International Experiences On Financing Mechanisms for Renovations

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THE EUROPEAN UNION
The European Regional Development Fund
Interreg IVA
ÖRESUND – KATTEGAT – SKAGERRAK
Urban Transition Öresund

Contents

1 Background

The aim of this report is to present international experiences on different financing mechanisms for energy efficient renovations and based on the experience gathered and lessons learnt contribute to the development of a financing mechanism for retrofit projects in the Öresund Region in the frame of the Urban Transition Öresund EU project.

1.1 Problem description

The Kyoto commitment of the EU as well as the ambitious national energy-saving and greenhouse gas mitigation targets can be met through appropriate practical energy saving measures in new and existing buildings (e.g. EuroACE, 2010; McKinsey, 2009). The implementation of these measures, however, is often challenging; this is due to various barriers. These barriers include the suboptimal use of resources, lack of incentive in the principal-agent structure, and asymmetric information, where different players have different level of knowledge decisions are based on. In addition, investments, seemingly profitable, are not carried out - mainly due to the uncertainty with regards to future energy prices and future energy efficiency technologies. Financial barriers often related to complicated decision-making procedures, especially when it comes to decisions on investment in energy efficiency measures. There are often not enough own funds to finance investments or if there are, (credit) institutions are reluctant to lend money. It is often due to lack of awareness and understanding of the lender on the purposes of the investment. In order to overcome barriers related to financing and investment decisions and to promote energy efficient retrofit measures, lessons learnt from different international financial schemes for retrofits are essential to enhance the knowledge and understanding on barriers and whether and how they have been addressed by these schemes.

Some, in different ways successful, financial schemes were found to be worth to assess on an international, national, local level as well as some innovative schemes, which involve private financing. In this report, some of these schemes have been investigated closer. These include preferential loans and subsidy schemes on a national level in Germany in the UK, local financing in London, in the UK and third party financing in Germany and Austria. It is with the aim to contribute to the decision on further financial scheme development in the Öresund Region.

1.2 Objectives

The objective of this study is to investigate various financial mechanisms for energy efficient renovations; more specifically, how these schemes overcome financial barriers to energy efficient renovations. The special focus is laid on energy service company financing (ESA- and EPC-based models) as these non-government instruments have been shown to have an important role to play in mobilizing private funding (BPIE, 2012). Based on the synthesis of different international experience, underlying factors facilitating successful financial arrangements will be discussed. This knowledge will serve as a base for contributing the development of financial mechanisms for renovations in the Öresund Region.

1.3 Research Design and Outline

In order to fulfill the aim of this study, the research design will follow the steps described here-below. (1) In Chapter 2, barriers to energy efficient residential renovations and potential strategies to overcome them are presented. The overview is based on a literature review. (2) In Chapter 3, there is an overview of selected financial schemes for energy efficient renovations. This step includes a literature review, including academic literature, company documentation, public reports and interviews. The scope of the study will limit to experience derived from Europe. (3) Chapter 3 also includes the presentation of experiences how selected financial schemes overcome barriers to energy efficiency with the focus on the design of financing mechanisms (source of finance, target audience, building types and measures); in some cases even the contextual implementation (institutional framework and actors), the outputs (intended and achieved direct results) and the outcomes (intended and unintended impacts, side effects) are touched upon. (4) In Chapter 4, a barrier analysis is carried out on an ESCO-model; the analysis is based on the tool presented in Chapter 2, literature review, interviews and workshops to assess the model developed by Dansk Energi against the tool. (5) Chapter 5, based on the findings of the assessed experiences, concludes with relevant facilitating factors for overcoming barriers and implementing financial mechanisms are highlighted.

1.4 Acknowledgement

I would like to express my gratitude for their continuous support, interest and enthusiasm to all members of the financial group in the Urban Transition Öresund project, and especially to Annette Egetoft (Copenhagen City), David Snällfot (Malmö City) and Karin Haldrup (Aalborg University). Special thanks to Silas Harbro (Dansk Energi) for the valuable time, insights and topical discussions. It has been a pleasure to work with all of you.

This report would not have been realized without the support of the EU InterReg funding for Urban Transition Öresund.

2 Overcoming barriers to energy efficiency

This section presents the findings of the academic literature review on barriers to energy efficient renovations and potential strategies to overcome them. The barriers are categorized into four groups: (F)inancial barriers, (I)nstitutional barriers, (B)uilding-related barriers and (E)nd-user related barriers. Based on the analysis of WEC (2013) and BPIE (2010 and 2012), these barriers can be overcome by barrier category-specific overarching strategies. The findings, i.e. barriers and general strategies to address these are presented in Figure 1.

Successful strategies to overcome financial barriers can be described in general as aiming for (a) improving access to capital and enhancing attractiveness, (b) reducing costs and (c) moving towards self-financing. In order to realize these strategies, barriers such as difficult access to capital, high risk exposure, high discount rates, long payback periods, low financier awareness and lack of standardized measurement & verification have to be addressed.

Successful strategies to overcome institutional barriers address (a) institutional and legal frameworks, (b) engage various (suitable) partners and (c) aim to enhance knowledge and capacity. In order to work with these strategies, barriers identified in different institutional and legal settings have to be removed, such as split incentives and the knowledge and capacity on energy efficient issues need to be improved at different actors' stake.

Successful strategies to overcome barriers related to building types and building measures aim to offer a suitable (a) range of measures to implement in a feasible (b) range of sectors/building types. In addition, successful strategies go beyond "picking low hanging fruits" and aim for (c) deep retrofits. These strategies ideally address barriers, which slow down innovation processes and make administration processes complex. In addition, these strategies aim to (better) manage the different types of risks by e.g. allocating them across different stakeholders.

Successful strategies to overcome barriers related to end-users aim to make the (a) customer journey less complex and work with (b) gaining consumer trust. These strategies often incorporate quality assurance in their offerings and (c) engage consumers through awareness raising and marketing. These strategies address then barriers, such as the complexity of issues related to energy efficiency, the lack of awareness, the lack of consumer trust and the poor diversity of consumers.

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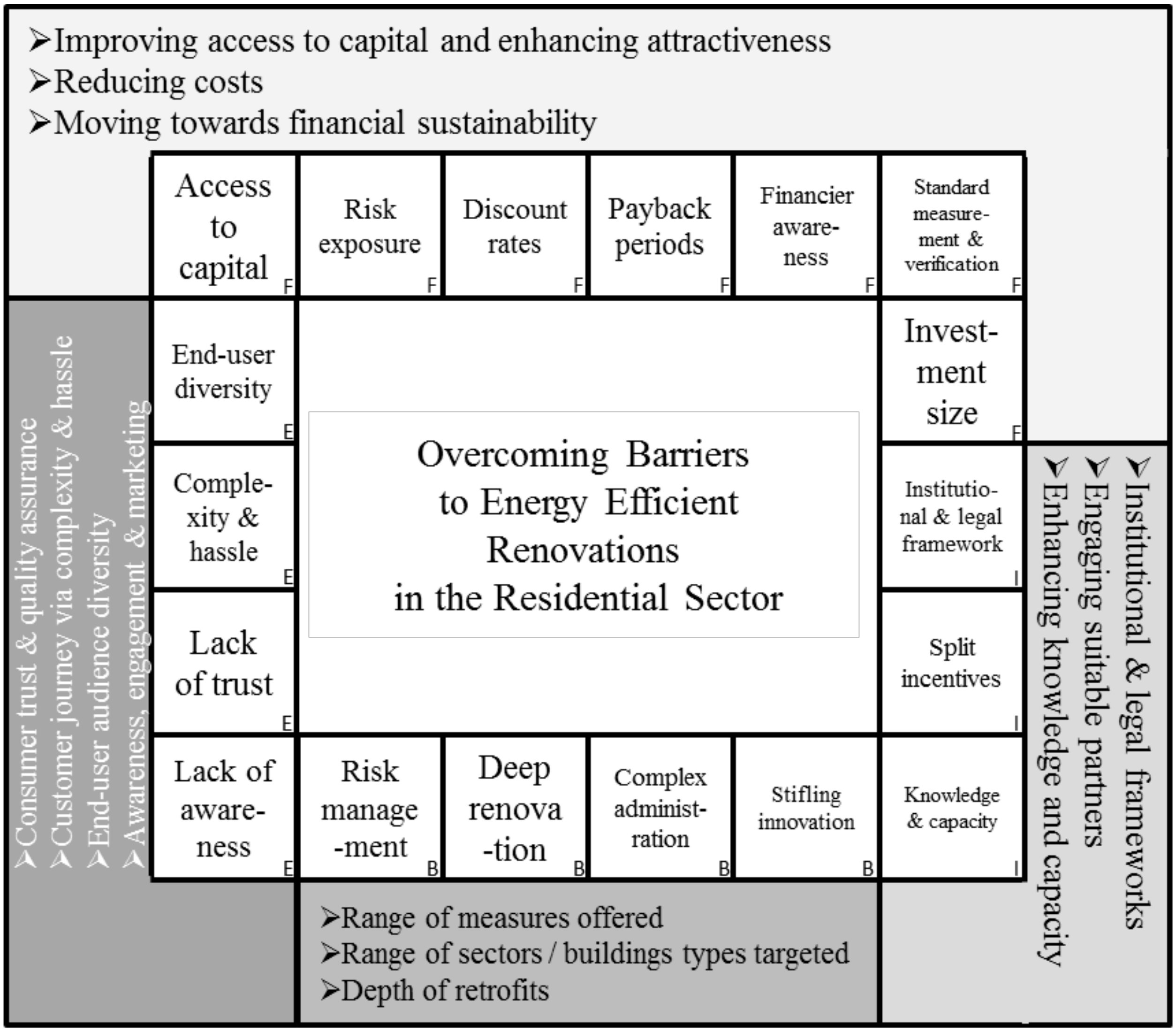


Figure 1 Overcoming barriers to energy efficient renovations in the residential sector (Source: WEC, 2013 & BPIE, 2012 (modified))

3 Financial schemes for energy efficient renovations

This section presents various financial schemes aiming at enhancing energy efficient renovations and some relevant experience how they overcome barriers to energy efficiency. The financial schemes are presented and discussed on different levels, such as (i) international, (ii) national, (iii) local and (iv) business, private financing. The description of the schemes focuses on some of the key elements in terms of a) the design of financing mechanisms (source of finance, target audience, building types and measures), b) the contextual implementation (institutional framework and role of actors), and c) the experience, such as the outputs (intended and achieved direct results, e.g. energy and/or cost savings) and the outcomes (intended and unintended impacts, side effects) related to the schemes. This description, in return, provides a good base to assess how the described financial schemes have overcome some barriers to energy efficiency in renovations.

3.1 International Institutional Financing

The importance of institutional financing lies in addressing certain barriers, which simply cannot be overcome by other means of financing. It is questionable whether and how much this form of financing enhances e.g. innovation, but its role under certain circumstances, in e.g. emerging markets is indisputable.

The key institutions financing energy efficiency in buildings are Global Environment Facility, World Bank, United Nations (UN) globally. On a European level, the European Investment Bank (EIB), the European Union (EU) through various funds and the European Bank of Reconstruction and Development (EBRD) are becoming increasingly important and can play an even greater role in the future[1]. A brief summary of the current activities of the above-mentioned institutions for municipalities and cities follows here.

3.1.1 Global Environment Facility (GEF)

The Global Environment Facility (GEF) is a partnership for international cooperation to address global environmental issues. Recognizing that to achieve global goals actions needs to take place in cities, GEF started to support cities in 1999. Building on previous experience, GEF has recently launched the Sustainable Cities Integrated Program (US$ 100 million)[2]. This program is to demonstrate how innovation and high impact investment can support a sustainable management of cities. This effort seeks to provide policy and governance support to facilitate integrated urban design, planning, and management, which lead to sustainable and resilient

[1] "Though there is concern that some Member States are almost entirely dependent on such funding for their national programmes." (BPIE, 2012)

[2] GEF began supporting urban programs with two grants in 1999: one for São Paulo to improve its transport infrastructure, and the other for Beijing to improve its sewage treatment and district heating. Since 1999, GEF has invested in 100 projects in 110 cities across 60 countries, with US$580 million in grants and an additional US$7.23 billion leveraged in co-financing from the private sector and other sources. The projects cover all major urban sectors such as energy, transport, water, and waste management. Some successful examples include Tianjin Eco-city, the Introduction of Climate Friendly Measures in Transport in Mexico City, and the Global Fuel Economy Initiative in African and South American cities (GEF, 2014).

development and sound ecosystem management. GEF seeks to work more directly with city governments to help their efforts in green and resilient urban planning and management.

To complement the Sustainable Cities Integrated Program, the GEF-6 Climate Change Mitigation Focal Area has an indicative allocation of US$210 million to support urban interventions with significant mitigation potential. Examples of projects eligible for support include (a) integrated land use planning that supports transit-oriented development, (b) mainstreaming building energy efficiency codes in cities, (c) piloting distributed energy resource systems in urban districts, and (d) energy recovery from municipal waste (GEF, 2014).

GEF is also supporting urban resilience through its Adaptation Strategy, directing US$195 million towards projects that enhance urban resilience through the Least Developed Countries Fund and the Special Climate Change Fund (GEF, 2014).

3.1.2 World Bank (WB)

The World Bank has several initiatives to support mostly cities in developing countries in their development towards sustainability. The World Bank's technical and financial assistance for urban development has increased significantly in the past years: total commitments (IBRD/IDA) have increased 67% to an annual average of US$4.32 billion (2010-2014) from US$2.57 billion (2005-2009). In September 2014, for instance, the World Bank announced a new initiative: Low-Carbon Livable Cities (LC2) Initiative. It is to support developing country cities around the world in their efforts to plan low-carbon, climate-smart development and get finance flowing (World Bank, 2014). The initiative – which aims to reach 300 of the largest developing country cities in the next four years – offers a comprehensive suite of tools and activities tailored to cities' specific needs and level of progress on their climate-smart development path, ranging from greenhouse gas inventories and assessments to low-carbon investment planning and financing solutions

To support this, for example, a City Creditworthiness Program was designed to help city financial officers conduct thorough reviews of their municipal revenue management systems and take the first steps to qualify for a rating. According to internal WB estimates every dollar invested in the creditworthiness of a developing country city is likely to mobilize more than US $100 in private sector financing for low-carbon and climate-resilient infrastructure. One example is a mechanism to pool financing opportunities. Connecting cities that want to finance the same type of investment, the initiative will help them access the market together at better financing terms.

3.1.3 United Nations (UN)

The UN supports sustainable cities in various ways; one of the frameworks is the Sustainable Cities Programme (SCP), which in 1996 grew out of a cooperation between UNEP and UN-HABITAT on the environmental aspects of policies, planning and management of cities. The SCP is supporting city demonstrations in a growing number of countries, which currently amount to more than 60 city and country-level initiatives (SCP, 2014). Other programmes supporting urban development include regional urban environmental strategy for the Asia-Pacific region (with focus on transport, ecohousing and waste management) and the Global Environment Outlook (GEO) process in cities. GEO is designed to analyse the state of the local environment and the impacts of cities on the local, national and global environment. This helps cities to obtain meaningful environmental data, which can be used for decision-making and action. For instance, when through the Localising Agenda 21 programme this data is translated into demonstration projects.

3.1.4 European Investment Bank

The three main types of financial mechanisms the EIB provides both for the public and private sectors are (i) intermediated lending (e.g. framework loans, investment funds), (ii) risk-sharing instruments combined with grants/loans, technical support and/or partnering (e.g. European Energy Efficiency Fund, EEEF) and (iii) project support programmes (e.g. European Local Energy Assistance, ELENA; Joint European Support for Sustainable Investment in City Areas, JESSICA) (BPIE, 2012). More details on the individual programmes can be found in the Appendix or on the respective programme homepage.

3.1.5 European Union

The EU provides support for energy efficiency in buildings through various funds, such as the Structural and Cohesion Funds, the next period is 2014-2020; the proposal for an EU Cohesion Policy places emphasis on reaching energy targets, including through renovations. Other funds include e.g. 7th Framework Programme (R&D)[3], Intelligent Energy Europe (IEE)[4], and Horizon 2020[5]. More details on the individual programmes can be found in the Appendix or on the respective programme homepage.

3.1.6 European Bank for Reconstruction and Development

The EBRD, in general sees difficulties to find bankable energy efficiency building renovations, but has been active in supporting the improvement of district heating systems and third party financing companies in "new" member states. The main forms of EBRD financing are loans, equity investment and guarantees.

3.2 National Financial Instruments

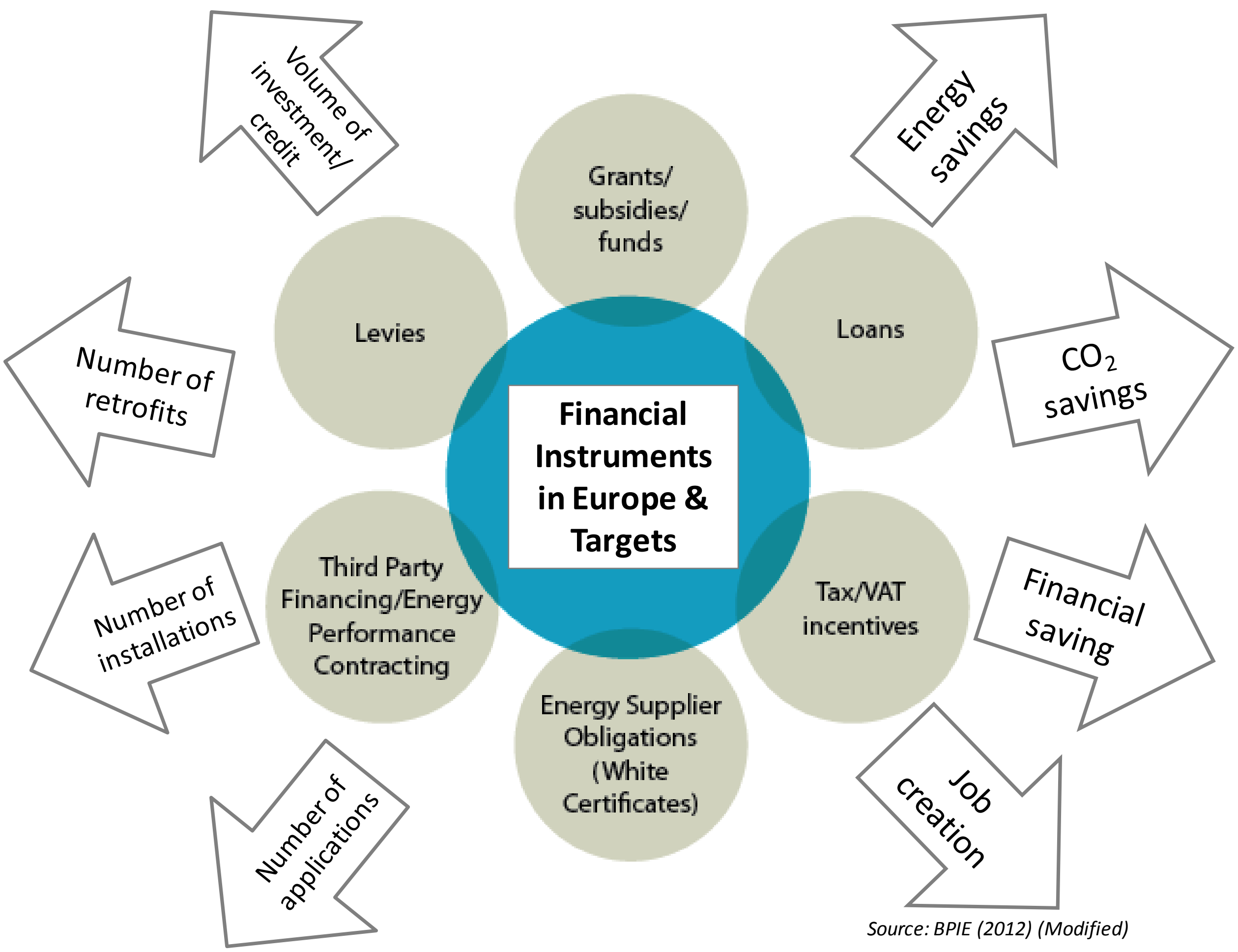
In order to overarch the energy efficiency gap[6] and realize the calculated energy saving potential through building renovations, significant economic support is needed for different types of measures and to different types of building owners to reach the necessary quality of renovation. Financial instruments are aimed at providing economic support to the existing financial resources of building owners. There are a variety of financial instruments targeting existing buildings in the residential sector, depending on the objectives and resources used; for instance, BPIE (2012) categorizes them as *conventional* and *innovative* financial instruments.

The most often used conventional instruments in Europe include grants and subsidies, which are often used together with (preferential) loans (BPIE, 2012). In addition, tax incentives, including tax reduction, tax credit and VAT reduction and levies are also considered conventional, however

[3] www.ec.europa.eu/energy/technology/fp7_en.htm
[4] www.ec.europa.eu/energy/intelligent
[5] www.ec.europa.eu/research/horizon2020/index_en.cfm
[6] Energy efficiency gap is the unexploited economic potential for energy efficiency, in other words, it emphasizes the technically feasible energy efficiency measures that are cost-effective but are not being deployed (Hirst & Brown, 1990).

used in a much lesser extent. Innovative instruments generally rely on private financing (and not government budgets, although there are exceptions) and used to a lesser extent; these include energy supply obligations (white certificates) and third party financing (energy performance contracting, energy services companies, on-bill repayment, guarantee programmes). According to another classification (Entranze, 2013) the most common "non-fiscal instruments strengthening support and financing activities within the market", besides energy saving obligations and contracting type of instruments, include quota system for renewable energy systems (heating), bonus/premium scheme (energy efficiency feed-in tariffs), and bank obligations to grant interest reduced loans. Financial instruments are often shown to target specific technologies, equipment or building aspects (e.g. envelop) and only few financial instruments target deep renovations or low energy buildings or follow a holistic approach (BPIE, 2012; BuildUp, 2014).

The effectiveness of the assessed European programmes is unclear; it is due to the lack of programme evaluations, standardized and/or on-going monitoring process, harmonized key performance indicators and ex-ante goals/objectives. Figure 2 illustrates the main types of financial instruments applied in Europe (grey circles) and some of their most relevant targets (grey arrows), which are also used as performance indicators for ex-post and ex-ante evaluations.



Source: BPIE (2012) (Modified)

Figure 2 Typical financial instruments promoting energy renovations in Europe and their targets (Source: BPIE, 2012 (modified))

These financial instruments target different audiences, use different organizational structures and intend to overcome barriers in different ways. *Direct grants and subsidies* are mostly offered from public funds and directly allocated by the authorities or through banks/foundations. The main advantages with this type of instruments are that they are versatile and particularly suitable for economically depressed areas and financially constrained markets. They can be deployed to support innovation and technology development and can also be used to target support at specific end-users to meet social policy objectives such as fuel poverty. They can also be used for demonstration activities and to encourage uptake of innovative measures. Since conditions can be attached to grants, private investments can be stimulated (e.g. require the simultaneous installation of other energy efficiency measures). The disadvantages related to grants and subsidies include high risks that the desired outcomes will not be achieved (e.g. investment in a specific type of measure), limited utility and sustainability of public funding (as they only can be used once, compared with revolving funds for example), and limited leverage and impact.

Preferential loan schemes often subsidize interest rates or support credit risks. They are typically supported by regulatory measures, whereby national and/or local authorities share the risks with banks and/or cover a share of the loan interest. The main advantages with these schemes are that they provide incentives for the final recipients to select the most appropriate and cost effective measures, they are well-understood mechanisms among both project developers and beneficiaries, and generally easy to administer. Since loans are repaid, the money can be reinvested into more projects. Main disadvantages with these schemes include the "mis-categorization" of energy savings (they may not be considered as a project cash flow) and the unsuitability for poorer households who have no income to repay the loan.

Tax incentives are accessed either through the tax office or at point of sale. They can be e.g. energy and climate tax (e.g. to create a fund for financing energy saving measures), sales tax (to promote market diffusion), tax rebates (given in recognition of energy savings investments) and differentiated VAT rates (to influence consumer choices of efficient technology or energy performance upgrade).

Third party contracting and energy services are described more in details in Section 3.4.

3.2.1 KfW schemes in Germany

KfW-Schemes amongst others offer favourable finances for energy efficient rehabilitation and energy efficient construction programmes. These are preferential loans essentially with specific characteristics in their design, context and intended outcomes. KfW schemes are an umbrella name for the programme including different preferential loans (long-term fixed rate low interest loans) provided by the German state bank, KfW[7] for energy efficiency refurbishment projects. The current schemes were launched in 2008 after the KfW CO_2 Reduction Programme and the KfW CO_2 Building Rehabilitation Programme were running out. The current programmes for

[7] KfW is a German government-owned development bank, established in 1948 as a part of the Marshall Plan. Its name is originated from Kreditanstalt für Wiederaufbau ("Reconstruction Credit Institute"). It started to run energy efficiency programmes in 1996.

residential buildings include KfW Energy Efficient Rehabilitation Programme and KfW Energy Efficient Construction Programme[8].

Scheme design

The programme "Energy Efficient Construction and Refurbishment" provides financing by way of soft loans and grants for energy efficient construction and refurbishment activities for the German residential sector. To be eligible for the programme, it is a precondition that the efficiency standards achieved by the project are better than the requirements as set out in the German Energy Savings Ordinance. Eligibility is based on two key parameters: (1) the annual primary energy demand compared to the demand of a new building (the so-called "reference building") and (2) the structural heat insulation (specific transmission heat loss) compared to the reference building. The basis for measuring the level of energy efficiency is the so-called "KfW Efficiency House Standard". There are three levels of promotional incentives for energy efficient construction activities expressed as Efficiency House Standards 40, 55 and 70. This means that the primary energy consumption of the housing unit in question corresponds to 40%, 55% or 70%, respectively, of what the reference building is allowed to consume according the Energy Efficiency Ordinance. For all levels, the promotional interest rate is the same. The difference pertains to the level of partial debt relief (in percent), in the form of a repayment bonus, which is granted to the borrower (in addition to the favourable interest rate) once the targeted efficiency level has been reached and verified by an energy expert[9]. The KfW scheme is designed so that retail/commercial banks give the KfW loans directly to customers (see Figure 3). By doing so, the KfW schemes address three important barriers to energy efficiency. Firstly, the inclusion of retail banks facilitates risk diversification. Secondly, the use of customers' existing banks promotes more customer trust toward loan schemes. Thirdly, as retail banks can charge an additional interest rate premium on top of the KfW interest rate (generally capped at 0.75% per year for household loans), they are incentivized to enter the business and manage these costs.

Target audience. These two programmes, KfW Energy Efficient Rehabilitation Programme and KfW Energy Efficient Construction Programme, target building owners in general with "satisfactory" credit scores. In Germany, the group of building owners consists of private home-owners, housing enterprises, housing cooperatives, real estate agents, municipalities, local community associations, districts, civil groups and other establishments of public law. Finance can be accessed for almost all types of residential buildings through private landlords and owner-occupiers (represents 40.6% of the German residential market), tenants through landlord

[8] Similar programmes are running for municipal, commercial and industrial building, however, aligned with the focus of this report, here the focus is on residential buildings.

[9] For instance, the Efficiency House 40 benefits from a 10% debt relief. The maximum loan amount is €50,000. For energy efficiency refurbishment activities, there are in total six promotional levels: starting with Efficiency House 55 as the most ambitious level, followed by Efficiency House 70, 85, 100 and 115 as well as a separate level for monument buildings. The incentive in terms of partial debt relief starts at 2.5% for the Efficiency House 115 and reaches 17.5% for the most ambitious level Efficiency House 55. Customers who do not target a deep retrofit of their building or housing unit can benefit from promotional loans for single measures such as windows, heating systems or insulation. Customers who do not want to apply for a loan also have the option to apply for a grant. The amount available is based on the same energy efficiency levels as for the loans and calculated based on the maximum loan amount applicable. It varies between 10% and 25% of the maximum loan amount of €75,000 (i.e. between €5,000 and €18,750).

agreement (36.6%), other housing providers (22.7%) and ESCOs (Pfliegner et al., 2012). The scheme addresses the building-related barriers; the broad range of potential borrowers unlocks access to a wide range of housing types, both in terms of the range of building types and the diversity of tenure types. In addition, it encourages the participation of diverse end-users.

Building types and measures. The KfW-schemes have different packages supporting home improvements both by ways of offering loans for single energy efficiency measures (e.g. insulation of cavity wall or loft or floor; window replacement) and a combination of measures (e.g. building envelop improvements, heating replacement, heat distribution and ventilation measures; for more details on the combination of measures see Appendix). This scheme unlocks some building-related barriers by offering a wide range of measures. In addition, KfW loans may cover the costs for energy assessment, planning, project design and management; these costs otherwise would be additional to the actual energy efficient installation. By this action, it facilitates the end-users journey and eliminates some hassles on the way. As the maximum credit amount for loans is defined per housing unit, renovations of single apartments are ruled out, thus the entire apartment building is addressed.

Source of finance. The majority of financial sources for KfW loans originate from the capital markets. Due to federal guarantees for KfW's commitments and funds[10] from the Federal Government, KfW gets good credit rating on the market and thus can secure the finance at low interest rates for high volume. Out of €1.5 billion annual governmental housing fund, in 2010 €0.8 billion was allocated to KfW's energy programmes (Novikova, 2013). The total funds spent on energy efficiency in 2012 were €3.6 billion (KfW, 2012). The publicly subsidized interest rates for retrofit loans can be as low as between 1% and 2%. This scheme provides simpler access to capital and makes the loans attractive to borrowers, by addressing one of the main financial barriers. Credit guarantees provided by the state is a very important form of 'strategic niche management' to promote an emerging sector and to maintain attractiveness for lenders, especially when there is little willingness to lend across sectors, high-yielding investments are rare and the economic climate is relatively instable. The main question is, however, whether this sector can sustain financing without the need for guarantees, e.g. to what extent funds can be recycled as loans are repaid and whether investors become familiar enough with energy efficiency refurbishments so that these schemes can participate in credit markets.

[10] Previously, general Federal Funds were used to secure low interest rates and subsidies, while in the future funding from the Energy and Climate Fund, including carbon certificate revenues and power plant duties, is used for the same purpose.

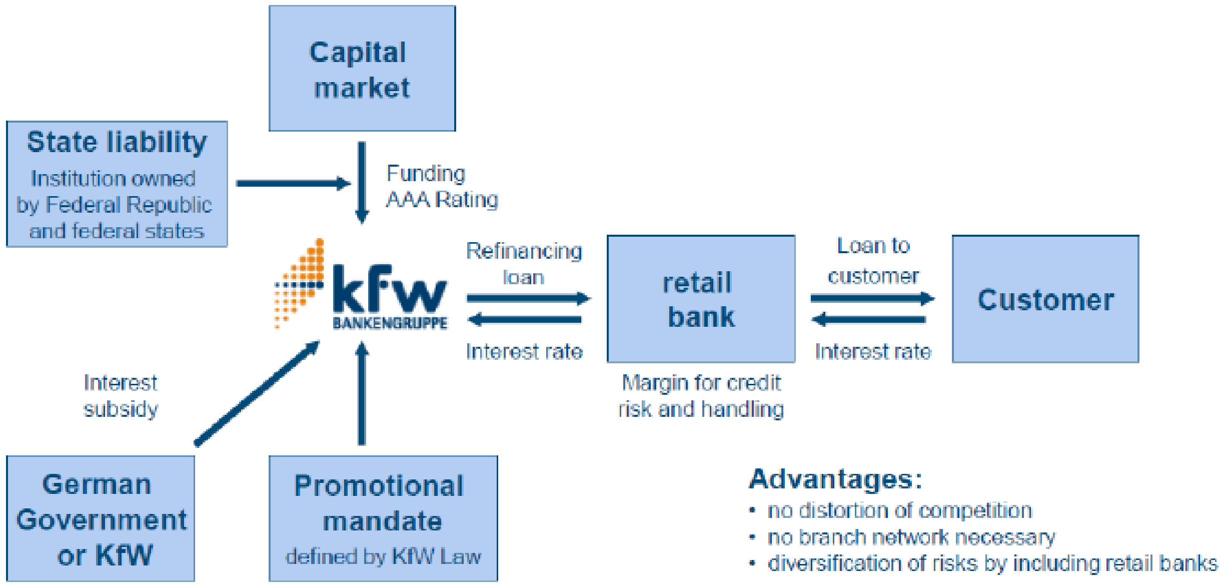


Figure 3 KfW funding structure (Source: Gumb, 2012)

Contextual implementation

Institutional framework. The KfW schemes are nationwide energy efficiency programmes, run by the state and contribute to fulfill the requirements formed under the non-binding German Energy Concept 2050 and the legally binding German Energy Conservation Act (EnEv). The budget granted for the KfW programmes is determined by the parliament. The Energy Concept aims amongst others for a climate-neutral building stock by 2050 and an increased rate of energy-saving modernization from 1% to 2% per year. The Energy Conservation Ordinance, in case of major renovations, amongst others requires improvements in the building envelop which results in 30% more energy efficiency than before. It also requires the application of energy efficient technologies when upgrading the heating (and/or cooling) and ventilation solutions. There are subsidies linked to the Energy Conservation Ordinance, both for new built and refurbishment projects. These subsidies are available also for all KfW loan-takers and linked to the energy efficiency level achieved. The KfW loans rate well below ordinary retrofit loans and further bolstered by these subsidies, whereby the most energy efficient properties can receive up to 17.5% of subsidized loan, makes the financing more accessible and thus the investment more attractive for building owners. This design element, i.e. linking subsidies to preferential loans, has a great potential to open the doors for deeper retrofits. In addition, KfW schemes are nationwide and run by the state, which might explain the high levels of investment. It also contributes to reducing costs (lower borrowing costs, lower interest rates); these schemes are also more likely to achieve administrative economies of scale by aggregating a large number of smaller projects. The funding of KfW programmes however might face uncertainty in the medium term – as long-term budget cannot be granted for parliamentary reasons, which might create an atmosphere of uncertainty and could also undermine the stakeholder engagement.

Actors. The main players of the scheme are the national government, KfW, regional commercial banks, approved energy assessors, supported by DENA. The suitable partners/actors involved in the scheme have been crucial to overcome institutional barriers. The role of KfW and the regional banks have been previously explained. KfW due to its quasi-public sector status and established reputation and the regional banks due to their close relation and extensive knowledge about their customers ensure trust and quality in these programmes. In addition to KfW and its retail banks, building societies and credit unions market the KfW schemes to building owners. The point of intervention is when building owners approach these institutions to arrange finance for general buildings refurbishment. Additional awareness raising and marketing activities on energy efficiency are run by DENA, the German Energy Agency. KfW also has promotional activities, such as the KfW awards, information campaigns and a KfW academy to train business partners. These activities have been essential to address key barriers to end-user engagement and increase the awareness and enhance the knowledge among stakeholders. The role of energy assessors is to verify the energy savings; the KfW funding can be provided only after this verification. The involvement of energy assessors contributes to standardization, thus to overcome key barriers of financing.

Outputs and outcomes

The KfW schemes themselves contain both output-related elements (intended and achieved direct results) and outcome-related elements (intended and unintended impacts and side effects). In the frame of the programmes, both single and a combination of measures could be chosen to achieve cost effective energy savings and potentially receive financial rewards (a percentage of the loaned amount) for it if certain overall energy requirements were met. As a result of the KfW schemes, the achieved direct results can be indicated by the increasing take up rates; today over 3 million German homes improved energy efficiency as a result of the schemes.

The impacts of the KfW schemes are indicated in realized energy savings and CO_2 reduction. As no external evaluation has been made on the running schemes, examples of impacts are provided from the previous programmes (CO_2 Reduction Programme and CO_2 Building Rehabilitation Programme), which saved 12,500 GWh in total by 2004 (KfW, 2013). This energy saving would translate to 2.645 $MtCO_2$ reduction. In addition, it is estimated that due to the programme between 200 000 and 300 000 jobs are created or protected each year. These outcome figures have to be treated with caution, as there is too little external evaluation available on the results and monitoring.

3.2.2 Green Deal in the United Kingdom

One of the most recently introduced financial support programmes is the Green Deal; it was launched in January 2013 in the UK. The main goal of the programme is to improve energy efficiency of households (and non-domestic properties). The innovative element of the Green Deal is that the loan is attached to the building (technically to the electricity meter) and not to the building owner.

Scheme design

The Green Deal[11] is a preferential loan covering the upfront costs of energy efficiency measures in buildings. The loan is tied to the building and operates with a "golden rule". The "golden rule" is that the benefits of expected savings will have to be equal to or greater than the cost of improvements, including interest payments. In practice, only those measures qualify under the system that allow for re-financing by the energy cost savings within a pre-defined period (in this case 25 years), the costs are added to the energy bills (in this case electricity bills). This design requires the electricity suppliers then to transfer the payments to the Green Deal provider. Since the loan is on the property itself, the new owner or tenant "inherits" the cost burden in case of ownership transfer or change of tenant (Department of Energy and Climate Change, 2011). In case of non-compliance (e.g. households failing to meet the golden rule) or particularly vulnerable households, there is an additional support mechanism, the new Energy Company Obligation (ECO)[12]. The Green Deal, by enabling investments at zero upfront cost is to remove an important barrier to energy users[13].

Target audience. The loan is available for everyone, independently of e.g. income levels. For home owners, there is a limit of £10 000 for the total cost of improvement. In reality, however commercial loans have very limited attractiveness for most consumers (Dawson, 2005).

Building types and measures. Domestic energy efficiency improvement measures include insulation (e.g. solid wall, cavity wall, loft, and door), glazing and smart meters as well as heating and hot water systems and micro-generation. The scheme is flexible, currently there are 45 measures approved to receive funding, but more may be added as technologies advance. There is a risk however that the impact on the delivery of measures, particular insulation, implies a radical shift from well-known energy efficiency measures with an established supply chain towards more sophisticated and expensive technologies. In addition, the financial solution still does not offer solution for the hassle and disruption of building work and the lack of reliable advice at the point of installation. This is supported by the fact that energy suppliers have found it necessary to offer quite significant discounts (typically 50%-100%) under CERT to householders to incentivise purchases (Eyre, 2012).

Source of finance. The upfront costs, i.e. the Green Deal loans are given out by Green Deal providers. These are private companies providing Green Deal Plans, including the financial agreement, warranties, customer relations and energy efficiency improvements and installations. Currently, there are about 50 companies authorized as Green Deal Providers (DECC, 2014). The financial risk is seemingly distributed among different market actors; however, if the government

[11] Similar programmes have been in place in the US for some years (Bird and Hernández, in press; Fuller et al., 2009; Jewell, 2009; Johnson et al., 2012).

[12] Through the ECO mechanisms, the Affordable Warmth Obligation, Carbon Saving Obligation and Carbon Saving Communities Obligation, the UK government aims to provide enough support for the 230 000 low-income households to make these relatively expensive measures cost-effective (BPIE, 2012).

[13] When developing the Green Deal, another scheme was considered, the Property Assessment Clean Energy (PACE) mechanism´, which was established in the US in 2008. Its key element is that it facilitates repayment of energy efficiency loans through a special tax on the property's tax bill (both domestic and commercial properties). This special tax is secured by placing a lien on the property which is senior to all other payment liabilities related to the properties including mortgages, thus reducing the default risk significantly (Ya He, 2012).

does not underwrite the Green Deal, Green Deal providers bear the risk of credit default risk. As mentioned before, the Green Deal loan is attached to the building (technically to the electricity meter) and not to the building owner. The loan is repaid via a surcharge on the electricity bill (on-bill repayment). Consequently, in case of ownership transfer or change of tenant, the new owner or tenant continues to pay the costs on-bill. In addition, it has to be noted that the Green Deal loans are commercial rate loans, which might not be that attractive to households. The approach of attaching payments to the electricity meter is new; customers will pay loan charges from the electricity bill, while actual costs will be reduced on e.g. gas bills. So the intuitive linkage referred to in some Green Deal literature might be confusing for the customers in reality.

Contextual implementation

Institutional framework. Alongside the Green Deal, which focuses on the most cost-effective measures, the Energy Company Obligation (ECO) was introduced in January 2013 to cover those measures that do not meet the Golden Rule and to support customers living in fuel poverty. UK policies for carbon emissions reductions in the existing housing stock have a long tradition in supplier obligations14. Under these obligations, the Department of Energy and Climate Change (DECC) imposes an energy/carbon savings target on energy companies. ECO places three obligations on energy companies: a) a carbon saving target, b) a carbon saving communities target (focused on the 15% most deprived areas and rural households), and c) an affordable warmth obligation (requiring a defined reduction in energy costs in low income households) (DECC, 2012). These targets have to be achieved by implementing energy efficiency or carbon saving measures in buildings.

Actors. Energy suppliers can choose different strategies to meet the obligations, including the development of own businesses, outsourcing to third parties, promotion of energy efficient technologies via retailers and collaborations with social housing providers. The Green Deal and the ECO programmes are linked via various mechanisms, for instance, Green Deal providers may offer finance plans that combine Green Deal funding with ECO mechanisms, Green Deal providers also have access to ECO funding from energy companies by offering carbon savings in competition with other providers (DECC, 2012) and/or measures that do not fulfill the Golden Rule can be funded by ECO and be bundled with Green Deal funded measures. Alongside the accredited Green Deal providers, accredited advisors are to inspect and recommend measures and accredited installers are to install them in order to ensure good results in Green Deal. These accreditations and the option to be able to choose suppliers and installers potentially address barriers related to knowledge of energy saving options and distrust in the supply chain. However, it should not be assumed that it will substantially increase the general consumer interest in energy efficiency issues. Maybe the challenge is less the awareness, but more to gain consumer commitment for energy efficiency issues, i.e. make non-interested consumers to interested ones. The scheme misses to address the supply chain actors and assure deliveries of measures offered. The Green Investment Bank is another important actor supporting private sector investments in the UK's transition to a green economy. The programme would further benefit from its

[14] Key policies for carbon reduction in households since 1994 include Energy Efficiency Standards of Performance (EESoP, 1994-2002), Energy Efficiency Commitments (EEC1, EEC2, 2002-2008), Pay As You Save (PAYS, 2009-2011), Carbon Emissions Reduction Target (CERT, 2008-2012), Community Energy Saving Programme (CESP, 2009-2012), as well as the Warm Front Scheme which focused on mitigating fuel poverty (2000-2012).

engagement, for instance it could potentially underwrite loans and thus minimize the risk of investors.

Outputs and Outcomes

Intended and achieved direct results. The impact assessment of the Green Deal and ECO programmes estimates a high uptake in the offered measures. For instance, it predicts that roughly 100 000 installations of solid wall insulation will be delivered annually in the coming 10 years, which is almost 1 million installations by 2022 (DECC, 2012)[15]. An increase from 22 000 (2011) to 100 000 (2015) installation of solid wall insulation over three years might sound overly optimistic (DECC, 2012; Eyre, 2013). It is also questionable whether the capacity of the existing supply chain is enough to serve this development. In addition, historically, due to cost minimization, energy companies did not focus on cavity wall insulation (because it is more difficult to install). While, DECC (2012) estimates a rapid increase in cavity wall installation, due to the cumbersome nature of the installation, it is likely to remain at low levels. ECO could risk that carbon target not being achieved.

Intended and unintended impacts. The overall carbon target for the ECO (January 2013 - March 2015) is 27.8 $MtCO_2$ and for the Green Deal is 5.6 Mt CO_2 (DECC, 2012). Based on an analysis made by Eyre et al. (2013), Green Deal and ECO together will only deliver 26% of the carbon savings that the policies in place in years 2009-2012 (CERT and CESP) achieved. Some of factors contributing to the weaker performance might include lower savings from individual measures (lighting and appliance measures with high savings potential are not included in these programmes), high costs of singular measures (e.g. solid and cavity wall insulation) under unchanged investment levels of energy suppliers, and the exclusion of cavity wall insulation and loft insulation from the CSC scheme (Eyre et al, 2013).

In addition, DECC (2012) indicates that the impact of ECO on decreasing fuel poverty will affect 125 000 – 250 000 households by 2023 (DECC, 2012). The number of households currently in fuel poverty is about 20-40 times this figure (DECC, 2012). However, evaluations (e.g. ACE, 2012, DTI, 2001 and Hills, 2012) show that Green Deal and ECO will cause only a 29% reduction in total fuel poverty spending and due to distributional impacts they are more likely to increase than decrease fuel poverty.

3.3 Local Financing

The role of cities on the way towards sustainability has been increasingly accentuated; however without the application of feasible ways of financing mechanisms the actual impact is questionable. Revolving funds have found to be a strategically important delivery mechanism, where any return on investments can be reinvested in e.g. urban development projects. Some good examples have been found amongst others in London, Manchester, Rotterdam, and the Haag. The below example demonstrates how JESSICA, the national Structural Fund Programmes along with other public and/or private financial sources can make contributions to their urban development funds to get the wheel rolling. The urban development funds then invest these

[15] In comparison, according to the CERT annual review on an average 13 200 solid wall insulation were installed per year (Ofgem, 2011).

monies, in the form of equity, loan and/or guarantee - not grants - in urban development projects. Returns on investments are reinvested in other urban development projects.

3.3.1 Urban Development Funds in London

Contextual implementation. The Mayor's Climate Change Mitigation and Energy Strategy set out a target to reduce London's CO_2 emissions by 60% by 2025 (from 1990 levels). London's boroughs and social housing providers also have their own carbon reduction targets. Domestic properties account for 36% of London's carbon emissions, and as at least 80% of London's buildings will still be standing by 2050. As a response to these challenges, LGF was launched in October 2009 by the Mayor of London and the European Commissioner for Regional Policy as the first JESSICA Holding fund in the UK. The London Green Fund was established by the London Development Agency (LDA), which is now the Great London Authority (GLA) under the European Commission's JESSICA initiative. The EIB manages the LGF on behalf of the GLA and LWARB. Under the LGF, there are three Urban Development Funds targeting domestic energy efficiency today: RE:NEW, LEEF and Greener Social Housing. Alongside supporting energy efficiency in domestic buildings, the RE:FIT programme addresses public buildings.

3.3.2 London Energy Efficiency Fund

Design of the scheme. The London Energy Efficiency Fund (LEEF) invests in energy efficiency retrofit to public, private and voluntary sector buildings and infrastructure in order to make it more energy efficient and environmentally friendly (LEEF, 2014). LEEF is one of three Urban Development Funds (UDFs) procured by the European Investment Bank (EIB) on behalf of the London Green Fund. LEEF was set up in 2011 and is managed by Amber Infrastructure Ltd, who is responsible for securing additional funding, assessing project proposals and taking the final decision on which projects are funded. The Amber Green Infrastructure is funded by the Royal Bank of Scotland and Arup& Partners acting as technical advisors. LEEF provides primarily debt financing (where applicable, equity can be provided) to projects involving a) adaptation or refurbishment of existing public, private and voluntary sector buildings and b) decentralized energy systems. LEEF encourages project sponsors to consider how best to achieve economies of scale e.g. by grouping buildings or eligible parts of broader refurbishment projects together. The scheme has a limited pot of money and thus works on a first come first served basis.

Target audience. The beneficiaries of LEEF are the ones undertaking a refurbishment programme / retrofit project in a London-located private / public / voluntary sector building, those whose works contribute to improved energy efficiency through reducing consumption and/or carbon emissions. The fund targets investments of between £3-10m (maximum £20m per borrower). Smaller projects may also be approved for funding but are considered on a case-by-case basis. These are private and commercial building owners, public and voluntary sector bodies, developers, ESCOs, energy companies and other project promoters.

Building types and measures. Building types falling under the scheme include private and commercial buildings, buildings that belong to the central government, local authorities, charities, as well as museums, galleries, religious buildings, educational buildings, prisons and social housing. Eligible energy conservation measures include insulation, boiler replacement and ground source heat pumps. LEEF also supports larger projects on campus-based combined heat and power (CHP), district heating and renewable energy generation.

Source of finance. LGF has over £100 million capital to be invested by December 2015. It is made up of £50 million from the London ERDF Programme, £32 million from the Greater London Authority (GLA), and £18 million from the London Waste and Recycling Board (LWARB). The The LGF provides funding for three UDFs that invest directly in waste, energy efficiency, decentralised energy and social housing projects. They are 'revolving' investment funds, where monies invested in one project are repaid and then reinvested in other projects. LEEF was set up in August 2011 with £50 million allocated from the LGF. LEEF today has £100m capital from (£50m from the London Green Fund and up to £50m additional private finance) to be lent to public or private sector borrowers on projects that promote energy efficiency. LEEF is targeting a minimum of £70 million of investment, predominantly through senior or mezzanine loans. Loans are flexible and competitive with tenors of up to 10 years and annual interest rates from 1.65%.

3.3.3 RE:NEW (domestic energy efficiency)

The RE:NEW programme was instigated in April 2009 and made progress in the first two phases; it has delivered improvements to over 100 000 homes and saved over 22 MtCO_2 per annum. In the third phase, RE:NEW has received funding from ELENA (EIB) under the CIP-Intelligent Energy Europe Programme with a 10% match fund provided by the GLA. With the introduction of the ECO and Green Deal, to best tap the benefits, RE:NEW support teams have been established to support local authorities and social housing providers (for free) to deliver domestic retrofit projects faster, bigger and with better value for money.

The support is tailored to each organisation and comprises (a) a review of retrofit potential, (b) formulation of retrofit projects, (c) funding and procurement advice, and (d) support through the procurement process. Typical measures undertaken under the RE:NEW scheme include insulation (loft and cavity, internal and external solid wall), heating upgrades, water efficiency measures and double glazing and draught proofing. In addition, district heating upgrades and renewable schemes can also be supported. The scheme aims to address a wide range of measures and aims to reach out to a mixed tenure structure.

3.3.4 Greener Social Housing Fund

The Greener Social Housing Fund was launched in 2013 and got £12 million from LGA. The investments are primarily in the form of loans to registered social housing providers for retrofitting the housing stock. The Housing Finance Corporation Ltd. is responsible for assessing project proposals and taking the final decision on whether or not to invest. More details are available at http://www.thfcorp.com.

3.3.5 RE:FIT (public energy efficiency)

The RE:FIT scheme is to support public sector organisations to reduce their carbon footprint and subsequent energy bills by streamlining the procurement process for energy services. It is by providing pre-negotiated, EU-regulation-compliant contracts that can be used with a group of pre-qualified Energy Service Companies (ESCOs). The ESCO designs and implements energy conservation measures, which enable organisations to cut running costs, energy consumption and carbon emissions. The ESCO guarantees the level of energy savings, thus offering a secure financial saving over the period of the agreement. This innovative model transfers the risk of performance to the ESCO. Helping RE:FIT to succeed is the Programme Delivery Unit (PDU). The PDU is the public face of the RE:FIT programme, proactively recruiting building owners into the programme and supporting organisations throughout the process through benchmarking, recommending optimum financial and CO_2 savings, and helping organisations through the procurement, implementation and verification phases. This type of performance contracting approach is new to many public organisations and the support of the PDU gives them confidence in the model and the process. The PDU's support is fully funded by the GLA and a grant from the ELENA programme (European Local Energy Assistance), so the service is provided at no cost to London's public sector organisations. The target is for 40% of public sector buildings in London to be retrofitted by 2025. This would retrofit 11 million m^2, realising a reduction in carbon emissions of over 2.5 million tonnes per annum.

3.4 Involvement of Private Financing: ESCO-models

ESCOs play an important role in delivering energy saving measures in the modernisation of the building stock. ESCO-models and contracting addresses the barrier that many building owners have problems in raising the capital for refurbishment measures and/or are not willing to incur debts. In general, contractors finance the refurbishment measure and get repaid by the energy cost savings (pay-as-you-save). From the perspective of the home owner the measures are cost neutral or in the case of very profitable measures even beneficial (when the cost benefit is shared by the contractor and home owner). In order to promote ESCO activities, often adjustments and improvements in the national framework conditions are needed, such as in risk management for the long repayment periods (e.g. to carry the risk against payment defaults) and in legislation, e.g. clear rules how contracting projects should be dealt with in the case of a transfer of ownership. The main disadvantage of these models is that a single implementation without a combination with other financing does not sufficiently address very ambitious energy standards as required by the long-term targets. Another sensitive issue is the risk allocation, depending on the mechanism how and where the risk is allocated (e.g. whether it has to be factored in by the contractors), financing conditions might be worse than those under state-financed grant programs. Two examples from Germany will be discussed more extensively here, Energy Service Contracting (ESC) and Energy Performance contracting, while other mechanisms will only be briefly and not country-specifically touched upon.

Energy services can be divided into different categories. In the German market, the earlier services were more informational (incl. information, communication, consulting services), the driver behind was to improve customer relations and retention (Bunse, Irrek, Siraki, Renner, 2010). Other service-models include "add-on" services, i.e. add-on services to the energy delivery contracts and the main driver for providing the services is customer retention. (Bunse, Irrek, Siraki, Renner, 2010). Thirdly, the more comprehensive energy services, such as energy contracting aim beyond customer retention and relations; they are profitable themselves.

3.4.1 ESCO-models in Germany

Contextual implementation. The main policies “steering” the energy service market include the European Energy Service Directive (ESD) and Energy Efficiency Directive as well as the German national energy targets on energy intensity, energy productivity, and energy efficiency, including electricity and heat reduction targets (Lehr, Lutz, Pehnt, Lambrecht, Seefeldt, Wünsch, Schlomann, Fleiter, 2011) and climate mitigation targets. Energy efficiency services started to emerge in the early 1990s; today the German energy service market is one of the most mature in Europe with an approximated number of 500 ESCO(-like) companies (Hansen, 2009). More than half of these are involved in energy contracting and the majority of the companies offer Energy Service Contracting (BEA, 2011). ESC is the most common type, with a market share of around 80-85%. Energy Performance Contracting (EPC) has a market share of about 10-15%. Maintenance and administration of technical installations has about 5% of the market (Bunse, Irrek, Siraki, Renner, 2010; Hansen 2009). Even though energy services have a relatively long tradition in Germany, there still exists some suspicion from many customers towards energy contracts. In order to overcome uncertainties around energy services, in 1995, the Berliner Energiagentur GmbH (BEA) started an Energy Saving Partnership. Under the partnership buildings are grouped into pools, which are then subjected to an EPC contract. So far around 24 pools (including over 1400 buildings) have been contracted under this partnership programme (BEA, 2011). This is just one example how energy agencies help to overcome uncertainty and trust issues, and facilitate and intermediate in energy service projects. In addition, energy agencies have the expertise in procurement processes and legislations. An example for that is Siemens, who works with EPCs and customers only through energy agencies. In case of direct inquiry from the customer side, the customer is referred back to the energy agency, who then sets up the project and includes Siemens (alongside other companies) in the procurement bidding phase.

3.4.1.1 Energy Service Contracting (ESC)

Scheme design. Energy Supply Contracting (ESC) ensures delivery of useful energy (as opposed to energy carriers), such as heat, cooling, steam, compressed air. Energy efficiency measures are taken on the supply side and the ESCO is responsible for the whole “delivery process” of the useful energy to the customer. The ESCO functions as a “one-stop-shop” that entails all expertise to provide customers with including know-how, technology, engineering, energy, finances and legislations. For instance, in the case of heating, it includes the planning and installation of heat boilers, energy distribution, system operation and the maintenance of production facilities, including fuel procurement. Most commonly the ESCO would own the heating or cooling systems during the contract period; around 70% of the supply facilities are owned by the ESCO in Germany (Bunse, Irrek, Siraki, Renner, 2010). An ESC contract often contains a price guarantee for the energy. Energy savings are typically around 10-20%. The energy efficiency goal in ESC is fairly indirect; on the one hand, the customer wants to pay as little as possible for the useful energy delivered and on the other hand ESCOs will increase their profit. If ESCOs get paid per sold unit, they have a constant incentive to optimize their installations, run it more efficiently, lower the costs and increase the profits. The ESC can also provide incentives to switch to new technology if technology development has created a more favorable and cost effective option. ESCOs often state a minimum delivered energy to the customer which means the customer has to buy at least the stated amount. This can erase incentives for customers to carry out energy efficiency measures on the demand side. Still, efficiency measures remain on the supply side and there are no incentives to lower the demand side consumption.

Target audience. ESC models generally address decentralized power supply systems. However, they can also be used to build up district heating systems. (Although in Germany, only 13% of the residential buildings are connected to district heating, compared to around 50% in Sweden (Ecoheat4.eu, 2014).) and many buildings rely on ESC instead. About 50% of the ESC market is in the public sector where buildings are often put into pools. ESC projects can also be delivered both in the industrial and the residential sector; according to some studies, investments in the residential sector are less risky, as buildings are more likely to still be there in 10 years, while a private industry not. ESC is a popular model also for hospitals.

Building types and measures. ESC measures include technologies delivering useful energy (heat, cooling, steam, compressed air) and related expertise. ESC is more suited for local/small-scale power supply systems, such as heat boilers, heat pumps, than larger systems, such as district heating. Small-scale measures are also less risky in a sense that for instance, in case of the customers' bankruptcy during the contract period, the ESCO might be able to remove the installation from the customers' facility (e.g. if they installed the heat-boiler in a portable container).

Source of financing. There are several ways to finance ESC. Most typically, the ESCO provides the customer with an investment free energy service contract, which runs for 10-15 years and the ESCO is remunerated for their investments during the contract period. The contracting time and types can vary; one model often applied is that customers can sign up for a contract which is automatically renewed after a certain time (e.g. 5 years) unless the customer chooses to end the contract after this period. If the customer decides to not renew it, they are obliged to buy out and take over the operation of the "installation". This is a common practice in case of permanent solutions such as geothermal energy. Other types of ESC contracts include larger installations and/or higher risk projects. In these cases, the customer might have to make an investment up front and bear the costs of secondary systems, e.g. radiators and other "in-house" elements. As the project financing can be easily tailored to individual customers and customer fees can also be adjusted to compensate for e.g. higher risks or different contract lengths, to harness learning and economies of scale, it is very common for ESCOs to specialize in certain customer type (industry or residential). According to Wagert (2012) about 95% of all the ESC contracts are without customer financing.

3.4.1.2 Energy Performance Contracting (EPC)

Scheme design. Energy Performance Contracting (EPC) is a performance based business model in which the cost savings from the installed energy efficiency measures secure financing for the project and the ESCO will be remunerated based on the energy savings generated. The main characteristic of the EPC is that the ESCO guarantees a minimum savings level which they are responsible to reach. It is done by setting up a baseline, i.e. energy use before the project implementation. To determine energy savings, energy use before and after the project implementation are compared. This is done by monitoring the project through periodical measurement and verification (M&V). Setting up a baseline, however, can be cumbersome. Some of the factors that cause uncertainty include incomplete yearly energy bill, extreme fluctuations in temperature from one year to another (causing unrealistic average values), level of equipment maintenance, differences in residents' behavior and occupation levels and architectural changes (Hansen, 2006; Bleyl-Androschin, 2011). Following up the project results (measurement and verification) can be costly. The involvement of energy agencies are seen as an important driver for the EPC-market development in Germany. The Energy Saving Partnership programme, by building up a database of good practices and providing know-how, not only helps to spread awareness and raise trust in EPC, but also helped in creating a more standardized procurement process. This standardization is one of the main characteristics of the German EPC-market. Its advantages include an easier start-up and project realization, as well as an easier process for third parties (e.g. energy agencies) to aid in the procurement. On the down side, the standardization might lead to "stiffer" projects, less adaptation to customer needs, which can lead to less effective projects in some cases (Wagert, 2012).

Target audience. EPC is suited for large scale projects (e.g. building pools), and especially in the public sector. The savings guarantee, which is typically 20-30% energy savings during a 10-15 years period, makes the EPC an attractive and safe investment for the public sector. The guaranteed savings model requires financially strong customers and a "mature market" with high awareness. Given that the measures are being financed by the customer from the start, ESCOs can offer more comprehensive long-term energy efficiency measures. Without awareness and capital customers will be less likely to trust the guarantees and financial institutions will be less likely to provide loans to the customer. The shared savings model is suited for markets where customers lack financial resources (since the customer does not have to provide the financing) and/or where the awareness of EPC amongst financial institutions is low. In the shared saving model, the customer benefits from the savings from day one. In Germany, the shared savings model is especially important in municipalities, which do not have that much access to beneficial loans like for instance Sweden (Sjögren, Schulz, 2011). The larger public institutions often have the in-house competence on energy, but lack finances; the EPC model provides access to financing. Public procurements can however be complex and EPC in itself is a fairly complex contracting form, with high transaction costs involved, which is not suited for smaller projects. The long payback times also make EPC it less attractive for the private sector. By pooling, transaction costs for individual buildings can be lowered and buildings with greater potential for energy savings can compensate for those with less. But the EPC still does not address the landlord/tenant problem which does not support landlords to include EPC costs in the tenant rents in the private residential sector.

Building types and measures. The energy efficiency measures are generally demand side, however supply side measures, for instance, the installation of an efficient heat boiler, can also be incorporated. In fact, due to the lack of district heating system and thus the facilities' larger dependency on supply sources, the integration of supply side is common in Germany. Typical EPC measures include more efficient building controls and automation (such as demand controlled lighting and ventilation), energy management systems, service and optimization of technical facilities, behavioral change projects etc. (The outsourcing of the service and maintenance organization is very common in Germany.) Pooling the measures can overcome barriers related to deep renovation and implementing less cost effective measures. When measures with short payback time and large savings that are easy and less costly to implement (e.g. heating optimization) can be bundled with measures with a much longer payback time that can be more costly to implement (e.g. building envelop refurbishments, insulation, new windows), the ones with shorter payback time can help finance the ones with longer payback time.

Source of financing. The EPC projects are self-funded, i.e. being financed by the energy savings they generate. The investment mainly covers the technical equipment and working hours (e.g. project development, documentation, customer-side optimizations) as well as the risk costs and the ESCO profits. Depending on the form of EPC, the initial investment are made either by the ESCO, customer or by a third party (e.g. bank, financing institution). In the guaranteed savings EPC model, the customer finances the project, either through own funds or through loans and thereby takes the financial risk. In return, the ESCO guarantees a minimum energy savings level (%) and thereby takes the performance risk. Savings exceeding the guaranteed level will be split between the ESCO and customer. In the shared savings EPC model, the ESCO finances the project and according to a predetermined share, the savings are split between the customer and ESCO. The model can include a savings guarantee, which is set so that the payback from the energy savings during the contract period will cover the investment costs. In both models of shared and guaranteed savings, the ESCO has to compensate the customer if the guaranteed savings are not reached. In shared savings, the ESCO takes both the performance and the financial risks, which on the one hand requires financially strong ESCOs and on the other hand it tends to lead to “safer”, less ambitious energy efficiency (so-called “low-hanging-fruit”) projects with shorter payback times. As the ESCO does not get paid for its services at the start of the project (but gets remunerated during the course of the contract period), for an identical project, the shared savings model can result in longer contract times than the guaranteed savings model. In Germany, the EPC projects mostly fall under the shared savings model, thus with “safer” solutions and shorter payback time, but guaranteed savings is also used. There are only ten ESCOs being active offering EPC projects, these include Siemens, Hochtief, YIT, MVV AG, Johnson Controls, Evonik New Energies, Cofely, Sauter, Imtech Contracting, Getec AG (Bunse, Irrek, Siraki, Renner, 2010; Sjögren, Schulz, 2011).

3.4.2 Other ESCO-models

3.4.2.1 Chauffage

Scheme design. Chauffage model, also called comfort contracting, is based on the ESCO providing a function to the customer. The function can be related to temperature, lighting, and air quality. In case of temperature-related comfort contract, it includes, for instance, delivering e.g. 21 degrees comfort to the customer (i.e. keeping the facility, or certain places in it, at a certain temperature) rather selling MWh. The payment is decided based on the costs the customer pays for the function prior to the contract. Usually, the ESCO offers a lower, but fixed price for the function offered. Then the ESCO takes the responsibility for all needed to provide the contracted function, e.g. installation of heat boilers/coolers, fuel purchase, operation, service and maintenance and customer side installations. It is in the interest of the ESCOs to implement energy efficiency measures, optimize the system in order to lower the cost of operation and maximize their earnings. Contract lengths vary from one year up to 25 years; the longer the contract time, the more long-term investments the ESCO makes. The price risk of customers is eliminated by the ESCO offering a fixed price. In this sense, the ESCO takes both risks arising in the supply side, e.g. due to oil or gas price fluctuations and also demand-side risks, e.g. high energy use due to cold winters. Chauffage contracts are generally less complex (than e.g. EPC) with lower transaction costs and without the same need for costly measurement and verification (Wagert, 2012).

Target audience. The chauffage model fits to commercial building owners (e.g. shopping malls). Due to the nature of their tenants, these customers have themselves a high requirement for purchasing and providing certain functions. For instance, losing one tenant can lead to significant losses for the property owner; it can take up to one year to find new tenants in the commercial sector and additional time to adapt the facilities to the new tenants' requirements (Wagert, 2012). The largest incentive for the customers in this model is to raise the value of their facilities by lowering the net operating cost of the building. In these contracts, the tenants pay for the energy consumed, they also benefit from the lower bills. According to Wagert (2012), the value increase is typically much higher than the investment for energy efficient measures.

Building types and measures. The chauffage model incorporates energy efficiency measures on both the supply side and the demand side. On the supply side measures can include installation of heat boilers/coolers, fuel purchase, operation, service and maintenance. On the demand-side, measures mostly include the technical installations related to heating, cooling, ventilation, electricity, water, sewerage. In terms of energy efficiency measures requiring more customer involvement and behavior change, such as switching lighting technology and changes in the building envelop, the ESCO might only play a consulting role. Although, as by these investments both the property value and the ESCO's profit increase, there is an incentive for both parties to proceed. Barriers can be the lack of ESCO interest in these investments, e.g. since the ESCO has more of a consultant role, the contract on the demand-side measures may not always be as comprehensive as e.g. in an EPC model. In addition, the lack of customer involvement and awareness of potential energy savings and thus the lack of investment action taken can also hinder good results of the chauffage model, which could be overcome by building in other mechanisms, such as shared savings (see in chapter on EPC). This model is fairly sector specific, does not reach out to larger building pools and does not address comprehensive measures.

Source of financing. In the chauffage model, most investments are made by the ESCO. The customer (property owner) does not have to bear high upfront costs and can enjoy the cost decrease from day one, as the fixed fee offered by the ESCO will be lower than the fee prior to the contract. The ESCO investments will focus on lowering the operational costs; in case of longer contracts lower fixed customer fees are paid and more long-term investments are made.

3.4.2.2 Integrated Energy Contracting (IEC)

Scheme design. Integrated Energy Contracting (IEC) is a business model that involves both supply side and demand side energy efficiency measures. The model intends to address the disadvantages of EPC and ESC, namely the complexity of EPC couples with high costs and the lack of demand-side focus of ESC. To address, for instance, the baseline setting and the costly M&V process in EPC, IEC applies and quality assurance instruments (QAI) to secure the function of the energy efficiency measures rather than quantifying the actual energy savings. For example, instead of measuring energy savings, expected energy savings can be calculated (so-called deemed savings) or thermal cameras can be used to ensure the function of insulation improvements. (In addition, some measurements can be done to assure the functionality.) QAIs have to be tailored for each project. There is however little experience gathered so far on the types of QAI to apply for certain measures (Bleyl-Androschin, 2011). The consequence of ESCO's not meeting the QAI targets might also need further clarifications. The savings potential of an IEC is typically in the range of 20-30%.

Target audience. The (little) experience gathered so far on IEC models suggests that the model is suited better for medium-sized projects, as smaller projects might have too high transaction costs and large-scale projects (e.g. centralized district heating systems) might simply work better with EPC (Wagert, 2012). The fact that the IEC model does not require so high energy cost baseline supports this observation. The practical limit has not yet been investigated but it should be closer to that of ESC (which is around €20 000) than EPC (Bleyl-Androschin, 2012). In terms of markets, IEC might be more suited towards markets having a larger share of ESC, however how to implement IEC with different customer types and on different markets, still requires further investigations, not least the payment method.

Building types and measures. The scope of IEC is the whole building or factory and the typical measures include energy management, controls, HVAC, lighting, and behavioral education. (Bleyl-Androschin, 2009). The ESCO responsibilities typically include building audit, suggesting and implementing energy efficiency measures on the demand side, planning and installing the supply facility (e.g. heat-boiler) dimensioned after the buildings estimated energy use, service, maintenance and operation of the supply side (including fuel-purchase), providing quality guarantees, and follow-up.

Source of financing. In the IEC model, the payment method for ESC projects is used, whereby the ESCO is remunerated for every sold energy unit, €/MWh (Wagert, 2012). The price per energy unit includes capital costs, service costs, profit and the fuel costs (or any other cost that needs to be covered). Most of the price elements are fixed (except the fuel, which is marginal). With the ESC model the ESCO would be paid more money the more useful energy is sold to the customer. In the IEC model, to decouple the fixed costs from the amount energy sold, the fixed costs are paid separately from the marginal costs. The fixed costs cover up the capital costs, service costs and profit for the ESCO, and can be adjusted yearly. The marginal cost (i.e. fuel) will be paid by the customer at a "self-cost", namely, the customer pays only the direct cost of the actual fuel that is used for the installation (e.g. heat-boiler or cooler) and the ESCO does not get any remuneration for this part. By doing so, there is no incentive for the ESCO to sell more energy units than required[16]. The supply side energy efficiency incentive (see ESC chapter), whereby the ESCO can increase their profit by running the supply-facilities as optimal as possible will remain for the ESCO, and the customer will also have an incentive to limit the final consumption of energy since they do pay the variable cost with this pricing model (Wagert, 2012).

[16] It has even been suggested that the customer could even pay a lower price than the "self-cost" for the fuel, subsidized by the ESCO to really rule out any remaining incentive for the ESCO to "sell" energy (Bleyl-Androschin, 2012).

3.4.2.3 Facility Management (FM)

The inclusion of Facility Management in the types of energy services is justified by the nature of services it provides and manages in relation to buildings (e.g. catering, security, cleaning). The offerings can be extended to energy related services, such as service and maintenance of technical installations and energy optimization. This would save the hassle of entering into new contracts; a "one-stop-shop solution" would also lower some of the transaction costs and the operational costs. The way of incorporation varies by company and contract type. Facility management companies usually chose the EPC or the chauffage model to guarantee energy savings. Energy management requires highly skilled personnel. While cutting costs is one of the main advantages of integrating energy services in facility management, finding skilled personnel might be one of the main drawbacks of this approach. It is shown to be difficult to find facility managers being skilled in all the areas needed for successful facility management (Wagert, 2012). In addition, the main aim for integration seems to be rather cutting the costs than assuring quality, which deteriorates the values of the application of this model.

4 Case Study: Barrier analysis on Dansk Energi's model

This section presents *experiences of Dansk Energi ESCO-model and how identified barriers to energy efficiency can be overcome by applying this model.* The model is presented by describing the design of the financing mechanisms, i.e. the source of finance, target audience, building types and measures, and the contextual implementation, i.e. institutional framework and involved actors. The focus will be on how this ESCO-model overcomes barriers presented in Chapter 2. Based on the assessment, the underlying facilitating factors for successful implementation of financial mechanisms will be also identified.

The background to the development of this model is to overcome one of the most controversial barriers to energy efficiency, namely financing. When potential customers do not have access to attractive capital resources to cover the projects' relatively high investment up-front costs, the projects will not be implemented; even if the repayment period is relatively short and the immediate risk is low. Since the global financial crisis (2008), both traditional banks and treasuries have been limited by the more frugal budgets and increasing demands for capital adequacy and risk management. The capital alleviation has cut off a large part of investors from obtaining loan financing for their energy efficiency projects, and has challenged traditional business models (Savage, 2011). The model presented below is a respond to this challenge.

4.1 Scheme design

The model builds on existing structures and business models, such as Energy Performance Contract (EPC) and Energy Service Agreement (ESA). The central element of this model is however to establish a separate pool that brings together and finances several smaller energy efficiency projects through "one process". This is done through a financial structure, so-called Special Purpose Vehicle (SPV), which ensures that risk are allocated to the "right" actors and thus the best financing conditions are ensured[17]. One of the main purposes of SPV is to ensure that investments not going bankrupt as a result of the actors' decisions and financial situations. This is done by engaging an independent Administrator, an authorized legal entity on behalf of the investors (such as CorpNordic or Nordic Trustee), who determines about the distribution of funds and assets to be transferred, as well as how they should be structured and who can provide the funding. This model can overcome a number of barriers. By linking together a critical mass of projects it can achieve a larger scale and thus can improve credit conditions for the pool of projects by attracting funding from commercial banks and pension funds. It can reduce risks by spreading the borrowings over a portfolio of qualified projects and allocates risk where the best is and separate financial and technical risks of individual projects. By standardizing processes and documents, this model can provide more stability, better access to the project fund, lower transaction costs and improve transparency and predictability.

Target audience. A potential target audience of this model can be illustrated through the example of Fredriksberg. The project was concluded in 2013 through an ESCO agreement with Schneider

[17] The funding conditions for the SPV do not depend on the owners' credit rating; it is based solely on the project's ability to provide a sufficiently large positive cash flow to respond financing, service payments and returns to the project owner.

Electric. The energy efficiency improvements were carried out on about 80 municipal buildings for a total of DKK 150 million. The annual savings of municipal electricity and heating bills amounted up to DKK 11 million; the expected payback period is app. 14 years. In a Danish context this project is relatively large and most future projects are not expected to represent the same size.

Measures and building types. The energy efficiency measures range from the replacement of appliances to building renovations. Denmark has a long tradition of including building insulation, the installation of thermostats, heat pumps and double glazing. These measures can also be divided into core products, with energy efficiency characteristics, and comfort products, which enhance comfort and functionality. For a more attractive building and better energy efficiency gains, in most cases, when investments are decided upon, both types of upgrades shall be considered. It is because these projects often increases customer comfort and indoor air quality in a building through improved building envelope that furthermore reduces noise, drafts and temperature variations and a number of these investments paid back within a few years (Deutsche Bank, 2012).

Source of financing. This is expected to take place through a specially designed fund or investment pool that brings together energy efficiency projects. The resulting savings from the projects are aggregated to service the capital that institutional investors provide to the investment pool, for example by investing in bonds. In this way, investors take the financial risk, and ESCOs the technological and operational risk. The scheme is designed so that the project owner enters into an ESA with a SPV under which the SPV finances and implements energy efficiency project – at a share of the resulting savings which cover the investment costs. The payment warranty, included in the ESA contract, specifies a fixed periodic payment. Alternatively, a special pledge agreement is introduced to provide a first priority mortgage to the lender without an asset transfer. Furthermore, the SPV enters into a contract with the ESCO through an EPC. A loan agreement specifies the terms under which the lender provides capital to the SPV, the size and the time period of the loan. The investors provide debt and equity financing for the capital investments and eventually for the operating costs of the project. Through the EPC contract, the ESCO is responsible for the implementation of the project, including savings guarantee, service agreement for operation and maintenance as well as measurement and verification.

4.2 Contextual implementation

Institutional framework and actors involved. Transition to low-carbon economy through renewable energy and energy efficiency is high on the agenda of the Danish government. To reach the ambitious climate targets and uncap promising energy saving and renewable energy potentials, the Danish energy policy has been mainly applying regulative and informative instruments; energy efficiency in buildings has been promoted through for instance the energy saving obligations of energy companies', increase in energy taxes, requirements in the building regulations on the choice of energy efficient components for replacement, inspection of boilers, heating and ventilation systems, and the disposal scheme for oil burners (Implement Consulting Group, 2013). There is a great need for energy efficiency investments[18], however since the

[18] For instance, to meet the EU's 2020 target of reducing energy consumption by 20% alone required investments of around DKK 626 billion per year and a carbon-free European economy by 2050, where the housing sector is to

financial crisis (2008), energy investments are lagging behind and the access to finance has become more difficult in Europe maybe even more than before. Tighter state and municipal budgets prevent access to public pools and due to tighter regulation and stricter requirements; it is also more difficult for banks to provide long-term financing for projects. In this financial climate, institutional investors and pension funds have been recognized as key actors towards the transition of green economy. Basically, there are two main reasons why pension funds have got the attention with relation to energy efficiency investments. Firstly, the long pay-back periods energy efficiency projects calculate with. Pension funds' horizons (i.e. focus on long-term revenue) and pay-back period requirements are longer than other capital providers (e.g. banks, venture capital providers). Basically, long payback times match the strategy of pension funds as long as the return of investments is closely linked to the related risks. Secondly, global examples show that pension funds tend to prioritize sustainable investments[19]. In Denmark, pension funds have risen steadily since 1980, reaching about 2 500 million DKK (in household assets) in 2010. This is a relevant amount to invest in sustainable projects.

4.3 How does this model overcome barriers to energy efficiency?

A number of barriers have been identified to explain why on paper attractive investments have not resulted in more energy efficiency projects (McKinsey and Company, 2007). Financial barriers, more specifically funding, are among the most controversial ones. This model has mainly been designed to mainly address financial barriers to energy efficiency. However, studies show that overcoming financial barriers might not be enough to get the wheel rolling, awareness raising and customer engagement are just some of the indispensable complementary strategies without which any in itself profitable financial mechanisms is deemed to failure.

4.3.1 Strategies to address financial barriers

This model improves the access to capital for building owners through a SPV. The building owner enters into an ESA with a SPV; under this contract the SPV finances and implements the contracted energy efficiency projects. The SPV savings are supposed to finance the investment costs. The funding conditions for the SPV does not depend on the owners' credit rating, but is based solely on the project's ability to provide a sufficiently large positive cash flow to cover the financial costs, service payments and the return on capital to the project owner.

This model enhances the attractiveness for funding from the capital market by creating a project pool with a critical mass of projects and separating the different functions/areas, responsibilities and risks. A larger scale can lead to improved credit conditions which in turn can be attractive for commercial banks and pension funds.

This model reduces the costs at different stakeholders on the long run. In general, project aggregation can achieve lower borrowing costs and hence offers the potential for lower interest rates. The project owner avoids indebtedness as well as can enjoy the comfort (quality of life)

reduce its CO_2 emissions by 88-91% (compared to 1990 levels) is estimated to require many trillion crowns of investments (Hudson, Schoop, Neuhoff, 2013).

[19] Between 2004 and 2011, pension funds invested over USD 12 billion in renewable energy projects (e.g. wind, solar and biomass).

delivered by the energy efficiency improvements without an additional cost or ongoing operational responsibilities. The service provider (e.g. ESCO) can save costs and potentially deliver more projects by focusing on and using its primary skills of project implementation (operation and maintenance) rather than financial and administrative arrangements. The investors, through outsourced technical know-how and project and documents standardization can also work with lowered transaction costs.

This model is moving towards financial sustainability by accessing credits for investments from the capital markets. However, the institutional framework is not satisfactory for its full implementation; more specifically there is a need for change and support not least in terms of the legislative framework, such banking license for creating SPVs, securitization, non-payment restrictions, land regulations on mortgage, and rental regulations on landlords' possibilities of passing the costs onto tenants. Changes in the institutional framework would also give positive signals to financiers to invest and raise awareness on energy efficiency investments.

4.3.2 Strategies to address institutional barriers, stakeholder practices and partnerships

This model strives to build partnerships by engaging diverse (suitable) partners, bringing in different expertise, allocating responsibilities with suitable partners, and sharing and thus reducing risk at individual actor's stake. The engagement of intermediary agents, in this the SPV and an independent administrator, are shown to be crucial elements in this type of ESCO-models. The collaboration with local authorities, municipalities cannot only extend the primary target group of industrial and commercial buildings, with municipal ones, e.g. schools and institutions, but also help to coordinate national and local schemes alongside each other. In addition, it can improve the social outcomes of the scheme, e.g. in terms of health issues, job creation. Further collaboration with NGOs and grass-root communities could help to reach hard-to-reach groups, such as single-family house owners.

This model aims to address split incentives, i.e. the owners paying the costs and tenants benefitting from it. Currently, however, the rental regulations in Denmark restrict the landlord's ability to pass on both capital and operating costs to the tenant. The change of legal framework is needed to support the scheme here.

This model aims to enhance knowledge and capacity at certain actors' stake; it is to the extent ESCO-models monitor measure and verify the outcomes mainly to provide evidence to investors and funders about the profitability of the scheme. A more comprehensive approach however would not only require following-up outcome indicators, such as the numbers and types of installations, energy savings, reliable baselines, post intervention data, financial costs and benefits of the scheme (including indirect cost and benefits, such as tax revenues and health care costs), social impacts (employment, distribution), and greenhouse gas estimates, but also managing capacity building and awareness raising among facility owners – who still face two types of risk, arising from the energy price and behavior (non-)change. This might require academic involvement.

4.3.3 Strategies to address buildings and measures related barriers

This model addresses barriers related to the lack of diversity in building measures offered in ESCO-schemes. To its advantage, under an EPC contract many different measures can be offered; and during the energy audits the most cost-effective measures per building are identified. Ideally, the audit takes into account the interaction between different measures and thus identifies the most cost-effective packages. Innovations, however, might be neglected in such a scheme, as the list of measures is predefined and/or the uncertainty around new technologies does not match with the complicated financial schemes.

This model although aims to cover a wide range of buildings in multiple sectors, under the current circumstances, only partially addresses this barrier. The theoretical potential is still to be exploited. As mentioned above, municipal buildings still enjoy other preferential types of loans to renovate, while single family-houses are difficult to gather into one pool to increase the economies of scale and with the diversified portfolio risk hedge effectively against risks of under-performance and default in individual sectors.

This model fails to address the depth of retrofits. And this can be said in general by ESCO-models; with the measured implemented under ESCO schemes, 20-30% of energy savings can be reached. However, further savings require different types of incentives, other schemes.

4.3.4 Strategies to address barriers related to consumers and end-users

This model aims to facilitate the customer journey by engaging local ESCOs, with which customers are already in relationship and for which customers already developed trust. The ESA type of contract, its financial plan and standardized processes, and the ESCO as a single contact point for the customers aim to guarantee simplicity and comprehensiveness in the cavalcade of different actors and contracts this model is built on.

This model fails to address the diversity of end-user audience, both in terms of tenure types and vulnerable groups. In order to support this diversity, different schemes could be developed for rental and owner occupied houses as well as for hard-to-reach and vulnerable groups. In the latter case, for instance, the most important issues to address are related to debt, property ownership, up-front costs and credit checks. Again, the ESCO scheme could be complemented with additional schemes to tackle these issues.

This model raises awareness at certain stakeholders stake (ESCO, SPV, investors), while fails to do so at others (facility manager). Increase the awareness of the scheme and of energy efficiency in general, which might also change the perception of new energy efficient technologies is crucial to gain the trust of facility managers/project owners. The engagement of communication experts and extended market studies on needs, behaviors, priorities of target group, how, when and why this group uses energy and why they participate in the scheme (e.g. financial savings, value-adding to homes) could be beneficial.

5 Concluding remarks

Based on the findings of the assessed experiences, the following main conclusions can be drawn in terms of key factors facilitating overcoming major barriers and implementing financial mechanism.

There is a great variety of financial mechanisms present throughout Europe to support improved energy efficiency in buildings. Preferential loans and the involvement of private financing through energy service companies are two of the most common instruments, depending on the institutional and political context however, their application in different countries varies a lot.

The study confirms the finding of previous studies (e.g. BPIE, 2012; WEC, 2013) that financing retrofitting requires the possible bundling of different financial mechanisms available; this is due to the overall cost of a deep retrofit. Deep retrofits include measures with high up-front costs and long pay-back periods meaning that the capital is not quickly returned to the scheme's funds and the scheme offering this loan may take a longer period to achieve financial self-sufficiency. This tension between financial sustainability and deep retrofits has been increasingly recognized and the need for intervention has been increasingly accentuated. Deep retrofits still represent the most effective savings (on a large scale and in the long term), therefore the continuous evaluation of the existing schemes is important for further learning and understanding scheme implementations and outcomes.

In order to enhance attractiveness to finance, funder loan guarantees, especially in the emerging phase, when legal, technical and financial conditions are not fully developed are very important. This support might be needed until the schemes can fully participate in credit markets. Projects in the industrial and commercial sector with high return on energy efficiency investments can be beneficial for increasing the visibility and enhancing the credibility with investors.

It is increasingly important to adjust certain national practices and regulations in favour of certain schemes to be implemented. A good example for this is the Green Deal, which encouraged the country's largest mortgage lender to give preferential interest rates for additional mortgage borrowing designated for home energy efficiency improvements. Another good example is the specification of PACE on the differences between energy efficiency measures; movable measures shall be tied to the customer and non-movable measures to the property.

In order to facilitate the consumer journey and ensure the trust of consumers, using existing institutions with which consumers are familiar with are essential. These include local energy companies, existing social networks (schools, word of mouth, neighborhoods) for which customers already developed trust. One classic example is the German KfW scheme using local retail banks to provide preferential loans, relying on the mutual trust and long-term relationship between client and service provider.

Combining incentives, not only could lead to more energy savings, but also facilitate the customer journey and reach out to certain groups to which one single measure would not have been able to. For instance, in the Green Deal scheme, alongside the preferential loans in order to reach households which would not have been reached otherwise, additional subsidies have been offered under the Energy Company Obligation scheme to specific households. In order to achieve more energy savings than can be achieved by ESCO schemes (20-30%), additional incentives could be introduced which promote e.g. deep renovations.

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Appendix A.

Mandate/ Activity	Years of funding period	Purpose of the scheme	Scheme type	Financial instrument	Public, Private or PPP	Beneficiaries / recipients	Process	Total Resources	Funding bodies/countries
Grant finance									
Intelligent Energy Europe (IEE II)	2007-2013	Supports the use and dissemination of clean and sustainable energy solutions and Europe-wide exchange of related knowledge. Focuses on removal of non-technical barriers to adoption. The IEE II provided as well the PDA support under the MLEI Key Action.	Funding instrument / PDA	Grants		Min. 3 independent legal entities, each established in a different eligible country Min 1 entity for the PDA		€ 600 million	Project funding of up to 75 per cent of project costs
European Local Energy Assistance (ELENA) – IEE II	2007-2013	Funds up to 90 per cent of technical support cost to prepare, implement and finance investment programmes to implement large energy efficiency and renewable projects	PDA	Grants		Local or regional authorities, or other public bodies	Application to IFIs for TA funding	€ 132 million	Funded under the IEE II Programme. Project funding up to 90 per cent of eligible costs. Implemented by IFIs (EIB, KfW, CEB and EBRD)
7th Framework Programme (FP7)	2007-2013	FP7 provides funding for innovation up to the pre-competitive demonstration level. It supports transnational research cooperation, technological development, researcher mobility, and research activities in particular between enterprises and public research organisations.	Funding instrument	Grants		Various including SMEs and consortia of business and research institutes		€ 2.35 billion is allocated to energy	EC
Horizon 2020	2014-2020	Supports the development and deployment of innovative SE technologies and solutions. Includes the successor to the IEE II and PDA activities under its Energy Challenge – Energy Efficiency Focus Area, topic EE 20.	Funding instrument PDA	Grants	Public and private	Min 3 entities from 3 EU Member States 1 entity or consortium for the PDA	Application to INEA, EASME, RTD or DG ENER Application to EASME	According to call	
ELENA - EIB	2014-2015	Provides grant support for development of large-scale SE Investment projects	PDA	Grants	Public	1 entity or consortium	Application to EIB	€ 30 million	
Debt instruments									
Sustainable energy financing facilities (SEFF)		Combine credit lines with technical assistance to help local banks support hundreds of smaller sustainable energy projects in the region	Technical assistance and credit	Loans	Private	Commercial & household EE projects in 15 countries (through 46 banks) across EBRD countries	Local banks use the credit lines to provide commercial loans, at their own risk	€ 1.5 billion	Technical assistance is offered free, supported by grant funding from EBRD donors
Hybrid instruments									
European Energy Efficiency Fund (EEEF) - EEPR	2011-ongoing	Uses unspent funds of the EEPR. It focuses on financing energy efficiency, small-scale renewable energy, and clean urban transport projects targeting municipal, local, regional authorities (and national authorities, if justified) as well as public and private entities acting on behalf of those authorities.	Structured finance vehicle	Loans, Equity, Guarantees	PPP	Local authorities, ESCOs	Direct investment or via financial institutions	Initial fund volume: € 265 million Target size: €500-600 million	EU Contribution: €125m – junior tranche [+ €20m in grants for TA]; EIB : €75m – mezzanine tranche Deutsche Bank: € 5m - mezzanine tranche; Cassa Depositi e Prestiti SpA (CDP, Italy): €60m – senior tranche
EU Structural and Cohesion Funds	2007-2013	European Regional Development Fund (ERDF), European Social Fund (ESF) and Cohesion Fund (CF), provided funding for investment in a wide range of areas to support economic, social and territorial cohesion, including investments in EE, RE and energy infrastructure as well as in R&D, innovation and skills related to those areas	Priorities set out in Operational Programmes at national or regional level	Grants, Loans, Equity, Guarantees		Wide range of potential beneficiaries; all direct beneficiaries of EU Cohesion Policy have to be published by the Managing Authorities, see http://ec.europa.eu/regional_policy/country/commu/beneficiaries/index.cfm?LAN=en	Specific to each MS or region, shared responsibility between EC and MS authorities	€ 347 billion	EC total budget: € 347 billion. Around € 12 billion of this allocated to energy investments, with further amounts for R&D, innovation and skills related to energy. Co-financing by MS
EU Structural and Cohesion Funds	2014-2020	European Regional Development Fund (ERDF), European Social Fund (ESF) and Cohesion Fund (CF), provide funding for investment in a wide range of areas to support economic, social and territorial cohesion, including investments in EE, RE, energy infrastructure and sustainable urban transport, as well as related research and innovation.	Priorities set out in Operational Programmes at national or regional level	Grants, Loans, Equity, Guarantees		Wide range of potential beneficiaries	Specific to each MS or region, shared responsibility between EC and MS authorities	€ 325 billion	EC total budget: € 325 billion. At least € 23 billion of this expected to be allocated to investments in EE, RE, smart distribution grids and sustainable urban transport, including research and innovation as well as potential further amounts for skills related to those areas

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Mandate/ Activity	Years of funding period	Purpose of the scheme	Scheme type	Financial instrument	Public, Private or PPP	Beneficiaries / recipients	Process	Total Resources	Funding bodies/countries
									and smart energy infrastructure. Co-financing by MS
Private Financing for Energy Efficiency instruments (PF4EE)	2014-2020	Address substantial regulatory and market failure leading to current underinvestment in viable EE investment opportunities. Two core objectives are: 1. To increase debt financing to final recipients (e.g. SMEs) from private financial institutions for EE projects which contribute to meeting EU EE directives and support MS EE programmes in line with priorities set by NEEAPs. 2. To help make EE lending a more sustainable activity across the European financial sector through facilitating the development of a track record of financing that builds up information and expertise in the performance of EE projects amongst financial institutions. This in turn will help stimulate follow on lending from these financial institutions – as well as providing market signalling to other financial institutions.	Structured finance instrument	Loans, Guarantees, Technical Assistance	Private	Financial institutions, SMEs, Wide range of potential recipients	Investment via financial institutions	Not yet confirmed	MS financial institutions will make an application for funding

(Source: EC, 2014)

Appendix B.

Package	Measures
0	• Retrofitted insulation on exterior walls • Retrofitted insulation on the roof • Retrofitted insulation of the basement ceiling or outside walls of heated rooms in contact with the ground • Replacement of existing windows
1	• Replacement of central-heating boiler • Retrofitted insulation of the roof • Retrofitted insulation on exterior walls
2	• Replacement of central-heating boiler • Retrofitted insulation of the roof • Retrofitted insulation of the basement ceiling or outside walls of heated rooms in contact with the ground • Replacement of existing windows
3	• Replacement of central-heating boiler • Change of heating energy carrier • Replacement of existing windows

Package	Measures
4	• A combination of measures from package 0 to 3 • Proof of a 40kg reduction of CO_2 emissions per m2 floor area and year through calculations by an accredited energy advisor
5	• Replacement of a) decentralised furnaces fired by gas, oil or black coal, or b) night storage heaters, or c) black coal-fired central heating boilers with a heating system complying with the building code Or • Replacement of standard oil- or gas-fired central heating systems installed before 01.06.1982 with oil- or gas-fired condensing boilers combined with solar thermal or other renewable energy sources (i.e. biomass)

(Source: WEC, 2013)