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Financing energy efficiency in buildings: an international review of best practice and innovation

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List of Acronyms

AAU	assigned amount units
BELP	BESCOM Efficient Lighting Programme
BESCOM	Bangalore Electricity Supply Company
CEB	Council of Europe Development Bank
CO ₂	carbon dioxide
DfID	Department for International Development
EBRD	European Bank for Reconstruction and Development
ECO	Energy Company Obligation
EECA	Energy Efficiency and Conservation Authority
EMCA	Energy Conservation Service Industry Committee of China Energy Conservation Association
EPC	energy performance certificate
ESCO	energy service company
EU	European Union
FHMA	Family Housing Management Account
FTE	full-time equivalent
GEF	Global Environment Facility
GHLC	Government Housing Loan Corporation
IFC	International Finance Corporation
IMF	International Monetary Fund
JHF	Japan Housing Finance Agency
KfW	Kreditanstalt für Wiederaufbau
KREDEX	Credit & Export Guarantee Fund
KUSSCO	Kenya Union of Savings & Credit Co-operatives
MFI	micro-finance institution
NZ	New Zealand
OBR	on-bill repayment
OECD	Organisation for Economic Co-operation and Development
PACE	property-assessed clean energy
PAR	portfolio-at-risk
PAYS	pay as you save
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
WB	World Bank
WSGR	Wilson Sonsini Goodrich & Rosati

Executive summary

Energy savings are among the fastest, highest impacting and most cost-effective ways of reducing greenhouse gases emissions. Low cost energy efficiency measures have long been regarded as the 'low-hanging fruit' in delivering a clean energy economy.

However, the groundswell of general interest observed does not in itself produce specific, bankable energy efficiency investment opportunities without other factors being in place. Even with high and volatile energy prices, energy security issues and awareness of climate change policy drivers, there is a mixed picture of actual demand for energy efficiency from both private and public sector clients. Despite the proven cost-effective opportunity to reduce energy consumption, a significant proportion of the energy efficiency improvement potential is not being realised.

A key reason for this relates to the financing of energy efficiency. Barriers to financing mean that, in the past, energy efficiency has not been able to attract significant amounts of private capital.

These barriers take a range of well-recognised forms. The Buildings Performance Institute Europe reported in 2010¹ that information failure, high subsidies, lack of technical expertise, uncertainty over savings, and externalities still characterise the energy efficiency market, while 'split incentives' discourage both building owners and occupiers from investing in energy efficiency measures if direct benefits are not perceived. Financial barriers include the initial cost barrier, high transaction costs, long payback time, and risk exposure. Furthermore, lack of knowledge among finance providers about energy efficiency prevents customers from accessing capital, and the absence of standardised measurement and verification practice further increases transaction costs.

To examine these and other barriers in greater detail, eight case study schemes – from a range of different economies and contexts, targeting different sectors and employing different financing methods – were selected for systematic evaluation and to understand how such barriers are addressed in a wide range of different contexts. In addition, further schemes not examined in the same depth, provided evidence for supplemental analysis. The main eight schemes covered are summarised in Table 1 overleaf.

Overview of case studies

The levels of investment involved in the schemes vary greatly. India's BELP is a small regional scheme (initially a pilot) and this is reflected in the small investment of \$37,300 for marketing purposes. Similarly, Palm Desert EIP is a local scheme, and so involves a relatively modest investment of \$11.6 million. Faulu Kenya, one of the larger microfinance institutions in Kenya, based its energy lending on an \$8.2 million bond. This reflects the emerging nature of energy lending in Africa. Estonian KredEx schemes ranks here as a middle-scale programme receiving significant levels (\$92.1m) of state support for operation on a nationwide basis. KredEx also makes use of innovative mechanisms such as the sale of emissions allowances under the Kyoto protocol. Finally, the schemes in Japan (Flat 35), New Zealand (Warm Up NZ), Germany (KfW) and China (ESCO LGP) represent the largest programmes, with KfW having an annual budget of over \$5 billion dollars. Both the New Zealand and German schemes are major nationwide energy efficiency programmes run by the state, explaining the high levels of investment. Meanwhile, the large sums involved in the Chinese ESCO sector represent both investments by major international institutions and also the huge amount of funding leveraged by ESCOs in the context of a large, growing and relatively inefficient industrial sector.

¹ (BPIE 2010)

Table 1: Overview of the eight case studies selected

Scheme name	Short name	Country	Type of scheme	Region	OECD/non-OECD	Sectors targeted
Bescom Efficient Lighting Programme (BELP)	BELP	India	Efficient lamps offered with an on-bill repayment option	Asia	Non-OECD	Residential (urban); small commercial
ESCO Loan Guarantee Programme	ESCO LGP	China	Energy performance contracting, supported by guarantees	Asia	Non-OECD	Commercial; industrial
Flat 35 mortgage scheme	Flat 35	Japan	Preferential mortgage terms available to efficient buildings	Asia	OECD	Residential (mainly owner-occupied)
KfW's energy efficiency schemes	KfW EE	Germany	Preferential loans available to efficiency projects	Europe	OECD	Residential; commercial; public
KredEx's energy efficiency schemes	KredEx EE	Estonia	Loans, grants and guarantees for efficiency projects	Europe	OECD	Residential
Microfinance for clean energy	Kenyan microfinance	Kenya	Loans (including group loans) for renewable energy measures	Africa	Non-OECD	Residential; small commercial; small agricultural
Palm Desert Energy Independence Program	Palm Desert EIP	US	Property assessed clean energy programme	North America	OECD	Residential (mainly owner-occupied); commercial; industrial
Warm up New Zealand	Warm Up NZ	New Zealand	Insulation and heating measures offered with repayment through mortgage or council tax	Australasia	OECD	Residential

Financial returns also vary widely, though data here are often not comparable due to different monitoring approaches. Globally, energy efficiency finance schemes have very different aims in terms of economic returns. Some schemes, such as Chinese ESCOs, aim to make a profit, and in China this has become a fast-growing and successful commercial sector. In contrast, some schemes are seen as a form of state service provision, and so aim to be broadly revenue neutral, or even to operate as a net consumer of financial resources, albeit with wider social and indeed economic returns. Warm Up New Zealand is an example of this type of scheme. Although the state invests huge sums, and makes little or no profit on loans (municipal authorities report that interest charged serves only to cover administration costs), the wider impact of the scheme is valued as a net benefit of \$0.7 billion, mainly due to health benefits (which represent approximately 99% of the total benefits)². The BELP scheme not only saved customers money but, by reducing the peak load, meant that the need for generation

² (Grimes et al. 2012)

capacity was minimised. The evaluation report gives this a value of \$25.6 million (for all CFLs sold during the programme period)³. Like many schemes worldwide, KfW, KredEx and many Kenyan microfinance schemes aim to recycle funds as loans are repaid, or to become 'revolving', to a greater or lesser extent. KredEx is often cited as a best practice case in becoming financially self-sustaining.

In terms of take-up rates, the New Zealand scheme stands out as achieving both a large number of recipients and also a relatively high proportion of the target group (12%), reflecting the scale of the programme, which has only been running since 2009. In contrast, Palm Desert EIP (launched in 2008) is at present a much smaller programme with a lower take-up rate. Flat 35, KfW and KredEx all have relatively high shares of their respective markets, due to their quasi-public sector status and established reputations. For KfW and Flat 35 their reputations are linked with their long histories; KfW was established in 1948 and began energy efficiency work in 1996. The Japan Housing Finance Agency was set up in 1950 (then the GHLC), and has been offering Flat 35 for over 10 years. KredEx was set up more recently, in 2001, but has also benefited from strong state support.

Energy reductions similarly reflect the scale of the different projects, with Chinese ESCOs showing by far the greatest savings (despite the relatively recent emergence of the sector, with pilot ESCOs first created in 1998), and the national schemes showing greater savings than local ones. The relationship between savings achieved and investments made is more informative; BELP stands out here as a very inexpensive programme that nonetheless achieved significant savings in the short period it was running (around two years). Warm Up New Zealand generated only slightly higher savings, with only a 1% cut in average household energy use, but at a much greater cost (this is because the rebound effect of comfort-taking in newly-insulated homes was identified as very high). It is important to note that not all schemes had a core goal of reducing energy use; the comfort taking in the New Zealand scheme was an important benefit and Faulu's energy loans may have increased consumption, but also met important human development goals. The impact of energy savings on greenhouse gas emissions depends on the carbon-intensity of the energy supply to the region in question. For example, the fact that New Zealand has a relatively low-carbon energy supply means that its carbon savings appear lower than might be expected from the cut in energy use.

Finally, deadweight and additionality are important factors in any cost-benefit analysis. In other words, how much of the recorded impact would have happened in the absence of the programme? Unfortunately this information is very often not available. As a general rule, deadweight will be low in cases where there are few alternative support mechanisms for energy efficiency, and high in cases where energy efficiency is already a well-established and understood field, or is promoted by the wider legislative, economic and cultural climate. For example, in Japan there are voluntary standards for energy efficiency in buildings which, in combination with the Flat 35 scheme, have a strong impact in promoting efficiency.

Key barriers examined

The analysis of the case study finance schemes encompasses a comprehensive barrier analysis, highlighting the ways in which schemes have addressed and overcome typical barriers to energy efficiency take-up and finance provision. The barriers identified can be identified as falling into four distinct groups: Finance; Institutions and Stakeholders; Measures and Buildings; and Consumers and End-Users. Table 2 summarises some of the key insights gained.

³ (BELP Evaluation Committee 2006)

Table 2: Key insights from barrier analysis

Finance	
<i>Access and attractiveness</i>	<p>All the schemes assessed for this study are inherently about facilitating access to finance for energy efficiency improvements which have been identified by scheme designers as worth supporting. Where lenders conventionally offer loans for energy efficiency to end users (either residential or commercial customers) a key barrier to success may often be higher than usual interest rates on these loans, or high fees and charges – for many of the reasons described above. Each of the case study schemes has enabled access to capital and enhanced the attractiveness of finance in a distinct way.</p> <p>A closely related issue (which is often a root cause of high interest rates and fees for beneficiaries) is the wariness of investors and lenders about financing energy efficiency. This is usually owing to a mixture of high perceived risk exposure, long payback periods, lack of awareness and the absence of established methods for assessing the value of investments. In many of the cases studied, this had been a serious problem in the past, and had gradually been overcome through a range of measures. These have often involved state guarantees. Such guarantees are intended to send a clear signal to financial institutions that projects in certain emerging sectors are worth lending to, for both commercial and social reasons. They can in some cases be seen to create a ‘breathing space’, that is an environment in which energy efficiency investments gain a chance to prove themselves and develop a positive investment track record which can later mean that there is no need for a continued guarantee.</p>
<i>Reducing costs</i>	<p>High administrative costs can be one cause of high interest rates and fees, and can reduce a scheme’s cost-effectiveness. Estonia’s KredEx schemes have found that loans have lower administrative costs (for the institution) than previous grant-based schemes because most of the work is done by the banks. The banks’ work of course also entails administrative cost, although it is likely that these are lower per customer account than is the case for KredEx.</p> <p>High administrative costs may come about as a result of the absence of quick, simple, robust and established methods for assessing the value and risks of energy efficiency investments, as well as from investments’ often small-scale nature and high specificity (meaning that administrative costs are high relative to the overall capital costs). In cases where schemes aim to establish standardised methods of assessment, measurement and verification in the first place, relatively high administrative costs may be unavoidable, at least until methods are agreed and have become more commonplace. In either case a challenge for schemes is to keep administrative costs low as well as to identify a suitable means of covering them.</p>
<i>Becoming self-sustaining</i>	<p>An important challenge for many finance schemes is to become financially self-sustaining. A scheme may succeed (especially in the short term) by drawing on the resources of the state or other funders. However, its position will always be precarious, especially in a challenging economic climate. It will not only be vulnerable to complete closure if priorities change, but is likely to face funding uncertainty in the medium term (as in the case of KfW’s energy efficiency programmes; which cannot be granted a long-term budget for parliamentary reasons) and an atmosphere of uncertainty can be detrimental to stakeholder engagement. This can be addressed if a scheme is designed to be able, ultimately, to support itself. This can be either on a revolving basis (after an initial funding injection) or by accessing credit through financial markets. This barrier has been successfully overcome in several of the case studies.</p>

Institutions / stakeholders

Institutional/legal frameworks Innovative financing mechanisms, often for innovative technologies, may encounter legal hurdles. These barriers may relate to changes that have to be made to planning rules and building codes, consumer protection frameworks, property law and rules governing financial transactions and liabilities. Innovation may be actively hindered by existing rules, or may simply require additional laws to establish a clear and reliable framework for specific forms of investment. For example, Palm Desert’s Energy Independence Programme required enabling legislation to be enacted by the state. In 2008, state legislation in California was introduced that authorised cities and counties to establish ‘Property-Assessed Clean Energy’ style programmes. This legislation was based on the principle that such programmes would serve a public purpose and hence local authorities had the authority to provide the finance. Palm Desert City was the first authority to formally resolve to establish this type of programme in response to this State legislation. National guidelines for pilot PACE programmes were released in May 2010 covering issues such as safeguards for mortgage lenders, homeowners and others.

Engaging stakeholders Schemes may be more likely to succeed in reaching their target audiences if they have buy-in from a range of actors across the supply chain and wider society. Energy efficiency projects are often typified by a large number of stakeholders such as end-users, technology providers, engineering and construction firms, project developers, owners, investors, financiers, government agencies and utilities. Frequently the key to successful stakeholder engagement is to map out, understand and work with the dynamics of power and influence stakeholders have over each other.

Knowledge and capacity Institutional challenges do not only concern the relationships between stakeholders, but also the capacity of the different stakeholders; in other words, the knowledge, skills and expertise they can bring to a scheme. This challenge is especially problematic in contexts where energy efficiency is a new and emerging sector and technologies are not widely known. For example, a major obstacle to the development of micro-finance for energy in Kenya was a lack of technical capacity within lending institutions such as Faulu, who did not employ energy specialists. This limited the value of advice available to potential borrowers. One scheme evaluation reported that even though the national micro-finance umbrella organisation had trained its own staff in technical installation and equipment inspection, it was dependent on a single person for expertise on more complex products.

Measures (technologies) and buildings

Measures coverage There are two broad approaches to measures: (1) requiring an energy audit to identify cost-effective measures for each building on a case-by-case basis; or (2) using a list of specified eligible measures. In some cases, such as the Pennsylvania, USA’s ‘Keystone HELP’ scheme, borrowers can choose which route to follow, and may qualify for a lower interest rate if they choose the audit route. In addition, some schemes take an approach related to this first route, but require a property to meet a certain standard of energy performance (as in Japan’s Flat 35), or a certain degree of improvement (as in some KredEx apartment loan schemes).
Prescribed measure approaches are simpler and less costly to administer, but normally achieve lower energy savings than approaches based on audits and standards. This is because an audit can take into account the interaction of different features within a building (such as heating, ventilation and insulation), and can identify ways of combining measures into the most cost-effective package. In addition, a prescribed measure approach may be less well suited to avoiding ‘lock in’ – that is, a situation in which the installation of certain energy improvements in a building make the subsequent installation of additional measures necessary to achieve deeper savings more difficult, technically impossible or financially not viable.

Sector coverage There are advantages in targeting a wide range of buildings when considering the design of an energy efficiency *finance* scheme. This helps maximise potential savings and distribute benefits widely; a larger and more diverse portfolio can hedge effectively against risks of under-performance and default in individual sectors; and it can potentially reduce administration burden (compared to having several more specific schemes). Similarly, targeting multiple sectors may produce the same hedging effect and relative reduction of administrative costs.

<i>Depth of retrofit</i>	Estonia's KredEx has incentives for deeper savings; its apartment grants provide different levels of subsidy depending on the final energy performance class achieved. In Germany's KfW-led programmes the level of subsidy is linked to a series of levels of energy efficiency achieved, with the most efficient properties able to get up to 17.5% of the loan subsidised. In Japan's Flat 35, five to ten year mortgage interest rate reductions of 0.3% are available for homes with the highest efficiency standards.
Consumers and end-users	
<i>Trust and quality</i>	In the case of India's BELP, trust was ensured through use of well-known brands and company involvement, as well as a warranty on products, and hologram quality mark. Close to 55% of the respondents purchasing directly from the retailers and 70% of the respondents purchasing under instalments valued the utility company's branding as "important". In Warm Up New Zealand and Germany's KfW programmes the use of customers' existing banks promotes trust. In a very different context, a similar principle applies to Kenyan microfinance; microfinance groups are likely to be trusted by their members, as they already have a stake in them.
<i>Complexity and hassle</i>	If schemes' target audiences are particularly diverse, a range of financial offers may be needed to accommodate their different financial circumstances and needs. At the same time, research into successful energy efficiency retrofit schemes has shown that it is vital to make the customer journey as easy as possible: any breaks in the process result in some customers losing interest and take-up rates falling. Successful schemes use a streamlined assessment and installation process and schemes where assessors are prepared to make weekend / evening visits to the householder have been shown to be particularly successful.
<i>Audience and marketing</i>	A key barrier to most schemes is awareness among potential beneficiaries; both of energy efficiency in general and of the scheme in particular. Furthermore, if people are aware of energy efficiency technologies, they may have negative perceptions of them. Any engagement approach needs to take into account the needs, behaviours and priorities of the target audience; how, when and why they use energy and why they might wish to participate in a scheme.

Recommendations: understanding context and thinking through scheme design

Given the diversity of the case studies assessed, and the breadth of the World Energy Council's membership, recommendations for decision-makers and practitioners in energy efficiency finance are necessarily non-prescriptive. In order to accommodate this breadth and diversity, we highlight broad contextual considerations – in addition to the barriers analysed – that must be taken into account in the design and operation of any finance scheme. These relate to the nature of: political, legal and institutional contexts; social and demographic context; economic and industrial contexts; the built environment; and climate and geography.

To facilitate systematic thought about finance scheme design and operation for a wide variety of different purposes and in a broad range of contexts, we provide an energy efficiency finance scheme 'decisions map'. This takes the form of a matrix (to be found in section 6) containing conclusions and recommendations for each of the main barriers, mapped out across each of the areas of context. It illustrates the importance of a thorough approach to energy efficiency finance which builds on the vast wealth of experience already accumulated from around the world, and is designed to facilitate this type of approach.

1 Introduction

1.1 Background: financing energy efficiency in buildings

Energy efficiency⁴ has a major role to play in economically, environmentally and socially sustainable energy policies. Energy efficiency can play a vital role in reducing the energy intensity of economic activity and avoiding the need for significant new supply. At the same time it can help reduce reliance on imported fuels and exposure to energy prices volatility⁵. End-user energy efficiency and energy efficient technologies would need to contribute 31% to the global CO₂ emissions reductions necessary between 2009 and 2050 to limit global warming to 2°C⁶. Most of these savings need to occur in buildings, with improvements to the building shell and more efficient provision of heating, cooling and other building services.

Energy savings are among the fastest, highest impacting and most cost-effective ways of reducing greenhouse gases emissions. Low cost energy efficiency measures have long been regarded as the 'low-hanging fruit' in delivering a clean energy economy⁷.

However, the groundswell of general interest observed does not in itself produce specific, bankable energy efficiency investment opportunities without other factors being in place. Even with high and volatile energy prices, energy security issues, and awareness of climate change policy drivers, there is a mixed picture of actual demand for energy efficiency both from private and public sector clients⁸. Despite the proven cost-effective opportunity to reduce energy consumption, a significant proportion of the energy efficiency improvement potential is not being realised⁹.

A key reason for this relates to the financing of energy efficiency. Barriers to financing mean that, in the past, energy efficiency has not been able to attract significant amounts of private capital¹⁰.

These barriers take a range of well-recognised forms. The Buildings Performance Institute Europe reported in 2010 that information failure, high subsidies, lack of technical expertise, uncertainty over savings, and externalities still characterise the energy efficiency market, while 'split incentives' discourage both building owners and occupiers from investing in energy efficiency measures if direct benefits are not perceived. Financial barriers include the initial cost barrier, high transaction costs, long payback time, and risk exposure. Furthermore, lack of knowledge among finance providers about energy efficiency prevents customers from accessing capital, and the absence of standardised measurement and verification practice further increases transaction costs¹¹.

There is a need to better understand the barriers to energy efficiency investment and to develop and strengthen innovative and best practice approaches which promote sustainable and cost-effective financing options. This report addresses this topic by reviewing energy efficiency finance schemes, centred around eight case studies. Each of these cases includes elements of best practice, and each also has a degree of innovation in its approach.

⁴ 'Energy efficiency' includes high efficiency technologies, infrastructure and processes, demand reduction and retrofit strategies.

⁵ (K. Hamilton 2009)

⁶ (IEA 2012)

⁷ (Kim et al. 2012)

⁸ *Ibid.*

⁹ (BPIE 2010)

¹⁰ (Makinson 2006)

¹¹ (BPIE 2010)

The report has three objectives:

1. To analyse the ways in which key barriers are successfully addressed, highlighting best practice and innovation along the way
2. To analyse the contextual factors affecting the success of schemes, which determine the transferability of scheme elements
3. To draw conclusions and make recommendations which enable decision-makers, scheme designers and practitioners to think through finance scheme design systematically to maximise benefits, minimise costs and avoid unintended consequences

The end result is a 'recommendations matrix' for the design and implementation of future finance schemes for energy efficiency. These lessons are drawn directly from the real experiences of the eight cases, together with additional insights where appropriate from a broader set of schemes and findings from a wider literature review. The recommendations address ways in which costs can be minimised and benefits maximised in future programmes, and also consider how schemes could be tailored to specific contexts.

1.2 Scope and types of scheme

This review uses a broad definition of energy efficiency in buildings. We consider schemes aimed at both residential and commercial/public or industrial buildings, and a wide range of energy efficiency measures and technologies (even including renewable generation, in one case, where transferable lessons are suggested). Similarly, the review uses a relatively broad definition of energy efficiency finance. This is because various finance models have emerged in different international contexts, to address the particular needs of specific end-user and customer markets¹². The main scheme elements considered here are: soft loans; on-bill repayment; guarantee programmes; property-assessed repayment; and energy service company (ESCO) models. The remainder of this section introduces each of these approaches.

1.2.1 Soft loans

These are loans that are enhanced or 'softened', for example with low interest rates and/or interest-free periods at the start of the loan term (also called preferential loans). Many public international financing institutions and national governments have begun experimenting with loan programmes to kick-start the market and to fill the debt gap where local and traditional banking sector actors are not active¹³. In most cases, preferential loans are delivered through public-private partnerships where the government provides a financial support to the bank, which in turn offers a preferential interest rate to its customers.

Loans may be provided to an individual residential or non-residential customer, or to a group of customers, such as an apartment association or micro-finance group. Preferential loans for energy efficiency can also be delivered through mortgages; for example, preferential mortgage terms may be offered to efficient homes, or an existing mortgage can be extended to allow a customer to finance efficiency improvements (on better terms than a new loan could offer). Soft loans are often combined with grants and subsidies, in order to make efficiency improvements even more cost-effective and appealing to customers. Often, these grants will be targeted at specific vulnerable or difficult to reach groups who might not otherwise be able to access the loan scheme.

¹² (Kim et al. 2012)

¹³ (Makinson 2006)

These measures address the high investment costs of energy efficiency and give a signal to the market about desired improvements¹⁴. This can stimulate market growth, particularly for small energy efficiency ventures and ESCOs in under-developed markets. In the US, soft loans have also proven successful for the scale-up of smaller residential and commercial energy efficiency projects¹⁵.

1.2.2 On-bill repayment (OBR)

This approach uses utility or third-party capital to pay for energy efficiency or renewable energy retrofits in a building. The customer repays the cost of this through an additional charge on their utility bill. OBR is often combined with a soft loan approach, as above (i.e. end users are offered a loan at preferential rates, which can be repaid through a utility bill). Because customers are able to quickly realise the economic benefits of energy savings, OBR addresses the 'first-cost' hurdle to energy efficiency retrofits and expands customer demand¹⁶.

Within this basic framework, OBR programmes vary significantly. There are a range of finance sources (government funding, utility investment, capital markets), programmes are administered by various types of organisation (e.g., utilities, government agencies, or other third parties) and they target different types of customers and buildings. In some cases, repayment is not through a utility bill but another bill, such as a local property tax. WSGR¹⁷ suggest that in the US, while OBR programs are currently in pilot stages and market penetration is still low, these programmes are generally seen as successful, with low default rates and borrowing costs.

1.2.3 Guarantee programmes

Energy efficiency projects can be structured with various guarantees. Guarantee mechanisms seek to engage financial institutions by supporting and sharing the credit risk of energy efficiency investments. In this way they help financiers to accept the risk for debt lending and act as a catalyst to scale up private investment in energy efficiency. Makinson¹⁸ states that guarantee mechanisms are an essential complement to other financing approaches, in order to fill the financial gaps encountered by early stage energy efficiency ventures. They may be intended as a temporary public sector intervention: as successful loan repayment is demonstrated, financiers will see that energy efficiency can be a competitive and profitable lending product line and the need for guarantees may end.

Guarantee mechanisms are most urgently needed in developing countries, where the guarantees must cover a very large amount of the loan, sometimes up to 150% (as opposed to most energy efficiency guarantee programmes in Europe that typically provide 50% guarantee, and most programmes worldwide that do not exceed a 90% guarantee level). Brazilian experience shows that general guarantee funds for small and medium-sized enterprises (SMEs) largely failed, because they only covered 80% of loan amounts¹⁹. However, guarantee funds are not a stand-alone solution and are not appropriate for all market situations. In some cases, such as the Bulgarian Energy Efficiency and Renewable Energy Credit Line programme, which provides debt lending via a credit line with local banks, guarantees are not (or not yet) appropriate, as the main financing challenge is bank liquidity. Guarantees are appropriate where financial institutions have sufficient liquidity, but a low appetite for risk¹⁹.

¹⁴ (BPIE 2010)

¹⁵ (Makinson 2006)

¹⁶ (Kim et al. 2012)

¹⁷ *Op cit*

¹⁸ *Op cit*

¹⁹ *Ibid.*

1.2.4 Property-assessed repayment

This is an approach developed in the United States, from 2007, that enables local governments to finance energy efficiency improvements using land-secured special assessment or ‘improvement district’ structures. In the US it is known as Property Assessed Clean Energy (PACE). The authority to create land-secured municipal finance districts already exists in most states around the country and has been used as far back as the 17th century to finance local improvements such as sewer lines, parks, and sports arenas. Under such authority, local governments issue bonds to finance local improvements that have a public purpose. They then collect the money to repay the bond through assessments levied against properties that receive a benefit from the improvements. The assessments are collected along with property taxes and are secured by a lien on the property. In a typical PACE program, existing municipal improvement district authority is expanded to include energy efficiency or renewable energy improvements on private property. These districts generally are established as a result of petition or vote of constituents or property owners in a local jurisdiction and then approved by the governing body of that jurisdiction. Property owners voluntarily agree to have assessments levied against their property in exchange for receiving the up-front capital for the energy efficiency improvements²⁰.

1.2.5 Energy service companies (ESCOs)

These are generally companies which offer energy demand reduction services, often financed through so-called ‘performance contracting’, where the energy savings generate cash flow which pays for the installation of the equipment plus a margin²¹. These market actors have received much attention, largely due to their role as a market driver and high impact on energy efficiency sector growth. In most developed markets the ESCO assumes the costs of the equipment, process replacement and building retrofit through an energy performance contract (EPC). Payback is defined as a percentage of energy savings as stipulated in the EPC. Whilst geared towards removing finance barriers faced by the end-user, ESCOs require financing both for themselves as ventures and for the projects they undertake²².

1.3 Structure of the report

The following sections present the methodology, findings, conclusions and recommendations of the review.

Section 2 outlines the methodology, including a summary of the literature sources reviewed and the process of identifying best practice cases and gathering data.

Then, in section 3, we present a high-level comparison of the costs and benefits of each of the eight case studies (each of which is provided in full in Appendix I). In this way the schemes are introduced at the heart of this report and provide the backdrop to subsequent analysis.

In section 4, we consider the main barriers to energy efficiency financing. These fall into four broad categories: financial; institutional structures, stakeholder practices and partnerships; buildings and measures; and consumers and end-users. For each category, we explore ways in which different schemes have overcome challenges, and so represent forms of best practice or innovation in this area.

Section 5 then synthesises findings from all the cases to draw out high-level conclusions affecting the transferability of approaches to other contexts. These issues are considered under the headings of: political, legal and institutional contexts; social and demographic contexts; economic and industrial contexts; built environment; and climate and geography.

²⁰ (Kim et al. 2012)

²¹ (K. Hamilton 2009)

²² (Makinson 2006)

Finally, section 6 provides a matrix of recommendations for the design and implementation of future finance schemes for energy efficiency. These include recommendations for overcoming the major barriers identified, mapped out against the different areas of context assessed in section 5.

2 Methodology

This section outlines the methodology used in the production of this report, which involved three main stages: reviewing literature; selecting cases and gathering data; and developing an evaluation framework and using this to compare the case studies and develop recommendations.

2.1 Literature review

The study began with a literature review. We employed a cascade approach to reviewing the current literature on soft loans, starting from the identification of existing reviews and summaries and moving from these to more detailed work on specific themes as appropriate. Initial literature included recent studies by the Buildings Performance Institute Europe, Global Buildings Performance Network, Institute for Building Efficiency, UNEP Finance Initiative, Climate Policy Initiative, European Climate Foundation and the European Bank for Reconstruction and Development's Sustainable Energy Financing Facilities. It also included country-specific innovative think pieces, such as outputs from E3G's work (funded by Transform UK) on financing energy efficiency in the UK using the Green Investment Bank and Green Bonds, and studies from the Clinton Foundation's Climate Initiative work-stream on building retrofit.

The aim of this initial review was two-fold. First, it was used to identify a long list of potential case studies, representing 'best practice' in the field²³. Second, it was used to develop a set of issues to be addressed in the report, which formed the basis of the evaluation and analysis framework.

2.2 Case study selection and data collection

The literature review was used to identify a 'long list' of over 130 potential case studies, which was then shortened to a medium list of 15 schemes, ensuring a good spread of: geography; developed, transitional and emerging, and developing economies (including OECD and non-OECD countries); and different building sectors. Eight schemes from the medium list became case studies in the short list. In selecting these cases, the emphasis was on selecting schemes that have robust ex-post evaluation data and/or good expert contacts available, to cover a wide range of potential issues for the evaluation framework. See Table 3, overleaf, for an overview of the cases.

As well as reviewing published documents, we identified and contacted national experts for each scheme to request their assistance with the work. The data gathered was used to complete the evaluation matrix (see below), and then to create a summary of each case study. Due to a lack of sufficient data, not all indicators were available for all case studies. Consequently, it is difficult to determine which of the available instruments is the most cost-effective. Furthermore, the great variety in the different tools makes comparison between them difficult. However, the quantitative and qualitative data available are sufficient to suggest important lessons from these diverse examples of best practice.

²³ Appendix II presents the 'long list' of case studies, with links to further resources on each.

Table 3: Overview of case study schemes

Scheme name	Short name	Country	Type of scheme	Region	OECD/non-OECD	Sectors targeted
Bescom Efficient Lighting Programme (BELP)	BELP	India	Efficient lamps offered with an on-bill repayment option	Asia	Non-OECD	Residential (urban); small commercial
ESCO Loan Guarantee Programme	ESCO LGP	China	Energy performance contracting, supported by guarantees	Asia	Non-OECD	Commercial; industrial
Flat 35 mortgage scheme	Flat 35	Japan	Preferential mortgage terms available to efficient buildings	Asia	OECD	Residential (mainly owner-occupied)
KfW's energy efficiency schemes	KfW EE	Germany	Preferential loans available to efficiency projects	Europe	OECD	Residential; commercial; public
KredEx's energy efficiency schemes	KredEx EE	Estonia	Loans, grants and guarantees for efficiency projects	Europe	OECD	Residential
Microfinance for clean energy	Kenyan microfinance	Kenya	Loans (including group loans) for renewable energy measures	Africa	Non-OECD	Residential; small commercial; small agricultural
Palm Desert Energy Independence Program	Palm Desert EIP	US	Property assessed clean energy programme	North America	OECD	Residential (mainly owner-occupied); commercial; industrial
Warm up New Zealand	Warm Up NZ	New Zealand	Insulation and heating measures offered with repayment through mortgage or council tax	Australasia	OECD	Residential

2.3 Evaluation framework

The literature review was used to determine the issues that the evaluation framework would capture. The framework then formed the basis for analysing the medium list of schemes, and was then used for more detailed analysis for the chosen case studies, once these had been selected. The framework took the form of a spreadsheet matrix, which included:

- Scheme design factors: Source(s) and structure of finance; target audience(s), building types and geographical coverage; measures supported; offer(s) and propositions; liabilities, risks and where they rest; and monitoring and evaluation mechanisms.
- Contextual implementation factors: Institutional framework; key stakeholders; barriers addressed; marketing and engagement; and differentiation.
- Outputs: intended and achieved direct results.
- Outcomes: intended and unintended impacts and side effects.

For points c) and d), the framework covered quantitative costs and benefits (such as costs to the public purse; take-up; investment mobilised; and energy and carbon savings), as well as qualitative costs and benefits (such as key successes and failures; barriers overcome and not overcome; and lessons learned).

The matrix approach enabled the rapid identification of gaps in our developing knowledge about the scheme, and enabled easier comparison of different schemes. An excerpt from the spreadsheet matrix is shown in Figure 1, in which schemes are arranged in rows and factors and indicators captured in each column.

ENERGY EFFICIENCY FINANCE SCHEME	Brief description	Current status	Source of info	Region	OECD or non-OECD country	Type of scheme (PAYE / OBR / ESCO / soft loan)	Source and structure of finance	Target audience	Geographical coverage	Building types	Measures supported	Basic offer or mechanism	Supporting policies	Liabilities/Risk (for whom)	Monitoring and evaluation mechanisms	Institutional private/public policy risk	
German KfW (Kreditanstalt für Wiederaufbau)	Large state development bank runs programmes	Ongoing	Which report, papers in dropbox	Europe	OECD	Soft loan	Soft loans provided through KfW, a development bank	Home (first homes only) and other residential property	Germany	Residential, commercial, public (depending on)	Residential programme: All energy efficiency Street lighting, refurbishment of buildings	Low interest (subsidised) loans up to 175,000 per year	KfW programmes are set out in Germany's 1st National Energy Efficiency Action Plan 2008-	In general, this is a low risk scheme as the benefits of EEF are a revolving retrofit guarantee fund. This involves	There are KfW-commissioned evaluations	KfW is a Gov sector is a of Concept O/E Established-2004. See u	
Bulgarian Energy Efficiency Fund (EEF), also called Estonian KREDEX	Revolving fund, PPP acting as financing/guaranteeing 'Credit and Export Guarantee Fund'	Ongoing	D. Dulov presentations; Uge-Voracek et al. papers; Mija-Adler presentation, papers in dropbox	Europe	OECD	Revolving fund, soft loans	Capitalized with grants from the World Bank (EFT). The Revolving loan fund, KREDEX is a self-sustaining fund in the	Municipalities, SMEs, Universities and hospitals; ESCOs	Bulgaria	Public buildings, industrial premises	Thermal insulation; New windows/doors; New heating	EEEF is a revolving retrofit guarantee fund. This involves	On the basis of the directive issued in 2009 by the Estonian National Energy Efficiency Action Plan 2008-	EEEF	There are KfW-commissioned evaluations	EEEF	
Palm Desert Energy Independence Program	PACE scheme in California that allows a public body to offer	Ongoing/reopened in 2010 with caveat re mortgages	Which report, papers in dropbox	N America	OECD	PACE	Initial source of capital (loan funds) was a \$2.5M	Residential and SME, commercial	City of Palm Desert, California	Residential, commercial, industrial. Loans are	Energy efficiency measures (fabric and efficient heating items not permanently attached such as efficiency and renewable Photovoltaic)	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions
Sonoma County Energy Independence	PACE scheme in California, that allows a public body	Ongoing	papers in dropbox	N America	OECD	PACE	The program is financed from the general fund to initial loan capacity of \$40 million drawn from reserves of	residential, commercial	Sonoma county, California	residential, commercial	Energy efficiency measures (fabric and efficient heating items not permanently attached such as efficiency and renewable Photovoltaic)	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions
Boulder County Climate Smart Loan Program	PACE scheme, Colorado, that allows a public body to offer	On hold since 2010 due to mortgage issue	papers in dropbox	N America	OECD	PACE	Revolving loan fund totaling \$2.5M is funded through City	residential	Boulder county, Colorado	residential, commercial	Energy efficiency measures (fabric and efficient heating items not permanently attached such as efficiency and renewable Photovoltaic)	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions
Oregon-Clean Energy Works	Oregon holistic energy efficiency programme that rec	Ongoing	Which report, papers in dropbox	N America	OECD	Soft loans; OBR	A revolving loan fund totaling \$2.5M is funded through City	Residential owner-occupiers (not flats)	Oregon	residential	Energy efficiency measures (fabric and efficient heating items not permanently attached such as efficiency and renewable Photovoltaic)	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions
Green Municipal Enabling Fund in Canada	The Federation of Canadian Municipalities (FCM)	Ongoing	Reports by FCM and KPMG, papers in dropbox	N America	OECD	Soft loans	The Government of Canada has endorsed EESD	local authorities	Canada	public buildings, others?	Diverse environmental schemes e.g. grants to homeowners	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions
Warm Up New Zealand: Heat Smart	Soft loan scheme subsidising insulation and clean heating for	Ongoing	Giemes et al, EECA and others, papers in dropbox	Australia	OECD	Soft loans; council tax repayment	State funded. The scheme is partially grant funded but funding comes from UNEP through the Mediterranean	homeowners and landlords	New Zealand	Residential	The funding can be used to install ceiling and solar water heating	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions
Prosol Tunisian solar water heating scheme	End-user financing mechanism supporting the	Ongoing (first phase ended, slightly modified scheme)	Many reports in dropbox, including UNEP report	Africa	Non-OECD	OBR	Funding comes from UNEP through the Mediterranean	Residential customers	Tunisia	Residential (plus plots in industrial, hotel and other)	Mainly solar PV e.g. in Murang'a. PV system to power	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions
Kenya solar home systems-SACCO financing	Micro-financing for solar and other measures through	All appear to be closed	Various, including SEPPA and UNEP (in dropbox) Katsiki and	Africa	Non-OECD	Soft loans; co-op model	Nicotine Finance Agency (NIFA) helps private ESCO model, supported by international funded	Residential customers; agricultural co-ops; Home-owners/buyers. NIFA also has a loan business and industry	Vaies by scheme. There are regional co-ops in Murang'a and	Commercial, residential	Mainly solar PV e.g. in Murang'a. PV system to power	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions
Japan's Flat 35 scheme	State-based mortgage securitisation	Ongoing	Yamori and Kondoh; Hamilton, EA, IJHF, IJHF, papers in dropbox	Asia	OECD	Mortgage	Japan Housing Finance Agency (JHFA) helps private ESCO model, supported by international funded	Home-owners/buyers. NIFA also has a loan business and industry	Japan	Residential	NA (homes must meet thermal efficiency standards)	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions
Chinese ESCOs (multiple schemes)	Various schemes exist to support ESCOs, including	Ongoing	Various - See dropbox	Asia	Non-OECD	ESCOs; soft loans	Japan Housing Finance Agency (JHFA) helps private ESCO model, supported by international funded	business and industry	Various locations in China	Industrial, commercial	ESCO EPCs, can include for e.g. boiler replacement	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions
India's BELP lighting programme	Utility-led pilot program to create a	Closed (influenced new, similar)	BELP Evaluation Committee Report.	Asia	Non-OECD	OBR	Japan Housing Finance Agency (JHFA) helps private ESCO model, supported by international funded	urban residential sector	BESCOM distribution network companies	urban residential	Lighting retrofit - reclamping	Property owner can receive up to a 20-year loan (although Helps property owners to finance energy efficiency. PACE interest rates are 5.2% and 6.66% (for two loan types)	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	See PACE risk note. See PACE risk note. See PACE risk note. See PACE risk note.	California goal of reducing its greenhouse gas emissions	California goal of reducing its greenhouse gas emissions

Figure 1: Excerpt from evaluation matrix

3 High-level comparison of the case studies

This section aims to provide a high-level introduction to the eight case study schemes, focusing on key quantitative data that indicate the costs and benefits of each scheme. We have aimed to provide data on each variable for each scheme; however, this is not always possible due to poor data availability. The aim of this section is to describe and compare the schemes, rather than to explain or evaluate their impacts; this latter task is the subject of sections 4 and 5. To provide an overview, Table 4 shows the key costs and benefits of the eight schemes.

Table 4: Overview of scheme costs and benefits [financial data given first as expressed in original sources, then in parentheses in 2012 US dollars].

Scheme name	Financial inputs (and leveraged funding)	Financial returns (direct and indirect)	Take up rate	Energy saving	CO ₂ impact (or greenhouse gas equivalent) ²⁴
BELP	Bulb suppliers provided 1.5 million RS (\$37,300)	Reduced cost of power purchase 33.5 million RS (\$0.9 million)	More than 50,000 consumers were involved per year; 4% of BESCOM's customers each year	Annual energy saving: 15.3 GWh (BELP data)	Annual reduction: 0.014 Mt CO ₂
Flat 35	The Japanese government funded JHF (GHLC at the time) with a budget of ¥10 billion (\$89.8 million) in 2005 and ¥30 billion (\$0.3 billion) in 2006 ²⁵ .	Not known	In 2011, nearly 150,000 home-buyers applied for Flat 35 mortgages, representing over a quarter of the mortgage finance market	Homes built or refurbished to the highest Flat 35 standards use approximately one third the energy used in a typical Japanese home	Not known

²⁴ Emissions conversion factors from <http://www.theclimateregistry.org/downloads/2013/01/2013-Climate-Registry-Default-Emissions-Factors.pdf>.

²⁵ (IEA 2008)

Scheme name	Financial inputs (and leveraged funding)	Financial returns (direct and indirect)	Take up rate	Energy saving	CO ₂ impact (or greenhouse gas equivalent) ²⁴
KredEx	CEB loan and EU structural funds grant: €49 million (\$68.1 million); Estonian government: €17.3 million (\$24 million) (2010-2011). Total: €66.3 million (\$92.1 million)	The small income from loan interest is returned to the revolving fund.	<p>Since 2000, 21,979 households have used the housing guarantee. 9.2% of housing loans issued in Estonia in 2011 had a KredEx guarantee.</p> <p>Since 2004, there have been 583 apartment loan guarantees (3.4% of apartment buildings)</p> <p>There have been 391 apartment loans since 2009 (2.3% of apartment buildings).</p> <p>By 2011, there have been grants to 266 apartment buildings (1.6% of apartment buildings). Also 1,038 smaller audit grants.</p>	<p>Apartment loans' average predicted energy saving is 39.3%.</p> <p>Expected saving from apartment loans and apartment grants is 75 GWh per year, expected saving over 20 years is 1,500 GWh (KredEx data)</p>	Expected savings translate into 0.077 Mt CO ₂ per year.
Warm Up NZ	New Zealand Government funding, 2009-2013: NZD 350 million (\$0.3 billion)	Central estimate of gross benefits for the programme of NZD 1.28 billion (\$0.9 billion); a net benefit of NZD 0.95 billion (\$0.7 billion)	Over 180,000 households; 12% of households.	Around 1% of average annual household electricity; around 1% of average annual total metered energy (Warm Up NZ data) (This scales up to an estimated 20.5 GWh in total, per year ²⁶).	Based on the 20.5 GWh estimate, there is a CO ₂ reduction of 0.003 Mt CO ₂ per year.

²⁶ This is a derived estimate based on the assumption that total average energy consumption per NZ household is 11,410 kWh/year per house (HEEP)

Scheme name	Financial inputs (and leveraged funding)	Financial returns (direct and indirect)	Take up rate	Energy saving	CO ₂ impact (or greenhouse gas equivalent) ²⁴
KfW	Total funds spent on energy efficiency in 2012 were €3.6 billion (\$5.3 billion) ²⁷ . In 2010 \$0.8 billion was allocated by the Government to KfW specifically for energy programmes ²⁸ (\$1.1 billion).	In 2011, for every €1 public money spent on the energy efficiency programmes, over €15 were invested in construction and retrofit, and more than €4 went back to the public finances in taxes and savings	2.1 million homes had energy efficiency work funded through KfW loans between 2001 and 2011; 5.3% of homes.	The CO ₂ Reduction Programme and the CO ₂ Building Rehabilitation Programme up to 2004 saved 45PJ; 12,500 GWh in total (KfW data)	The 12,500 GWh saving by 2004 would translate to 2.645 MtCO ₂ ²⁹ . Projected (in 2004) total reduction from improvements to existing buildings is 2–2.5 Mt CO ₂ .
Palm Desert EIP	City council in 2008 gave seed funding of \$2.5million (\$2.7 million in 2012 terms), followed by a further \$2.5million from a bond. In 2010 a further \$6 million (\$6.3 million in 2012 terms) was made available from the sale of bonds: a total of \$11 million (\$11.6 million in 2012 terms)	Not known	By 2012 EIP had loaned \$5.5million to finance improvements in 240 homes; 1% of Palm Desert households	First year energy bill savings of around \$125,000 (\$134,000 in 2012 terms) (Palm Desert EIP data)	Not known
Chinese ESCOs	\$26 million (\$32.4 million in 2012 terms) from GEF; additional funding from DfID to set up EMCA; co-financing of \$255 million (\$318.2 million in 2012 terms)	Not known	From 2003-2006, the Programme issued 85 loan guarantees to 29 ESCOs (half the active ESCOs at the time). By late 2010, EMCA's membership was 560 ESCOs.	In 2007, projects initiated in that year were estimated to save (lifetime) 616,390 GWh (GEF data ³⁰).	Total lifetime carbon savings from the Second China Energy Conservation project are expected to be 84 Mt CO ₂ .

²⁷ (KfW 2013)

²⁸ (Novikova et al. 2013)

²⁹ NB this is based on the current emissions factor, not the historic one

³⁰ <http://www.thegef.org/gef/node/1373>

Scheme name	Financial inputs (and leveraged funding)	Financial returns (direct and indirect)	Take up rate	Energy saving	CO ₂ impact (or greenhouse gas equivalent) ²⁴
Kenyan microfinance	Faulu's energy lending was established by a US\$ 7 million bond in 2005 (\$8.2 million in 2012 terms)	Faulu has a 10% profit margin on energy-lending	Faulu has branches in around 50 of Kenya's 67 districts, and has 3,130 active groups, with about 70,000 clients and 54,000 active loans. Between 2003 and December 2006, about 4,000 clients took advantage of Faulu's energy products, about 5.7% of clients	Not known. Energy use may increase due to provision to previously non-electrified areas.	Not known.

The levels of investment involved in the schemes vary greatly. India's BELP is a small regional scheme (initially a pilot) and this is reflected in the small investment of \$37,300 for marketing purposes. Similarly, Palm Desert EIP is a local scheme, and so involves a relatively modest investment of \$11.6 million. Faulu Kenya, one of the larger microfinance institutions in Kenya, based its energy lending on an \$8.2 million bond. This reflects the emerging nature of energy lending in Africa. Estonian KredEx schemes ranks here as a middle-scale programme receiving significant levels (\$92.1m) of state support for operation on a nationwide basis. KredEx also makes use of innovative mechanisms such as the sale of emissions allowances under the Kyoto protocol. Finally, the schemes in Japan (Flat 35), New Zealand (Warm Up NZ), Germany (KfW) and China (ESCO LGP) represent the largest programmes, with KfW having an annual budget of over \$5 billion dollars. Both the New Zealand and German schemes are major nationwide energy efficiency programmes run by the state, explaining the high levels of investment. Meanwhile, the large sums involved in the Chinese ESCO sector represent both investments by major international institutions and also the huge amount of funding leveraged by ESCOs in the context of a large, growing and relatively inefficient industrial sector.

Financial returns also vary widely, though data here are often not comparable due to different monitoring approaches. Globally, energy efficiency finance schemes have very different aims in terms of economic returns. Some schemes, such as Chinese ESCOs, aim to make a profit, and in China this has become a fast-growing and successful commercial sector. In contrast, some schemes are seen as a form of state service provision, and so aim to be broadly revenue neutral, or even to operate as a net consumer of financial resources, albeit with wider social and indeed economic returns. Warm Up New Zealand is an example of this type of scheme. Although the state invests huge sums, and makes little or no profit on loans (municipal authorities report that interest charged serves only to cover administration costs), the wider impact of the scheme is valued as a net benefit of \$0.7

billion, mainly due to health benefits (which represent approximately 99% of the total benefits)³¹. The BELP scheme not only saved customers money but by reducing the peak load, meant that the need for generation capacity was minimised. The evaluation report gives this a value of \$25.6 million (for all CFLs sold during the programme period)³². Like many schemes worldwide, KfW, KredEx and many Kenyan microfinance schemes aim to recycle funds as loans are repaid, or to become 'revolving', to a greater or lesser extent. KredEx is often cited as a best practice case in becoming self-sustaining (this is discussed later in section 4.1.3).

In terms of take-up rates, the New Zealand scheme stands out as achieving both a large number of recipients and also a relatively high proportion of the target group (12%), reflecting the scale of the programme, which has only been running since 2009. In contrast, Palm Desert EIP (launched in 2008) is at present a much smaller programme with a lower take-up rate. Flat 35, KfW and KredEx all have relatively high shares of their respective markets, due to their quasi-public sector status and established reputations. For KfW and Flat 35 their reputations are linked with their long histories; KfW was established in 1948 and began energy efficiency work in 1996. The Japan Housing Finance Agency was set up in 1950 (then the GHLC), and has been offering Flat 35 for over 10 years. KredEx was set up more recently, in 2001, but has also benefited from strong state support.

Energy reductions similarly reflect the scale of the different projects, with Chinese ESCOs showing by far the greatest savings (despite the relatively recent emergence of the sector, with pilot ESCOs first created in 1998), and the national schemes showing greater savings than local ones. The relationship between savings achieved and investments made is more informative; BELP stands out here as a very inexpensive programme that nonetheless achieved significant savings in the short period it was running (around two years). Warm Up New Zealand generated only slightly higher savings, with only a 1% cut in average household energy use, but at a much greater cost (this is because the rebound effect of comfort-taking in newly-insulated homes was identified as very high). It is important to note that not all schemes had a core goal of reducing energy use; the comfort taking in the New Zealand scheme was an important benefit and Faulu's energy loans may have increased consumption, but met important human development goals. The impact of energy savings on greenhouse gas emissions depends on the carbon-intensity of the energy supply to the region in question. For example, the fact that New Zealand has a relatively low-carbon energy supply means that its carbon savings appear lower than might be expected from the cut in energy use..

Finally, deadweight and additionality are important factors in any cost-benefit analysis. In other words, how much of the recorded impact would have happened in the absence of the programme? Unfortunately this information is very often not available. As a general rule, deadweight will be low in cases where there are few alternative support mechanisms for energy efficiency, and high in cases where energy efficiency is already a well-established and understood field, or is promoted by the wider legislative, economic and cultural climate. For example, in Japan there are voluntary standards for energy efficiency in buildings which, in combination with the Flat 35 scheme, have a strong impact in promoting efficiency.

³¹ (Grimes et al. 2012)

³² (BELP Evaluation Committee 2006)

4 Overcoming barriers: best practice and innovation

This section draws on the detailed review of the eight case study schemes to identify a number of barriers to the success of energy efficiency finance schemes. These barriers fall into the following four broad categories:

- Finance
- Institutions, stakeholders and capacity
- Buildings and measures
- Consumers and end-users

For each set of barriers, we discuss ways in which problems have been addressed in a range of cases. We also highlight where these barriers and the ways of overcoming them are well understood, well-established and for which the case studies reflect best practice – and where they are more recently identified barriers that are leading to new and innovative approaches to overcoming them.

4.1 Finance

Energy efficiency investments face a wide range of frequently interconnected financial barriers. The schemes reviewed for this study attempt to address all of these to varying degrees³³. The degree to which each barrier is encountered and understood in different countries and sectors can differ considerably:

- **Access to capital** can be made difficult when the up-front or initial cost of energy efficiency improvements is high. This barrier is increased when there are competing, and often better understood, priorities for investing the capital that actors are able to access.
- **Risk exposure** is the riskiness relative to the potential return on an investment. This can adversely affect the perceived attractiveness of energy efficiency investments. Where the benefits of energy efficiency investment are not well understood, or the magnitude of predicted savings is not easily quantifiable or readily trusted by investors, this may both increase perceived risk and reduce estimates of predicted returns – in turn reducing the attractiveness of energy efficiency to investors by increasing risk exposure.
- **Discount rates** are closely related to risk exposure. In assessing the merits of investing in energy efficiency, a high discount rate is used to reflect high risk exposure – reducing the attractiveness of energy efficiency relative to other investment options. Typically, uncertainty about the robustness of methods to estimate savings from energy efficiency, along with a resultant under-appreciation of some of the wider financial benefits (such as reduced exposure to fuel price volatility), leads to the application of a high discount rate to returns, which increases the perceived risk.
- **Payback periods** are a barrier when considering energy efficiency investments beyond the 'lowest-hanging fruit'. Payback periods may be long, especially in the case of deep building retrofits – where they may be in excess of 30 years – and far exceed payback times expected of other investment options. Often, non-energy benefits such as increased employment, improved health and comfort, and reduced pollution need to be quantified in order to make investments such as deep retrofits attractive. Yet at the same time, investors are usually not familiar with cost-benefit analysis techniques for benefits that are not directly monetised.

³³ Adapted from (BPIE 2010).

- **Financier awareness** is frequently a barrier for potential borrowers because lending institutions are not typically trained in understanding energy efficiency investments. Improved awareness, through training as well as a gradual build-up of on-the-job experience, can change the way lenders assess the value of energy efficiency investments, particularly in terms of the assessment of risk exposure, the discount rates used and the payback period expected.
- **Standardised measurement and verification** methods are critically important to ensure lenders do not need to spend a disproportionately large amount of time assessing the value of energy efficiency investments compared to other options, which would increase transaction costs in the form of higher administrative fees and/or interest rates.
- **Size** of investments can pose a problem, particularly as energy efficiency investments are typically smaller in size than other infrastructure projects, such as in transport or energy supply. The smaller-scale nature and often high specificity of energy efficiency projects can mean that transaction costs are high relative to the overall investment and that previous examples of directly comparable successful investments are rare.

4.1.1 Improving access to capital and enhancing attractiveness of finance and investments to borrowers and lenders

4.1.1.1 Borrowers

All the schemes assessed for this study are inherently about facilitating access to finance for energy efficiency improvements that have been identified by scheme designers as worth supporting. Where lenders conventionally offers loans for energy efficiency to end users (either residential or commercial customers) a key barrier to success may often be higher than usual interest rates on these loans, or high fees and charges – for many of the reasons described above. Each of the case study schemes has enabled access to capital and enhanced the attractiveness of finance in a distinct way, as summarised in Table 5.

The Japan Housing Finance Agency (JHF)-backed 'Flat 35' mortgage can offer low interest rates due to the financial structure of JHF. JHF's status as an incorporated administrative agency which enables it, through the bonds it issues, to access private finance at relatively low cost, and pass this low cost, but still market-rate, finance on to Flat 35 customers via private banks. For the German KfW, the Federal Government guarantees all its commitments and hence KfW has an AAA credit rating. In addition, interest rates are publicly subsidised. As a result, rates for its retrofit loans can be as low as between 1% and 2%. In the case of energy efficient retrofits, such low rates quite explicitly enhance relative attractiveness as borrowing costs for 'conventional' retrofits are usually a few percentage points higher. Estonian KredEx also offers relatively low interest loans, enabled by its status as a state-backed institution.

In some Kenyan microfinance schemes (such as those run through Savings And Credit Co-operatives or SACCOs), the group lending model gives individuals better interest rates than they would otherwise get. Interest rates may still appear high (one SACCO, Murang'a has offered a loan with an interest rate of 12%; the large microfinance institution Faulu has offered 20%) but these are available to people who may have had no previous access to finance. For Palm Desert's Energy Independence Programme (EIP), the superior lien position of the PACE loan (relative to any other loans on the property) makes it less risky for the municipality to issue a loan and so helps reduce costs. However, this also has implications for relations with mortgage providers, and has created serious problems for PACE schemes (as discussed below).

In Warm Up New Zealand, municipal authorities are offering a range of different interest rates but most are set at 7% (which Auckland council says covers their cost of borrowing and administration costs). Other councils have offered lower rates by subsidising the interest rate.

Table 5: Enabling access to capital and enhancing attractiveness of finance

Scheme	Country	Access to capital / attractiveness of finance
Bescom Efficient Lighting Programme (BELP)	India	Efficient lamps offered with an on-bill repayment option, removing up-front cost to consumers
ESCO Loan Guarantee Programme	China	Encouraging banks to lend to ESCOs more cheaply than they otherwise could (or lend in the first place) via state-backing of investments: China's National Investment & Guaranty Company offering banks 90% loan guarantee for ESCO lending
Flat 35 mortgage scheme	Japan	High quality mortgage-backed securities sold in capital markets by Japan Housing Finance Agency enable Flat 35 mortgages to have relatively low, long-term fixed interest rates
KfW's energy efficiency schemes	Germany	KfW also able to access capital markets, and offers finance with publicly subsidised interest rate. Rate well below ordinary retrofit loans and further bolstered by additional capital subsidy available to those who achieve higher energy performance standards in their retrofit project
KredEx's energy efficiency schemes	Estonia	Loans, grants and guarantees are offered for efficiency projects. Interest rate and duration of loans are more favourable than market loans (with higher grants also offered for deeper retrofits). Guarantees improve access to finance for building improvements. KredEx benefits from an Estonian state guarantee for its loan from an international bank.
Micro-finance for clean energy	Kenya	Microfinance concentrates on enabling access to capital for individuals who may not initially have been able to borrow for any purpose. Loans are offered to individuals and to groups; group loans are a strategy used to reduce lender risk and minimise defaults, so reducing costs to beneficiaries.
Palm Desert Energy Independence Program	US	Property assessed clean energy programme; improvements are financed by a lien on the property, which addresses the issue of upfront costs, and is generally cheaper than a commercial loan.
Warm up New Zealand	New Zealand	Insulation and heating measures offered with repayment through mortgage or council tax. Council interest rates are generally used only to cover administration costs, and mortgage rates are generally more favourable than other commercial loans. Some grants are also offered to specific eligible groups.

4.1.1.2 Lenders

A closely related issue (which is often a root cause of high interest rates and fees for beneficiaries) is the wariness of investors and lenders about financing energy efficiency. This, as stated before, is usually owing to a mixture of high perceived risk exposure, long payback periods, lack of awareness and the absence of established methods for assessing the value of investments. In many of the cases studied, this had been a serious problem in the past, and had gradually been overcome through a range of measures. In the first instance, these have often involved state guarantees. Such guarantees are intended to send a clear signal to financial institutions that projects in certain emerging sectors are worth lending to, for both commercial and social reasons. They can in some cases be seen to create a 'breathing space', that is an environment in which energy efficiency investments gain a chance to prove themselves and develop a positive investment track record which can later mean that there is no need for a continued guarantee.

Under China's ESCO Loan Guarantee Programme, funder loan guarantees and partial guarantees have been offered by the state-governed Loan Guaranty Company with World Bank support, and were

especially necessary in the past when the sector was first emerging and conditions were difficult (legally, technically and financially). In Estonia's KredEx, state loan guarantees are provided, and for the German KfW (as mentioned before), the Federal Government guarantees all its commitments and hence KfW has an AAA credit rating. Credit guarantees are a conventional form of 'strategic niche management' used to promote an emerging sector³⁴. However, a key question in assessing a scheme's success is the extent to which those guarantees remain necessary, or whether the sector is able to develop to the extent that investors are familiar with energy efficiency financing projects, allowing the schemes to fully participate in credit markets without the need for guarantees. This appears to have become the case in China, where loan guarantee programmes have kick-started high-return energy efficiency investments, predominantly in the commercial and industrial sectors, by increasing visibility and enhancing their commercial credibility with investors. However, in the cases of Germany's KfW programmes and Estonia's KredEx, state guarantees are still important. This may be partly due to the current economic climate and a decreased willingness to lend across all sectors, as well as partly due to the less high-yielding nature of the investments available.

4.1.2 Reducing costs

High administrative costs can be one cause of high interest rates and fees, and can reduce a scheme's cost-effectiveness. Estonia's KredEx has found that loans have lower administrative costs (for the institution) than previous grant-based schemes because most of the work is done by the banks. The banks' work of course also entails administrative costs, although it is likely that these are lower per customer account than is the case for KredEx. As outlined in the introduction to section 4.1, high administrative costs may come about as a result of the absence of quick, simple, robust and established methods for assessing the value and risks of energy efficiency investments, as well as from investments' often small-scale nature and high specificity (meaning that administrative costs are high relative to the overall capital costs). In cases where schemes aim to establish standardised methods of assessment, measurement and verification in the first place, relatively high administrative costs may be unavoidable, at least until methods are agreed and have become more commonplace. In either case, some level of administrative costs is unavoidable, and a challenge for schemes is to keep them low as well as to identify a suitable means of covering them.

In the KfW scheme, the commercial banks that channel the KfW loans to consumers are allowed to charge an additional interest rate premium (on top of the KfW interest rate) that reflects their administrative costs and risks. This is capped, generally at 0.75% per year for loans to households, offering an incentive for banks to manage these costs.

It is difficult to compare administration costs across schemes, because if data is published, it may cover a wide range of different and non-comparable activities, and is often not specific to an organisation's energy efficiency schemes. Some information is available for Palm Desert EIP; the local government staff time required to administer the programme has an annual cost of about \$90,000 (approx. 1.5 full-time equivalent staff). The City's costs for running the programme are recovered through differences between bond rates and loan interest rates to consumers: there is no fixed rate administrative charge paid up-front by those taking out loans. However, an assessment collection cost is charged through the property tax bill. Experience to date among PACE schemes suggests that there may be significant programme cost savings through aggregation or scaling up schemes (e.g. to the county level) since there are administrative efficiencies linked to running larger-scale programmes. Aggregation can also achieve lower borrowing costs and hence offers the potential for lower interest rates. This may also explain how KredEx and KfW can keep administrative costs relatively low, as both are large, nationwide

³⁴ (Schot and Geels 2008)

schemes which are more likely to achieve administrative economies of scale by aggregating a large number of smaller projects.

To administer the Warm Up New Zealand programme, the Energy Efficiency and Conservation Authority (EECA) employs the equivalent of 22.5 full time people (FTEs) and 2.1 FTEs of contracted labour. The costs associated with this are estimated at NZ\$2.5 million in the first year (2009) (\$1.1 million) and to total NZ\$7.3 million (\$5.4 million) over the four years of the programme. For BELP, a much smaller scheme, BESCO appointed three dedicated staff to oversee the programme³⁵. Pilot schemes and innovative programmes may require proportionally more administrative resources than larger or more well-established schemes, due to their novelty and the associated challenges of scheme management. While low administrative costs are generally seen as a desirable outcome, the key issue is that administrative resources (financial, human and other resources) should provide adequate capacity to support all aspects of the scheme, while being proportionate to its size and impacts. This support may include establishing monitoring and evaluation protocols, co-ordinating partners and providing project management, among other important tasks.

Minimising the occurrence of defaults and overdue payments through careful scheme design is also an important element of keeping scheme costs down. 'Pay As You Save' (PAYS) schemes, for example, must also have an effective and socially responsible way to deal with defaults. Britain's Green Deal finance, an example of PAYS, recoups loans via a surcharge on electricity bills. Delinquency can thus lead to electricity disconnection, although there are safeguards in place to protect vulnerable consumers. BELP had a bill-based repayment mechanism, and there was a disconnection option if customers do not pay bills. Since the lamp cost is small relative to an electricity bill, disconnection due to the scheme is not a serious issue in this kind of scheme. However, if it were scaled up to a PAYS loan for more costly measures, this would need to be considered.

Flat 35 and Warm Up New Zealand have mortgage-based offers, so existing default and repossession procedures would apply. For PACE schemes, the loan is treated in the same way as property taxes, and is subject to the same procedures in the event of default. The loan is secured on the property, and so in extreme cases, the property may be repossessed. In this case, the PACE loan is reclaimed first, before any mortgage or other claims.

In KredEx, if a person is not fulfilling obligations to their housing association it is theoretically possible they will lose their apartment. In reality these cases are very rare because usually people fulfil their obligations³⁶. It is possible that taking a loan as part of an association of neighbours encourages people to meet their obligations more than an impersonal bank loan would.

4.1.3 Moving towards financial sustainability

An important challenge for many finance schemes is to become financially self-sustaining³⁷. A scheme may succeed (especially in the short term) by drawing on the resources of the state or other funders. However, its position will always be precarious, especially during a challenging economic climate. It will not only be vulnerable to complete closure if priorities change, but is likely to face funding uncertainty in the medium term (as in the case of KfW's energy efficiency programmes; which cannot be granted a long-term budget for parliamentary reasons) and an atmosphere of uncertainty can be detrimental to stakeholder engagement. This can be addressed if a scheme is designed to be able, ultimately, to support itself. This can be either on a revolving basis (after an initial funding injection) or by accessing

³⁵ (Tata Power 2013)

³⁶ (Adler 2013, *pers comm*)

³⁷ Some finance programmes will have clear and deliberate short-term objectives to fulfil without a view to becoming autonomously financially viable in future. Here we focus on schemes for which financial self-sustainability is a desirable outcome.

credit through financial markets. This barrier has been successfully overcome in several of the case studies.

Estonia's KredEx is now self-financing, having received an initial injection of funds from the European Regional Development Fund (ERDF) and Council of Europe Development Bank (CEB). The revolving fund model worked, in this case, in a relatively short period of time. This was helped by a very low rate of defaults on loans and the fact that the returns on the energy efficiency investments supported have been very high in relation to the capital costs. It has also been suggested that KredEx has quickly established an effective revolving fund in its commercial (not energy efficiency) loans business, partly by imposing administrative charges on applicants as well as by achieving low default rates³⁸.

It is important to note that there may be a tension between financial sustainability and the promotion of 'deep retrofits' (i.e. measures that in combination save large amounts of energy). These kinds of measures, or packages of measures, often have high up-front costs and long pay-back periods. Loans with long pay-back periods inevitably mean that capital is not quickly returned to the scheme's funds, and a scheme offering these loans may take a longer period to achieve financial self-sufficiency. However, it is widely recognised that deep retrofits are necessary in order to achieve energy savings that are on a large scale and, in the long term, represent the most cost-effective savings.

Chinese ESCOs were heavily supported by external funders via the loan guarantee programme at first, but are now less so since the sector has become established. This is as a result of greater technical knowledge amongst stakeholders, enabling legislative frameworks and recognition from investors. The establishment and funding of a trade body representing and defining ESCOs' interests and (considerable) opportunities in China was key to achieving this enhanced institutional capacity and unlocking private investment.

JHF's status as an incorporated administrative agency which enables it, through the bonds it issues, to access private finance at relatively low cost, and pass this low cost, but still market-rate, finance on to Flat 35 customers via private banks. Although KfW is also able to access capital markets and thus offer borrowers relatively low-cost finance, it also continues to receive state funding to bring interest rates down further for its programmes for reducing energy consumption and emissions from buildings. The example of the UK shows how state backing to bring down the cost of energy efficiency finance can also be more 'hands off': the Green Deal Finance Company was set up by supply chain actors to aggregate small scale energy efficiency lending for homes and small businesses into a portfolio sufficiently large to attract investment from capital markets in order to bring interest rates down. The UK Government welcomed this activity, and showed its support by providing a loan to help it with initial administration and setup costs³⁹. In addition, the UK Green Investment Bank, a private financial institution with a public policy remit, is committed to supporting the Green Deal Finance Company in gaining access to long-term institutional finance to keep the latter's interest rates lower than they otherwise would be.

Some large Kenyan microfinance institutions, such as Faulu, access credit markets for financing. Faulu was originally set up and funded by a charity, but is now a limited liability company. As such, it can derive funding from credit operations and borrowing on the open market in Kenya. Now, due to a change in the enabling laws, Faulu is also a deposit-taking institution (offering savings accounts), and so has increased financial security.

³⁸ (Chrichton 2006)

³⁹ (TGDFC 2012)

4.2 Institutions, stakeholders and capacity

As with any type of energy efficiency programme, financial schemes must be able to engage with existing institutional structures and stakeholders in addition to fostering partnerships between a wide range of stakeholders whose involvement is needed to design, deliver and evaluate the scheme for its target audiences. Barriers to achieving this include:

- **Institutional and legal frameworks**, encompassing existing laws and practices which may favour other options, such as investment in energy supply infrastructure⁴⁰, over energy efficiency investments
- **Split incentives**, which occur when the immediate benefits of energy efficiency investment do not accrue, fully or in part, to the investor; addressing split incentives requires attention to the design of the finance offer, but equally to engaging the stakeholders across whom the costs and benefits are split (e.g. landlords and tenants)
- **Knowledge and capacity** amongst all stakeholders in the energy efficiency supply chain, which are critical for adequately and credibly promoting the benefits of investments and facilitating take-up of finance offers

4.2.1 Institutional and legal frameworks

Innovative financing mechanisms, often for innovative technologies, may encounter legal hurdles. These barriers may relate to changes that have to be made to planning rules and building codes, consumer protection frameworks, property law and rules governing financial transactions and liabilities. Innovation may be actively hindered by existing rules, or may simply require additional laws to establish a clear and reliable framework for specific forms of investment.

Palm Desert EIP required enabling legislation to be enacted by the state. In 2008, state legislation in California was introduced that authorised cities and counties to establish PACE style programmes. This legislation was based on the principle that such programmes would serve a public purpose and hence local authorities had the authority to provide the finance. Palm Desert City was the first authority to formally resolve to establish this type of programme in response to this State legislation. National guidelines for pilot PACE programmes were released in May 2010⁴¹ covering issues such as safeguards for mortgage lenders, homeowners and others. However, despite this legal framework, disputes have arisen between institutions (see below).

Kenya's micro-finance sector is regulated by legislation, which now allows some micro-finance organisations to take deposits. This change, in 2009, has helped micro-finance institutions (MFIs) become more financially secure. However, there is still a perceived lack of state support; the involvement of NGOs, international funders and community groups has compensated for this.

For Chinese ESCOs, at first (around the year 2000), legal frameworks and lack of knowledge about potential energy savings and the technologies to achieve them made business difficult. This meant significant external support was needed in the form of loan guarantees underpinned by the World Bank and others. The large and rapid returns on investment quickly enabled this support to be withdrawn as the ESCO market rapidly became self-supporting.

A related issue concerns the response of existing institutions to energy efficiency finance schemes. The clearest example of this is that some US PACE schemes have been forced to close by disputes with major financial institutions. The PACE lien on the property is superior to the first mortgage on the property.

⁴⁰ (Janssen 2004)

⁴¹ (US Department of Energy 2010)

This makes them an asset class that is attractive to private investors and hence the PACE model can attract private sector capital. Mortgage lenders however have concerns about this situation and in 2010 the Federal Housing Finance Agency (FHFA) determined that PACE loans were a significant risk to mortgage lenders and secondary market entities and called for PACE programmes to be paused. Following this, Fannie Mae and Freddie Mac, who operate mortgage securitisation in the USA, instructed lenders that they would not purchase mortgages on properties with outstanding PACE obligations. As a result, most PACE programmes were suspended and many people with PACE obligations were required to repay them in full before selling or refinancing a property. Some authorities (e.g. Sonoma County in California) have re-started their programmes, simply requiring participants to sign a disclosure related to this issue. Legal disputes are currently in progress. In contrast, the introduction of Green Deal finance in the UK has encouraged Nationwide, the country's largest mortgage lender, to offer preferential interest rates for additional mortgage borrowing designated for home energy efficiency improvements⁴².

4.2.2 Engaging suitable partners

Schemes may be more likely to succeed in reaching their target audiences if they have buy-in from a range of actors across the supply chain and wider society. Energy efficiency projects are often typified by a large number of stakeholders such as end-users, technology providers, engineering and construction firms, project developers, owners, investors, financiers, government agencies and utilities⁴³. Table 6 illustrates the range of stakeholders in the case study schemes.

Table 6: Key stakeholders (excluding end-users) in each of the case study schemes

Scheme	Country	Key stakeholders
Bescom Efficient Lighting Programme (BELP)	India	BESCOM (utility company); light-bulb manufacturers; USAID; International Institute for Energy Conservation, Bureau of Energy Efficiency (state body); residents' welfare groups
ESCO Loan Guarantee Programme	China	Funders including World Bank, IFC and DfID; ESCOs; EMCA (trade body for ESCOs); China National Investment and Guaranty Company
Flat 35 mortgage scheme	Japan	Japan Housing Finance Agency (incorporated administrative agency); commercial banks
KfW's energy efficiency schemes	Germany	KfW; national government; regional commercial banks; approved energy assessors
KredEx's energy efficiency schemes	Estonia	KredEx; national government; commercial banks; apartment associations; EU; CEB (international bank); Luxembourg government (for AAU trading)
Micro-finance for clean energy	Kenya	International funders (NGOs and supranational bodies), microfinance institutions and their local groups and co-operatives; KUSSCO (umbrella body for co-ops); commercial banks
Palm Desert Energy Independence Program	US	Office of Energy Management (part of Palm Desert City authority); mortgage providers; approved contractors
Warm up New Zealand	New Zealand	Energy Efficiency and Conservation Authority (state body); commercial banks; local authorities; approved contractors

An exemplar for the engagement of utilities and manufacturers is India's BELP. This was a utility company led project, with the active involvement of product manufacturers. BELP involved distribution and sale of CFLs via existing market mechanisms and the supply chain, which reduced the need for additional expenditure. Product manufacturers benefited from the scheme because it aimed to transform the market for CFLs in the region, which had previously been dominated by low-quality

⁴² Nationwide, 2013: <http://www.nationwide.co.uk/mediacentre/pressreleases/viewarticle.htm?ID=2124>

⁴³ (Kim et al. 2012)

imports. The financing scheme enabled the manufacturers to increase sales of their high-quality bulbs, which would previously have been too expensive for most customers. BELP's evaluation report states that BESCO also benefitted from the scheme because it reduced peak load, helping address energy shortages at peak times. Other reported benefits to BESCO included improvement of system load factor; improvement of power quality and improvement of customer relations⁴⁴.

Local authorities are another important potential partner. Warm Up New Zealand works closely with these, as they are key to one of its repayment mechanisms. KredEx sometimes works with municipalities, if they offer a support scheme for apartment buildings. KredEx will then exchange information with them. In general, municipalities are informed about KredEx schemes and can give the information to their citizens. KredEx staff also attend municipality-run events and give presentations. The benefits to local authorities will depend on the specific context, but might include improvement of health and social outcomes and the associated prevention of costs to local services (New Zealand saw major health benefits from the Warm Up scheme⁴⁵), regeneration of local environments and opportunities to promote complementary local and national schemes alongside each other.

Another challenge is engaging NGOs and other possible 'third sector' providers of support to end users. In Warm Up New Zealand, NGOs provide additional subsidies that fit in with the main scheme, where this complements their objectives. Grassroots community groups are rarely involved in energy efficiency finance schemes. However, in Kenyan microfinance, SACCOs and other local microfinance groups are involved, including small rural groups. In Estonia's KredEx, social housing associations can apply for loans. In both cases, the benefits these groups gain from participation are clear, as their members are able to access finance they could not otherwise use. Using these groups, in both cases, may help engage 'hard-to-reach' groups (see also section 4.4.3.2, below).

If a scheme does succeed in engaging the diverse sectors and stakeholders mentioned above, it may then encounter problems associated with partnership working. These can include diverse objectives and lack of co-ordination. One way to address these is through a central co-ordinating body.

In Warm Up New Zealand, the central co-ordinating body is the national energy agency. The partnership-based scheme succeeds by working through partners' existing processes – mortgages and council rates. In India's BELP, co-ordination was by the utility BESCO and an energy agency, the International Institute for Energy Conservation (IIEC). Each actor fulfilled a specific role. BESCO brought the payment mechanism and customer engagement, manufacturers brought the product, with a brand and quality mark, other agencies (e.g. USAID) brought technical expertise.

In the diverse sectors in Kenya and China, umbrella organisations such as KUSSCO and EMCA help provide a unified voice for their respective members. These can act as a contact point for external funders.

4.2.2.1 Split incentives

Split incentives refer to the situation in which the costs of measures are borne by one person and the benefits enjoyed by another. This can relate to landlord/tenant issues and current/future owner issues.

On the second issue, any PAYS scheme faces the problem that a current property owner might invest in measures, but then move house before recouping the full benefit, and still be left making the repayments. For this reason, a Palm Desert PACE loan stays with the property. However, this means that only non-movable measures can be covered (not lighting, for example). Across all loan schemes,

⁴⁴ (BELP Evaluation Committee 2006)

⁴⁵ (Grimes et al. 2012)

there is a link between the measures available and the type of loans offered. When measures are non-movable the debt can generally be fixed to the property (as in the case of PACE) and when measures are movable the debt may be tied to the customer (as in the case of BELP). However, this apparently simple pattern may be complicated in practice by legal issues, such as the FHFA/PACE controversy in the US (see above).

4.2.3 Lack of knowledge and capacity

Institutional challenges do not only concern the relationships between stakeholders, but also the capacity of the different stakeholders; in other words, the knowledge, skills and expertise they can bring to a scheme. This challenge is especially problematic in contexts where energy efficiency is a new and emerging sector and technologies are not widely known. For example, a major obstacle to the development of microfinance for energy in Kenya was a lack of technical capacity within lending institutions such as Faulu, who did not employ energy specialists. This limited the value of advice available to potential borrowers. One scheme evaluation reported that even though the umbrella organisation KUSCCO had trained its own staff in technical installation and equipment inspection, it was dependent on a single person for expertise on more complex products like solar and biogas⁴⁶.

USAID provided technical assistance to BELP, because the project was a pilot scheme. The initial pilot led to a wider rollout; moving beyond the USAID technical assistance, BESCO was able to extend second phase of the initiative in peri-urban franchise areas. BESCO and participating consultants launched specific training sessions for the following stakeholders: staff at the retail and wholesale distribution centres; BESCO staff at the customer support and billing centres; BESCO sub-divisional and divisional officers⁴⁷.

To help develop technical capacity and support SACCOs in their energy lending, KUSCCO received grants, technical assistance, and capacity building through external funders. For example, the Shell Foundation helped with printing promotional materials, developing training materials for SACCOs, developing guidelines on energy products and services, and developing building management information systems to establish formal procedures for capturing energy information⁴⁸.

4.2.3.1 Monitoring and verifying outcomes

One area in which organisational capacity is especially critical is the task of monitoring and measuring outcomes. The monitoring that is required will depend on the scheme's goals. Most schemes gather basic data such as numbers and types of installations, necessary for their own internal planning and external reporting. Beyond this, the most important measurable outcome is normally energy saving, though this is not always easy to measure. For example, reliable baseline and post-intervention data may not be available, or the scheme's stakeholders may not have the resources needed to gather and analyse it. Another key measure concerns the financial costs and benefits of the scheme (including indirect costs and benefits such as tax revenue and healthcare costs). Some schemes may also monitor social impacts such as employment, or the way in which scheme benefits are distributed. If environmental goals are prioritised, some monitoring (or at least, informed estimating) of greenhouse gas impacts may also be valuable.

Monitoring is not only useful in order to inform refinements of a scheme or provide lessons for future policy. It can also play a vital role in ensuring financial sustainability; for example, in providing

⁴⁶ (Kabutha et al. 2007)

⁴⁷ (Limaye 2009)

⁴⁸ *Ibid.*

evidence to investors and funders (both public and private) that a scheme is cost-effective or profitable, that it represents an acceptable risk, or that it is worthy of investment

However, this review suggests that, even in many good schemes, monitoring is often not a priority. One exception is Warm Up New Zealand, where the state commissioned extensive evaluations by academic researchers, with a series of reports each focussing on one area of impact (financial, health, and others). This provides vital evidence on the scheme's costs and benefits for its continuing evolution and refinement. In KredEx's energy efficiency programmes, banks report on the loans they have made and the energy impacts they expect. However, this need for reporting has been described by a KredEx representative as "burdensome" to beneficiaries⁴⁹.

It has been noted that some schemes specify a limited range of eligible measures, while others focus on the final level of efficiency achieved. For the latter category, verifying this energy saving is an important challenge. In Germany's KfW scheme, energy savings have to be verified by an approved energy assessor before funding can be drawn from KfW, and in Estonia's KredEx an audit is performed before a loan or grant is made. Households applying for Japan's Flat 35 loans must submit certificates which certify the required standards have been met. These must be obtained from suitably qualified surveyors or assessors.

4.3 Measures and buildings

A challenge faced by all schemes is determining what measures, what sectors and which buildings should receive finance from the scheme. Failure to balance competing elements here can result in a number of barriers to progress, including: stifling innovation; complex and off-putting scheme administration; and missed opportunities for deep renovation.

- **Stifling innovation:** restricting the availability of finance to a defined set of energy efficiency technologies can simplify a scheme and can reassure investors that only well-proven and cost-effective options are being supported. However, it can also present significant barriers to market entry for newer, more effective options and hence may slow the rate of progress.
- **Complex administration:** greater flexibility in which buildings, sectors or measures are eligible for finance can increase a scheme's coverage and enable innovation. However, such flexibility may create needs for additional reporting and verification, which may make schemes overly complex and unattractive to building owners. At the same time, administering one scheme that covers a broad range of buildings, sectors and measures may be more cost-effective than running several distinct schemes; these factors need to be carefully considered and balanced.
- **Deep renovation:** schemes may choose to support only the most cost-effective measures available, so that returns are maximised and scheme sustainability is promoted. However, this can result in missed opportunities, for example when major building renovation work is being carried out and a broader range of energy efficiency improvements could be made.
- **Risk management:** a narrow focus on certain buildings, sectors and measures may be seen by investors as risky; a 'hedging' strategy that spreads investment across a diverse set of liabilities may be preferred.

4.3.1 Range of measures offered

Table 5 illustrates the range of measures for which finance can be provided in each of the case study schemes. Schemes range from offering single technologies to encouraging whole-building deep retrofits.

⁴⁹ (Adler 2011)

The measures on offer are inextricably linked to the nature of the finance provided, as can be seen when comparing Table 7 to Table 5.

Table 7: Measures offered by each of the case study schemes

Scheme	Country	Measures offered
Bescom Efficient Lighting Programme (BELP)	India	Efficient lamps (compact fluorescent and tri phosphor fluorescent tubes)
ESCO Loan Guarantee Programme	China	Energy performance contracting (many different measures)
Flat 35 mortgage scheme	Japan	Property must meet energy standard (using any measure)
KfW's energy efficiency schemes	Germany	Fabric improvements; heating replacement; heat distribution measures; ventilation measures
KredEx's energy efficiency schemes	Estonia	Insulation; new windows/doors; renovation of heating systems; renovation of ventilation systems; installation of renewable energy devices
Micro-finance for clean energy	Kenya	Solar thermal; solar photovoltaic; LPG stoves; biomass facilities
Palm Desert Energy Independence Program	US	Fabric efficiency measures; replacement of heating, ventilation and air conditioning, lighting, pool pumps, and water heating equipment; solar photovoltaic; solar thermal
Warm up New Zealand	New Zealand	Insulation; heat pumps

Brown and Conover suggest that there are two broad approaches to measures⁵⁰: (1) requiring an energy audit to identify cost-effective measures for each building, or (2) using a list of specified eligible measures. In some cases, such as the US Pennsylvania Keystone HELP scheme, borrowers can choose which route to follow, and may qualify for a lower interest rate if they choose the audit route. In addition, some schemes take an approach related to this first route, but require a property to meet a certain standard of energy performance (as in Flat 35), or a certain degree of improvement (as in some KredEx apartment schemes).

Prescribed measure approaches are simpler and less costly to administer, but normally achieve lower energy savings than approaches based on audits and standards. This is because an audit can take into account the interaction of different features within a building (such as heating, ventilation and insulation), and can identify ways of combining measures into the most cost-effective package⁵¹. In addition, a prescribed measure approach may be less well suited to avoiding 'lock in' – that is, a situation in which the installation of certain energy improvements in a make the subsequent installation of additional measures necessary to achieve deeper savings more difficult, technically impossible or financially not viable.

Of course, the approaches may overlap; a scheme may involve an audit or standard but also have a list of eligible measures (normally a long list, in these cases). Schemes that are based on eligible measures may be very specific (as in the case of BELP and Warm Up New Zealand) or more flexible. For example, in Palm Desert's EIP many measures are eligible. This is because the scheme takes a fairly open approach – it just provides the financial option and is not as tightly controlling of measures as some others. Even measures not automatically eligible, e.g. emerging technologies, can be evaluated and approved on a case by case basis. The main constraint that is placed on eligibility is that measures should be fixed to the property: this reflects the nature of the financing contract, where the responsibility for repayment rests with the property and hence the ability to benefit must rest there

⁵⁰ (Brown and Conover 2009)

⁵¹ *Ibid.*

too. In this case, building surveys are recommended, but are not a requirement for accessing the funding.

KfW also contains elements of both measure-based (output-related) and standard-based (outcome-related) approaches. The many eligible measures have been selected on the basis that they should offer cost effective energy savings; KfW loans are limited in size on per dwelling basis; it is up to borrowers to select a package of measures, and they can then receive financial rewards (a percentage of the loaned amount) if certain overall energy standards are met. Flat 35 mortgages are also linked to overall efficiency standards, not linked to specific measures.

However, as mentioned elsewhere, there are advantages to simple schemes such as Warm Up New Zealand and BELP; these can offer a simpler customer journey and reduce administration costs. These schemes can also ensure that the programme is designed in the best possible way to effectively promote that one measure, and can thus achieve high take-up rates.

Though BELP offered only one measure, it was still important to offer it in appropriately varied forms: BELP offered appropriate ratings of CFLs to replace 40, 60 and 75 Watts incandescent lamps.

In general, it seems that there are strong links between a scheme's approach to measures and its wider objectives in terms of market transformation and energy outcomes. For example, a scheme may aim to maximise overall energy savings, or it may aim to maximise the number of buildings that achieve a minimum standard. It may aim to install small measures in a large number of buildings (so benefitting many consumers) or to provide deep retrofits in fewer buildings (so targeting help on key beneficiaries). These fundamental decisions will affect the scheme's approach to eligible measures.

4.3.2 Range of sectors / building types targeted

There are advantages in targeting a wide range of buildings when considering the design of an energy efficiency *finance* scheme. This helps maximise potential savings and distribute benefits widely; a larger and more diverse portfolio can hedge effectively against risks of under-performance and default in individual sectors; and it can potentially reduce administration burden (compared to having several more specific schemes). Similarly, targeting multiple sectors may produce the same hedging effect and relative reduction of administrative costs. Table 8 illustrates the sectors and building types targeted.

In KfW almost all residential buildings can be eligible for support. Finance can be accessed by private landlords, owner-occupiers, tenants (with landlord agreement), housing providers and ESCOs. The broad range of potential borrowers unlocks access to a wide range of housing types.

However, there may also be benefits in targeting a certain type of building, perhaps because a particular problem has been identified. This kind of scheme may be able to incorporate design features that are most appropriate for this building type. For example, KredEx focuses on apartments because these were identified as a particular problem in Estonia. The majority of Flat 35 loans go to new construction; this relates to the nature of the Japanese building sector.

A key issue in scheme design is whether to focus on one sector (either residential or non-residential) or to develop a combined approach. An example of a multi-sector approach is Kenyan microfinance loans, which are often for business premises, but also have quite wide take-up among residential consumers.

Table 8: Sectors and building types targeted by the case study schemes

Scheme	Country	Sectors targeted	Buildings targeted
Bescom Efficient Lighting Programme (BELP)	India	Residential (urban); small commercial	All
ESCO Loan Guarantee Programme	China	Commercial; industrial	All; especially industrial facilities
Flat 35 mortgage scheme	Japan	Residential (mainly owner-occupied)	Mainly new buildings
KfW's energy efficiency schemes	Germany	Residential; commercial; public	All
KredEx's energy efficiency schemes	Estonia	Residential	Apartment buildings (and a small scheme for houses)
Micro-finance for clean energy	Kenya	Residential; small commercial; small agricultural	All
Palm Desert Energy Independence Program	US	Residential (mainly owner-occupied); commercial; industrial	All
Warm up New Zealand	New Zealand	Residential	All

It is not necessarily ideal for one scheme to cover both residential and non-residential end users, as the two sectors may have different needs and require different measures, financial offers and so on. However, there may be advantages in covering both, such as the economies of scale and reduced administration costs mentioned elsewhere. Covering both sectors may also help create a diversified portfolio of risk, and mitigate the effect of downturns in one sector.

4.3.3 Depth of retrofits

KredEx has incentives for deeper savings; its apartment grants provide different levels of subsidy depending on the final energy class achieved. In KfW the level of subsidy is linked to a series of levels of energy efficiency achieved, with the most efficient properties able to get up to 17.5% of the loan subsidised. In Flat 35, five to ten year mortgage interest rate reductions of 0.3% are available for homes with the highest efficiency standards.

4.4 Consumers and end-users

Significant barriers can be encountered by any type of energy efficiency finance scheme that relate to the nature of the final adopter or end-user of the energy efficiency improvements that are being supported. Many of these issues are not only important for finance schemes, but also apply to all energy efficiency programmes. Equally, lessons can also be drawn from non-finance-based energy schemes, and some of these key transferable approaches are considered here.

These barriers relating to end-users can cause a scheme problems even if the final adopter is not the immediate target audience of the scheme – for example if the scheme aims to support intermediaries such as ESCOs or local banks to finance end-users' energy efficiency investments. In such cases the intermediary ESCOs or banks would have a great deal of responsibility for ensuring that the barriers below can be overcome. Nevertheless, the lenders of first resort should ensure that their scheme can help address these barriers too by adopting an end-user-led approach to scheme design.

- **Lack of awareness** relating to the benefits of energy efficiency improvements, meaning that demand does not reflect opportunity, and that energy efficiency struggles to compete with other investment options.

- **Lack of trust** can range from concerns about the agency promoting energy efficiency, doubts about the quality or performance of the technology or product, to doubts about the quality of installation and workmanship.
- **Complexity and hassle** relating to securing finance, as well as disruption caused by the installation of energy efficiency improvements, can deter initially interested end-users
- **End-user diversity** can present issues for schemes, as marketing messages that engage one element of the target audience may not reach others. There may be 'hard to reach' groups that present a particular challenge to engagement approaches. At the same time, marketing campaigns can be extremely expensive, so need to be carefully designed and targeted.

4.4.1 Consumer trust and quality assurance

In India's BELP, trust was ensured through use of well-known brands and company involvement, as well as a warranty on products, and hologram quality mark. Close to 55% of the respondents purchasing directly from the retailers and 70% of the respondents purchasing under instalments valued BESCO branding as "important"⁵². In Warm Up New Zealand and Germany's KfW programmes the use of customers' existing banks promotes trust. In a very different context, a similar principle applies to Kenyan microfinance; SACCOs and other microfinance groups are likely to be trusted by members, as they already have a stake in them.

In the UK, research for the Energy Efficiency Partnership for Homes suggests that take-up of energy efficiency measures is higher when programmes are targeted at specific geographic areas (usually at the neighbourhood scale)⁵³. This is because those delivering the measures are able to engage with existing social networks, such as schools and community groups, to spread the message about the programme. The community led approach has been found to be effective because recommendations come from trusted sources, such as friends, family and neighbours.

India's BELP used a hologram on products, and one-year manufacturer's warranty. This was a key concern because low quality imported CFLs had previously been a problem, and reduced take-up. In order to ensure the quality of CFLs, BESCO used the Efficient Lighting Initiative (ELI) specifications. Standards for these bulbs had not previously been used in India. As a result the overall failure rate of the CFLs was less than 0.5% and the failed lamps were replaced by participating suppliers within a week⁵⁴. Warm Up New Zealand uses a list of approved suppliers.

4.4.2 Customer journey: complexity and hassle

4.4.2.1 Complexity

If schemes' target audiences are particularly diverse, a range of financial offers may be needed to accommodate their different financial circumstances and needs. In Warm Up New Zealand, flexible payment options are provided by banks and councils, and subsidies are available to certain people. India's BELP scheme offered either a discounted up front purchase or an on-bill repayment option. KredEx offers both a loan scheme and a grant scheme. In China's ESCO sector, a range of different contracting models have been used, including different risk models, depending on the scale, nature and target sector of different ESCO projects. Similarly, in Kenya, different institutions have provided different offers (i.e. interest rates and fees, loan duration, security needed). The fact that some institutions, such as agricultural co-operatives or SACCOs, are based around specific groups (e.g. tea

⁵² (BELP Evaluation Committee 2006)

⁵³ (Sustainable Development Commission 2010)

⁵⁴ (Limaye 2009)

growers, milk producers) may help them offer the most appropriate financial schemes to their members.

Combining offers with a mix-and-match approach can be effective; in Estonia, a KredEx grant may be combined with a renovation loan to decrease the share of required self-financing and maximise access to assistance. In Warm Up New Zealand, grants are combined with loans for certain groups; a deliberate effort to target vulnerable customers. A similar approach is now being adopted in the UK, with loans under the Green Deal scheme being offered to all consumers, and additional subsidies under the Energy Company Obligation being offered to certain eligible households. In these examples, diverse and complementary offers are used to ensure that the needs of vulnerable consumers are met. This relates to issues of equity (discussed further below); the needs of marginalised groups may be catered for by more flexible or local approaches. However, these may be less efficient, more risky and so more expensive.

Diverse financial offers might be needed in order to meet the needs of different end users. However, this may pose a challenge of over-complexity and customer confusion. Palm Desert PACE offers one simple, comprehensive financial plan, applicable to many people. India's BELP offer was also simple as it only involved one measure and two payment options. Warm Up New Zealand has a fairly simple offer as only insulation measures (and some heating) are included (which has its limitations), and there are two payment methods. There is clearly a balance to be struck between one-size-fits-all and over-complexity, which depends on the specific scheme and its context.

Another issue is the process that end users have to go through to benefit from the offer. India's BELP process was fairly simple for consumers (perhaps because it was only for one small product). Eligible customers could visit a BESCOM service centre to get a voucher, and acquire the lamps from approved retailers. However, outright cash purchase was still the most preferred route resulting from consumers' choice to avoid filling out agreements for repayment and to avoid queues at the bill collection centres⁵⁵.

For Warm Up New Zealand, a well-designed website makes it easy for customers to see what help they will be eligible for, and to find registered providers in their area. This is in contrast to the UK Green Deal, in which there are providers, assessors and installers to be found, each through a separate search facility.

4.4.2.2 *Hassle*

Research into successful energy efficiency retrofit schemes has shown that it is vital to make the customer journey as easy as possible: any breaks in the process result in householders losing interest and take-up rates falling⁵⁶. Successful schemes use a streamlined assessment and installation process⁵⁷ and schemes where assessors are prepared to make weekend / evening visits to the householder have been particularly successful⁵⁸ in the UK.

Project management of the process for more major works can make a significant difference also. This is particularly the case for comparatively complex measures such as solid wall insulation: ensuring that contractors have an established formal process for onsite project management can make a significant difference to the customer journey in many cases⁵⁹.

⁵⁵ *Ibid.*

⁵⁶ (CAG Consultants, Impetus Consulting, and Wade 2011)

⁵⁷ (Faulk 2010)

⁵⁸ (Pepler and Wheldon 2009)

⁵⁹ (Morris 2010)

In France, the government subsidised 0% interest Eco-Prêt loans scheme addresses some of the hassle factor of disruption during whole-house retrofits by allowing two years for completion of all works funded by the loan. The loans may also cover the cost of project management⁶⁰. Covering costs other than the energy efficiency investment itself can be a source of hassle if these are not included within a financing mechanism. A number of other schemes have tackled this barrier, including KfW, Clean Energy Works and A-Profitto.

KfW's CO₂ Refurbishment loans may encompass a range of costs additional to the actual installation of energy improvements. These include energy assessment, project design, planning applications and project management⁶¹.

A similar approach is taken in Clean Energy Works Oregon (CEWO) which allows any additional works directly associated with the energy efficiency improvements to be financed at the same (often subsidised) rate as the measures themselves⁶².

The region of Milan's A-Profitto low interest loans scheme built in numerous considerations to minimise hassle. The regional energy agency helped prepare loan applications, and loans were allowed to cover costs beyond the energy improvements themselves, such as scaffolding and 'making good costs'. Generally, and in the interests of simplicity, these additional costs were accepted by the banks without checking that they were absolutely necessary⁶³.

4.4.3 End-user audiences diversity

4.4.3.1 Support for different tenure types

A risk for these schemes is the tendency to focus on owner occupiers, particularly in the residential sector. This is perhaps understandable, as they both own property (which can act as security) and will be the main beneficiary of improvements (and deal with any associated installation hassle, so no further permissions are needed).

Warm Up New Zealand and Palm Desert EIP are open to landlords and Flat 35 loans are available for new build rental properties. KfW examined the distribution of their loans in 2009 compared to the national distribution of tenure: owner occupiers have a representative share, private landlords are underrepresented but their share is increasing, and cooperatives and social housing providers are somewhat overrepresented. The latter's slight overrepresentation may be viewed as unsurprising owing to the relative ease with which they are likely to be able to navigate the application process and manage the retrofit of their buildings. While there are no specific incentives for housing companies, the maximum credit amount for loans is defined per housing unit, which makes renovations of entire apartment buildings possible.

4.4.3.2 Hard to reach and vulnerable groups

For some of these schemes, one rationale is the need to reduce fuel poverty and promote affordable warmth. However, unless schemes are carefully designed to engage vulnerable groups, they are likely to miss out on support. This is especially problematic where schemes involve debt, require property ownership, involve some up-front costs or require credit checks.

⁶⁰ (Le ministère du Développement Durable 2011)

⁶¹ (KfW 2012)

⁶² (Peters, Moran, and Armstrong 2010)

⁶³ (Zabot, Monguzzi, and Ruggieri 2011)

Warm Up New Zealand includes a special subsidy for people with a community services card (specific vulnerable groups⁶⁴), which is also available to landlords with tenants in these groups. As a result, in 2009/10, 57% of insulation and 55% of heating measures went to low-income households. In 2010/11 this fell to 47% and 50% respectively⁶⁵.

KredEx has a focus on apartment associations, including grants to assist with projects' basic/planning costs – this widens the range of people able to participate. The scheme also has special offers for young families and for families with many children. It also offers support for people in restituted buildings i.e. buildings that were confiscated and then returned to previous owners. Some Kenyan microfinance uses existing agricultural co-operatives; this can help reach rural areas and not just the most well-off (but not generally the very worst off).

As noted, credit checks can exclude the most vulnerable consumers from benefiting from schemes. Palm Desert PACE involves no credit checks beyond very basic ones; i.e. around any other liens on the property, or bankruptcy. Most other schemes involve credit checks as it is likely to be difficult to set appropriate interest rates without a reasonable grasp of the risk of default within the energy efficiency portfolio of a finance scheme.

4.4.4 Awareness, engagement and marketing

A key barrier to most schemes is awareness among potential beneficiaries; both of energy efficiency in general and of the scheme in particular. Furthermore, if people are aware of energy efficiency technologies, they may have negative perceptions of them. For example, in India, the prevalence of poor quality CFLs had meant many consumers viewed the technology negatively. To create a more positive perception and raise awareness of BELP, BESCO hired a branding and marketing agency to develop a marketing and promotion plan, including newspaper advertisements; leaflets and brochures circulated through monthly bills; posters at the BESCO billing centres and key government offices; scrolling advertisements on local cable networks; hoardings; occasional mobile vans displaying BELP Mascot and CFL signs. BESCO, in coordination with the participating suppliers, designed and implemented road-shows at the billing and collection centres and key public offices. This was paid for by product manufacturers. Workshops were also conducted with residents' associations.

Estonia's KredEx uses mass marketing campaigns across a variety of media. In October 2011, an information campaign aimed at inhabitants of apartment buildings took place with a message "We believe that renovation is feasible for every association!" Information channels included television, radio, outdoor media, internet, printed media and direct mailing. In November, KredEx co-organised an 'Energy Saving Week', the purpose of which is to increase the awareness of Estonian inhabitants of opportunities for energy saving⁶⁶.

For KfW, Germany's banks, building societies and credit unions market the scheme to property owners, often when the latter are seeking finance for general property refurbishment. Supporting this are energy efficiency campaigns run by DENA (the German Energy Agency), and a range of KfW promotional activities including KfW awards, information campaigns and a KfW academy to train business partners. The success of this activity is indicated by the high rates of take-up.

⁶⁴ CSCs are available to people aged 18 years and older, on a low to middle income level, and who are a New Zealand citizen or permanent resident. Those receiving social benefits are automatically issued with a card. CSCs allow holders access to lower costs of health care, through subsidised health services and prescriptions (Grimes et al. 2012).

⁶⁵ (Grimes et al. 2012)

⁶⁶ (KredEx 2012)

Any engagement approach needs to take into account the needs, behaviours and priorities of the target audience; how, when and why they use energy and why they might wish to participate in a scheme. Drawing on an example of a non-finance based scheme, the UK's Act on CO2 campaign (a mass communication programme aimed at raising awareness of climate change and promoting behaviour change) illustrates the risks of public engagement. A 2009 television advert called 'Bedtime Stories' cost £6 million (\$11.7 million) but was widely criticised as being based on fear and guilt messages that are largely ineffective in the environmental context⁶⁷. In many cases, engagement based on consumer priorities means using messages that focus on financial savings. However, in the US, as well as emphasising money-saving, PACE schemes are often described as 'home improvement' schemes, a description that resonates with the public's interest in renovating and adding value to their homes.

⁶⁷ (POST 2010)

5 Contexts and transferability

This section considers the transferability of the lessons identified in section 4, reviewing a range of contextual factors that need to be taken into consideration if similar schemes are planned elsewhere.

5.1 Political, legal and institutional contexts

A first and vital factor in transferability is the role of the state, since governments and local authorities can act as barriers or facilitators to energy efficiency finance schemes. A key factor in the success of Warm Up New Zealand is the commitment of the national Government; similarly, KfW, Flat 35 and KredEx do rely on a supportive State. These institutions each occupy a uniquely privileged role in their respective countries. Programmes on this scale would not be transferable to contexts without this level of long term financial and legislative support.

Legislation can also be a barrier or a facilitator, and should be considered as a factor in transferability. Obstructive legislation (such as China's barriers to investment) may need to be removed, or facilitating legislation (such as PACE laws) enacted before a scheme can be recreated. A new institution may need to be created, or the powers of existing institutions expanded, especially if a nationwide or market-transforming scheme (such as KfW, Flat 35, KredEx, Warm Up New Zealand) is proposed.

Existing institutions can also be barriers or facilitators, so it is important to consider how a new scheme will fit into current structures and markets. Competition between actors, or even conflict, as in the case of FHMA and PACE schemes, can be deeply detrimental. Engagement with the relevant institutions throughout the design and implementation of the scheme can help to ensure that relationships are co-operative and effective. Clearly defined roles, remits and liabilities are also important, especially if institutions are working in partnership. This is illustrated by the case of KfW, where an essential element of the scheme design is the agreement that on-lending banks can increase the interest rate to cover their administrative costs and also the credit risk that they are exposed to; without this element, the on-lending model would not have worked.

Specific historical and political factors should also be taken into account. For example, KredEx makes provision for 'restituted' buildings – those returned to owners, having been confiscated under past regimes.

5.2 Social and demographic contexts

The transferability of a scheme will be affected by population characteristics. One factor is tenure patterns; many schemes are only, or mainly, applicable to property owners and so would have limited value in contexts of high rental tenure unless overcoming split incentives is part of a scheme's design. Even schemes which aim to be tenure-neutral (such as the Green Deal) may in practice favour owner-occupiers. In some contexts, it might be appropriate to design in specific provisions for the rental sector and social housing.

Another dimension of context concerns the prevailing user behaviour. This can include norms, expectations of comfort and patterns of occupancy and energy consumption. For example, a key factor in the design of BELP was the fact that in India, system peak load is determined by evening lighting in the residential and small commercial sectors.

Public attitudes are also important; in India, there was a perception of CFLs as low quality due to cheap imports in the past. This had to be addressed in the design of BELP (through trusted brands, minimum standards, a hologram and warranty).

5.3 Economic and industrial contexts

Economic, business and industrial contexts are of course vital to any financial scheme, including energy efficiency schemes. Developed and developing countries will have very different contexts for energy efficiency financing. This can involve differences in: capacity for investment and for scheme participation in credit markets; capacity for householders to invest in measures; and technical capacity in the sector.

These differences do not rule out transfer of schemes from developed to developing countries. However, technical assistance may be needed, for example, USAID assistance in BELP, and Chinese ESCOs' support from international agencies.

Even among developed countries there will be differences in the financial climate for investment and loans, and technical capacity of the sector.

Schemes will also need to take into account the specific characteristics of the national, regional or local economy, and especially the circumstances of their potential beneficiaries. For example, in Tanzania, some banks (FINCA and CRDB Bank) have tried to lend to energy enterprises through pilot schemes but have had limited success because of the problem of a lack of collateral for borrowers from low income rural areas. Other African schemes (such as Uganda Micro-finance Ltd) have addressed this by treating the equipment itself as collateral; this is sometimes called a micro-leasing model⁶⁸. One of Kenyan Faulu's schemes required a member to own two cows, as security⁶⁹, and many other schemes require cash collateral rather than property⁷⁰. This suggests that there are generally options for locally-specific security, even when building ownership levels are low.

5.4 Built environment

A fundamental issue is the nature and state of the building stock. This will determine the kind of measures that need to be offered and, as has been shown, the nature of these measures is a major determinant of other scheme design features (for example, the cost, payback period and movability of measures affects the suitability of different finance plans).

Transferability will depend on the predominant building types and ages; for example, whether a location has mainly apartments or houses, or mainly old or new buildings. The longevity of buildings is a factor in Flat 35. KredEx specifically designed schemes to help renovate apartment blocks, because it is most cost-effective to do this work en bloc, rather than on individual flats.

Another factor is the existing level of efficiency measures, or building quality. One reason for the success of Warm Up New Zealand as a large-scale scheme offering limited set of (mainly) insulation measures is the low starting point in terms of building efficiency. Many New Zealand houses are poorly insulated, draughty and rely on inefficient or poorly performing heat sources (such as unflued gas heaters or open fires). The majority of households in the South Island rely on non-metered energy sources (solid fuels and non-metered gas) for space heating⁷¹. Similarly, the rapid expansion of the Chinese ESCO sector may be due to the huge energy saving potential that has existed in the industrial sector. Fuel types are another factor to consider, also shaping the choice of appropriate measures.

⁶⁸ (Kariuki and Rai 2010)

⁶⁹ (Kabutha et al. 2007)

⁷⁰ (Kariuki and Rai 2010)

⁷¹ (Grimes et al. 2012)

5.5 Climate and geography

Climate and geography will determine the suitability and effectiveness of measures, for example, solar thermal and PV measures in Africa, and warmth measures in New Zealand. Evaluations⁷¹ found climate had a significant effect on the energy savings achieved by Warm Up New Zealand measures, and so there was regional variation in effects; the measures were most cost-effective in the colder parts of the country. If a nationwide scheme is proposed, it may be appropriate to consider regional variations within the country, and design in the flexibility needed to ensure that all areas benefit. One way to do this would be by using cost-effectiveness criteria rather than specification of measures; this may be an especially effective route in countries with significant climate variations.

Some schemes may be more suitable for urban or for rural populations. For example, KredEx's apartment schemes are aimed at urban areas, while Kenya's SACCOs are largely agricultural. Specific geographical characteristics may also be addressed in schemes, for example, Flat 35 promotes earthquake proofing.

6 Recommendations / framework for thinking about scheme design

Given the diversity of the case studies assessed, and the breadth of the World Energy Council’s membership, recommendations for decision-makers and practitioners in energy efficiency finance are necessarily non-prescriptive. In order to accommodate this breadth and diversity, we combine the broad contextual considerations discussed in the previous section with the barriers analysed in section 4.

To facilitate systematic thought about finance scheme design and operation for a wide variety of different purposes and in a broad range of contexts, we provide an energy efficiency finance scheme ‘decisions map’. This takes the form of the matrix below, which contains conclusions and recommendations for each of the main barriers, mapped out across each of the areas of context. It illustrates the importance of a thorough approach to energy efficiency finance which builds on the vast wealth of experience already accumulated from around the world, and is designed to facilitate this type of approach.

Table 9: Energy efficiency finance scheme decisions map

Barrier	Political/legal/institutional	Social and demographic	Economic and industrial	Built environment	Climate and geography
Finance					
Access and attractiveness	Consider the suitability of connecting to the predominant routes used by target audience to access finance in other areas (e.g. mortgage finance; commercial loans). Also consider the current willingness of financial institutions to lend for such purposes.	Explore what the typical interest rates used for similar purposes are, and research the extent (if any) of subsidy needed. What is the financial situation of target audience (e.g. levels of debt aversion, credit-worthiness and current debt levels)?	Consider the supply chain. What is the solvency, financial health and economic outlook for the construction and energy efficiency industry?	Consider nature of built environment for design of financial products / offers (e.g. multi-family / single-family dwellings; office / retail etc).	Be particularly aware of urban / rural differences with respect to the considerations on the left.

Barrier	Political/legal/institutional	Social and demographic	Economic and industrial	Built environment	Climate and geography
Reducing costs	Which institutions are best-placed, already active in area, and potentially share administrative burdens across existing related activities. Consider appropriate institutional scale for keeping costs down. Consider institutional pathways / options for scaling scheme up in future if it is successful (assuming scaling up saves on costs of delivery). Establish institutional acceptance and precedents of State underwriting of lending.	Look to aggregate (scale) and hedge (diversify) lending, but understand target market well and market / promote scheme accordingly.	Helping the supply chain to gear up to reduce longer term operational costs, and to bring down costs of technologies through market transformation. Additional accreditation, quality assurance and training may be required, but take care not to make these unnecessarily onerous.	Consider current building stock turnover / replacement rates and implications for whether you are refurbishing or rebuilding. Wherever possible try to harness and connect to existing investment activity in the built environment.	Prioritise / target regions with greatest energy and emissions benefits, so reducing costs in relation to these.
Becoming self-sustaining	Where possible, adapt and connect to existing institutional practices. Where aiming to embed new practices, ensure medium to longer term commitment to scheme to succeed in this area.	Aim for medium to long-term engagement with target audience through scheme, building up confidence and trust in the improvements / measures the finance scheme is supporting – with a view to ultimately changing standard behaviour and investment decisions.	Ensure that scheme is a good fit with current economic climate and medium to long-term outlook.	Identify long-term aims for transformation of the built environment and ensure scheme is connected to these aims.	-

Barrier	Political/legal/institutional	Social and demographic	Economic and industrial	Built environment	Climate and geography
Institutions / stakeholders					
Institutional/legal frameworks	Identify rules and regulations which could hamper or encourage adoption of energy efficiency in buildings.	Identify and clarify options for where debt liabilities can be placed (e.g. with individual household / business or with property), and minimising grey areas / legal loopholes in relation to this. For example, what are the rules governing multi-family buildings with multiple tenants and owners? What are the rules governing landlord-tenant relationships / leases?	What existing quality and accreditation standards are there in the construction sector? Are they relevant to energy efficiency, and can these be built on, or are entirely new standards needed? Examine existing consumer protection rules (e.g. relating to finance and quality guarantees). Are they 'fit for purpose' for the products (finance and energy efficiency) the scheme offers?	Consider building codes and voluntary standards. Do they exist; are there energy efficiency codes/standards? Should the scheme be widening adoption of minimum standards or encouraging adoption of the highest standards?	-
Engaging stakeholders	Identify 'hard power' / 'legitimate' authority: engage powerful stakeholders who do not necessarily have any current involvement with energy efficiency or energy efficiency finance, and who could potentially pose a risk to the scheme. Design-in conflict avoidance.	Identify 'soft power' / 'charismatic' authority: the known and trusted stakeholders with links to the target audience.	Map out and understand the nature of the supply chain in relation to the scheme's objectives. Which players tend to be at the forefront of market transformation? Which players are more traditional / conventional? Engage each appropriately.	In the built environment, the tenures, building types, business sectors and business sizes targeted will affect who the key stakeholders are.	-

Barrier	Political/legal/institutional	Social and demographic	Economic and industrial	Built environment	Climate and geography
Knowledge and capacity	Ensure adequate institutional capacity is in place from the start and can keep pace with scheme growth. Disseminate knowledge to key institutions and legitimate authorities. Ensure there is sufficient technical capacity (e.g. from energy agency or trade association) in place to provide assistance to day-to-day operators of scheme.	Design delivery mechanisms that people cope with and are attracted to: in other words, scheme offers must balance simplicity with bespoke-ness. Build on target audiences' existing knowledge and capacity. Identify misconceptions about finance and energy efficiency and challenge them. Support the 'charismatic' authorities identified to achieve this.	Identify and understand what further support the supply chain needs. Support industry initiatives in knowledge and capacity transfer, such as supply chain mentoring.	Try to understand nature and potential for energy savings in the built environment as much as possible. Are existing data collection and surveys helpful to inform the scheme? Can the scheme help justify better data collection about the built environment?	-
Measures and buildings					
Measures coverage	What are the arrangements for determining and maintaining list of energy efficiency technologies supported by scheme? Are the arrangements for auditing and verification of measures performance / savings both rigorous and accepted by industry?	What do target audiences want? And how does this compare with what is needed to achieve long-term goals for the built environment?	Consider how to support industry innovation and good practice: is the scheme focusing on proven technologies, new markets or both? Does supply chain have ability to transform the market and innovate?	Ensure that technologies offered are adequately supported by the financial products.	Consider regional appropriateness of measures offered; differentiate scheme in different regions where necessary.
Sector coverage	Consider and plan for potential institutional complexity in a scheme targeting multiple sectors.	Small business owners are householders in the same place sometimes. Define sectors to target carefully. Also consider 'sectors' to target in terms of both people and physical / economic dimensions.	Naturally consider sector-specific differences in products and services offered (residential, commercial, industrial). Identify overlaps: could one sector's transformation have positive economic spill-over effects in other sectors?	Consider energy efficiency potentials in different sectors and the roles and contributions of each sector in achieving energy policy or low carbon transition objectives.	-

Barrier	Political/legal/institutional	Social and demographic	Economic and industrial	Built environment	Climate and geography
Depth of retrofit	For financing deep retrofits, identify whether whole building performance standards exist.	Decide whether scheme should aim to finance retrofit according to people’s current practices / behaviours / tastes, or whether finance offered should be supporting a different way of doing things (often deep retrofits).	For deep retrofits, a large amount of detailed attention needs to be paid to integration and collaboration of different actors / trades.	Use state of building stock and progress in transforming its energy performance to determine whether retrofits can be incremental or need to be deep. If opting for incremental, make sure ‘lock-in’ (that is, blocking path to a deep retrofit at a later stage) can be avoided.	-
Consumers and end-users					
Trust and quality	Identify existing quality assurance, training and accreditation schemes for energy efficiency; consider which non-energy related accreditations and qualifications are most readily adaptable to the scheme’s needs.	Schemes need to be designed to increase both trust and quality from the target audiences’ point of view. Lack of confidence in quality will powerfully undermine any scheme.	Prioritise support for areas of, or sectors within, supply chain which do not enjoy the highest levels of consumer confidence.	Consider the development and promotion of accessible exemplar buildings to inspire consumer confidence.	-
Complexity and hassle	Ensure clear institutional leadership on scheme is perceptible by target audience, even if lots of institutional actors are in fact involved. Consider carefully which institution(s) will interact with target audiences. ‘One-stop-shops’ are the best approach.	Being able to offer highly-tailored finance is good, but ensure diversity and potential complexity of finance on offer is suitable for level of financial literacy of target audience.	Consider possibility of supporting project managers through finance scheme, especially if the scheme is aiming to support more complex or deep retrofits.	Consider showcasing live retrofits as exemplars.	-
Audience and marketing	Establish a recognised, trusted ‘face’ of the scheme. Combine where possible with other marketing activities.	Link strongly into existing consumer preferences, such as ‘home improvements’, ‘greater comfort’ etc’.	Encourage the industry players who most frequently engage with the target audience to co-market / market the scheme.	Use exemplars and demonstrate they can be typical buildings and are achievable, not ‘science fiction’.	Ensure marketing efforts make the most of consumer preferences according to climate. difference.

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Appendix I – Case studies

BELP: BESCOM Efficient Lighting Programme, India

Overview and Goals

BELP was a utility-led, market-based programme to promote compact fluorescent lamps (CFLs), with on-bill repayment. A pilot (December 2004–September 2005) was followed by an extended programme (June 2006–September 2007), which is now closed.

The programme aimed to reduce electricity consumption, especially peak demand, as part of India’s National Action Plan on Climate Change 2008, which includes a "national mission for enhanced energy efficiency, approved in 2010. It aimed to overcome the barrier of the high initial cost of CFLs compared to conventional bulbs. It also aimed to promote trust in the product by using recognised brands and a guarantee.

Institutional structures

BESCOM had overall responsibility for the programme, and three lighting product suppliers (Philips, Osram and Asian Electronics)

were involved, as well as numerous retailers.

The process followed these steps:

1. Eligible **customers** get vouchers from **BESCOM** service centre
2. **Suppliers** provide lamps to approved **retailers**
3. **Retailers** issue lamps to eligible **customers**
4. **Retailers** collate sales documentation and forward it to **suppliers**
5. **Suppliers** submit an invoice with the sales documentation to **BESCOM**
6. **BESCOM** applies the costs to **customers’** electricity bills
7. **BESCOM** pays back the **suppliers**
8. **Suppliers** disburse payments to **retailers**

The International Institute for Energy Conservation, IIEC (an NGO) managed overall program design and management, monitoring and evaluation, and the US Agency for International Development (USAID) provided technical assistance. The Bureau of Energy

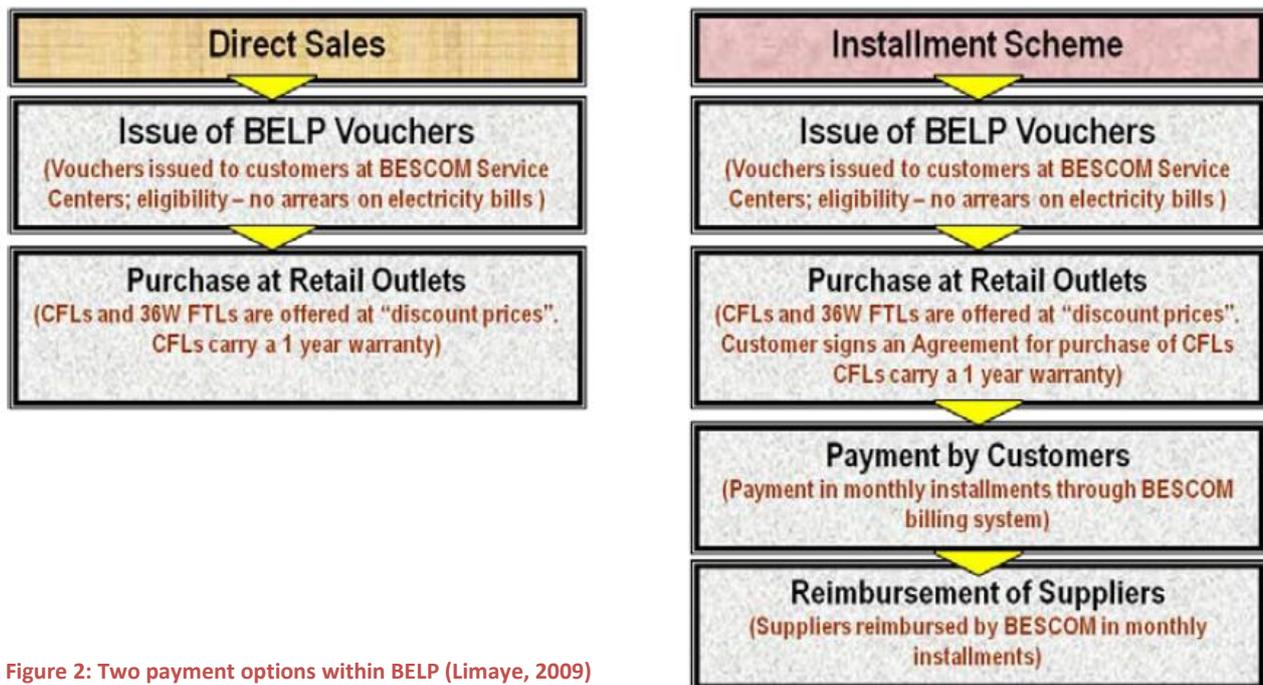


Figure 2: Two payment options within BELP (Limaye, 2009)

Efficiency was the government agency responsible, and set standards. Residents' Welfare Associations were involved in engagement activities such as workshops.

Measures and recipients

The scheme was targeted at BESCO's domestic and small commercial customers in the Bangalore area (as detailed in the Electric Power Tariff 2003). Eligible customers were those with no arrears on their BESCO electricity bills.

The technologies promoted under the program were compact fluorescent Lamps (CFLs) and Tri Phosphor 36W Fluorescent Tubes. However, more emphasis was given to CFLs⁷².

The CFLs were distributed through supplier-regulated channels involving 7 large-scale wholesale distributors and 200 retailers spread over Bangalore city. From 2006 to 2007 the pilot scheme was expanded to four more cities in the BESCO service territory, covering many hundreds of thousands of residential customers.



Figure 3: Official mascot of the programme

Financial structures and funding

Bulb suppliers provided 1.5 million RS (\$37,300)⁷³, solely for joint marketing campaigns. There was no cost to BESCO.

Bulbs were available under two purchasing options: direct purchase at a reduced price, or payment through electricity bills. Outright cash purchase was the preferred route for consumers, to avoid filling out agreements for repayment and to avoid queues at the bill collection centres.

All three suppliers offered a price point of RS 110 (\$2.74) to 125 (\$3.12), a price reduction of over 25% on the prevalent market price⁷⁴. (Suppliers were selected by BESCO partly based on price offered). The payment was in instalments over a nine-month period, with the aim that payments would be covered by the savings made through using CFLs. There was provision for disconnection in the case of non-payment of electricity bills.

Engagement and marketing

Engagement included a focused marketing campaign in specific geographical areas within the BESCO urban territory, including: marketing materials such as posters, leaflets, car stickers and moving advertising boards; mailed information; brochures from participating suppliers; newspaper advertisements; occasional mobile vans displaying BEMP Mascot and CFL signs; TV and radio commercials and electronic media. Sensitization workshops were also run for Residents' Welfare Associations.

Results

Early in 2006 a committee reviewed the pilot scheme, aiming to evaluate peak demand reduction and energy saving, using data on the sales of CFLs from the three suppliers and non-participating suppliers. It also aimed to evaluate power quality issues related to CFLs, and suggest technical measures to be taken up during the next phase of BEMP and CFL programmes in other utilities. Mechanisms included a billing analysis to evaluate system benefits, evaluation of customers' acceptance of the program, and BESCO's procedures and

⁷² (Limaye 2009)

⁷³ (Tata Power 2013)

⁷⁴ (Limaye 2009)

systems effectiveness, and a survey to estimate lamp performance and participation statistics.

In the pilot scheme, there was a total estimated sale of 430,000 CFLs, an increase of 175,000 on the previous year's sales. By November 2007, 550,000 CFLs had been sold. More than 50,000 individual consumers were involved per year⁷⁵ (out of 1.3 million residential customers in the Bangalore area; so BELP reached around 4% of customers each year).

The evaluation of the 2004-05 pilot claims that peak reduction with the BESCOM system was in the range of 26 MW (11 MW of which were directly due to BELP lamps) and annual savings were close to 38 GWh (15 GWh of which were directly due to BELP lamps). Seven-monthly consumption for a sample of 100 BESCOM consumers reduced from 94,072 units to 86,932 units (a drop of 7,140 units). However, the same data shows that for all-electric homes, there was a net increase in energy use over the period, due to increasing use of appliances and equipment⁷⁶. Figures are not available for the expanded scheme, despite it having closed in 2007.

The pilot scheme evaluation reports that annual greenhouse gas emission reduction for the *additional* CFLs sold was approximately 15,267 tons of CO₂⁷⁷. The project also fostered customer relations.

Strengths, weaknesses and lessons

The evaluation committee report states that power quality issues regarding the bulbs were raised, but cost constraints meant the power factor was limited. However, the CFLs promoted had a power factor of 0.55–0.6, which is the standard for CFLs (over 95% of the world market)⁷⁸.

Trust was ensured by a 12 month warranty for free replacement of CFLs, and a tamper-proof hologram used on the bulbs, as well as utility

branding. Overall failure rate of the CFLs was insignificant and was moderated by the supplier warranty. The post-implementation survey indicated a very high level (over 60%) of customer satisfaction with the programme.

A key success was that bulk procurement resulted in a reduction of bulbs' retail price by over 20% compared to pre-scheme costs. Other strengths included the participation of Residents' Welfare Associations in promoting this initiative to a wider base of consumers, and raised awareness. The evaluation found that market transformation was achieved, with non-participating suppliers also reducing prices and experiencing sales growth due to the programme's implementation.

At least two other programmes (in Mumbai and Nashik) have used technical and implementation features of BELP. Transferability may be high to other developing countries – the similar Efficient Lighting Initiative (ELI) programme had success in many locations. Since 2009 India has had a countrywide bulb subsidy programme (with no repayments), the Bachat Lamp Yojana, which builds on some aspects of the BELP scheme (involvement of private sector CFL suppliers and state level Electricity Distribution Companies) but also involves the Government of India and the leveraging of the sale of Certified Emission Rights under the Clean Development Mechanism of the Kyoto Protocol.

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⁷⁵ (M. Patankar 2007)

⁷⁶ (BELP Evaluation Committee 2006)

⁷⁷ *Ibid.*

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KredEx energy efficiency and housing financing schemes, Estonia

Overview and goals

KredEx is Estonia's "Credit and Export Guarantee Fund"; a revolving fund that supports financing of energy efficiency projects (among other services).

KredEx was established in 2001 with the main aim of helping Estonian companies develop, raise finance, and expand their exports. It also aims to support the upgrade and renovation of domestic housing, including promoting energy efficiency through grants, loans and loan guarantees. A range of offers aim to ensure that various social groups in need of help can benefit from this funding.

Institutional structures

The context to KredEx is partly provided by European regulation; Estonia has undertaken measures aimed at complying with Directive 2002/91/EC of the European Parliament and the Council on the energy performance of buildings. Directive 2006/32/EC on the efficiency of final consumption of energy and energy services has been adopted since 2008.

KredEx is a state-owned credit and export guarantee fund which was founded by the Ministry of Economic Affairs and Communications. KredEx is a not-for-profit entity but sureties and guarantees issued by KredEx are backed by a state guarantee. KredEx has received loans from the Council of Europe Development Bank (CEB), guaranteed by the Estonian state, and also receives funding from the European Regional Development Fund (ERDF), and income from the sale of Assigned Amount Units (AAUs) under the Kyoto protocol.

Other stakeholders include the commercial banks Swedbank and SEB, which get favourable funding from KredEx and make loans to apartment building associations, and other commercial banks which participate only in the loan guarantee schemes. Apartment associations are important stakeholders, as loan and grant beneficiaries. Municipalities also

occasionally work with KredEx, when they run complementary schemes.

Measures and recipients

KredEx offers three types of mechanism for funding energy efficiency: loan guarantees, loans and grants.

KredEx offers **Housing Loan Guarantees** for the purchase of new living premises or renovation of existing ones, to decrease the down-payment obligation for certain eligible applicants (see below). To implement these guarantees, KredEx has agreements with most of the credit establishments in Estonia. A guarantee fee 3% of the guarantee amount is paid when the contract is signed as a one-time payment. The loan guarantee amount is up to 24% of the value of the loan guarantee property, but not more than €19,200.

Additionally, there is an **Apartment Building Loan Guarantee** for renovation work. Guarantees are mainly necessary for buildings where the market value of apartments is low, or those which have only an apartment community, not a formal association (which are not required by Estonian law), i.e. the loan receiver is not an independent legal person. The guarantee covers up to 75% of the loan amount. There is a guarantee fee of 1.2-1.7% of the guarantee balance per year. Banks participating in this scheme are Danske Bank, Krediidipank, Nordea, SEB, Swedbank and Versobank.

An **Apartment Building Renovation Loan** was introduced in 2009 to provide long-term low-interest loans specifically for apartment renovations. A precondition for receiving the loan is an energy audit. The loan period is up to 20 years and the minimum loan is €6,400 (\$9,500). No collateral is needed. Interest rates are up to 4.5%, fixed for no more than 10 years. This contrasts with conventional loans, which would typically offer higher interest rates, with

a higher contract fee and shorter maturity⁷⁹, often unsuitable for an apartment building. Self-financing is at least 15%, which can be covered by a reconstruction grant, as the schemes can be combined (see below). The loan is offered through the banks Swedbank or SEB.

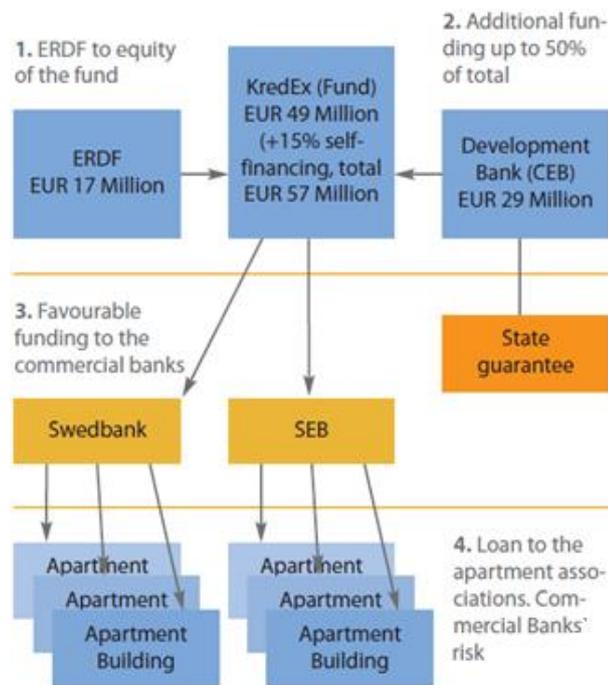


Figure 4: Structure of apartment building renovation loan scheme (UrbEnergy, undated)

The **Apartment Reconstruction Grant** is suitable for apartment associations planning full-scale reconstruction. Only newly starting reconstruction work is supported. Larger grants are available for projects that involve more improvements; this encourages deeper retrofits. To obtain a 15% grant, an apartment building must achieve energy saving of at least 20% if its area is up to 2,000m², or at least 30% in an apartment building of over 2000 m²; and also achieve energy label E. To obtain a grant of 25%, in addition to the above terms, it must achieve energy label D. To obtain a grant of 35%, it must achieve energy label C. Additionally, for this final category, up to 90% of design costs are supported.

There was also an “**Energy audit, building design and expert evaluation grant**” for

apartment associations planning to begin the renovation of their building. This covered:

- an energy audit – max €700 (\$1,040)
- a technical inspection – max €700 (\$1,040)
- building design documents – max €5,000 (\$7,425)

These covered 50% of eligible costs. However, the scheme has been closed as all the funding has been used.

There were also **grants for families with many children** to improve living conditions, originally with a maximum grant of 320,000 Kron (\$19,457). This could be used to purchase living premises, build, reconstruct, renovate or expand living premises, or construct or change technical systems in living premises. In April 2011, KredEx stopped accepting applications for these grants.

Briefly, during 2012, the offer of **Renovation Grants** was extended to houses (demand soon exceeded the available funds). Grants were divided into two packages; efficiency renovations and renewable energy. Grants for efficiency renovations covered 25% or 40% of eligible costs (depending on whether energy class D or C was achieved). Grants for renewables covered 60% (for solar thermal) or 70% (for photovoltaics or a wind turbine) of equipment purchase and installation costs. The minimum grant award amount was €1,000 (\$1485) and the maximum €30,000 (\$44,550).

Target audience

Eligible groups for the **Housing Loan Guarantee** are: young families (a parent or parents raising a child of up to 15 years), young specialists and tenants living in restituted buildings. A young specialist is an up to 30-year-old person, who has acquired secondary or vocational secondary education, and is employed or self-employed. A tenant living in restituted premises is a person having a tenancy contract in living premises restituted (returned to a former owner) as unlawfully expropriated property through ownership

⁷⁹ (Adler 2011)

reform. (This restitution is a common issue in ex-Soviet states).

The target groups for the **apartment loan, grants and guarantee** are apartment associations, building associations and communities of apartment owners. The apartment loan guarantee is suitable for apartment buildings that wish to take a loan from a bank to finance renovation but whose risk is evaluated higher than average by the bank (e.g. a high share of debtors, the apartment building is located in an area with low market value of apartments or in a mono-functional settlement, investment per m² is higher than the average), or who wish to use the KredEx guarantee to insure the risk of payment difficulties. The association or community must be creditworthy. The loan and grants are also aimed at these apartment associations, with the Reconstruction Grant being especially aimed at those wishing to undertake a major programme of works.

As noted above, there was briefly a grant for private individuals who own houses, and a grant for families with at least four children, under an income threshold (both now closed).

Buildings and measures

The **apartment measures (grants, loans and guarantees)** are available to apartment buildings, which are defined as buildings having at least 2 (or for certain schemes, 3) apartments. The target groups for the apartment loan are apartments built before 1993. The apartment grants (both the Reconstruction and the Audit/design grants) and the Apartment Loan Guarantee include apartments built in any year.

The **Apartment Renovation Loan** is mainly used for insulation and heating systems. Measures can include: full or partial insulation of frontages of apartment buildings; reconstruction and insulation of roofs; replacement of windows and exterior doors; insulation of cellar ceilings; insulation of roof ceilings; replacement, reconstruction or

rebalancing of heating systems; replacement of ventilation systems; and certain facilities for the use of renewable energy in apartment buildings.

The **Apartment Reconstruction Grant** is mainly meant for apartment buildings with several floors, including at least three apartments. The main eligible measures are: insulation of envelope structures; exchange of windows and front doors; replacement or reconstruction of the heating system; reconstruction of the ventilation system or installation of a system with heat recirculation; installation of equipment necessary for using renewable energy; reconstruction of the control system or drive of lifts; and design, project management and supervision.

Renovation Grants for houses covered: insulation, heating, ventilation, new windows and doors; solar thermal; photovoltaics or a wind turbine.

The housing loan guarantee is for residential buildings. It covers purchase of new living premises or renovation of existing ones.

Finance and funding

KredEx is a self-sustaining revolving loan fund in the jurisdiction of the Ministry of Economic Affairs and Communications. Initial funding was provided by the Government. According to the Enterprise Support and State Guarantees for Loans Act of 2003, KredEx's housing loan guarantees (for renovation and purchase) are counter-guaranteed by the state, up to a limit of €96 million (\$143 million)⁸⁰.

From June 2008, the "Energy audit, building design and expert evaluation grant" was financed by structural funds from the European Union. In addition, from summer 2009, KredEx funded its "Renovation Loans" for apartment buildings with financial resources from European structural funds (€17 million; \$22.6 million) and an additional loan from the Council

⁸⁰ (Adler 2011)

of Europe Development Bank (CEB) (€28.8 million; \$38.3 million).

A condition of the CEB loan was a guarantee from the Estonian state. This was used to provide low interest loans to two commercial banks, Swedbank and SEB Estonia, with a term of 20 years. The banks then provide loans to apartment associations, (as explained above) with credit risk taken by the banks.

The loan contract is between the bank and the apartment association; the bank can legally claim against the association in case of default. The association can in turn claim against apartment owners, following agreement at a general meeting⁸¹. If a person is not fulfilling obligations to the association it is theoretically possible they will lose their apartment, but these cases are very rare because usually people fulfil their obligations⁸². It is possible that taking a loan as part of an association of neighbours encourages people to meet their obligations more than an impersonal bank loan would, due to social pressures⁸³.

From 2010, the source for the apartment Reconstruction Grant funds is the sale of Assigned Amount Units (AAUs) under the Kyoto Protocol by Estonia to Luxembourg. The total fund provided by the agreement was €30 million (\$39.7 million).

Housing and energy efficiency are a relatively small part of KredEx's business. For example, in 2012, housing guarantees were 16% of all guarantees; €11 million (\$16.3 million) out of €68 million (\$101 million)⁸⁴.

The latest available annual report is for 2011. The following figures are from that report unless stated otherwise⁸⁵.

⁸¹ (Pugri)

⁸² (Adler 2013, *pers comm*)

⁸³ (Shahidur R. Khandker 2012)

⁸⁴ (Adler 2013)

⁸⁵ Figures from 2011 are converted from euros using exchange rate of 1.39243 USD to a euro the average for the year).

Apartment loans

From 2009 to 2012, the "Renovation Loans" fund for apartment buildings was worth €49 million (\$72.8 million)⁸⁶. For the apartment loan issued to banks, €674,500 (\$937,315) of interest income was earned in 2011 (at an interest rate of 2.0–2.7%). The outstanding balance of apartment loans, as of December 31st, 2011 was €37.5 million (\$52.1 million). The banks take a fee; for Swedbank this is currently 1% of the loan amount, minimum €191.73 (\$285).

Housing loan guarantee

The amount of actual (paid) claims for the housing guarantee in 2011 was €291,000 (\$404,387). The housing loan guarantee portfolio valid on December 31st, 2011 was €42.3 million (\$58.8 million). In 2012, housing guarantees were issued that were worth €11 million (\$15.3 million)⁸⁷. KredEx's income from housing guarantees in 2011 was €311,147 (\$432,000).

Housing and apartment grants

Funding for apartment grants has come from several sources, including the Kyoto agreement with Luxembourg.

In 2011, the Ministry of Economic Affairs and Communications provided €2.6 million (\$3.6 million) in funds for housing support measures, mostly for direct grants to families with many children (as outlined above). (The rest was for development projects connected with housing, such as training and surveys, and the administration of grants and development projects.)

In 2011, €3.7 million (\$5.1 million) in grants connected with housing (refurbishment and purchase) were paid. This included:

- €0.5 million (\$695,000) from EU structural funds for apartment grants
- Grants for families with many children: €2.9 million (\$4 million) (this was mostly from

⁸⁶ (Adler 2013)

⁸⁷ *Ibid.*

the Estonian state budget, from the Ministry of Economic Affairs and Communications, as above).

- It also included a contribution to the Apartment Grants, development projects connected with housing and a grant to the Kiviõli Town Government

In total, from September 2010 to March 2013 apartment grants were given worth €20.9 million (\$31 million)⁸⁸.

Administrative costs

In 2011 grants for apartment buildings involved administration expenses of €137,707 (\$191,363.89). Administrative costs to KredEx are lower for revolving loans than for previous grant-only schemes because most of the work is done by the banks; these may also have lower costs per account due to their existing loan business.

Marketing and engagement

KredEx runs well-funded media campaigns to promote awareness of energy efficiency and to encourage householders to invest in such renovations⁸⁹. Engagement methods have included: press conferences; seminars/workshops aimed at intermediaries (builders, energy auditors, project designers, local municipalities); advertisements in newspapers/magazines; use of the internet (website, news, articles); direct mailing; leaflets/booklets; and cooperation with banks.



Figure 5: Sample of KredEx marketing materials

Results

Banks provide monthly reporting about the loans given (to apartments). This includes: information about buildings; description of investments; number of dwellings concerned; date of energy audit, savings; total investment cost; loan amount; supplementary bank loan; loan maturity; and loan interest rate / margin.

When applying for a Renovation Loan, applicants must submit an energy consumption report for 3 calendar years preceding the application for a loan. Together with the audit and building designs submitted, this enables assessment of the potential energy savings.

An evaluation was also carried out by the Technical University of Tallinn (available only in Estonian, and not reviewed here).

Take-up

Estonia has 17,000 multi-apartment buildings and 90% of the housing stock was built before 1990. 75% of the population live in multi-

⁸⁸ (Adler 2013)

⁸⁹ (Davies and Holmes 2011)

apartment buildings. The vast majority are in private ownership, and occupied by owners.

Housing loan guarantee: In 2011, KredEx issued housing loan guarantees worth €5.9 million (\$8.2 million) on loans worth €45.2 million (\$62.9 million). That year, the extant loan guarantees reached €31.1 million (\$43.2 million). 558 young families purchased or renovated their homes in 2011 (loan guarantees of €3.3 million (\$4.6 million)). Since 2000, 14,133 young families and 69 tenants of restituted houses have improved their housing. The small growth of the housing market (17%) compared to the level of 2010 kept the housing loan guarantee volumes of KredEx fairly static (growth of 3.6%). Stricter terms for housing loans, an increase in payment risks and a remarkable fall in the value of guarantee property in 2011 kept the share of housing loans with a KredEx guarantee at 9.2% of the total volume of housing loans issued in Estonia in 2011 (compared to 10.4% in 2010).

Apartment guarantee: In 2011, the apartment building guarantee portfolio reached €11.1 million (\$15.4 million), growing by €1.5 million (\$2.1 million) in one year. Since 2004, the total number of apartment buildings that received a loan for renovation with a KredEx guarantee was 583, the total amount being €23.7 million (\$32.9 million). The existence of the Reconstruction Grants has somewhat increased the issuing of loans and loan guarantees for apartment buildings, but people remain careful about acquiring new liabilities.

Apartment loan: During 2011, a total of 167 loan agreements were concluded to the amount of €16.7 million (\$23.2 million); the total investment with the help of the loan was €23.2 million (\$32.2 million). The average loan amount of the loan agreements concluded in 2011 was €100,000 (\$139,000), the average self-financing was 27.9% and the average length of the loan period was 15.2 years. In 2012 the average area of the buildings having

used the loan was 2,251 m², the average number of apartments was 37⁹⁰.

In total, 391 loan agreements to the amount of €34.3 million (\$47.7 million) have been concluded since 2009. In total, with the help of loans, €45.2 million (\$62.8 million) has been invested in apartment buildings, 939,176 m² have been renovated, and the living premises of 14,680 apartments and 33,700 inhabitants have been improved. Over 60% of loans are to a single county, Harjumaa, which includes Tallinn; 48.8% of the buildings supported are in Tallinn. However, about a third of the population live in the city, so this is not seen as a problem⁹¹.

Apartment grant: By the end of 2011, grants had been allocated to 266 apartment buildings, including a 15% grant to 162 apartment buildings, a 25% grant to 78 apartment buildings and a 35% grant to 26 buildings. In total this is €5.8 million (\$8.1 million), with the help of which, a total amount of €31 million (\$43.1 million) will be invested in apartment buildings. From September 2010 to November 2011 the average grant was €26,192 (\$36,000)⁹².

Grant for energy audit of apartment buildings, building expert evaluation and building design: 1,038 grants were paid in 2011, totalling €491,000 (\$682,000).

Reconstruction grants for restituted apartment buildings: In 2011, grants were paid totalling €92,000 (\$128,000) to renovate 20 apartment buildings.

Large family grant: Home grants were issued to 290 large families in 2011, totalling €2.2 million (\$3.1 million). The families had a total of 1,254 children. Since the grant's inception, the total amount of grants paid to these families is €9.1 million (\$12.6 million), which has helped 1,324 families, with 6,423 children.

⁹⁰ (Adler 2013)

⁹¹ Adler, personal communication

⁹² (Adler 2011)

Impacts

The main purpose of energy efficiency measures in apartments was to save at least 20% of energy in buildings up to 2,000m² and to save at least 30% of energy in buildings more than 2,000m². For apartment loans, the average predicted energy saving achieved with the reconstruction work is 39.3%.

In 2004 just under 2,000 jobs were estimated to have been supported through KredEx's activities.

Strengths, weaknesses and lessons

Credit guarantee agencies and funds are common across most EU member states, but generally do not offer the energy efficiency schemes that KredEx does. KredEx offers an example of best practice in that:

- It has also won credibility with the commercial banking sector in a short period, becoming an established player in the local financial market.
- Loan programmes are easier to administer, with potentially lower administrative costs than grants.
- Funds stay in constant use due to the revolving model
- There are opportunities for smaller buildings as well as apartments

Various barriers are addressed by these schemes. Upfront costs are addressed, both through grant and loan schemes. The cost of borrowing is addressed through the loan guarantee scheme. Another problem addressed is the renovation of apartment blocks –this could not be done flat-by-flat, so schemes are designed for apartment associations on a whole-building basis. The needs of specific vulnerable groups are addressed e.g. large families, tenants in restituted buildings.

Weaknesses are that:

- End-beneficiaries are still careful with taking the loan, and take-up has not been as rapid as had been hoped.

- There are many documents to prepare before a loan application can be finalised; it is much easier just to get a usual commercial loan (with no energy audit or building design documents needed).
- Reporting is burdensome, as banks report to KredEx, and KredEx has to report to the Ministry and CEB and the Ministry to the EC⁹³

Lessons learned include:

- Preparation takes a long time – for Estonia it was 2 years;
- A legal framework is needed to support measures; KredEx benefitted from a 2001 Government directive giving it a permit to grant state aid and a new law (Enterprise Support and State Guarantees for Loans Act, from 2003) meaning that KredEx's loan guarantees are counter-guaranteed by the State. Before that banks had no guarantee against the bankruptcy of KredEx.
- Combining different measures is beneficial
- An all-round approach - awareness raising, promotion, state and local support, legal and financial framework – is the key to success

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⁹³ (Adler, pers comm)

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Microfinance for energy, Kenya

Overview and Goals

Micro-financing is offered for solar photovoltaic systems and other measures through microfinance institutions and savings and cooperative credit organizations (SACCOs).

These schemes aim to help people, often in low-income rural areas, to install measures (mainly micro generation) by addressing the up-front costs. This is often in off-grid areas. This is in line with Kenya's stated National Energy Policy, which aims "to facilitate provision of clean, sustainable, affordable, reliable and secure energy services at least cost while protecting the environment. However, in actual fact the Ministry of Energy provides few current policy incentives or allocations for solar energy⁹⁴ and these microfinance schemes have often been supported by external agencies. In addition to environmental goals, these schemes often have development aims; for example, an institution called Faulu Kenya aims at providing a range of financial services to low-income economically active members of the community.

Figure 6: Sample of typical solar products financed



Institutional structures

There are at least 10 microfinance institutions in Kenya⁹⁵. Microfinance specifically for energy measures is offered by existing institutions; these can be SACCOs or larger microfinance institutions (MFIs). SACCOs are groups that provide savings and loans to their members,

often based on income from cash crops. In some schemes, SACCOs and microfinance institutions provide loans to their members to enable them to purchase energy measures.

One example of an MFI that has offered energy loans is Faulu Kenya. Faulu is registered in Kenya as a company with limited liability under the Companies Act. Its majority shareholder is Food for the Hungry, a Christian relief and development organization, which originally set up Faulu, now one of the largest microfinance institutions in Kenya. It has branches across the country.

In the Faulu scheme, existing client groups send a loan application to Faulu. Once processed, this triggers a request to Chloride Exide, the solar energy company, for installation. Faulu disburses payment directly to Chloride Exide, who then installs the system and gives the client basic training in proper use and maintenance.

All SACCOs and microfinance institutions are regulated by the Kenyan state. Various schemes exist to support and promote these loan programmes, including schemes run by international charities, the Cooperative Bank of Kenya, the International Finance Corporation and the Kenya Union of Savings and Credit Cooperatives (KUSSCO), which provides support to SACCOs. International funders such as the United Nations Development Programme (UNDP) and the US Agency for International Development (USAID) provide backing to some of these schemes.

Measures and recipients

SACCO energy loan schemes are generally only open to SACCO members, and the intended audience varies between schemes. Faulu has broad outreach throughout Kenya, with a presence in more than 50 of the 67 districts of Kenya. The bulk of Faulu's clients are owners of micro and small enterprises. A KUSSCO scheme also has widespread presence.

⁹⁴ (Mark Hankins, Anjali Saini, and Paul Kirai 2009)

⁹⁵ da Silva, personal communication

Many SACCOs are agricultural co-ops and there is an emphasis on rural areas. For example, Faulu Kenya disbursed energy loans to 196 urban clients and 591 rural clients – roughly 25% urban and 75% rural - between June 2006 and January 2007. Overall, energy loan clients tend to include more women than men, but more male clients borrow funds for solar home systems than female clients⁹⁶.

Buildings were generally residential or commercial in Faulu's schemes. In 2006 Faulu offered the Mwangaza solar loan product, which included panel(s), batteries, wiring, regulator, and sometimes an inverter. The solar systems were typically used for lighting (home or business), charging mobile phones and small batteries, and providing electricity to small direct current appliances, such as radios and black/white televisions. A notable characteristic of solar energy products is that they are relatively small.

Their prices ranged between KSH 10,000 (\$162) and KSH 27,000 (\$437). There were also LPG and biogas loan products offered by Faulu, and other institutions and SACCOs.

Most Kenyan microfinance institutions offered fixed-rate loans. Faulu's Mwangaza solar loans had a ceiling of KSH 100,000 (\$1,619) and a repayment period of up to one year. The rate of interest was 20% charged on a flat rate basis. Different terms were offered by different schemes; one scheme was run by the Kenyan Co-op Bank in conjunction with Murang'a SACCO, and offered a term of 24 months and an interest rate of 12%.

Finance and funding

Faulu Kenya uses the group lending methodology—lending to a group of borrowers who are jointly liable for a single loan—supported by an elaborate institutional framework that works through mobilized groups. Its energy lending was first established by listing a \$7 million bond on the Nairobi stock

exchange in 2005 (\$8.2 million in 2012 terms). In the past, Faulu Kenya's loan fund base was solely derived from credit operations and borrowing on the open market in Kenya. Now, due to a change in the enabling laws, Faulu is a deposit taking institution.

Risk is a key issue in microfinance. Faulu seems to perform well, achieving portfolio-at-risk (PAR) of four per cent, compared to the Kenya commercial banks' rate of over 20%. PAR is a measure of microfinance success, and refers to the proportion of the loans that are in default. One report states that out of 5000 liquefied petroleum gas (LPG) cooker loans, Faulu Kenya had a 100% repayment rate⁹⁷.

Data on SACCO and microfinance loans is limited. In 2004, Faulu made LPG loans worth KSH 117,142 (\$2,281), representing 1.5% of all loans. In 2005, LPG loans were worth KSH 175,714 (\$3,421) – for both years this represented around 1.5% of all Faulu loans. However, very few new loans were disbursed in the first half of 2006, and by June 2006 LPG loans had fallen to 0.3% of the total. Solar loans are even more rare: in June 2006 there were seven solar loans that were outstanding, worth KSH 95,260 (\$1,542), with a balance outstanding of KSH 59,646 (\$966).

Faulu management estimated that it has a 10% profit margin on energy-lending⁹⁸. In 2009 Faulu held loans from seven different sources at varying interest rates, including an overdraft from Standard Chartered Bank Kenya Limited at 12.0% and a €5 million (\$6.7 million) loan from Deutsche Bank at 6.5% interest⁹⁹.

⁹⁶ (Kabutha et al. 2007)

⁹⁷ (Kariuki and Rai 2010)

⁹⁸ (Kabutha et al. 2007)

⁹⁹ (Ken Wathome 2009)

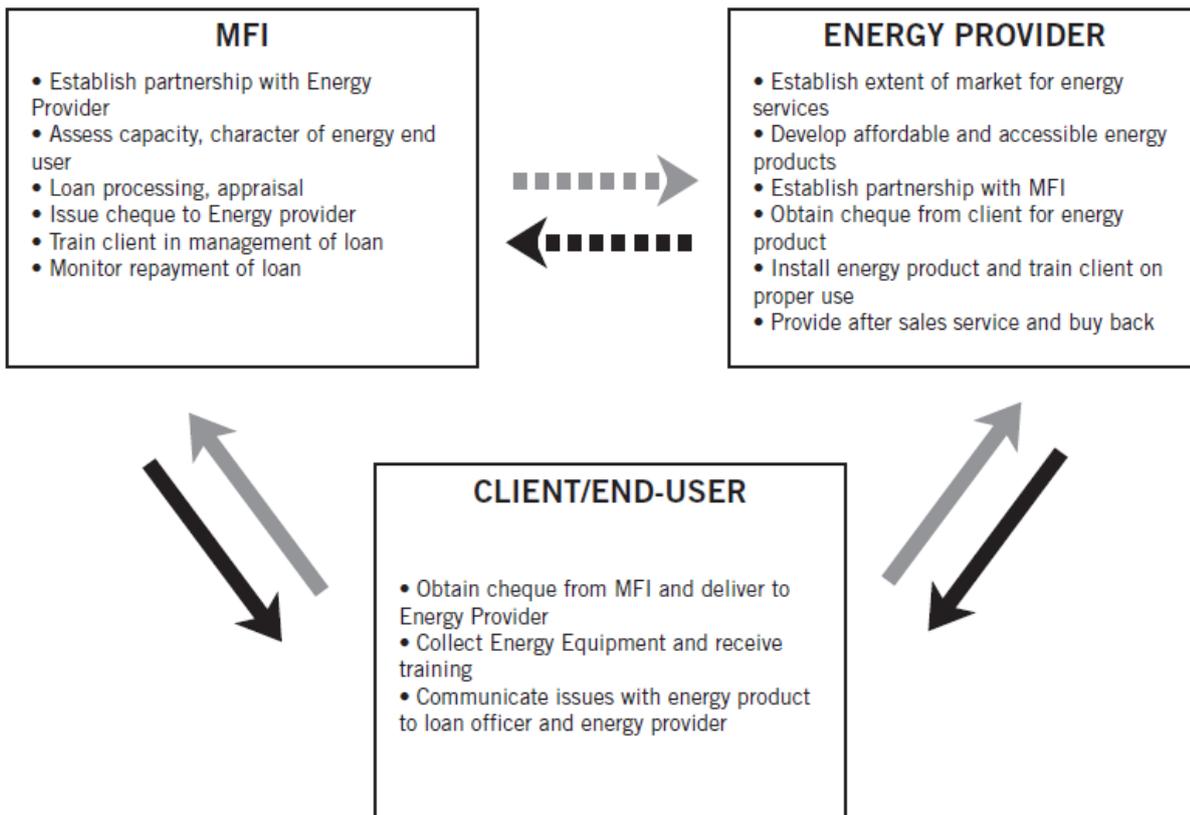


Figure 7: Faulu Kenya Basic Energy Loan Delivery Model (Kabutha et al, 2007)

Marketing and engagement

Marketing is through individual institutions and SACCOs to their members. In 2004 and 2005 a heavy marketing effort promoted by Faulu management resulted in high take up of their energy loans. In this scheme, the solar product was offered through the existing Faulu group structure, during weekly meetings of client groups where a loan officer gives a 'pitch' for various products.

Results

Faulu did not track or manage energy-specific data separately from core business products, making assessment of energy product performance difficult. Lack of energy data monitoring also made it difficult for Faulu to determine where costly bottlenecks in service delivery may be occurring and develop means to address related high transaction costs. Other SACCO projects also have very limited evaluation data.

Kenya has 3,983 active SACCOs¹⁰⁰, but relatively few members have energy loans, and take-up varies by scheme. Faulu has branches in around 50 of Kenya's 67 districts, and has 3,130 active groups, with about 70,000 clients and 54,000 active loans. Between 2003 and December 2006, about 4,000 clients took advantage of Faulu's energy products, about 5.7 percent of the total client base¹⁰¹.

Even at its peak, the energy-lending portfolio was a very small addition to Faulu's total portfolio. In June 2006, of 42,249 clients with active accounts, only 135 had outstanding LPG loans and 7 had solar loans. The small number of solar loans was possibly because solar systems are more complex, they lack support from the energy companies, there are weaknesses in the supply chain, the cost is higher, and clients could only access the technology as an addition to a business loan. The number of Faulu energy products plateaued after 2005, in part due to a drop-off

¹⁰⁰ (SASRA 2013)

¹⁰¹ (Kabutha et al. 2007)

of marketing efforts and a potential saturation of easy-to-identify urban clients¹⁰².

No data is available on energy impacts of these schemes. It should also be noted that these schemes may provide electricity to areas that previously had none.

As well as bringing energy supplies to off grid areas, microfinance schemes can help meet other human development goals, such as promoting cleaner, healthier heating methods (as widespread use of charcoal and firewood has negative social and environmental impacts).

Strengths, weaknesses and lessons

Due to various schemes, the concept of solar electricity is now well known within the SACCO community in Kenya. One review found that programmes perform better if they work with existing credit groups (such as through SACCOs) than with credit groups created for the purpose of energy loans. However, concentrating only on cooperative groups would severely limit replicability: not all households are members of such organisations¹⁰³. Faulu Kenya mainly focuses on providing financial services to the owners of small and medium enterprises. This limits its ability to deliver energy services to lower-income populations that may not be engaged in formal economic activities.

Weaknesses include issues around the low technical capacity of the MFIs. Faulu, other Kenyan MFIs, and related financing organizations are also limited by where they can offer quality energy products due to a shortage of rural energy companies or enterprises. The lengthy loan process to purchase energy products is another problem for Faulu - the time from when a field officer receives a completed application to when the system is installed and the user is trained can be two months. Central processing of loan

applications only adds to the time lag between application and installation.

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¹⁰² (Kabutha et al. 2007)

¹⁰³ (Mark Hankins and Robert van der Plas 2000)

Warm Up New Zealand: Heat Smart

Overview and Goals

Warm Up New Zealand: Heat Smart is a soft loan scheme with grants, promoting insulation and clean heating for homeowners and landlords.

The New Zealand Energy Efficiency and Conservation Strategy 2011-2016 (NZECS) is specifically focused on the promotion of energy efficiency, energy conservation and renewable energy. This includes a goal for “Warm, dry and energy efficient homes with improved air quality to avoid ill-health and lost productivity”. The Warm Up New Zealand scheme is a key way in which the government plans to achieve this. The scheme aims to overcome the barrier of the up-front cost of insulation and heating measures. It aims to make repayment simple, gradual, appropriate and non-intimidating by offering repayment options through council rates and banks. Partnering with banks and councils also helps with trust and recognition. It also aims to reach “hard to reach” and vulnerable groups, including in the rental sector.

Institutional structures

The Government’s Energy Efficiency and Conservation Authority (EECA) administers the programme, and the State provides funding for grants. Seven private banks offer financing schemes. Nine regional councils allow ratepayers to repay costs of measures over a period of time as part of their rates bill. Approved service providers fit the measures, and property owners take out loans.

Measures and recipients

Homeowners and landlords are eligible. Low income households (including landlords with low income tenants) are eligible for extra help; eligibility is established by an existing Community Services Card (CSC).

The funding can be used to install: ceiling and under-floor insulation, installed by an EECA approved Service Provider; a hot water cylinder

wrap, pipe lagging, draught-stopping, and a ground moisture barrier, where necessary. Efficient heating systems have also been available, but only on a limited basis - Heating grants under the programme ended in October 2012.

Homeowners with a house built before 2000 were able to get 33% (up to NZD 1,300; \$919) off the cost of installing ceiling and under-floor insulation and NZD 500 (\$353) for efficient heating systems. Low income households get a grant of 60% for insulation and NZD 1,200 (\$848) towards efficient heating systems. Landlords with low income tenants also qualify for the higher insulation grant.

The retrofits are audited by the Service Providers and EECA initially audited 10% of these (now 5%) to ensure quality and compliance. All products used in the retrofits must be on the EECA approved list.



Figure 8: Excerpt from Warm Up New Zealand flyer

Finance and funding

The scheme is state funded. Individual measures are partially grant-funded but households need to cover the remaining costs themselves, and can do this through loans. Finance is offered by the major high street

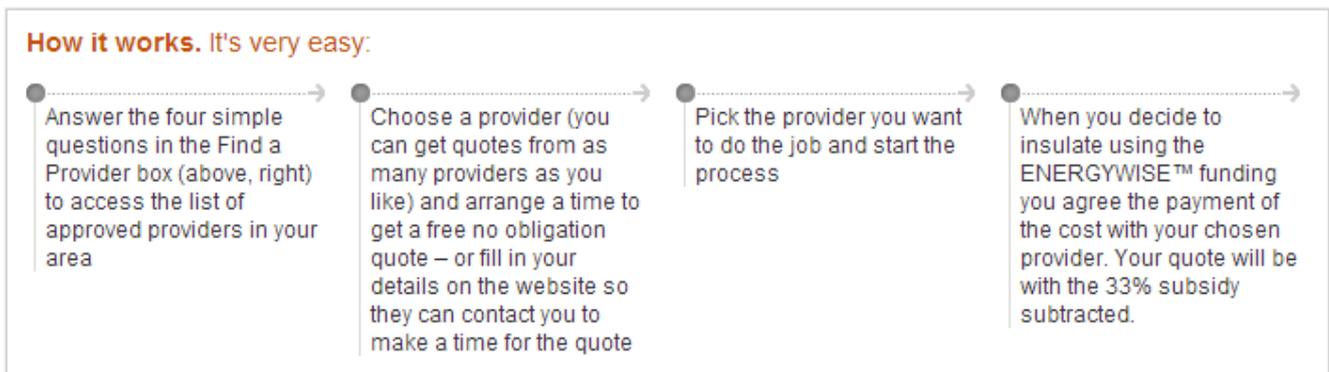


Figure 9: Extract from scheme website showing customer journey

banks and by local councils. The banks and councils therefore have liability for these loan risks – the state does not guarantee loans. State funding is NZD 350 million (\$259 million) in the period 2009-2013.

Warm Up New Zealand offers two routes for financing: loan from the local council to be paid back through an additional charge on the council tax or a commercial loan from a high street bank. The banks enable their customers to add to their mortgages to cover the cost of the retrofit with no charges. Councils provide access to funding which is fiscally neutral to them. The administration costs are covered by the interest rates which are around 7% and repayment is generally made over 9 years¹⁰⁴. The amount of funding available is capped by councils. The loan for the retrofit remains with the house as the repayments remain with the rates bill.

On top of this national framework EECA will have obtained around \$80 million in third party funding over the lifetime of the programme¹⁰⁵. This funding has been obtained from; private companies, electricity lines companies, charitable trusts, councils, banks, other government agencies, city and regional councils, health boards and other organisations.

This funding is distributed through a range of projects around the country to offer retrofits at

low or no cost to homeowners and/or tenants on low incomes. A number of these projects involved EECA partnering to target those in remote areas e.g. the Chatham Islands; Maori, Pacifica, and those with special health needs¹⁰⁶.

Marketing and engagement

The key objective of EECA's marketing and communications for Warm Up New Zealand is to generate interest and demand from homeowners to insulate, through educating and informing people on the benefits of insulation. It is then the role of Service Providers to convert this interest into action.

EECA's marketing strategy for years 1-3 of the programme was to extend the peak winter period by running two major campaigns either side of winter – a spring campaign (August-October) and an autumn campaign (February-April), creating a marketing footprint over an extended nine-month period. Another key part of this strategy is using EECA's TV campaign, "the Energy Spot".

Over the years of the programme, EECA's strategy has changed focus. The first year focused on building awareness of the programme and funding availability; the second year was about demonstrating benefits through testimonial experiences; year three focused on converting willingness into action through addressing affordability (with testimonials). In year four existing demand enabled EECA to reduce its programme marketing spend (leaving it to programme Service Providers),

¹⁰⁴ As a comparison, in March 2013 average credit card interest rates were 17.8% (Weighted average interest rate on personal interest bearing advances. Data from Reserve Bank of New Zealand)

¹⁰⁵ Patterson, personal communication

¹⁰⁶ Patterson, personal communication

while still promoting generic insulation (non-funding) messages.

The open framework of the scheme allows for multiple points for engagement, and interested households can find information about the programme from their local council, high street bank or national energy agency website. Approved insulation providers carry an ENERGYWISE mark.

Results

A suite of evaluations were commissioned by the State from university researchers. These cover health and employment impacts, energy impacts and a detailed cost benefit analysis.

Out of a total of 1,478,700 occupied dwellings¹⁰⁷, over 180,000 households have received a grant for an insulation retrofit (12%) and by the end of the programme it is projected that 230,000 households will have done so – over 15%.

A survey found that there is significant interest in bridging the gap between grants and actual retrofitting costs with loans from banks (4% would definitely take up a loan offer, 35% might = total 39%) and local authorities (1% say they have, 11% will and 48% might = total 60%).

Electricity savings and total metered energy savings due to insulation measures, while statistically significant, were quite small. Around 1% of average annual total metered energy (electricity and reticulated gas) is saved as a result of having insulation retrofitted. Since metered energy used for space heating represents only 16% of total metered household energy use, the implied savings on metered energy used specifically for space heating are considerably higher at approximately 4%¹⁰⁸. The main reason for the

savings having been so low is most likely to be a result of significant under-heating prior to energy improvements, with most of the efficiency gains taken in the form of increased comfort rather than energy savings.

The evaluation found a total cost per installation of around NZD 2,750 per household with Government costs per household of around NZD 1,500. A detailed cost benefit analysis produced a central estimate of gross benefits for the programme of NZD 1.28 billion (\$0.95 billion) compared with resource costs of NZD 0.33 billion (\$0.24 billion); a net benefit of NZD 0.95 billion (\$0.7 billion)¹⁰⁹.

The insulation delivered annual health related benefits (savings) per household treated of NZD854.4 (\$604) for 'CSC-homes'¹¹⁰ and NZD 335.6 (\$237) for non-CSC-homes. The heating measures provided health benefits of NZD9.27 (\$6.55) for each home (both groups)¹¹¹. Extrapolated out to the end of the programme in around September 2013 it is projected that the benefit to cost ratio of more than four to one will be achieved.

84% of customers surveyed felt they had a warmer home after the insulation was installed and 42% had improved health. Employment creation was estimated to be between 130-800 jobs per annum.

Strengths, weaknesses and lessons

A particular strength is the engagement of low income households. The more generous subsidies for low-income households and their landlords have resulted in particularly high demand from low-income households. Over 32,000 houses being insulated or having clean heating installed (out of the 57,908 homes treated between 1 July 2009 and June 2010) were low-income and 9,000 of these were homes from the private rented sector. By the end of the programme in around September

¹⁰⁷ New Zealand Census 2006

¹⁰⁸ These energy savings represented only 40% of the total space heating energy consumed in New Zealand. Only metered electricity and metered gas, which is only available in the North Island, was measured. Consumption of coal, wood, wood pellets and, non-metered gas was not measured.

¹⁰⁹ (Grimes et al. 2012)

¹¹⁰ Low income households; CSC stands for Community Services Card – a 'passport' for receiving benefits.

¹¹¹ (Grimes et al. 2012)

2013 it is estimated that of the 230,000 houses who have had insulation installed under the programme, 105,000 will be for low income households¹¹².

Service Providers fully assess the ceiling and under floor areas of a house for free when preparing quotes for potential customers. The cost of these assessments is then absorbed into the Service Providers' overall business costs. This has removed a barrier to engagement and these detailed assessments ensure that appropriate work is undertaken.

Marketing of the scheme has been a significant strength; as well as television and print media and the EECA Website, materials have been made available to Citizens Advice Bureaux, doctors' surgeries, Service Providers and installers and retail outlets.

A key objective of the scheme was to ensure that grants were delivered in the most cost effective way while also providing the greatest benefit to homeowners in terms of improving the warmth of homes. Because of this, houses built before 2000 were targeted – around 900,000 homes which had little or inadequate insulation and/or clean heating. In addition the focus for the grant funding was on areas where the greatest heat loss occurred, which would give best value for money for the limited funds available. This meant targeting a combination of ceiling or loft insulation and under floor insulation, which was the most effective use of resources.

By October 2012, independent reports had identified that the majority of the programme's benefits were derived from insulation grants and uptake of heating grants was limited when compared to insulation grants. The decision was then made to focus the remaining funds for the programme on insulation grants.

The key weakness is that the scope of the works is limited to small number of measures; the scheme could be widened to include a

broader range of technologies including wall insulation products. Efficient heating grants have been limited and have run out; the EECA states that this is because the programme is mainly about insulation.

The cost-benefit analysis¹¹³ found that even greater benefits would be achievable through consideration of four targeting strategies:

1. Prioritise the insulation component of the programme relative to the clean heating component of the programme.
2. Target clean heating to houses that use reticulated gas rather than electricity for heating prior to treatment.
3. Target insulation to houses in cooler rather than warmer areas.
4. Target insulation to low and middle income earners and other at-risk groups in terms of illness

Overall, the scheme provides a robust central framework that has allowed both the banks and local councils to add their own products and additional incentives.

The scheme appears to be largely transferable to contexts with a similar housing stock – and, dependent on funding and value, could be expanded to include other measures such as double glazing.

The principle unintended consequence of the programme was the high level of health benefits. While EECA expected a significant level of benefit for health the actual level (99% of benefits) was unexpected.

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KfW Energy Efficient Rehabilitation and Energy Efficient Construction Programmes

Overview and Goals

This scheme is from the German state bank KfW. It offers long term fixed rate low interest loans to support energy efficiency work during general refurbishment of existing buildings and to encourage energy efficiency standards in new build that are higher than the legally required minimum. The loans are supported by subsidies linked to the achievement of higher energy efficiency levels, together with general promotional activity. The current schemes were launched in 2008, but these built on similar programmes that had operated since 1996. To date, over 3 million German homes have improved energy efficiency as a result of the scheme.

The programmes aim to contribute to national carbon emissions reduction targets, essentially by adding energy efficiency work into the existing property renovation cycle. When the CO₂ Reduction Programme was first introduced in 1996 it also aimed to support a weakening construction industry and to channel investment into German Infrastructure.

The national climate change programme estimated that the programme would result in a reduction of 5-7MtCO₂ over the period 2000 to 2005, but this proved over-optimistic and evaluation of the programme in 2004 by Prognos IER¹¹⁴ suggested that the total reduction from improvements to existing buildings would be around 2 to 2.5MtCO₂. The current German government goal, expressed in the German Energy Concept 2050, is for a 'climate neutral building stock' by 2050. Recognising the additional progress needed, the energy strategy sets an aim of doubling the rate of energy-saving modernisation from 1% to 2% per year.

The use of soft loans is based on the idea that these are more cost-efficient than subsidies and that, because costs are spread over a period,

there is not such a large pressure on the federal budget.

Institutional structures

Overall German primary energy consumption and emissions reduction targets exist, but they are not legally binding. The German energy conservation act 2009 states that 'major changes to the building envelope (e.g. roof, exterior walls, windows) must be made 30% more energy efficient [than before] and the envelope must be 15% better insulated' and 'heating, hot water, ventilation, shading and cooling systems must be upgraded to include energy efficient, renewable technologies'.

Subsidies under the scheme are linked to the German Energy Conservation Ordinance (EnEV) that sets standards for the energy efficiency of new buildings.

KfW was founded in 1948 as the Promotional Bank of the Federal Republic of Germany. Its shares are owned 80% by the Federal Government and 20% by the Länder (regional government). Its key functions include environmental and climate protection, and promotion of housing, education, infrastructure and social development.

The other key stakeholders are the commercial banks.

Measures and recipients

The KfW Energy Efficient Rehabilitation Programme and the Energy Efficient Construction Programme build on the experience of the KfW CO₂ Reduction Programme and the KfW CO₂ Building Rehabilitation Programme. These programmes focus on residential buildings, but similar schemes targeting municipal, commercial and industrial buildings have been created.

KfW CO₂ Reduction Programme: From 1990 onwards KfW provided reduced interest rate loans for modernisation of properties in the former East Germany. In 1996 an energy

¹¹⁴ (Novikova et al. 2013)

efficiency element was added to this work, through the KfW CO₂ Minderungsprogramm (CO₂ Reduction Programme). In 1999 the CO₂ Reduction Programme was extended to cover the whole of Germany. The programme ran until 2008.

KfW CO₂ Building Rehabilitation

Programme: In 2001 the KfW CO₂ Gebäudesanierungsprogramm (CO₂ Building Rehabilitation Programme) was added. Whereas the CO₂ Reduction Programme supported investment in individual energy efficiency measures, this programme supported a series of packages of energy efficiency work. This programme also ran until 2008.

KfW Energy Efficient Rehabilitation

Programme: In 2009, this programme replaced the existing buildings elements of the CO₂ Reduction Programme and the CO₂ Building Rehabilitation Programme. In essence it is very similar to these programmes, but with the addition of a standard: ‘the KfW Efficiency House’.

KfW Energy Efficient Construction

Programme: In 2009, this programme replaced the new build elements of the CO₂ Reduction Programme and the CO₂ Building Rehabilitation Programme. As with the Energy Efficient Rehabilitation Programme, it is essentially similar to its predecessor programmes, with the addition of the KfW Efficiency House standard.

The current programmes are available to all building owners who have good enough credit scores, and there are no pre-defined target groups within this. The group of building owners includes private individuals, housing enterprises, housing cooperatives, real estate agents, municipalities, local community associations, districts, civil groups and ‘other establishments of public law’.

Between 1996 and 2000 the vast majority¹¹⁵ of applicants for support were private households. However, this situation seems to have changed

¹¹⁵ 85% in terms of loan volume; 70% of dwellings

more recently: KfW have examined how the distribution of their loans in 2009 compared to the national distribution of tenure¹¹⁶ and owner occupiers have a representative share, private landlords are underrepresented but their share is increasing, and cooperatives and housing companies are somewhat overrepresented.

Buildings and measures

The programmes are intended to be technology-neutral, the key criteria for measures are cost-efficiency and reductions in energy consumption. In the current programmes, energy savings have to be verified by an approved energy assessor before funding can be drawn from KfW¹¹⁷.

Current programmes support both single measures (wall insulation, loft insulation, floor insulation, window replacement / refurbishment, installation of ventilation, replacement of heating systems) and a series of packages, detailed in Table 10, below.

Table 10: Packages of measures supported

Package	Measures
0	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Replacement of central-heating boiler • Retrofitted insulation of the roof • Retrofitted insulation on exterior walls
2	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Replacement of central-heating boiler • Change of heating energy carrier • Replacement of existing windows

¹¹⁶ Tenure split: owner occupiers 40.3%, private landlords 36.6%, others 22.7%. Loans split: owner occupiers 40.6%, private landlords 32.5%, others 26.8% (source Pfliegner et al, 2012)

¹¹⁷ This differs from earlier programmes, where only a minority of plans had to be verified.

Package	Measures
4	<ul style="list-style-type: none"> A combination of measures from package 0 to 3 Proof of a 40kg reduction of CO2 emissions per m2 floor area and year through calculations by an accredited energy advisor
5	<ul style="list-style-type: none"> 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 <p>Or</p> <ul style="list-style-type: none"> 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)

Additional elements of the offer include redemption-free start up years and off-schedule repayments at no extra cost. Money must be drawn down from KfW within 12 months of the loan being approved (although extensions to 24 months are possible) and at least part of the funding must be spent on measures within three months of the funding being released.

Maximum loan values under the CO₂ Building Rehabilitation Programme were:

- for packages 0 to 3, €250 (\$263) per m² floor space
- for package 4, €100 (\$105) or €150 (\$158) per m² floor space, depending on the carbon savings achieved
- for package 5, €80 (\$84.23) per m² floor space

Finance and funding

Offers to home owners comprise low interest rate, long term loans, and a range of subsidies linked to the energy performance of the refurbished / new building. The loan can cover expenses related to the main investment, such as architects’ fees or energy advice. Home owners who do not require a loan can still apply for subsidies if their refurbishment will achieve the required standard of energy efficiency.

Under the CO₂ Reduction Programme in 1996, the average loan per dwelling was €8,317. Under the CO₂ Building Rehabilitation Programme in 2001, the average loan per dwelling was €20,643 (\$25,500).

Under the CO₂ Building Rehabilitation Programme, the interest rate was 1.3% for a 20 year loan and 1.6% for a 30 year loan. In September 2011, the interest rate was 1%, fixed for 10 years.

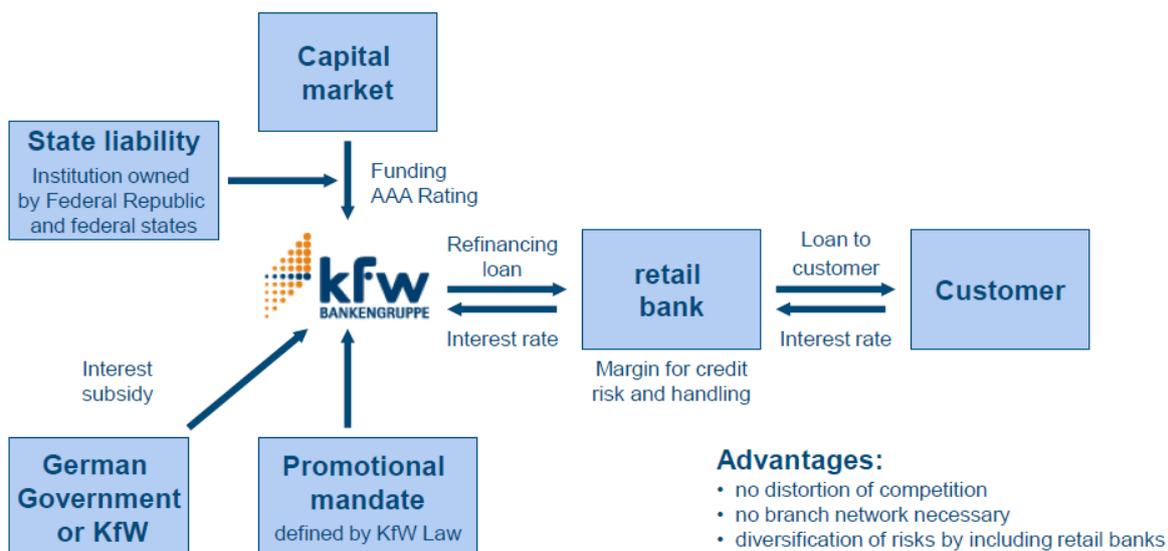


Figure 10: KfW funding structure (Gumb, 2012)

Subsidies provided under the programme are linked to energy efficiency standards set out in the German Energy Conservation Ordinance (EnEV)¹¹⁸. These are defined as a percentage of the loan that does not have to be repaid. The subsidies are available to everyone who takes out a loan; they are not linked to the applicant's income.

Subsidies under the CO₂ Building Rehabilitation Programme were initially set at 20% of the loan value for refurbishments that brought buildings to the then level of the EnEV for new buildings. In 2004, this was reduced to 15%.

Since 2006, the level of subsidy has been linked to a series of levels of energy efficiency achieved. These are expressed in terms of the energy use of the dwelling compared to that of a new dwelling meeting the EnEV standard: a house meeting the standard would be referred to as an Effizienzhaus-100 (Efficiency-House-100); one using 15% more energy would be an Effizienzhaus-115; one using 20% less energy would be an Effizienzhaus-80, and so on. A series of subsidies operated between 2006 and 2009, and a new series has been in place since 2010. These are both detailed in Table 11, below.

All these categories of subsidy are available for refurbishment projects; new homes have to achieve at least an Effizienzhaus-85 standard to be eligible.

KfW sources the majority of funding for its loan commitments from the capital markets. The Federal Government guarantees all its commitments and hence it has an AAA credit rating and the ability to secure the finance at low interest rates for high volume, long-maturity schemes. Federal funds are used to further reduce interest rates and provide subsidies¹¹⁹.

¹¹⁸ People can still receive low interest loans without the subsidies if they implement measures that do not achieve the required standard of energy efficiency.

¹¹⁹ Initially this funding came from post-war reconstruction funds, and so the scheme may only be replicable where there

Table 11: Subsidy levels

Year	Standard	Subsidy
2006 – 2009	Effizienzhaus-70	17.5% (max. €8,750; \$11,600)
	Effizienzhaus-100	10% (max. €5,000; \$6,600)
	Measures achieving 'considerable savings' (in homes built before 1995)	5% (max. €2,500; \$3,300)
2010 - present	Effizienzhaus-55	17.5%
	Effizienzhaus-70	15%
	Effizienzhaus-85	12.5%
	Effizienzhaus-100	10%
	Effizienzhaus-115	7.5%

The level of Federal funding has varied throughout the programmes' lifetime: in 2000 the government initially allocated €200 million (\$242.4 million) to cover the period to the end of 2003, but this budget was used up within the first year. Subsequently funding levels increased and, following the policy decision to aim for a doubling of the energy efficiency refurbishment rate, housing funds from Government sat at around €1.5 billion per year¹²⁰ (around \$2 billion). In 2010 €0.8 billion was allocated by the Government to KfW specifically for energy programmes¹²¹ (\$1.1 billion). In the past the funding has come from general Federal Funds, but in future it will come from the Energy and Climate Fund (which collects carbon certificate revenues and power plant duties).

is a large amount of funding available for infrastructure investment.

¹²⁰ Dorendorf, 2013

¹²¹ Novikova 2013 (ECEEE)

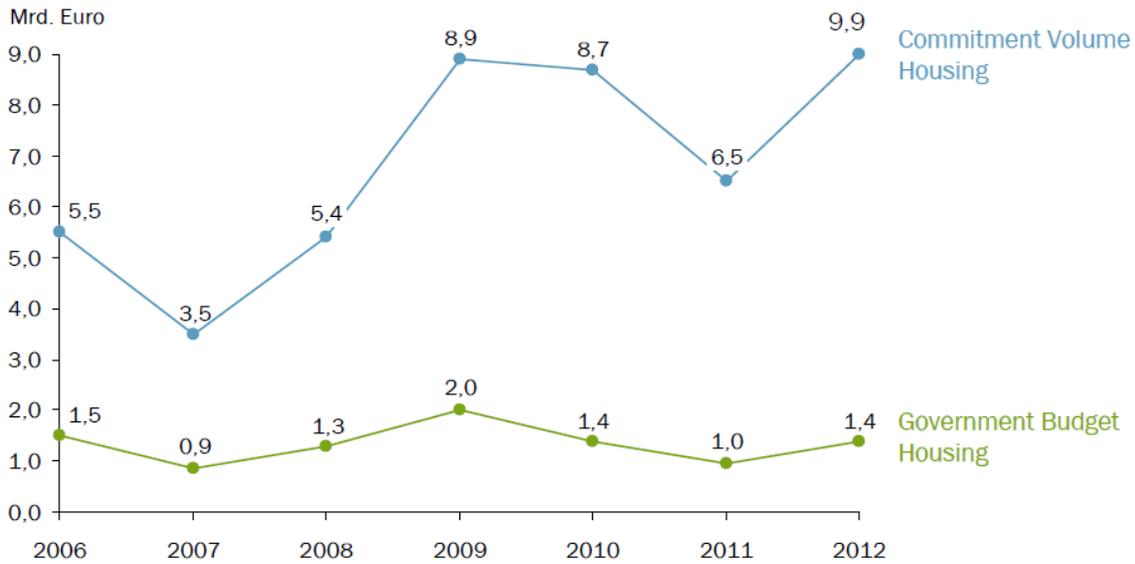


Figure 11: KfW commitments since 2006 (million Euro) (Dorendorf, 2013)

Although KfW funds the loans and integrates the Federal Government-provided interest rate reduction and other subsidies, on-lending is through commercial banks. Hence there is no distortion of competition and no need for a branch network for KfW. The commercial banks bear the risk of default¹²² (there is no legal relationship between the final recipient and KfW), but are allowed to charge an additional interest rate premium that reflects both their administrative costs and these risks. This is capped, generally at 0.75% per year for households.

The recipient guarantees the loan repayment through a secondary land charge on the property. The primary mortgage on the property takes precedence over this and the loan to value ratio of the property (i.e. the borrower’s collateral) is irrelevant to the decision to grant the loan. However, the loan is dependent on the borrower’s credit rating.

Marketing and engagement

Germany’s banks, building societies and credit unions market the scheme to property owners, often when the latter are seeking finance for general property refurbishment.

Supporting this are energy efficiency campaigns run by DENA (the German Energy Agency), and a range of KfW promotional activities including KfW awards, information campaigns and a KfW academy to train business partners.

In addition to defining the framework for subsidies, the KfW-Effizienzhaus is used as a brand. It offers a consistent standard, defined by DENA, has energy auditor approval, and also translates complicated energy efficiency regulation into an easy to understand quality mark.



Figure 12: The Effizienzhaus mark and certificate

¹²² For commercial sector loans, KfW does offer the banks some partial exemption from liability

Results

There is little published information about the monitoring and evaluation mechanisms used to track the performance of the programme, other than the requirement for energy assessments to support provision of subsidies. Most of the information about the scheme comes from sources within KfW and the independent evaluations that have been carried out seem to be based on a combination of data from KfW and modelling of impacts on buildings energy use. The key concern about the reported effectiveness of the programme seems to be around the treatment of deadweight / free-ridership: it appears that this is not taken into account in any reporting of impacts, despite some commentators suggesting that it could be as high as 30 to 50 per cent.

Take-up

There are no comprehensive published data on the overall level of take-up across all the schemes that have operated since 1996. However, KfW figures show that around 2.1 million homes had energy efficiency improvement work funded through KfW loans between 2001 and 2011. There are approximately 40 million dwellings in Germany (2010) so this is 5.3% of homes. It is likely that the volume is higher in the later years of this period, as subsidies have been introduced. This assumption is supported by a report of financed measures in 2010 in 868,000 existing properties and 50 per cent of new homes. Following a reduction in government funding, the anticipated level of activity in 2012 was around 300,000 to 400,000 properties.

There are no surveys that record the level of public familiarity with the programme. The entire budget is used each year, which may suggest that familiarity is high (or that commercial banks promote the scheme well) but there is no assessment of the level of latent demand that could be met with higher funding.

Energy impacts

There is no single figure for the overall impact of the programmes to date on energy use. However, there are estimates of the impact of the CO₂ Reduction Programme and the CO₂ Building Rehabilitation Programme up to 2004: the former is estimated to have saved 28.4PJ and the latter 16.6PJ. Note that neither of these figures includes any adjustment for deadweight.

Other impacts

Two different evaluations of the programmes operating between 2003 and 2005 suggest annual carbon savings from the programme that range from 50,000t to 500,000t. The disparity between these figures is not explained.

KfW's own figures suggest a carbon saving from the programmes in 2006-2009 in the region of 3 million tonnes per year, suggesting that the 500,000t figure above is perhaps more likely. Another estimate suggests that, on average, buildings that benefit from energy efficiency improvements under the programme achieve reductions in carbon emissions of 59%.

There are various estimates of the programme's impact on employment, ranging in recent years between 200,000 and 300,000 jobs created or protected each year. Largely as a result of this impact on employment combined with the purchase of energy efficiency measures themselves, the programmes are thought to have resulted in five times as much revenue for the government as it cost in terms of public subsidies. Note that these employment and government revenue figures should be treated with caution as they do not take into account deadweight effects

Strengths, weaknesses and lessons

The programmes are designed to overcome high initial investment cost and long payback period barriers, and also the lack of awareness of the impact of renovation in energy consumption and about the technical options available.

Key strengths of the programme are:

- The structure of incentives that encourages deep retrofits, with subsidies increasing with the level of energy efficiency attained
- The harnessing of existing refurbishment levels by adding energy efficiency into normal refurbishment activity
- The fact that the programme is comprehensive, since almost all domestic buildings can be eligible for the subsidies
- The existence of additional regional and local subsidies makes the overall picture very complex, but does ensure that offers of varying additional attractiveness are available in many places
- The KfW-Effizienzhaus brand creates visibility and transparency.

Potential weaknesses include:

- The changes in the incentives on offer, linked to take up of the budget: this is potentially confusing for customers
- Under the original programmes that supported individual measures and not packages, a large potential for improvement was not accessed: perhaps only around 1/3 of the available potential in the buildings concerned was actually achieved.

The reputation of KfW in Germany is based on its centrality to post-war reconstruction efforts. This situation is not replicated anywhere else, and hence caution is needed when considering transferring elements of the programme to other countries. Also, Germany now is a highly regulated social democracy with a high level of support for action on climate change; a situation which may in part be driving the relatively high level of uptake of the incentives.

Levels of core funding have been inconsistent and far lower than the €5 billion (\$7.4 billion) annually that the German national energy agency estimates that KfW needs to ensure that 2020 energy and climate objectives are met. Although demand is sufficient for the current budget to be spent, it might not be at the level

needed to meet these policy goals. KfW's budget is exposed to political trends as much as any central government programme; achieving budgetary stability will be important to the future of the programme. The case for doing so may well be strengthened by the finding that in 2011, for every €1 of public money spent on the energy efficiency programmes, over €15 were invested in construction and retrofit, and more than €4 went back to the public finances in taxes and savings – and that the positive leveraging effect of the programmes has been increasing¹²³.

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China's ESCO Loan Guarantee Programme / World Bank Second China Energy Conservation Project

Overview and Goals

A loan guarantee programme to support the developing Chinese ESCO sector.

The aim of the Programme, set up in 2003 (and which ran until 2010), was to enable ESCOs to access finance through regular commercial banking channels, in recognition of the large role ESCOs can play to capture China's considerable commercially viable energy saving potential in businesses. The wider context is the Chinese government's goal, established in 2004, of reducing China's energy intensity by 20% by 2020.

Institutional structures

The main stakeholders are the ESCOs themselves, China's main ESCO trade body – the EMCA, the state-owned loan guarantee company – I&G¹²⁴, China's commercial financial institutions, the National Development and Reform Commission, the Ministry of Finance, and the World Bank.

Measures and recipients

The primary target audience is China's burgeoning and gradually maturing ESCO market. The secondary, but still essential, audience is China's commercial banking sector. To some extent, I&G – the national loan guarantee company – is also a target, insofar as it is developing new capabilities to support lending specifically to the ESCO sector.

All buildings, processes and measures are potentially applicable – it simply depends on who the ESCOs' targeted customers' are and what their energy saving opportunities are. The bulk of the ESCOs' work takes place in the commercial, public, industrial and power sectors (the latter by deploying demand-side management programmes).

The ESCOs' offers will vary considerably according to their targeted clients' line of business and size. The central offer of the Programme is to provide loan guarantees of up to 90% to support and facilitate lending to ESCOs.



Figure 13: EMCA's 2010 summit

The EMCA, the main ESCO trade body in China, was set up under the auspices of the Programme. It is the main agent for accumulating and disseminating knowledge and expertise about ESCOs, and the investment opportunities they identify, to China's banking sector and I&G. It also exists to educate its members about accessing finance, particularly to raise awareness of the Loan Guarantee Programme. Specifically, by working closely with I&G, it provides the main link between lending institutions and ESCOs.

Finance and funding

\$26 million (\$32.4 million in 2012 terms) has been provided by the Global Environment Facility (GEF). Of this, \$22 million (\$27.5 million in 2012 terms) is funding delivered in four tranches into a trust fund held by the Ministry of Finance. I&G can issue (up to) 90% loan guarantees backed by the trust fund, and replenish the fund using guarantee fees and any subrogated (i.e. where rights are transferred) guarantee recoveries. I&G's management costs for the Programme, which are linked to the volume of loan guarantees issued, are withdrawn from the fund.

¹²⁴ China National Investment and Guaranty Co.

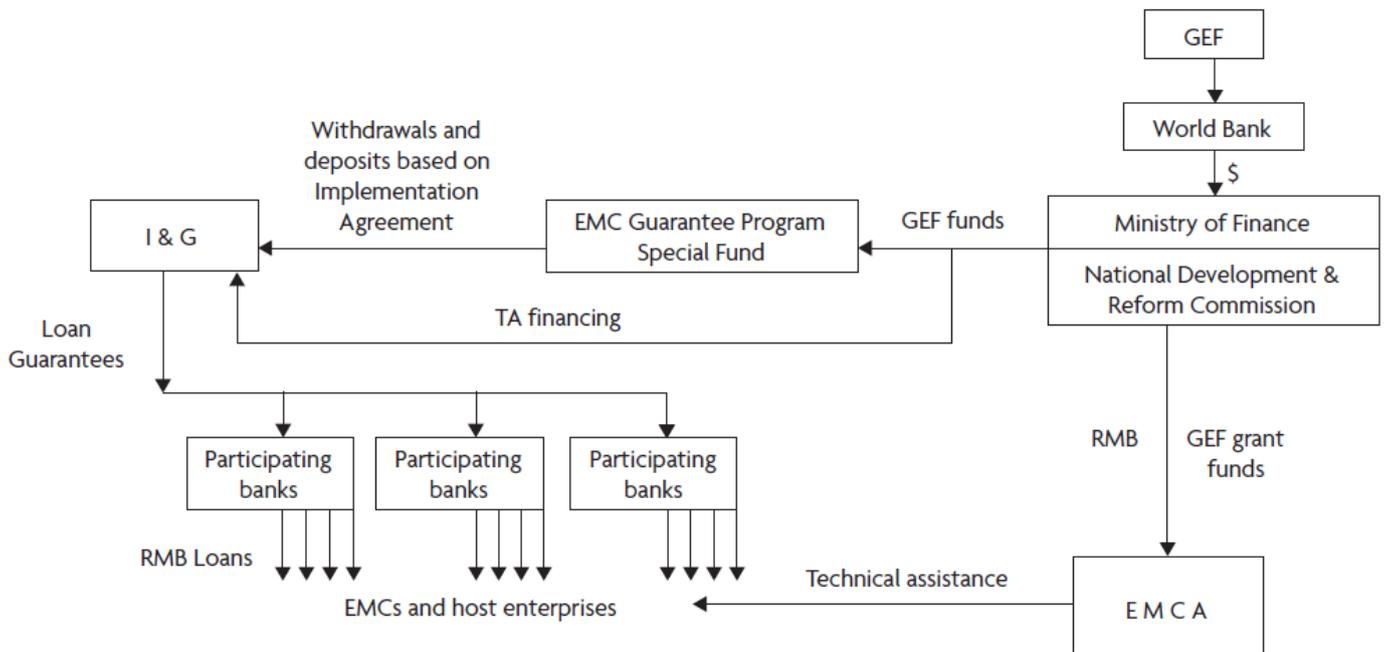


Figure 14: Structure of loan guarantee programme (Taylor et al, 2008)

As I&G is owned by the state, this effectively means that the government underwrites lending to ESCOs. As the energy saving potentials are considered to be very large, loan guarantees issued typically only last between one to three years. This enables the fund to revolve quickly, and is intended to further enhance its credibility.

Funding has also been provided by DfID to set up EMCA, and there has been co-commitment of \$255 million (\$318 million in 2012 terms) (the amount invested by ESCOs in projects for which they accessed loan guarantees).

Results

Monitoring was conducted by I&G, and evaluation by the World Bank.

In its first three years to 2006, the Programme issued 85 ESCO loan guarantees worth \$31.1 million (\$36.6 million in 2012 terms), which translated into commercial loans issued by 11 separate banks worth \$35.6 million (\$41.9 million in 2012 terms).

The 29 ESCOs taking out these loans have invested \$57.2 million (\$67.2 million in 2012 terms) in capturing their clients’ energy saving potential. These ESCOs represent half the number of companies active in energy performance contracting at the time. Total energy efficiency investment by the sector was estimated at \$280 million in 2006 (\$318.9 million in 2012 terms). A year later, total investment amounted to \$1.03 billion. By late 2010, the number of ESCOs registered with the government was 461, with nearly as many again still having registration applications pending¹²⁵. EMCA’s membership at this time was 560 ESCOs. According to the EMCA, the size of the ESCO market in 2010 was close to \$13 billion (\$13.7 billion in 2012 terms), comprising \$4.2 billion (\$4.4 billion in 2012 terms) of energy efficiency investments.

The investment in 2006 of \$280 million is estimated to have resulted in savings of 21 Mtoe over the course of the projects’ lifetimes¹²⁶. In 2007, projects initiated in that

¹²⁵ The government’s registration / accreditation framework was set up in 2009.

¹²⁶ (Xiaoliang, Lin, and Taylor 2011)

year were to save 53 Mtoe over their lifetime. Although formal evaluation has not yet been completed, total lifetime carbon savings accumulated via the Second China Energy Conservation project are expected to be 84 MtCO₂.

Strengths, weaknesses and lessons

It would appear that the bulk of investment by ESCOs is occurring without the support of the Loan Guarantee Programme. In 2006, the investment by ESCOs who accessed loan guarantees constituted 20% of the sector's total – despite the fact that the number of ESCOs supported represented half the number of active companies. This suggests that those seeking loan guarantees are the smaller players in the market. Indeed, I&G has been the first contact for accessing finance for the majority of active ESCOs. As these have matured, they have become more able to source finance without loan guarantees (and the additional costs these entail). This maturation is exactly the object of the exercise. By 2007, the energy efficiency investments by the ESCO sector in China had far exceeded (by a factor of 15) goals set by the World Bank's Second China Energy Conservation Project. Energy savings exceeded targets for that year by a factor of eight, and carbon saving targets were exceeded by a factor of nine.

The main barrier faced by ESCOs was the relative novelty of their business model in China. This meant that banks would not usually lend to them, and what little ESCO activity there was, was limited to the few who could access finance via private equity and strategic partnerships. Even so, there remained difficulties on the side of the ESCOs' clients, namely: their unfamiliarity with energy performance contracting models; and simultaneously their recognition that the ESCOs were not astute at accessing, or able to access, commercial finance. These issues also posed a barrier to the growth of the ESCO market.

Difficulties with accessing finance have not been unique to ESCOs – it has been true of many business sectors in China. Until mid-2005, banks' commercial interest rates were fixed within certain limits. This led banks to pursue low-risk debt portfolios, as they were unable to charge higher interest rates, including to ESCOs, to reflect the higher risk of the relatively unknown. This is where state loan guarantee companies, such as I&G, came in: to facilitate the financing of new business sectors and opportunities – often in pursuit of public policy goals. What has been unique to the ESCO Loan Guarantee Programme is the careful tailoring of loan guarantees to ESCOs' needs, enabled and facilitated by the EMCA's role in building ESCOs' borrowing capabilities, as well as its role in developing I&G's institutional capability to understand the ESCO sector. Given that loan guarantees have only existed in China since 1993, the role of the EMCA is likely to have been absolutely pivotal in making the Programme a success – given that it was set up at a time when the China's overall track record of loan guarantees was still quite short.

The World Bank's collaboration with the Chinese government and I&G served only to kick-start and accelerate the growth of the ESCO market. Given the very large energy saving potentials in the economy, its exponential growth is not surprising, and is of course not down to the Loan Guarantee Programme alone. Government support for ESCOs has been continuous, and has included tax breaks, regulations governing energy performance contracts, and an accreditation framework. The Programme's lasting legacy has been to embed the role and growing importance of ESCOs in China's economy in the institutions it engaged with over seven years.

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Palm Desert Energy Independence Program, USA

Overview and Goals

Palm Desert Energy Independence Program is one of a number of ‘Property Assessed Clean Energy’ Schemes implemented in the United States. Under these schemes, local authorities offer up front financing to eligible property owners to fund energy efficiency measures, and in some cases also water conservation measures and renewable energy systems.

The Palm Desert scheme is administered by the City’s Office of Energy Management and has provided over \$6 million in loans to homeowners since its inception in 2008. Loans start at \$5,000, with a maximum of \$100,000 and an interest rate of 7%. The program covers a wide range of energy efficiency and solar technologies.

The Energy Independence Program is designed to save property owners money, increase their energy security, help to tackle California power grid issues and contribute to national security and carbon emissions reduction goals. This is consistent with the City’s mission to help property owners invest in measures that will

support ‘the long-term health of the local, state and national economy and the global environment’ and supports its goal ‘to reduce electric and natural gas energy consumption by 30% within 5 years’ (2007-2011)¹²⁷. It also contributes to the California State commitment to return carbon emissions to 1990 levels by 2020.

The program also aims to test this relatively new means of funding energy efficiency investment, and to support local economic development by increasing local reinvestment.

Institutional structures

Most US States allow cities and counties to create special assessment districts. These enable bonds to be issued and repaid through property tax assessments. The finance has traditionally been used to fund physical improvements in the district such as street lighting. PACE schemes extend this mechanism to cover energy improvements in individual properties.

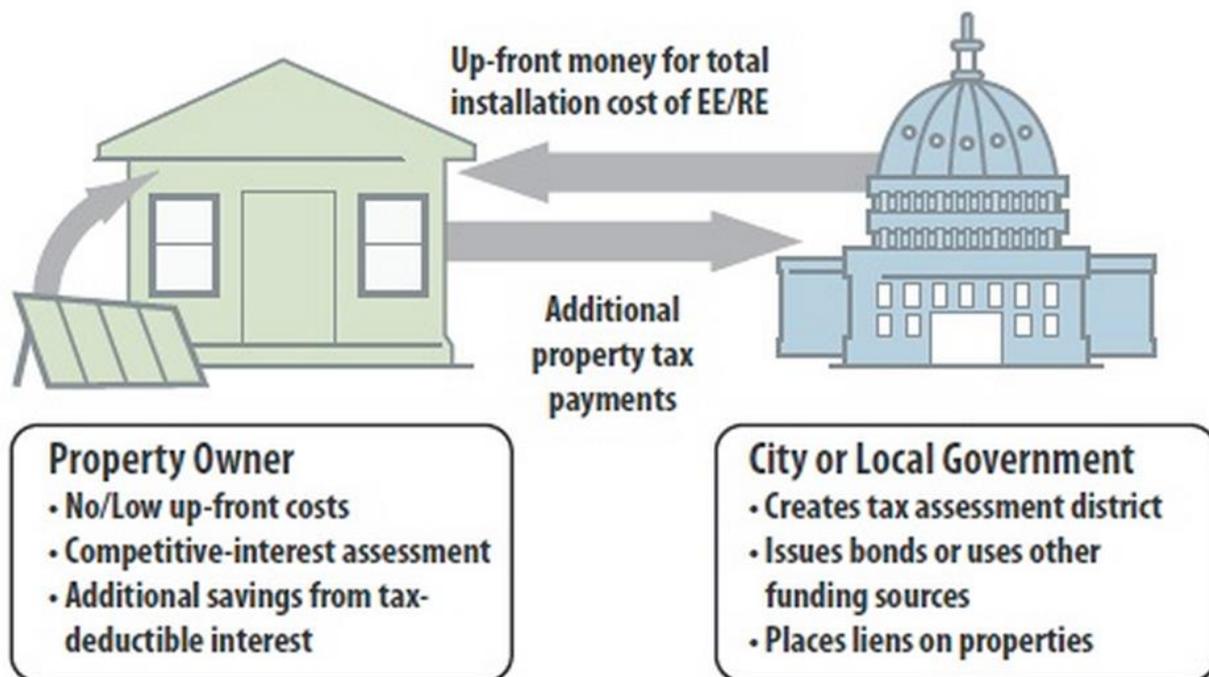


Figure 15: Basic PACE model (<https://financere.nrel.gov>)

¹²⁷ (P. Conlon 2008)

PACE schemes were first developed and introduced by the City of Berkeley, California in 2007. The first scheme funded residential solar installations. In 2008, state legislation in California¹²⁸ was introduced that authorised cities and counties to establish PACE style programmes. This legislation was based on the principle that such programmes would serve a public purpose and hence local authorities had the authority to provide the finance. Palm Desert City was the first authority to formally resolve to establish this type of programme in response to this State legislation.

National guidelines for pilot PACE programmes were released in May 2010¹²⁹ covering issues such as safeguards for mortgage lenders, homeowners and others.

The Palm Desert PACE programme is administered by the City's Office of Energy Management. This office is responsible within the programme for community outreach, energy surveys, advising property owners, processing loan applications, managing and tracking the funds available for the loans, monitoring individual and total energy conservation and integrating the Energy Independence Program with a pre-existing rebate programme, 'Set to Save'.

Benefits of PACE programmes for property owners include lower fuel bills, increased comfort and indoor air quality, lower carbon footprint and the potential for increased property value. For municipalities the benefits can include contribution to meeting greenhouse gas reduction targets and local job creation. Mortgage lenders may see benefit in PACE programmes because reduced utility bills mean more money available to repay mortgage loans and hence a lower likelihood of default (if the measures invested in result in savings larger than the repayment level). Also, any increase in property value following the funded

improvements means an increase in the collateral set against the mortgage.

Measures and recipients

Target audience

PACE funding is only available to property owners, so tenants in rental properties cannot access the fund directly, although they may be able to reach agreement with their landlords. Since renters tend to be lower-income households, this is a barrier to participation for some of those who would benefit most from fuel bill reductions. The loans are also not available for properties that do not pay property taxes, so government entities and some non-profit organisations are excluded.

The maximum loan term cannot exceed the useful life of the measures. There are also two other eligibility criteria that must be met under the Palm Desert programme:

- *Value to lien ratio* – the value of the property must be at least 10 times the combined value of the EIP loan and any other liens on the property that result in a special tax, special assessment or any other contractual assessment (excluding the primary mortgage).
- *Total annual property taxes and assessments* – the total amount of all property taxes and assessments must not exceed 5% of the value of the property (which can of course be highly variable)

PACE finance may be particularly well suited to property owners who have a good history of property tax repayment but issues with their credit rating. Property owners with good credit ratings are more able to access other, cheaper sources of finance for energy improvements.

A minimum of \$1.25 million (\$1.3 million in 2012 terms) of the initial \$2.5 million (\$2.7 million in 2012 terms) loan fund was initially reserved for residential property owners. Similarly, half of the 2010 \$6 million fund (\$6.3 million in 2012 terms) is reserved for energy efficiency upgrades and retrofits.

¹²⁸ Assembly Bill 811

¹²⁹ USDOE, Guidelines for Pilot PACE financing programs

Buildings and measures

EIP loans are specifically for energy measures; they cannot be used to finance broader refurbishment work. The programme cannot finance non-permanent measures such as lamps and appliances as these could be removed when the current owner leaves the property. Although primarily for refurbishment, EIP loans can be used by owners of new build properties to add energy measures after they have bought the property.

There are three categories of improvement that can be financed: efficiency measures, solar systems and custom measures. These are described in more detail in Table 12, below.

Table 12: Measures that can be financed

Category	Measures
Energy Efficiency	<p>A wide range of proven energy efficiency measures that meet specified efficiency standards (Energy Star), and those eligible for rebates under the Set to Save programme. This includes:</p> <ul style="list-style-type: none"> • Attic and wall insulation • Light fixtures • Reflective roofs and coatings • Windows, doors and skylights • Pool circulating pumps (variable flow, or multi-speed with controllers) • Natural gas pool heaters with a thermal efficiency of at least 84%
Solar systems	<ul style="list-style-type: none"> • PV systems • Solar thermal systems
Custom measures¹³⁰	<p>Emerging technologies (renewables and energy efficiency measures), evaluated and approved on a case by case basis by the Office of Energy Management, such as:</p> <ul style="list-style-type: none"> • Building Energy Management controls • Irrigation pumps and controls • Lighting controls • Natural gas fuel cells

Loans can be used to finance work under a combination of measure categories (e.g. energy efficiency plus solar).

The Office of Energy Management offers on-site energy surveys of properties, during which appropriate energy efficiency and renewable energy measures are reviewed with the property owner, together with the EIP finance offer. These surveys are recommended, but are not a requirement for accessing the funding. The energy surveys vary in cost but can be included in the EIP loan.

Loans cover the costs of equipment and installation, where installation can include elements such as architects fees and permits. The property owner is free to select a qualified contractor to carry out the work¹³¹, but the Office of Energy Management decides whether or not the equipment and installation costs quoted are reasonable, based on historical cost data, and may require alternative quotes. The amount of the loan may be restricted to the costs that the OEM considers reasonable, but the property owner will nonetheless be free to select their preferred contractor.

Note that in most PACE programmes, including Palm Desert, there is no requirement for the savings from measures to exceed the repayment level through the property assessment. Therefore, it is possible that fuel bills plus repayments will together be greater than the property’s fuel bills before the energy efficiency investment. However, in response to mortgage lender concerns, there is a general move towards restricting PACE programme financing to those measures that generate savings that are higher than the loan repayment level, hence improving the property owner’s ability to meet mortgage repayments.

Finance and Funding

Palm Desert city council seed funded the Energy Independence Program Loan Fund in 2008 with

¹³⁰ As Custom measures become Energy Star certified, they will move to the ‘energy efficiency’ track.

¹³¹ Property owners may choose to install the measures themselves, but in this case the loan cannot be used to cover labour costs.

\$2.5 million (\$2.7 million in 2012 terms) from its General Fund, followed by a further \$2.5 million from a Redevelopment Agency bond. This funding was all allocated and in 2010 a further \$6 million (\$6.3 million in 2012 terms) was made available from the sale of lease revenue bonds to a bank. Repayments may be used to fund further loans; as a reserve fund to insure bond issues against non-repayment; to cover scheme administration costs; or to repay the initial General Fund monies. The maximum amount loaned out at any one time is currently set at \$25 million, although this could be increased should the council wish.

The available loan amount starts from a minimum of \$5,000. There is a maximum loan amount of \$100,000, but any loan above \$60,000 must be approved by the City Manager. The annual interest rate is 7% and fixed for the duration.

There is a \$360 fee for procurement of a title report and title insurance, which can be included in the loan.

Loan recipients can also access rebates available under council and energy utility programmes to support a range of efficiency measures.

Loans from the fund are repaid through an assessment levied on the property, payable in semi-annual instalments through the property tax bill. The term of the loan in the Palm Desert scheme is usually limited to the useful life of the measures installed, although there is the possibility for property owners to present a case for a longer term (but agreement is at the city's discretion). In some PACE schemes, the loan term can be linked to the life of the bond or other mechanism used in the provision of the finance. A typical maximum loan term is 20 years. The obligation to repay the loan is attached to the property where the energy efficiency measures have been installed, not to the property owner, so the liability transfers to a new owner when the property is sold.

Mortgage lenders may wish to purchase PACE bonds, as this enables them to offer a new 'green' financial product to their customers.

The PACE lien on the property is superior to the first mortgage on the property. This makes it an asset class that is attractive to private investors and hence the PACE model can attract private sector capital. Mortgage lenders have concerns about this situation and in 2010 the Federal Housing Finance Agency (FHFA) determined that PACE loans were a significant risk to mortgage lenders and secondary market entities and called for PACE programmes to be paused. Following this, Fannie Mae and Freddie Mac¹³² instructed lenders that they would not purchase mortgages on properties with outstanding PACE obligations. As a result, most PACE programmes were suspended and many people with PACE obligations were required to repay them in full before selling or refinancing a property. Some authorities (e.g. Sonoma County) have re-started their programmes, simply requiring participants to sign a disclosure related to this issue, and a number of authorities in California, including Palm Desert and Sonoma County, are involved in legal proceedings to attempt to overturn this situation.

The local government staff time required to administer the programme needs to be taken into account. Estimates suggest that in Palm Desert the annual cost for this is about \$90,000 (approx. 1.5 full time equivalents in terms of employment).

The City's costs for running the programme may be recovered through e.g. differences between bond rates and loan interest rates: there will be no fixed rate administrative charge paid by those taking out loans. However, an assessment collection cost will be charged through the property tax bill.

¹³² Fannie Mae and Freddie Mac are government sponsored organisations that purchase a very large portion of single family home mortgages

Marketing and engagement

The Office of Energy Management is responsible for marketing the scheme. Primary marketing is the City's monthly free newsletter, the Brightside Newsletter.

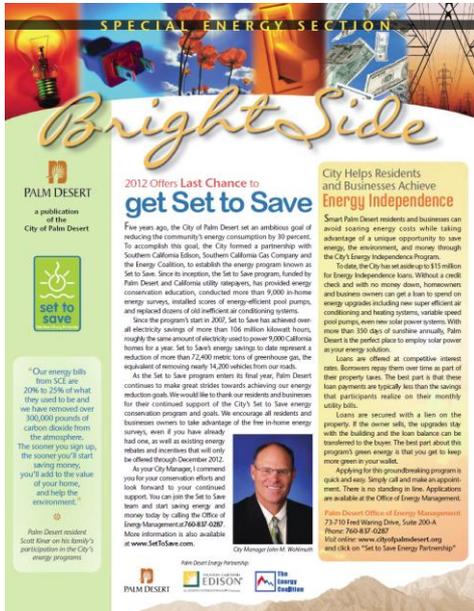


Figure 16: Cover of 2012 special edition of Brightside newsletter

Results

Property owners are required to agree to sharing historical and current energy use information for programme evaluation purposes.

Deason reported that the Energy Independence Program had loaned \$5.5 million to finance improvements in 240 homes¹³³.

An independent assessment of a similar programme, the PACE programme in Boulder, Colorado¹³⁴, estimated the impact of its activities in 2009 as follows:

- 85 short term jobs in Boulder County and a further 41 short-term jobs in other parts of Colorado
- \$7 million (\$7.5 million in 2012 terms) additional earnings and \$20 million (\$21.4 million in 2012 terms) additional economic activity across the State

- In addition to this, the impacts of significant energy retrofit spending that was stimulated by, but not funded through, the programme. This has not been quantified, but is estimated at around 20% or more of the amount funded by the programme.

Farrell notes that the net job creation impacts of PACE programmes will be much greater than for conventional public sector job creation programmes, because they do not rely on public sector funding that would have to be diverted from spending elsewhere¹³⁵.

Strengths, weaknesses and lessons

The aim of the Palm Desert programme is to provide an option for property owners who would otherwise be unwilling or unable to finance energy efficiency and renewable energy measures. The fact that the loan is tied to the property means that the barrier caused by a lack of commitment to spending on a home when the owner may sell before the investment has paid for is addressed.

One of the main strengths of PACE programmes may be the extent to which they bring together various streams of energy action into a comprehensive local programme: most other programmes fund or finance action amongst a specific group (e.g. low income weatherization programmes) or for specific fuels (e.g. utility electricity demand reduction programmes). In this way, they may be a first step towards comprehensive energy planning at the local level.

The existence of PACE financing makes it easier for property owners to comply with energy related legislation, and may therefore reduce opposition to such legislation.

The successes of PACE programmes to date do suggest that there is some level of demand for financing energy efficiency investment with long-term, relatively high interest rate loans. However, the overall level of demand for such

¹³³ (Deason 2012)

¹³⁴ Goldberg *et al*, 2011

¹³⁵ (Farrell 2010)

finance cannot be implied from programmes that have operated to date at a very small scale.

The long term financing available under PACE does enable deep retrofits and the maximisation of a building's energy efficiency. However, current PACE programmes do not demand deep retrofits and hence an opportunity may be being missed: the Palm Desert scheme sets a minimum loan level that is higher than those in Boulder County, Sonoma County and Babylon, but it is still relatively low (\$5,000).

Experience to date suggests that there may be significant programme cost savings through aggregation (e.g. to the county level) since there are administrative efficiencies linked to running larger-scale programmes. Aggregation can also achieve lower borrowing costs and hence offers the potential for lower interest rates.

The transferability of PACE programmes depends on the power of local authorities to provide loans and to collect repayments through property taxation, and also on the attitude of mortgage lenders towards properties with this type of charge on them.

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*Basic PACE Model diagram source:
<https://financere.nrel.gov/finance/content/funding-sources-property-assessed-clean-energy-pace-programs>*

Flat 35 Mortgage Programme, Japan

Overview and Goals

The aim of Flat 35 is to help private financial institutions supply fixed rate mortgages to customers, and increase the adoption and market penetration of ‘quality’ homes in Japan. As such, the achievement of specific energy efficiency standards is one of the goals of the Flat 35 programme.

The background policy target has been to increase the share of homes reaching Japan’s latest energy efficiency standard to 50% by 2008¹³⁶, to ensure that the housing sector makes its contribution to Japan’s greenhouse gas targets under the UN FCCC.

Institutional structures

The JHF is the principal agent in the delivery of Flat 35. Its purpose is to support the delivery of Japan’s housing policy objectives, particularly with respect to housing quality – but also post-disaster reconstruction – and its main activity is the securitisation of mortgage finance.

Prior to 2007, JHF was known as the Government Housing Loan Corporation (GHLC). Unlike the JHF, the GHLC did not lend via private banks, but lent to homeowners directly (with processing work carried out by private banks). Flat 35 was introduced in 2003¹³⁷. The JHF answers to the minister of finance and the minister of land, infrastructure, transport and tourism, who set the JHF’s targets, capitalise it and cover the cost of the interest rate subsidy (see ‘Measures and recipients’ below). JHF’s running costs are recouped via its base interest rate. The JHF contracts with the majority of customer-facing financial institutions; these span city banks, regional banks, credit associations, labour banks and members of Japan’s credit federation of agricultural cooperatives¹³⁸.

What is important in the context of Japan is that there exist official voluntary energy performance standards¹³⁹, whilst the mandatory building code does not contain any

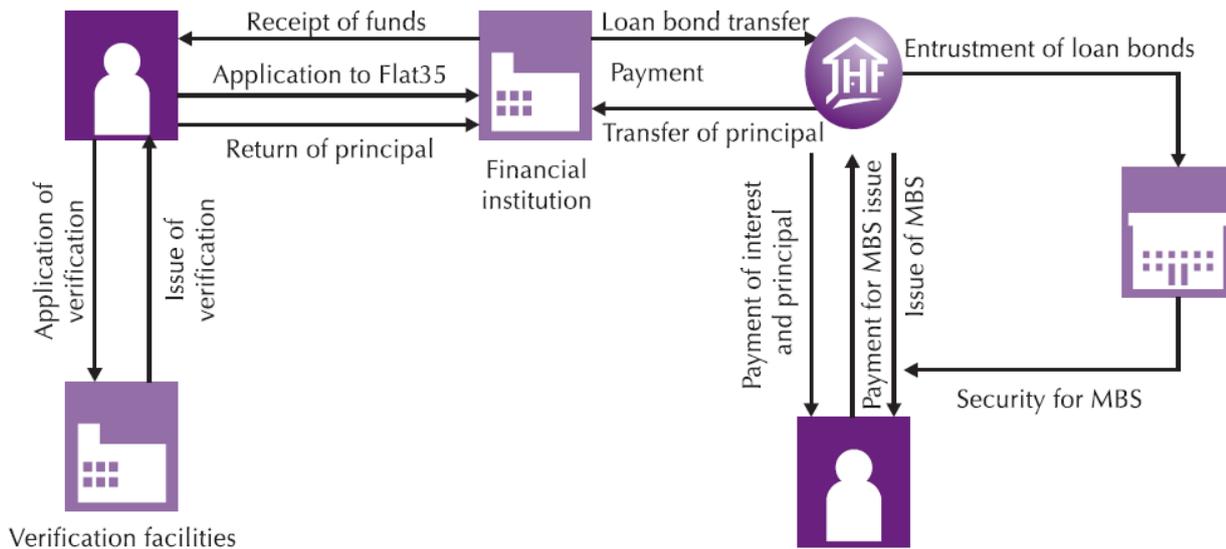


Figure 17: Flat 35 structure using mortgage backed securities (MBS) (IEA/AFD, 2008, based on JHF (2006), Disclosure Booklet: Details and features of line of business)

¹³⁶ (IEA 2008)

¹³⁷ (Yamori and Kondo 2008)

¹³⁸ (JHF unknown date)

¹³⁹ (B. Hamilton 2010) – references Japan Energy Conservation Handbook 2009

energy performance requirements. Thus, JHF has the ability to drive wider adoption of these standards by making them a prerequisite for accessing Flat 35's relatively attractive finance.

Measures and recipients

Approximately 60% of households in Japan are owner-occupiers¹⁴⁰; this is the principal target group of Flat 35. In addition, the JHF has other loan products for rental properties.

Residential buildings with floor areas less than 300m², mostly single-family homes, are a major target for Flat 35. Buildings larger than this – mostly multi-family buildings, which account for a large share of Japan's living floor area – are subject to more stringent standards and regulations¹⁴¹, but individual dwellings within a multi-family building are also one of the main markets for Flat 35. Both existing and newly-constructed homes can attract Flat 35 finance.

Flat 35 mortgages are linked to the mortgaged home achieving an overall thermal efficiency standard. It is not linked to specific measures being installed in homes¹⁴². There are currently four main standards for thermal efficiency in Japanese housing which have been linked with Flat 35 mortgages.

The basic offer of Flat 35 is a 35-year fixed rate mortgage with a relatively low rate, owing to the securitisation process described above. For owner-occupiers, as of November 2012, there are two offers linked to energy efficiency provided under the Flat 35 scheme by the JHF¹⁴³: Flat 35 and Flat 35 S. The latter has two variations – Plan A, and Plan B:

- Basic, market rate, Flat 35 mortgages are provided to customers on the condition that the home they are buying meets fundamental quality criteria regarding its minimum floor space, use, fire resistance and a basic standard of thermal efficiency –

the latter based on achieving 1980 thermal efficiency standards.

- If, in addition, the home meets one or more of four additional, more stringent, standards, then a Flat 35 S mortgage can be provided, which has a lower, government-subsidised, interest rate. The four additional standards relate to higher levels of either: earthquake resistance, accessibility, durability/flexibility, and/or energy efficiency. There are two variations of the Flat 35 S product. For each, the energy efficiency requirement is highlighted:
 - Plan A, which includes an interest rate reduction of 0.3% for the first ten years, requires homes to meet either the 'Top Runner' efficiency or 'Low Carbon Home' sustainability standard. Both these standards are more stringent than those required for...
 - ...Plan B, which includes an interest rate reduction of 0.3% for the first five years, and requires the thermal efficiency of the home to be compliant with 1999, or 'Grade 4', standards.

The various energy performance standards are explained in Table 13.



Figure 18: Illustration of standards for Flat 35 S

Finance and funding

The Japan Housing Finance Agency (JHF), an incorporated administrative agency with its capital provided by the Japanese government, acquires mortgages issued by private banks to home-owners where the homes purchased meet specific energy efficiency (or other

¹⁴⁰ (JHF 2010)

¹⁴¹ (IEA 2008);(Niimura 2013, pers. comm.)

¹⁴² (Niimura 2011)

¹⁴³ (Niimura 2013, pers. comm.)

enhanced quality) criteria. It sources the finance by issuing bonds, backed by these mortgages (i.e. mortgage-backed securities), to private investors. Bond yields are paid out to investors using the principal capital from borrowers, as well as the pre- or over-payments from borrowers – the option to pre- or over-pay without incurring fees is a key feature of Flat 35 mortgages. The mortgages are recorded on JHF's balance sheet, but are held as collateral in a trust account.

The interest rates, fixed over a period of up to 35 years, available to borrowers accessing Flat 35 mortgages are a combination of JHF's base rate plus the servicing fee of the private bank through which home-owners borrow¹⁴⁴. It is JHF's status as an incorporated administrative agency which enables it, through the bonds it issues, to access private finance at relatively low cost, and pass this low cost, but still market-rate, finance on to Flat 35 customers via private banks.

The Japanese government provided funding to capitalise JHF (GHLC at the time) with a budget of ¥10 billion (\$89.8 million) in 2005 and ¥30 billion (\$300 million) in 2006¹⁴⁵.

Marketing and engagement

As the JHF does not lend directly to home-owners, it is primarily up to private banks to market the scheme to customers. However, when the JHF was first set up in 2007, this was accompanied by a media advertising campaign to raise awareness. Presently, the JHF has a public-facing website dedicated to Flat 35 (www.flat35.com), which focuses on the different financial products the JHF backs, and provides a lot of detail about the different performance standards that need to be achieved to obtain Flat 35 mortgages.

¹⁴⁴ (Niimura 2011); (Yamori and Kondo 2008)

¹⁴⁵ (IEA 2008) – mentions: JHF (2006), *Disclosure Booklet: Details and features of line of business*.

Results

Households applying for Flat 35 loans must submit certificates which certify the required standards have been met. These are to be obtained from suitably qualified surveyors or assessors¹⁴⁶, governed by the national Performance Evaluation and Certification System for Houses (which is not specific to Flat 35-financed homes)¹⁴⁷. This system can evaluate homes on the basis of their design, during construction and/or after completion, across a range of categories, including energy performance. JHF itself reports on its activities to stakeholders formally, annually and publicly.

Take-up

The majority of loans issued under the auspices of Flat 35 go to new construction¹⁴⁸. In 2005 as well as in 2006, 60,000 households applied for Flat 35 finance¹⁴⁹, which is in the region of five to ten per cent of the mortgage finance market in those years. In earlier years (1996-2000), before the GHLC became the JHF, upwards of 200,000 homes a year were being built using its pre-Flat 35 loan products¹⁵⁰ (Flat 35 was launched in 2003). In the last three financial years for which data are available (2009 to 2011), applications for Flat 35 (including Flat 35 S) mortgages by home-buyers increased from approximately 80,000 in 2009 to nearly 150,000 in 2011. For context about the scale of take-up, new home starts by owners and new

¹⁴⁶ (Niimura 2011)

¹⁴⁷ (IEA 2008) – mentions: Matsuo (2006), "The role of indicators in policy design and best practices in Japan", presented at IEA Workshop Energy Efficiency in Buildings: Meeting the G8 Gleneagles Challenge, Paris, 27-28 November 2006

¹⁴⁸ (B. Hamilton 2010) – mentions: See IEA, "Progress With Implementing Energy Efficiency Policies in the G8" at 19, 2009. Available at http://www.iea.org/G8/docs/Efficiency_progress_g8july09.pdf. See also JHF, "Business Description" at http://www.jhf.go.jp/english/about/pdf/main_2.pdf

¹⁴⁹ (IEA 2008) – mentions: JHF (2006), *Disclosure Booklet: Details and features of line of business*.

¹⁵⁰ (IEA 2008) – based on Figure 19 on p. 66, which mentions: Source: JHF (2007b), personal communication.

homes started for sale in 2011 amounted to 544,000¹⁵¹.

The *proportion* of homes with a Flat 35 mortgage which achieve the 1999 ('Grade 4') energy standard or better (one of the prerequisites for receiving the Flat 35 S interest rate reductions) has grown significantly: it was 12%, 41% and 51% for the financial years of 2009, 2010 and 2011 respectively¹⁵².

Energy impacts

There are no specific data in addition to the above rates of take-up to indicate the energy savings achieved. However, Table 13 provides a high-level overview of the relative energy consumption and current market penetration of the different voluntary energy performance standards for Japan's homes.

Table 13: Different energy efficiency standards in Japan's homes¹⁵³

Standard	Heating / cooling requirement [kWh/m ² a]	Typical consumption per home [MWh]	Share of homes at this standard (2005)	Achieving standard gives access to...
Low Carbon Home	Approximately 10% less heating / cooling requirement than a home with 1999 fabric efficiency standard, and 2012 HVAC plus lighting and hot water efficiency standards; also requires additional sustainability measures ¹⁵⁴			Flat 35 S (Plan A)
Top Runner	Approximately 10% less heating / cooling requirement than a home with 1999 fabric efficiency standard and 2008 HVAC ¹⁵⁵ plus lighting and water efficiency standards			Flat 35 S (Plan A)
1999	128	6.1	4%	Flat 35 S (Plan B)
1992	222	8.9	14%	Flat 35
1980	286	10.8	21%	Flat 35
None	n/a	15.6	61%	Not eligible

¹⁵¹ (JHF 2012a)

¹⁵² (JHF 2012b)

¹⁵³ Adapted from (Niimura 2011)

¹⁵⁴ These include for example: home energy management systems; water saving measures; heat island reduction measures (e.g. green roofs); use of sustainable construction materials.

¹⁵⁵ Heating, ventilation and air-conditioning appliances

As mentioned before, the proportion of Flat 35 customers whose homes achieve the 1999 standard or better has been increasing; 51% in 2011.

Strengths, weaknesses and lessons

The main strength of Flat 35 is the relatively attractive long-term fixed interest rate it can offer. It is in a position to offer good rates because the JHF is able to sell high quality mortgage-backed securities at sufficient volume to achieve the low rate. It builds on this by offering government subsidised interest rates for homes achieving higher quality (including energy efficiency) standards. In addition, the extent of JHF's links with lending institutions in Japan is considerable¹⁵⁶. This is likely to be due to JHF's long-standing involvement in housing and construction, and its associated sources of finance (JHF's predecessor, the GHLC, was established in 1950 to facilitate post-war reconstruction¹⁵⁷).

The interaction between the Flat 35 programme and the fact that housing energy efficiency standards in Japan are voluntary is of particular significance. If the standards were mandatory, Flat 35 finance could not be linked to their achievement in newly constructed homes. As such, Flat 35 mortgages are a prime example of how the adoption of voluntary standards can be accelerated by the offer of preferential finance to achieve them.

Key sources

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Appendix II – Selected additional schemes and further resources

Name	Country	Type of resource	Link
Clean Energy Finance Corporation	Australia	Scheme website	http://goo.gl/q5jqB
Green Loans	Australia	Scheme website	http://goo.gl/O5zFJ
Low Carbon Australia	Australia	Scheme website	http://goo.gl/Yn6co
Sanierungscheck 2012	Austria	Information page	http://goo.gl/p82HP
FRGE Westhoek	Belgium	Information page	http://goo.gl/WlWjp
Energy Efficient mortgage loan insurance	Canada	Scheme website	http://goo.gl/qVrVB
China Utility-based Energy Efficiency finance program	China	Evaluation	http://goo.gl/m5sfc
L'éco-prêt à taux zéro	France	Scheme website	http://goo.gl/S45q2
Exoikonomo	Greece	Scheme website	http://goo.gl/B60pz
IREDA Revolving Loan Fund	India	Scheme website	http://goo.gl/KpzqF
Partial Risk Guarantee Fund for ESCOs	India	Scheme profile	http://goo.gl/N8Qve
A-Profitto	Italy	ecee paper	http://goo.gl/D9brW
Infonavit Green Mortgages	Mexico	Scheme profile	http://goo.gl/HQfVq
Green Credit Guarantee Fund	Mongolia	Scheme profile	http://goo.gl/YM4Zf
Green Loans	Netherlands	Scheme website	http://goo.gl/4VkfT
Fundo de Eficiência Energética	Portugal	Scheme website	http://goo.gl/zJXg0
Sri Lanka Renewable Energy Program	Sri Lanka	Case study	http://goo.gl/iw51H
K-Energy Saving Guarantee Program	Thailand	Scheme website	http://goo.gl/3teZD
Thai Energy Efficiency Revolving Fund	Thailand	Case study	http://goo.gl/VfuPM
PROSOL	Tunisia	Case study	http://goo.gl/nlgaW
Green Deal	United Kingdom	Government ex-ante impact assessment	http://goo.gl/VugmC
Green Investment Bank	United Kingdom	Scheme website	http://goo.gl/zQ3ug
Kirklees Recharge	United Kingdom	Case study	http://goo.gl/RKcFl
Nationwide Green Additional Borrowing	United Kingdom	Scheme website	http://goo.gl/EqP9U
RE:NEW London	United Kingdom	Rollout evaluation report	http://goo.gl/NV6HR
Clean Energy Works Oregon	USA	Consultancy report	http://goo.gl/UV3M3
Climate Smart Loan Program	USA	Scheme website	http://goo.gl/aIKyy
Colorado Energy Star Mortgage	USA	Scheme website	http://goo.gl/EGw1D
Energize Connecticut	USA	Scheme website	http://goo.gl/kC22S
Energy Efficient FHA Loans	USA	Scheme website	http://goo.gl/k1qiR
Energy Upgrade California	USA	Scheme website	http://goo.gl/fk4K8
Vermont Business Energy Conservation Loan Program	USA	Scheme website	http://goo.gl/bRDNP
Climate Investment Funds	Various	Programme website	http://goo.gl/yvH3q
Sustainable Energy Financing Facilities	Various	Programme website	http://goo.gl/Rlis2