential-energy-efficiency-in-south-eastern-europe-and-cis-policy-brief-by-hfhi/ (Accessed: 8 February 2024).

- Residential Energy Efficiency for Low-Income Households - REELIH - Improving Health (2022) Reelih Regional. Available at: https://getwarmhomes.org/energy-efficiency/improving-health/ (Accessed: 8 February 2024).
- Residential Energy Efficiency for Low-Income Households - REELIH - New publication online (2022) Reelih Regional. Available at: https://getwarmhomes.org/ (Accessed: 8 February 2024).
- REVOLVE (2023) 'Citizens, Democracy, and the Renovation Wave', 14 December. Available at: https://revolve.media/features/citizens-building-renovation (Accessed: 26 March 2024).

WELLBASED

Funded by the Horizon 2020 Framework Programme of the European Union