

RENOVATION IN PRACTICE



BEST PRACTICE EXAMPLES OF VOLUNTARY AND MANDATORY INITIATIVES ACROSS EUROPE

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SUMMARY OF FINDINGS

This review of successful renovation schemes operating in EU Member States has identified the following critical success factors that should be taken into account whenever an initiative, be it voluntary or mandatory, is developed:

- **Stakeholder engagement** across the full range of participants and interested parties maximises buy-in.
- **Reliable and readily accessible expert support** and guidance helps building owners make the right renovation choice.
- **Financing** needs to be tailored to the different building owners' requirements.
- **Standardised procedures** enable replication and repeatability.
- **Operating at scale** increases the potential to reduce overall costs.
- **Focus on quality** of products as well as suitably trained installers & advisers to enhance property value through building renovation.
- **Communicate** effectively to motivate participation among interested parties.
- **Incentivise a holistic approach** where deeper renovation is the preferred, or only, option.
- **Adaptability** to the needs of different applicants means the renovation solution will have widespread acceptability.
- **Political commitment** to ambitious renovation goals provides the essential underpinning to any initiative.

Furthermore, in order to boost the scale of renovation activities, there is scope for greater use of legislative tools to require building performance improvement under certain conditions. The following are considered priority opportunities:

1. Building on Article 5 of the Energy Efficiency Directive for Member States to renovate 3% of floor area of the Central Government estate every year, the requirement should be **extended to ALL public buildings**, including hospitals and educational establishments, so that the whole public sector leads by example.
2. Buildings in the lowest energy performance classes (which are often affected by problems such as mould growth, condensation and poor indoor air quality, in addition to being hard to heat) should over time be deemed **unsuitable for occupation**. By giving advance notice (say, 10 years as in the French case), owners will have time to make the necessary improvements. Financial support should be available for those with modest means. Three cases could be considered:
 - a. **Rented buildings** – both residential and non-residential – should become subject to progressively more demanding minimum performance requirements at time of change of occupancy or renewal of tenancy.
 - b. Sale of **privately owned and occupied buildings** – both residential and non-residential – could be conditional on achieving a minimum energy performance threshold.
 - c. A minimum energy performance threshold target could be set for **all buildings** (varied according to building type) within a given time frame.
3. Residential accommodation, such as **social housing**, should meet the highest energy performance ratings within a specified timeframe in order to provide comfortable, affordable housing, particularly for households at risk of fuel poverty.
4. Any building **extension, addition or change of use** should be conditional on the improvement of the overall energy performance of the original structure.
5. **Exchanging of heating or cooling equipment, or undertaking maintenance work on the building** should be accompanied by a requirement to improve the building's energy performance and an assessment of options for the introduction of renewable energy systems.

INTRODUCTION

As governments around the world formulate their responses to the challenge of climate change while at the same time ensuring energy security and provision of affordable energy, the ability to point to replicable schemes that successfully deliver improvements across all three areas is of paramount importance. Buildings are not only the most significant consumers of energy within the European Union (collectively accounting for 40% of the total consumption) – they also represent the largest untapped potential for energy saving and, with it, a reduction in greenhouse gas emissions, according to the International Energy Agency¹.

Scaling up building renovation, notably through reducing building heat loss and providing more efficient and clean heating systems is thus a priority for the European Union (EU). It is also the only truly sustainable solution for the scourge of fuel poverty, estimated to affect as much as one in four European citizens².

Ambitiously cutting energy use in buildings would not only reduce the EU's energy import bill of over €1bn every single day of the year³ – it would also reduce peak demand and add flexibility to the grid, thereby decreasing the need for investment in generation and grid infrastructure. A recent report by Ecofys⁴ revealed that savings in peak demand for electricity could be as high as 57 GW⁵, over one-tenth of the EU's total, resulting in a saving in expenditure on power generation capacity of €89-153 billion up to 2050.

Policies and measures to improve the energy performance of Europe's building stock can and must play a leading role in addressing the triple challenge of climate change, energy security and affordable energy, yet they will also lead to other benefits. These benefits include macro-economic development, enhanced health and wellbeing, improvements in public budget as well as lower air pollution, among others. This creates a very compelling incentive to scale up Europe's building renovation activities to achieve the buildings' full potential and bring a wide range of complementary improvements to our economies, to society and to the environment.

However, the task of improving Europe's building stock is a big and challenging one, requiring a total investment in the order of €1 trillion⁶. As such, the challenge should be considered a major infrastructure project – an investment in the most important infrastructure there is, namely our homes and work places.

This report examines a number of cases, some purely voluntary and some driven by regulatory signals that illustrate many ways to stimulate the renovation market across different building sectors. The key distinction between the voluntary and the regulatory approach is whether or not the building owner has some form of legal obligation to improve the building's energy performance under a certain set of conditions. Traditionally, schemes relied on making offers, be they grants, tax incentives, preferential loans or other forms of support, in order to encourage building owners to renovate their buildings. Policy makers have, however, come to realise that a purely voluntary approach will not deliver the scale of activity warranted to accelerate change and address the triple challenge outlined above, so there is an increasing range of more progressive approaches to renovation, including "mandatory" initiatives.

¹ "Capturing the Multiple Benefits of Energy Efficiency", IEA 2014 http://www.iea.org/bookshop/475-Capturing_the_Multiple_Benefits_of_Energy_Efficiency

² "Tackling Fuel Poverty in Europe: Recommendations Guide for Policy Makers", European Fuel Poverty and Energy Efficiency Project (EPEE), 2009. <http://www.nea.org.uk/Resources/NEA/Publications/Archive/Tackling%20fuel%20poverty%20in%20Europe.pdf>

³ <https://ec.europa.eu/energy/en/topics/energy-strategy/energy-security-strategy>

⁴ "Electricity in Europe 2014", ENTSO-E, https://www.entsoe.eu/Documents/Publications/Statistics/electricity_in_europe/entsoe_electricity_in_europe_2014.pdf

⁵ "The role of energy efficient buildings in the EU's future power system", Ecofys, 2015. http://www.eurima.org/uploads/ModuleXtender/Publications/128/Ecofys_XII_Report_final_13_10_2015.pdf

⁶ "Special Report: World Energy Investment Outlook", IEA, 2014. <http://www.iea.org/publications/freepublications/publication/WEIO2014.pdf>

Among the many possible circumstances under which building owners could have some form of obligation placed on them to improve a building's energy performance, we have identified 6 cases that are already in use in one or more EU Member States:

1. Within a specific timeframe;
2. When undertaking maintenance work on the building;
3. When renting a property ;
4. At change of building use;
5. When changing a boiler;
6. In case of an extension of the building surface.

Despite the introduction of a growing number and range of these progressive regulatory approaches to renovation, the vast majority of initiatives relies largely on voluntary participation. We reviewed around 500 recent or ongoing initiatives⁷ in order to select five schemes illustrating a wide variety of approaches and solutions that are available to tackle the renovation challenge, whether in terms of scale, financing, addressing non-technical barriers, level of ambition or achievement of social objectives. They are:

- **Zero energy homes at zero upfront cost: *Stroomversnelling* (The Netherlands)** – a holistic approach where zero-energy retrofits for the existing social housing stock are delivered quickly and at no cost to the tenants.
- **Revolving loan fund: *KredEx* (Estonia)** – a revolving loan fund focused on the renovation of multi-family apartment blocks commonly found across Central and Eastern Europe.
- **Large-scale national programme incentivising deeper renovation: *KfW* (Germany)** – provides a range of incentives and support measures, including subsidies, low-interest loans, as well as planning and construction support.
- **Tackling fuel poverty at scale: *Habiter Mieux* (France)** – combining the social objective of eradicating fuel poverty with the environmental one of cutting greenhouse gas emissions.
- **The carbon and energy fund (United Kingdom)** – a dedicated service providing energy performance contracts to improve large public buildings' energy performance.

In preparing this review of renovation practices, our aim has been to highlight the elements that make them a success story in order to inspire and stimulate others to replicate these achievements and share the years of experience and learning they embody. We also believe these initiatives should be studied closely by policy makers, so that the general principles behind successful schemes can be reflected in future legislation, notably the reviews of the Energy Performance of Buildings Directive (EPBD⁸) and the Energy Efficiency Directive (EED⁹).

⁷ See for example:

(i) BPIE Data Hub : www.buildingsdata.eu

(ii) BuildUp: <http://www.buildup.eu/financing-schemes/35695>

(iii) MURE database: <http://www.measures-odyssee-mure.eu/>

(iv) IEA database <http://www.iea.org/policiesandmeasures/energyefficiency/>

(v) "Energy Efficiency Policies In Buildings - The Use of Financial Instruments at Member State Level", BPIE (2012): www.bpie.eu

⁸ DIRECTIVE 2010/31/EU on the energy performance of buildings

⁹ DIRECTIVE 2012/27/EU on energy efficiency

MANDATORY RENOVATION

In the first case of mandatory renovation introduced across the EU in the 2010 recast of the Energy Performance of Buildings Directive, Member States are required to introduce minimum energy performance standards whenever a building undergoes a major upgrade, defined as one affecting 25% of the building area or where the total cost is 25% or more of the building's value. Two years later, the Energy Efficiency Directive included a requirement for Member States to renovate 3% p.a. of the total floor area of buildings owned and occupied by the central government.

Whilst these are positive developments that begin to address the largest area of energy use in Europe, namely the existing building stock, this legislation affects only a small proportion of Europe's buildings. As a result, there are no requirements to improve the vast majority of the existing building stock, where 40% of the EU's energy is consumed.

Recognising these shortcomings in the existing legislation, some Member States have implemented requirements to improve the energy performance of existing buildings, under certain conditions. The six "trigger points" which result in mandatory renovation are described below.

1. MANDATORY RENOVATION WITHIN A SPECIFIC TIMEFRAME

In **Germany**, the Energy Saving Ordinance (EnEV 2014) contains retrofitting obligations ("Nachrüstpflichten") which must be fulfilled by building owners within a specific timeframe. All retrofitting obligations, some of which have been in force for over ten years, are also subject to the precondition of cost-effectiveness. Specifically, the obligations address:

- **Insulation of top floor ceilings**

Ceilings on top floors that do not comply with the minimum thermal insulation requirements ($U\text{-Value} \leq 0.24 \text{ W/m}^2 \text{ K}$) must be insulated by the end of 2015. This rule applies to ceilings of heated rooms located below unheated attics. Insulation of the roof, or its compliance with minimum insulation standards, is considered sufficient to meet this requirement. Exceptions apply if a home has been continually occupied since 1 February 2002.

- **Insulation of hot water pipes and cooling distribution systems**

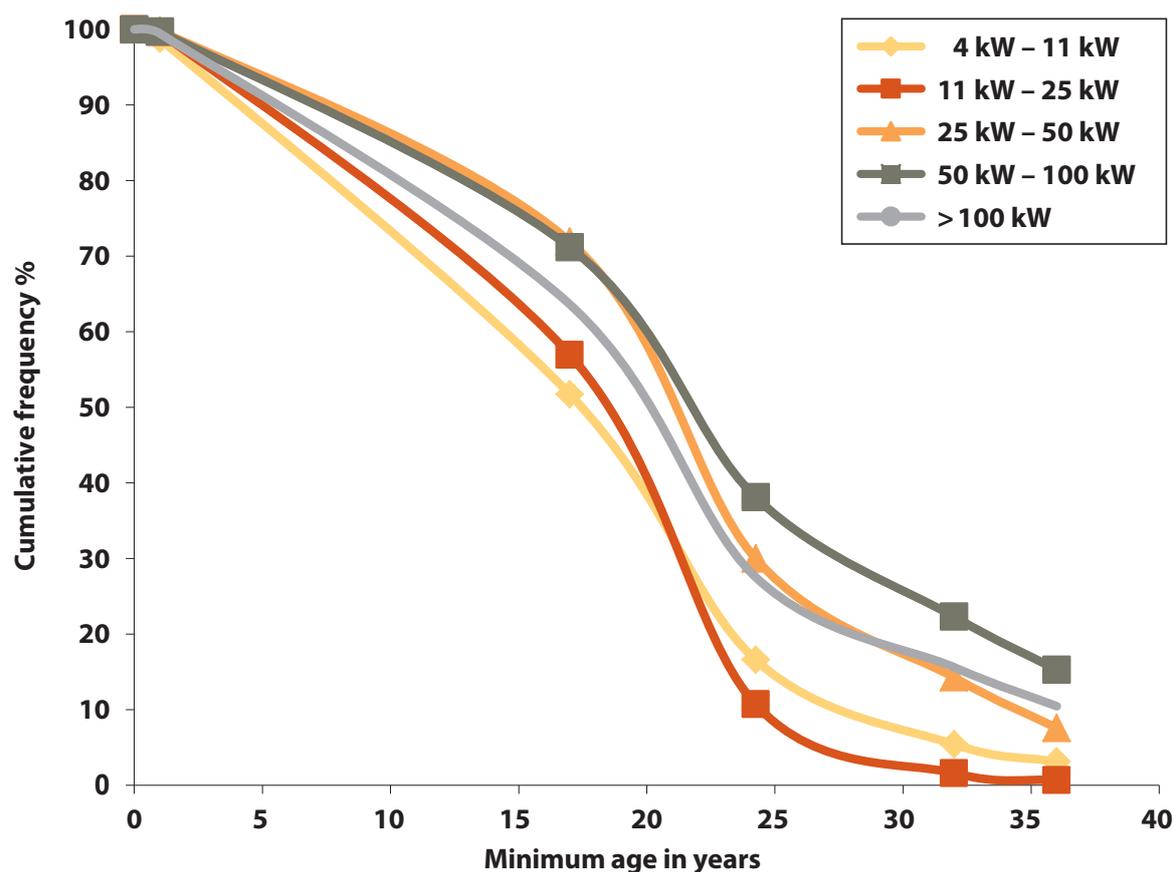
In place since 2004, this requirement concerns the insulation of all previously un-insulated and accessible hot water distribution pipes and fittings in unheated areas, cold water pipes in heated zones, as well as cooling distribution and fittings of air conditioning systems. The required thickness of insulation depends on the type, size and location of the device.

- **Replacement of old boilers**

Oil and gas boilers installed before 1985 will have to be de-commissioned as of 2015. Thereafter, heating systems installed since 1 January 1985 must be replaced after 30 years. However, the EnEV 2014 includes a number of exceptions to this rule. Low-temperature and condensing boilers are exempted from the obligation. Owners of single or two-family houses who were living in at least one apartment in their house as of 1 February 2002 are also exempt. If the house changes hands, the new owner must comply with the obligation within a period of two years.

The Federal Buildings Ministry estimates that there are between 500,000 and 600,000 gas and oil boilers subject to the replacement regulation as of January 2015. The following diagram illustrates the share of old and inefficient oil-boilers which allows a good forecast of the unused potential for energy savings and emission reduction.

Figure 1 – Age-structure of oil-fired boilers in Germany 2014 in relation to their nominal heat output (Source: Erhebung des Schornsteinfegerhandwerks, 2014)



The new regulation in the federal state of Baden-Württemberg also requires the installation of a 15%-share of renewable energy (or equivalent alternative measures such as insulation) when replacing a heating system in an existing building. (See also trigger point 5)

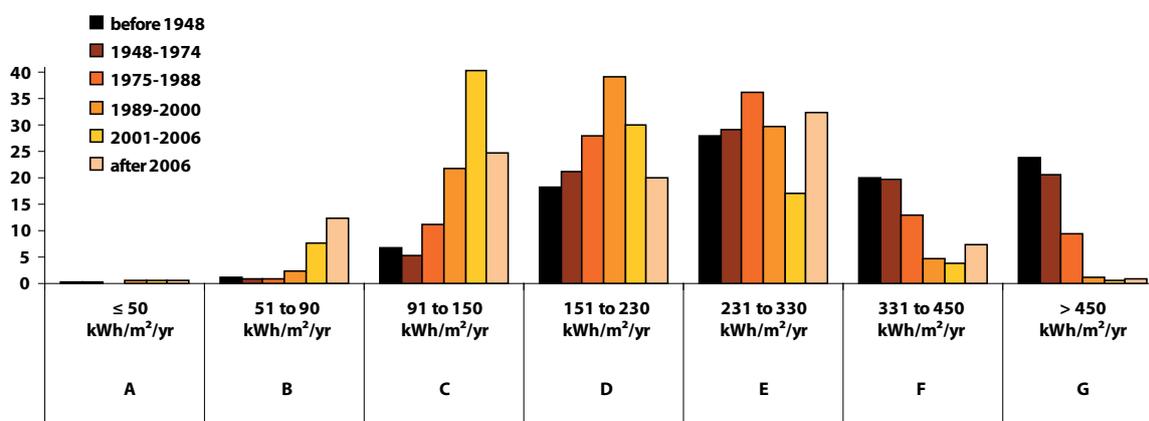
In France, among the provisions in the energy transition law of green growth¹⁰ (approved in August 2015), there is a renovation obligation for private residential buildings whose primary energy consumption exceeds 330 kWh/m²a. This affects all buildings with an energy performance rating in either of the two lowest bands, F or G. These buildings, including rented and owner-occupied, will have to be renovated before 2025¹¹. This measure will accelerate the needed transformation of the existing building stock, and help achieve the ambition of bringing the entire building stock to low energy levels (levels "Bâtiment Basse Consommation"(BBC) or equivalent), by 2050, which is also part of the new law.

The figure below illustrates the distribution of residential buildings according to EPC classes in France, with over 30% falling into the F and G bands.

¹⁰ Loi relative à la transition énergétique pour la croissance verte

¹¹ This is five years earlier than originally proposed

Figure 2 – Distribution of residential EPC ratings according to building age and EPC rating (Source: Ministère de l'écologie, du développement durable et de l'énergie)¹²



The legislative impact assessment notes:

“The heart of the target group consists of dwellings constructed between 1948 and 1988, those whose energy losses are the highest, representing approximately 15.5 million units (slightly less than half of the private and social housing stock).”¹³

The law includes a target to renovate 500,000 dwellings per year, starting from 2017, half of them occupied by vulnerable consumers. Furthermore, the legislation contains a number of financial and other provisions, including:

- Energy transition tax credits: 30% of the cost of the work, up to a limit of €8,000 for a single person and €16,000 for a couple.
- Zero-interest eco-loans to finance energy refurbishment.
- Energy refurbishment platforms to support private individuals in their renovation work.
- A dedicated guarantee fund to support financing of renovation works in buildings, managed by “Caisse des dépôts” for the period 2015-2017.¹⁴
- The creation of a “building handbook”, gathering all required data and information needed for proper use, maintenance and progressive improvement of the building¹⁵.

Among the buildings potentially affected by the mandatory renovation, it has been assumed that 10% will be exempted, because of:

- Technical impossibility (not suitable for exterior insulation materials or difficult access);
- Home-owners with low income who could not afford the works;
- The achievement of undeclared work or self-rehabilitation;
- Housing that would have been previously adequately insulated.

¹² http://www.developpement-durable.gouv.fr/IMG/pdf/CS534_cle099a94.pdf

¹³ Projet de loi relatif à la transition énergétique pour la croissance verte, étude d'impact ; <http://www.assemblee-nationale.fr/14/projets/pl2188-ei.asp>

¹⁴ “Ministère de l'écologie, du développement durable et de l'énergie” and “LOI n° 2015-992 du 17 août 2015 relative à la transition énergétique pour la croissance verte” (Title II, Article 3)

¹⁵ <http://www.anil.org/analyses-et-commentaires/analyses-juridiques/analyses-juridiques-2015/loi-relative-a-la-transition-energetique-pour-la-croissance-verte/>

2. IMPROVEMENT OF ENERGY PERFORMANCE ON THE OCCASION OF OTHER WORKS

The French energy transition law towards green growth described above also includes requirements to upgrade the energy performance of a building on the occasion of other works. This is meant to ensure that the performance level of a renovated building is compatible with new objectives of the national energy policy, through maximising the initial investment.

Significant maintenance or improvement works planned, e.g. on external façades and roofs, should be accompanied by an improvement in the energy performance of the respective building components. The philosophy is that undertaking performance upgrades at the same time as maintenance work reduces overall costs and disruption. The aim is to achieve, to the greatest possible extent, the performance required for new buildings, taking due account of the technical and economic feasibility and any architectural limitations. Also, any work to make rooms or parts of a building habitable must include energy performance improvement measures.

3. PROHIBITION OF RENTING OUT OR SALE OF A BUILDING UNIT WITH POOR ENERGY PERFORMANCE

In the **United Kingdom**, from April 2018, private landlords of residential as well as non-residential properties will only be allowed to rent their properties either if they improve the building's rating to at least energy class E, or if they carry out the maximum package of measures funded under Green Deal¹⁶ and/or Energy Company Obligation schemes, irrespective of whether the property achieves an E rating or better.¹⁷

Almost 10% of the 4.2 million privately rented homes in England and Wales currently fall below the E rating, so a large number of tenants will benefit from this requirement. It is estimated that the new legislation will help around one million tenants, who are paying as much as £1,000 (approx. €1,400) more a year for heating than the average annual bill of £1,265. These excessive costs are mainly down to poorly insulated homes. Estimates suggest that, on average, the difference in heating bill from the least energy-efficient properties and those with an energy rating Band "E" is £880 p.a.¹⁸

A 'regulatory backstop' has been proposed, which would come into effect several years after April 2018 to capture those privately rented properties which have not been re-let since April 2018.

In a related initiative, the UK Government announced that, from April 2016, landlords of residential properties will not be able to unreasonably refuse requests from their tenants for consent to energy efficiency improvements, where financial support is available, such as the Green Deal or the Energy Company Obligation. For a valid request, the tenant must specify and provide details of the measures they wish to install, and provide evidence to the landlord that the package is fully funded through appropriate schemes. Landlords are able to propose a counter offer where the energy efficiency improvements would deliver the same energy bill savings as specified in the tenant's request.

¹⁶ On 23rd July 2015, the UK Government announced that it will cease funding the Green Deal, but that it will work with the building industry and consumer groups on a new value-for-money approach.

¹⁷ Energy Act 2011

¹⁸ www.gov.uk/government/news/renters-and-landlords-to-enjoy-warmer-properties-and-cheaper-bills

The regulations apply to the domestic private rented sector in England and Wales, but the Government will be able to add additional tenancy types in the future. From 1 April 2018, the regulations will apply upon the granting of a new tenancy, whether to a new tenant or an existing one. From 1 April 2020, the regulations will apply to all privately rented property within the scope of the regulations.

Local authorities will be provided with powers to enforce compliance with the regulations. Penalties for a single offence may be cumulative, up to a maximum of £5,000.

The Government will work with the sector to develop industry guidance to help landlords, tenants, local authorities and wider sector bodies to understand and prepare for the regulations before they begin to apply from April 2016. In line with better regulation guidance, the Government has put in place a requirement to review the operation and effect of the regulations at no less than five-yearly intervals. The Government intends the first review to be carried out in 2020, prior to which it will build evidence about the progress and effectiveness of the regulations.

In the **Flanders Region of Belgium**, a new standard was put into force in January 2015, setting minimum requirements for roof insulation in residential buildings (single-family houses and multi-family apartments), when the building is to be rented out. If a residential building does not meet the minimum requirements (an insulation R-value of 0.75 m²K/W)¹⁹, it receives penalty points. If a building or apartment receives more than 15 penalty points, it will be illegal to rent it out. In an apartment building all apartments are penalised equally by the lack of roof insulation, not only the apartments that are located immediately under the roof.²⁰ Furthermore, from 2020 onwards, if the floor insulation fails to meet the specified minimum requirements, then the building will be characterised directly as ineligible for renting.²¹

The roof insulation is standard in theory, like all other minimum quality standards for housing, and not limited to rental housing. But the possible sanctions to a disqualification (annual tax, criminal enforcement) do not apply if the house is occupied by the owner.

4. REQUIREMENTS IN CASE OF CHANGE OF BUILDING USE

Denmark has established minimum energy requirements for building components in case of change of building use which would result in significantly higher energy consumption. Examples are: conversion of an outbuilding to accommodation, or conversion of usable roof space to accommodation²². The requirements are detailed in Table 1.

¹⁹ Equivalent to a U-Value of 1.3 W/m²K

²⁰ www.wonenvlaanderen.be/woningkwaliteitsbewaking/de-minimale-dakisolatieisnorm

²¹ Boosting building renovation, BPIE, 2013, www.bpie.eu

²² In the case of a change of use, construction factors may prevent full compliance with U-Values. The shortfall in efficiency must be compensated for by other energy solutions.

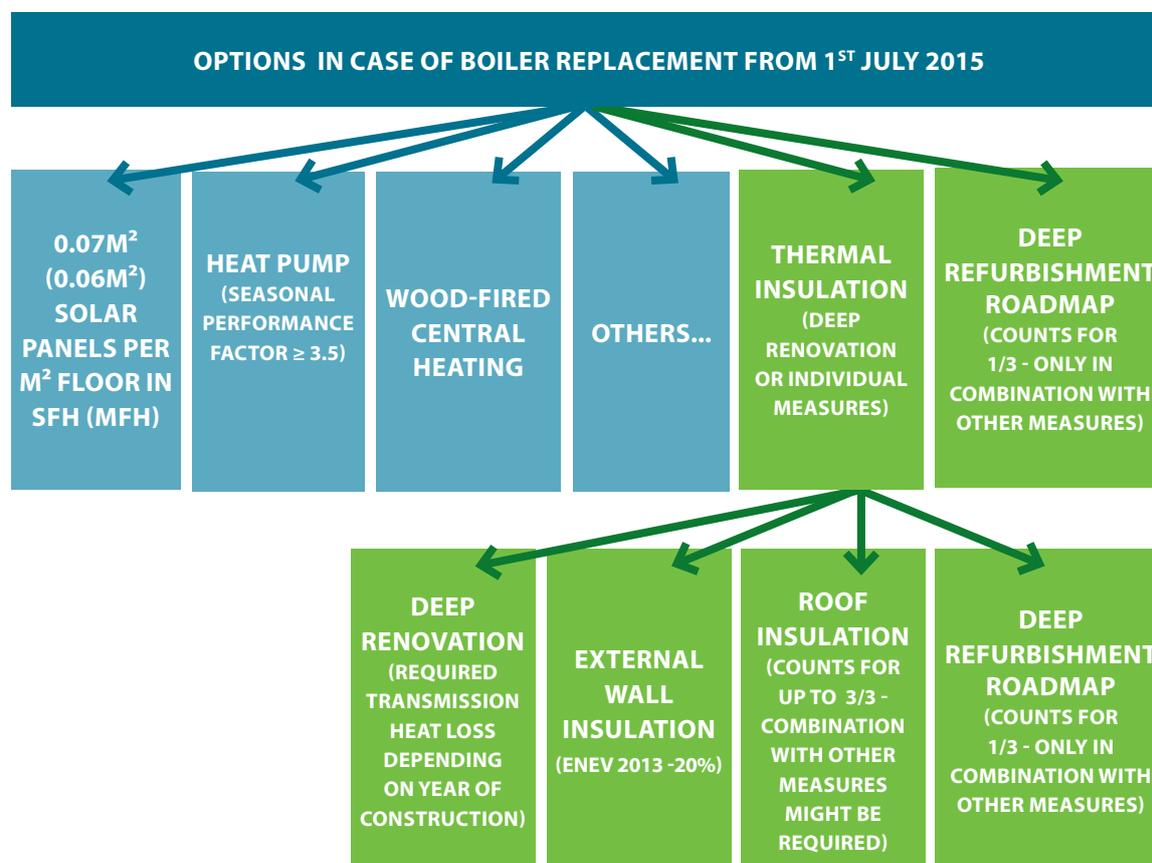
Table 1 – U values that need to be met in case of change of use (Source: BR10, 3.2 (Danish Building Regulation))

	U value W/m ² °C	
	Rooms/spaces heated to T > 15°C	5°C < T < 15°C
External walls and basement walls in contact with the soil	0.15	0.25
Partition walls and suspended upper floors adjoining rooms/spaces that are unheated or heated to a temperature more than 5°C lower than the temperature in the room/space concerned.	0.40	0.40
Ground slabs, basement floors in contact with the soil and suspended upper floors above open air or a ventilated crawl space	0.10	0.15
Ceiling and roof structures, including jamb walls, flat roofs and sloping walls directly adjoining the roof	0.10	0.15
Windows, including glass walls, external doors and hatches to the outside or to rooms/spaces that are unheated or heated to a temperature more than 5° below the temperature in the room/space concerned (does not apply to ventilation openings of less than 500 cm ²)	1.40	1.50
Roof lights and skylight domes	1.70	1.80

5. MANDATORY RENEWABLE ENERGY SUPPLY WHEN AN OLD BOILER NEEDS REPLACEMENT

The Renewable Heat Act (EWärmeG) is a state-law applying in Baden-Württemberg, a region in the south of Germany. Since January 2010, state authorities have required building owners to cover a minimum of 10% of their heat energy demand with renewable energy when replacing a boiler. The new version of the law came into force on 1 July 2015, raising the threshold to 15%. The EWärmeG 2015 applies to buildings built before 1 January 2009. Building owners can choose from a variety of technologies for renewable heat or opt to use alternative measures, including thermal insulation (Figure 3).

Figure 3 – Options in case of boiler replacement (Source: Ministry of Environment, Climate and Energy of the State of Baden Württemberg, revised by BPIE)



Also, the creation of a deep renovation roadmap for an individual building can be taken into account. For non-residential buildings, it counts as full compliance whereas for residential buildings it only counts for 30%, so additional measures need to be implemented. The renovation roadmap is intended to serve as important information and as a consulting and motivational tool.

Since introducing the E WärmeG, annual emission reductions of around 46,600 tonnes CO₂ have been achieved, of which just over 26,800 tonnes are from the building stock. This equates to an average saving of 1.3 t CO₂ per building per year²³.

A similar rule applies for the **Autonomous Province of Bolzano, Italy**. In case of a replacement or renewal of a heat generator, renewable energy sources must provide at least 25% of overall primary energy demand, and 60% of hot water heating energy demand²⁴. The requirement can also be met through energy efficiency measures, if the primary energy demand is reduced by 25% instead, or if the heat energy demand is covered by district heating. Compliance checks are randomly done by local building authorities.

²³ www.statistik-bw.de

²⁴ Decision of the regional government Nr. 362 from 03.04.2013

6. MANDATORY REQUIREMENTS FOR OLD BUILDING PARTS IN THE CASE OF BUILDING EXTENSIONS

Various regions and cities in **Italy** have introduced mandatory building performance upgrades in case the owner is extending the building²⁵. Examples include:

- **Autonomous Province of Bolzano:** by the end of 2019, owners of buildings will be allowed to expand the surface of their dwelling by up to 20%, or up to 200m², only if the building achieves heating consumption below 70kWh/m²/yr.
- **Region of Valle D'Aosta:** in case of expansion by 20% of buildings with a floor area higher than 2000m², the energy performance of the building must comply with the local energy class B level ($\leq 50\text{kWh/m}^2/\text{yr}$ for heating).
- **Trento Province:** the minimum requirement is energy class B+, while for an expansion of the building up to 30%, the minimum energy performance requirements are more restrictive.
- **Torino city:** Energy and environmental requirements for the improvement of the façade and the roof thermal insulation are in force when undertaking major renovation activities.

MANDATORY RENOVATION – KEY FINDINGS

The examples listed above illustrate the various ways in which authorities at national, regional and city level have introduced requirements on improving the energy performance of the existing building stock (either in its entirety or related to specific building elements), to complement the requirements embodied within the EPBD and EED. Taken together, they represent a growing movement that recognises that purely voluntary means (whether or not supported financially) will be insufficient to achieve the volume of energy renovation required to meet energy security and climate considerations, while at the same time delivering economic benefits to building owners. Some of the steps taken are tentative, while others are bolder, but all can be considered a base from which to increase the scope, coverage and ambition of more progressive and mandatory renovation initiatives.

With the experience gained through these regional or national initiatives, it is now timely for the EU institutions to examine the scope for introducing similar regulatory signals and more binding renovation requirements within the EU policy landscape. Action at EU level should not preclude individual jurisdictions for continuing to broaden and deepen the coverage of mandatory renovation.

In addition to the six cases described earlier, the following are considered priority opportunities:

1. Building on Article 5 of the Energy Efficiency Directive for Member States to renovate 3% of the total floor area of the Central Government estate every year, the requirement should be **extended to ALL public buildings**. In the drive to improve the EU's energy performance, the public sector needs to lead by example and initiate the required market transformation. It is important that our schools, hospitals and other public buildings set the example for energy efficiency and deployment of renewable energy technologies, thereby delivering the lowest possible running costs while providing efficient, healthy and comfortable spaces for the smooth operation of public services.
2. Residential accommodation such as **social housing** that is owned, managed or financially supported by the public sector should meet the highest energy performance ratings, in order to provide comfortable, affordable housing, particularly for households at risk of fuel poverty.
3. **Private rented buildings** – both residential and non-residential – should be subject to progressively more demanding minimum performance requirements at time of change of occupancy or renewal of tenancy.

²⁵ "Boosting building renovation", BPIE, 2013, www.bpie.eu

4. Any building **extension, addition or conversion** should be conditional on improving the overall energy performance of the original structure.
5. There should be progressive introduction of **mandatory requirements at sale of a property**, both residential and non-residential, so that the least efficient stock needs to be improved before it can be sold. Clearly, such provisions need to be applied with caution, and with safeguards for historic buildings as well as appropriate financing facilities to address situations where owners lack the resources to undertake the necessary works.

In order to assist the policy development process, the following points should be taken into consideration:

- It is important to have a long-term strategy and give building owners and the market enough time to prepare and adapt.
- Public consultation and engaging stakeholders are important in ensuring the acceptability and right design of legislation.
- Once introduced, mandatory renovation schemes need to be properly communicated, so they are seen as beneficial, rather than as additional regulatory burdens.
- Requirements for existing buildings must be designed in a holistic and technology-neutral way, triggering comprehensive improvement approaches rather than limiting the scope for savings by setting an unambitious threshold²⁶.
- Carefully designed but limited exemptions will need to apply in cases where the application of mandatory requirements is impossible, impractical, or unduly expensive.
- Better evaluation of current policies is needed to guide future decision and track record.
- Financial schemes should be designed to overcome barriers like split incentives, high upfront costs and lack of capital among some building owners.
- Effective compliance and control mechanisms need to be in place to ensure the mandatory renovation requirements are being implemented in practice.

²⁶ The case where sub-optimal energy savings are achieved is frequently termed the lock-in effect, where the implementation of a specific measure effectively precludes the attainment of the highest level of energy saving for the remaining economic life of the building or building component.

FIVE BEST PRACTICE RENOVATION CASE STUDIES

CASE STUDY 1 TECHNICAL AND FINANCIAL RE-ENGINEERING OF THE RENOVATION CHALLENGE

The Netherlands: Zero Energy Homes at Zero Upfront Cost - Stroomversnelling



Political context

In the 2013 Energy Agreement for Sustainable Growth²⁷, The Netherlands committed to having a sustainable energy supply system in place by 2050, to reducing CO₂ emissions by 80-95% by 2050, and to achieving 16% renewable generation by 2023. The Dutch environmental agreement states that the built environment is to have an energy-neutral energy supply by 2050. According to the Environmental Assessment Agency, this means that of the 7.5 million dwellings, 80% are to be renovated to energy-neutral levels in the next 35 years (6 million dwellings), which equals to 170,000 homes per year.

Scheme overview

The social housing building stock in the Netherlands is relatively old and poorly insulated; around half of the buildings were constructed between the 1950s and 1970s, before minimum energy performance requirements were introduced in 1995²⁸. Within the framework of the country's Energy Agreement, social housing corporations accepted an objective to achieve an average energy efficiency label B by 2020. In order to help deliver this target, an innovative scheme called Stroomversnelling²⁹ ("rapids") was developed by Energiesprong³⁰ ("energy leap"), a non-profit market development team, by bringing together six housing associations and four construction companies, together with a wider group of supporting stakeholders such as banking and lending institutions.

Stroomversnelling is a bottom-up approach supported by the Dutch government in which a zero energy concept for the existing social housing stock is stimulated in a faster and cheaper manner. The aim is to refurbish 111,000 rental houses to zero net energy³¹ by 2020, to be paid for by energy cost savings over a 30-year period. The scheme also aims to develop state-of-the-art renovation methodologies to be scaled up to industrialised production levels using prefabricated building elements. In order to achieve this, the project has been split into three stages:

- 1,000 dwellings in the "proof of concept" prototyping phase, where the construction companies develop their innovative technical solutions;
- 10,000 dwellings in the product and market acceptance phase;
- 100,000 dwellings in the full industrial-scale rollout³².

²⁷ "Energieakkoord voor duurzame groei" <http://www.energieakkoordser.nl/energieakkoord.aspx>

²⁸ The Netherlands country report in "Implementing the Energy Performance of Buildings Directive", 2010, Concerted Action EPBD. www.epbd-ca.eu

²⁹ <http://www.stroomversnelling.net/>

³⁰ <http://energiesprong.nl/>

³¹ Net zero means the renovated dwelling will not consume more energy for heating, hot water, lights and appliances than it produces from installed renewable energy systems.

³² http://www.measures-odyssee-mure.eu/public/mure_pdf/household/NLD31.PDF

Key features of the Stroomversnelling Project are:

- Renovation to net zero energy of the buildings is achieved within 10 days;
- The amount that tenants pay for housing costs (rent + energy) remains the same before and after renovation;
- An energy performance guarantee of 30 years is provided;
- To decrease costs while achieving constantly high standards of quality and to minimise time spent working on the property, a high degree of off-site industrial prefabrication is used;
- Tenants are offered an appealing proposition that highlights the comfort, liveability and affordability of the renovated home.

The first test phase took place between September 2013 and December 2014; during this time, 1,000 houses were successfully renovated to net zero energy levels. As of December 2014, several building renovation prototypes had been completed and evaluated. However, these will not be put through to the full industrialisation phase until all aspects of the refurbishment are satisfactory to all parties involved (construction parties, corporations and tenants).

Stroomversnelling represents a disruptive new business model for the renovation sector that involves a longer-term, holistic approach to delivering a single “product”, namely the zero energy renovation along with the financing arrangement as a fully integrated solution³³.

The dwellings targeted by this project were built in the 1950s, 60s and 70s and often have moisture, draft and noise problems coupled with high-energy bills. Additionally, the sanitary facilities are often outdated and in need of replacing. The project offers tenants better, healthier and more comfortable homes with attractive façades, solar panels and smart metering, thus improving the habitability of the home and also the look of the neighbourhood/district. New kitchens and bathrooms are also included within the deal.

Astrid Andre, former social worker, stated:

“This new house is great. You can’t hear the traffic from outside anymore. It feels as if I’m living in a private home, rather than social housing. Before, the wind used to go through the house in winter. I have arthritis and when the weather was colder, it became worse. But my bones are better now, more supple.”³⁴

Technical features

The biggest difference between a Stroomversnelling renovation and a normal renovation is that almost everything is produced off-site in a factory, with only a small percentage of the work required in the on-site installation phase.

Achieving a zero net energy renovation requires a holistic solution that (i) minimises the heat loss and energy consumption of the building, (ii) produces the needed energy in the most efficient manner, and (iii) generates renewable energy to meet the remaining (small) demand. Note, however, that the building is not designed to be self-sufficient in energy terms. Rather, the renewable electricity generation is designed to be roughly equivalent to the electrical energy use of the renovated building when averaged over the year.

³³ <http://www.nef.org.uk/about-us/insights/could-an-energiesprong-approach-to-off-site-manufacturing-transform-the-dom>

³⁴ www.theguardian.com/environment/2014/oct/10/uk-looks-to-dutch-model-to-make-100000-homes-carbon-neutral-by-2020

Typically, an installation will comprise:

- Highly insulated new façade incorporating triple glazing and a new roof with solar PV;
- Efficient ventilation system;
- Air source heat pump & heating system (or ground source where appropriate);
- Electric induction cooker and shower, A+++ rated appliances;
- Energy supply based solely on electricity and renewable sources;
- HVAC plant is contained in a purpose-built external energy module so that internal space is not compromised;
- In addition, a new low-maintenance kitchen and bathroom are provided.

Onno Dwars, Sustainability Manager from Volker Wessels, one of the construction companies, said their team use 3D scanning (see Figure 5), “Dry and Precast” processing, hybrid systems, smart façades with insulation and tubing for the heating system, modular roof units and Plug & Play technologies when designing their net zero energy prototypes for the project.

Figure 4 – 3D scanning, BIM generates technical drawings based on existing concepts, flexible factory makes prefab solutions (Source: Energiesprong, 2014)



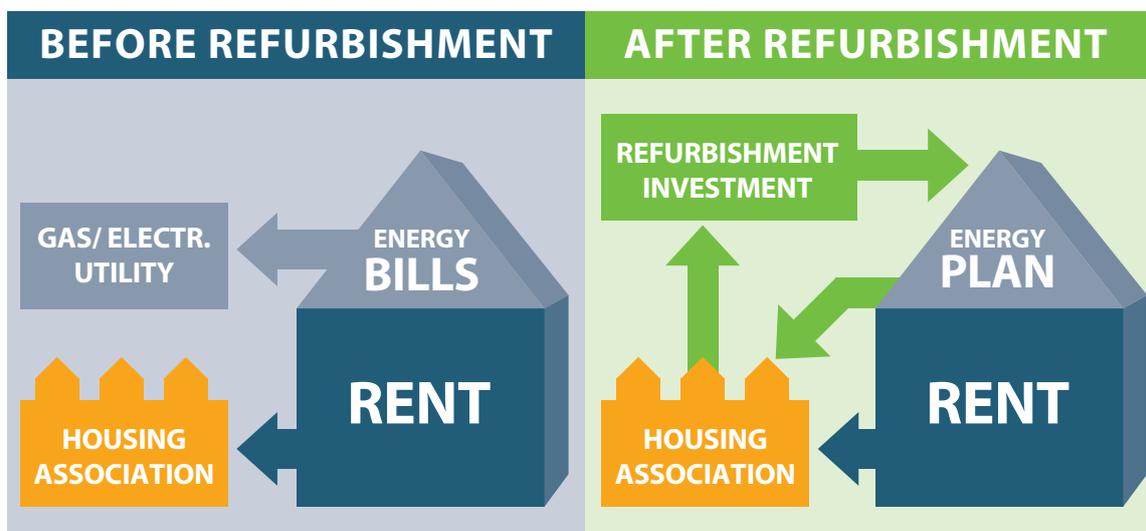
Financial features

Alongside the technical innovation is the necessary financial solution to deliver zero energy renovations at no cost to the tenants. The financial engineering behind Stroomversnelling is based on funding of the upfront capital costs from the triple-A rated WSW social bank³⁵ that has made available around €6.6 bn to underwrite government-backed loans to the housing associations³⁶, generating a 5.25% financial return on investment (using the WSW social bank discount rate for corporate projects) over a 30-year period. The housing associations that provide the upfront costs buy a 30-year performance and maintenance guarantee by using a monthly fixed-term payment received from the resident. This “energy plan” replaces the energy bills previously paid to utilities (see Figure 5), ensuring the tenant pays no more for the combined rent and energy bills than they did prior to renovation.

³⁵ The WSW is an independent institution enabling housing associations to obtain optimum financing for public sector real estate. http://www.english.wsw.nl/uploads/_media/_315_Engels%20solide%20belegging.pdf

³⁶ For more information go to: <http://www.theguardian.com/environment/2014/oct/10/uk-looks-to-dutch-model-to-make-100000-homes-carbon-neutral-by-2020>

Figure 5 – Financing renovation in the social sector (Source: NeZeR Green Deal for social housing³⁷)



In short, the financial model works like this:

- An initial funding allocation of €6.6bn is made available for participating housing associations by the WSW social bank;
- Housing association invests €40-70k per building to fund the capital works;
- Residents pay a combined “rent+energy plan” bill of around €650/month to the housing association (equivalent to, and replacing, their previous separate rent and utility bills);
- Housing association pays around €100 a month to the construction company to maintain the property (existing maintenance allowance per home);
- Contractor guarantees energy performance over 30 years.

Impact and potential for replicability

The project managers estimate that the average net CO₂ savings, once 111,000 homes have been renovated, to be 0.43 MtCO₂ per year (total savings minus embodied energy), representing 2.5% of the emissions of the Dutch residential sector³⁸. The first measured figures have been taken from the phase 1 prototypes. These buildings saved 2/3 of the original energy consumption by using energy efficiency measures, with the balance generated using renewable energy.

At the national scale, the investment input into the project will generate employment for over 55,000 people in the construction industry³⁹.

The Stroomversnelling project has benefitted from the lessons learned in previous Dutch initiatives to implement holistic renovations which have been undertaken in The Netherlands in recent years⁴⁰. In 2010, 134 houses in Roosendaal were targeted, realising a 72% energy reduction in heating and domestic hot water, at a cost of €130,000 each⁴¹. In 2011, 150 houses in Kerkrade were retrofitted to passive house levels at a cost of €100,000 each. Finally, in 2012, 188 zero energy dwellings were renovated in Apeldoorn at a cost of €80,000 per dwelling. These projects show how quickly the price/performance ratio is improving, as illustrated in Figure 6. Stroomversnelling is an up-scaled version of prior projects, moving from hundreds of renovated houses to a hundred thousand.

³⁷ For more information go to http://www.nezer-project.eu/download/18.1acdfdc8146d949da6d65ad/1419240585856/D7_4_StudyVisitReport_NL_Sep2014.pdf

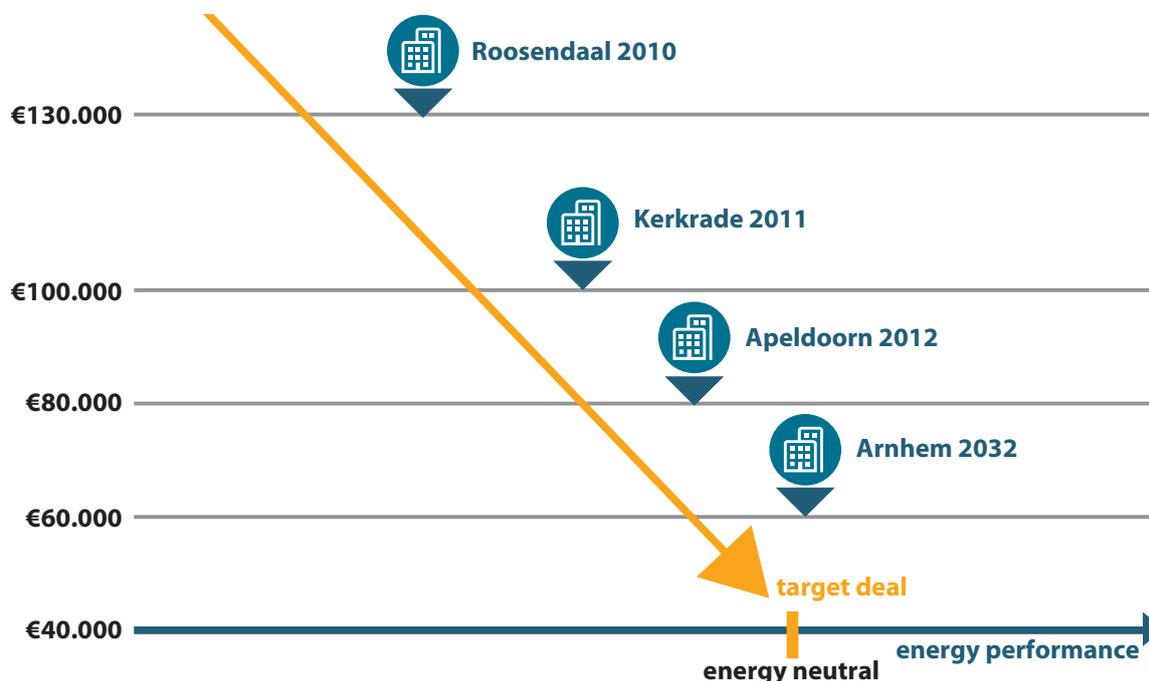
³⁸ <http://energiesprong.nl/wp-content/uploads/2013/09/Stroomversnelling-FAQ-intern-v6-19-juni-2013.pdf>

³⁹ <http://www.corporatienl.nl/hoer-de-stroomversnelling-van-energienota0-werkt/>

⁴⁰ “TRANSITION ZERO- White paper for the expansion of Energiesprong’s approach to France and the UK”

⁴¹ http://www.empa-ren.ch/A50/Annex%2050%20Final%20Publications%20for%20Internet/CaseStudies_ECBCS_A50.pdf

Figure 6 – Renovation costs against energy use as new generation of prototypes are installed.
(Source: Energiesprong, 2014 revised by BPIE)⁴²



The model is now being applied in the UK, with the establishment of Energiesprong UK⁴³, set up by a group of housing providers, charities and construction companies, with the intention of replicating the game-changing Dutch retrofit system to deliver whole-house refurbishments in the UK with near zero energy bills⁴⁴.

In a Nutshell

Scheme name	Stroomversnelling
Location	The Netherlands
Target sector(s)	Social Housing
Building types	Residential dwellings
Duration	2013-2020
Investment	€6.6bn over scheme lifetime
Energy/carbon saving	430,000 tCO ₂ /a
Key features	Holistic solution working in partnership with housing providers, tenants, construction companies and finance providers; No upfront cost to tenants; Rapid installation through extensive use of off-site construction; Achieves net zero energy levels.

⁴² http://energiesprong.nl/wp-content/uploads/2014/07/Transition_zero-1.pdf

⁴³ www.energiesprong.uk

⁴⁴ <http://nef.us6.list-manage2.com/track/click?u=907cd0a631b66ec99f2e6f8f0&id=55abadf413&e=f2a3811d8c>

CASE STUDY 2 REVOLVING LOAN LEVERAGING EU FUNDS

Estonia: KREDEX



Political context

Estonia is one of the EU Member States with the highest energy-consumption-per-capita, whilst also having one of the highest energy saving potentials. The government has established a National Development Plan of the Energy Sector (up to 2020) to act as the main programme in targeting energy conservation issues.

Scheme overview

The housing stock in Estonia was mostly built prior to 1980, with little attention given at the time to energy efficiency or energy performance requirements. In fact, before 2008, there were no legal obligations to insulate buildings or to provide efficient technical systems such as heating in buildings⁴⁵. As a result, Estonian buildings are wasteful in terms of energy use, having an average heating energy demand of around 200-400 kWh/m² per annum⁴⁶.

This poor energy efficiency, combined with the fact that the majority of the population lives in Estonia's cities, with three out of four people residing in apartment blocks, led to the Estonian Government establishing the KredEx Foundation, *Estonian Credit and Guarantee Fund* in 2001, in order to provide support for improving the energy performance of the housing stock⁴⁷. Originally based on grants, in 2009, KredEx renovation finance changed its structure to a revolving loan fund. KredEx manages the revolving fund, the first of its kind to use EU Structural Funds to provide low-interest loans to housing associations and municipalities.

This funding mechanism provides the housing sector with an opportunity to reuse funds going into the scheme to further renovate the building stock. The revolving fund structure is based on (see Figure 7):

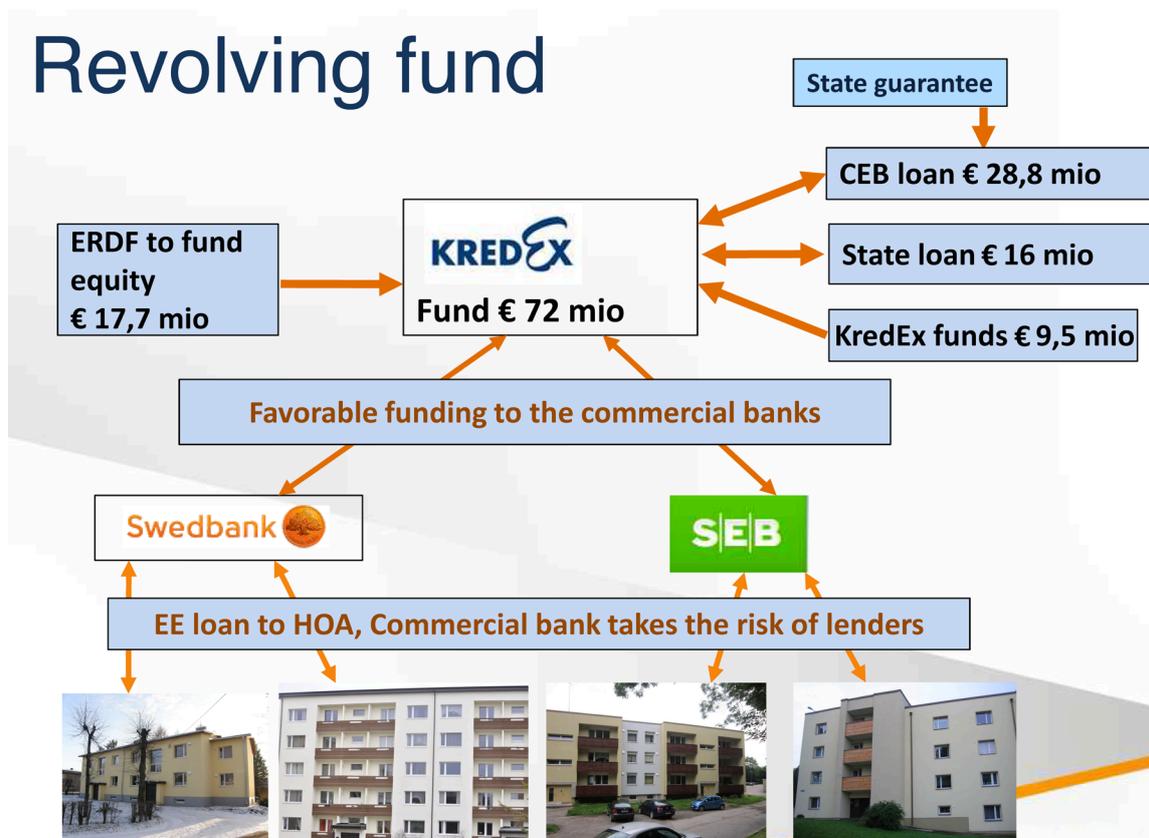
- **KredEx** coordinating the operational aspects of the fund;
- The **Ministry** of Economic Affairs and Communications steering project progress;
- **Commercial banks** taking on lenders' risks through checking borrower eligibility, repaying the loan to the bank and checking compliance;
- **Housing associations** organising apartment owners, managing the project proposal, reporting to banks and collecting loan repayments;
- **Apartment owners** making a collective agreement to undertake the block renovation.

⁴⁵ Estonia country report in "Implementing the Energy Performance of Buildings Directive", 2010, Concerted Action EPBD. www.epbd-ca.eu

⁴⁶ <http://www.kredex.ee/en/energy-efficiency/energiatohusus-korterelamus/>

⁴⁷ http://www.buildup.eu/sites/default/files/content/mirja_adler_2011_11_29.ppt

Figure 7 – Financial structure of the revolving fund scheme (Source: KredEx)⁴⁸



In 2010, KredEx also launched a grant scheme allowing eligible apartment buildings to receive up to 35% of the renovation costs, to complement the revolving loan programme. These grants are used to cover the self-financing requirements of the loans.

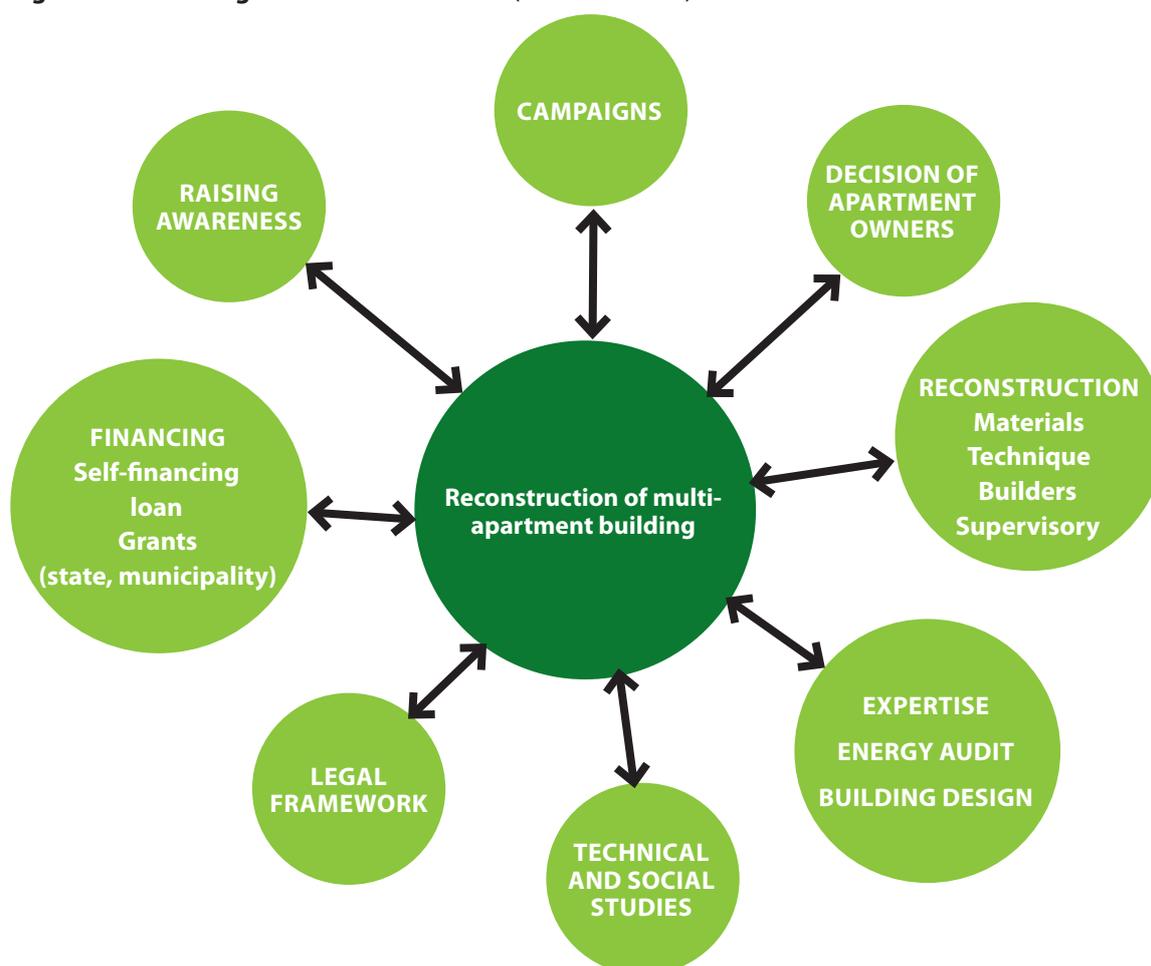
Mirja Adler, head of the KredEx housing and energy efficiency division, says: *“Usually, in multi-apartment buildings, owners’ incomes vary and quite large investment is needed to renovate a building completely. Depending on the price of energy, a small grant is a good motivator to start the process and long-term favourable loans are needed to make the investment affordable.”*⁴⁹

KredEx’s model is a holistic package with the necessary “sticks, carrots and tambourines” set up to ensure the success and expansion of energy renovations in Estonia - see Figure 7. Extensive awareness-raising campaigns ensure all key building stakeholders are informed about the scheme. Training days have also been organised for representatives of housing associations and energy auditors.

⁴⁸ http://www.eusew.eu/upload/events/4582_20861_lauri%20suu.pdf

⁴⁹ http://managenergy.net/sm_kred_ex_estonia.html

Figure 8 – Revolving Fund’s holistic model (Source: KredEx)⁵⁰



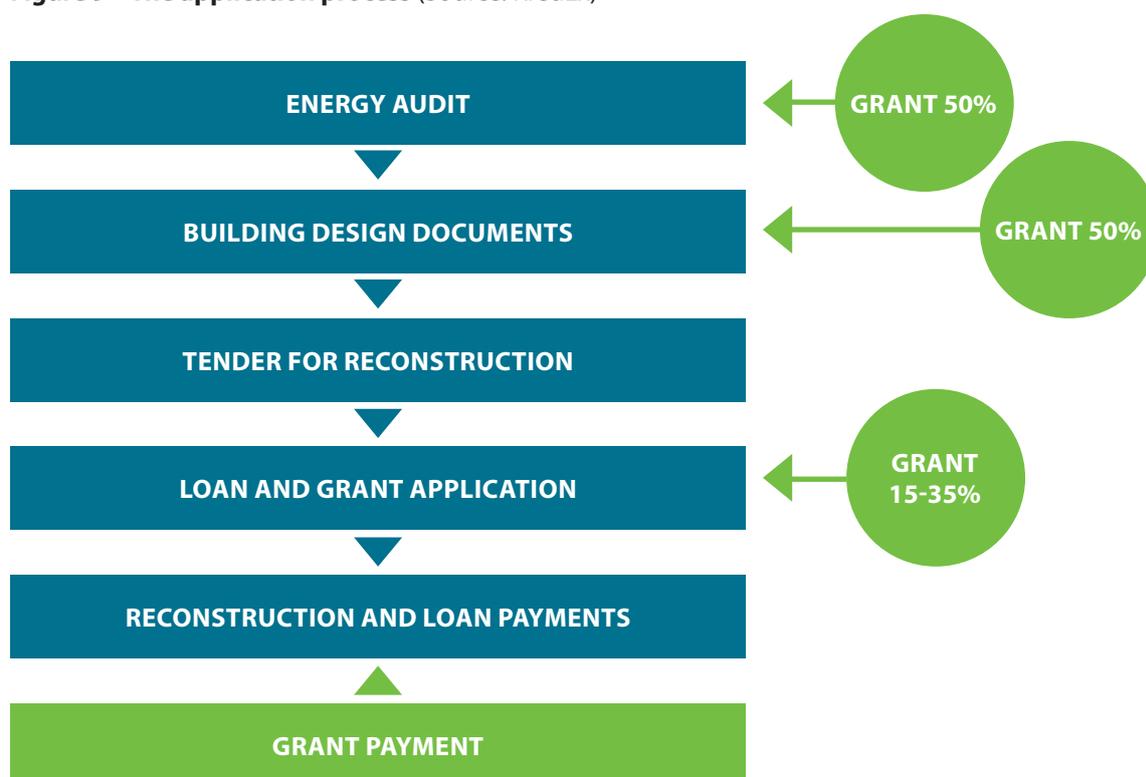
Technical features

In order for an apartment block to be renovated under the loan scheme, it must have been built before 1993. Beneficiaries follow a mandatory 5-step process - see Figure 9:

1. Carry out an energy audit at the start of the application process (undertaken by a licensed, accredited and independent auditing company). The energy auditor takes measurements, collects data, provides a technical overview of the state of the building to identify the baseline energy consumption and proposes energy efficiency refurbishment measures that will lead to reductions in energy consumption of at least 20%.
2. The measures recommended by the audit are then used in the building design documents.
3. A tender is written for the renovation of the building.
4. The housing association applies will apply for the loans and grants from the banks to the buildings.
5. The winning contractor completes the renovation that is supported by the loan and grant payments.

⁵⁰ http://www.buildup.eu/sites/default/files/content/mirja_adler_2011_11_29.ppt

Figure 9 – The application process (Source: KredEx)⁵¹



The technical aspects of each project will differ depending on the needs of the building and the results of the audit. Normally, the improvement works will consist of:

- Thermal insulation of the roof, walls/façade, cellar/roof ceiling;
- New windows and external doors;
- New or renovated heating system;
- New or renovated ventilation system;
- Installation of renewable energy devices.

To ensure the renovations have successfully reduced energy consumption, KredEx requires regular reporting of monitored and verified energy data. The requirement demands annually metered energy consumption data for heat and hot water in kWh/yr. KredEx, by checking invoices from heating companies, carries out spot checks on around 5% of the beneficiaries.

Financial features

The revolving fund has a total capital of €72M, financed by the European Regional Development Fund (€17M of ERDF equity), the Council of Europe Development Bank (€28.8M loan from CEB), the State (loan of €16M) and KredEx (€10.1M investment). The structural fund contribution allows for interest rates to be lowered and this enables KredEx to provide final recipients with preferential loans. The main financial aspects of the scheme are:

- Apartment/building associations and communities of apartments can apply for the loans, providing the building contains at least 3 apartments.
- Following a mandatory energy audit, loans can be used to finance measures that lead to an improvement in energy efficiency of at least 20% for buildings up to 2,000 m² or at least 30% improvement for larger buildings.

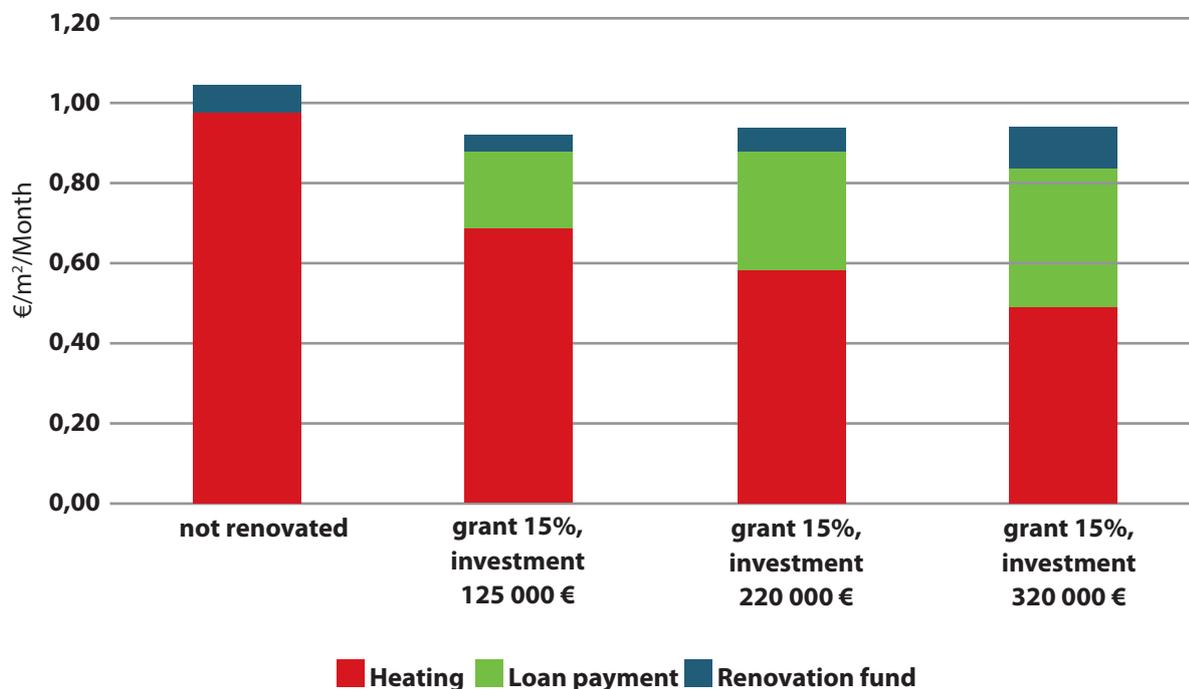
⁵¹ http://www.ifhp.org/sites/default/files/field/files_other/3-Adler.pdf

- Loans are paid back through the energy savings.
- The minimum loan is €6,400 per apartment.
- The loan maturity period is up to 20 years.
- Average interest rates in 2012 were between 3.5% and 4%, fixed for 10 years.
- At least 15% of the total awarded loan must be co-financed by the final recipients. The KredEx grant can be combined with the loan. The grant rate depends on the expected energy savings:
 - 15% grant if saving 20-30%, achieving energy label E and energy consumption < 250 kWh/m²a;
 - 25% grant if saving 40%, achieving energy label D and energy consumption < 200 kWh/m²a;
 - 35% grant if saving 50%, achieving energy label C and energy consumption < 150 kWh/m²a.

Figure 10 illustrates a financial comparison for the three levels, compared to the un-renovated building. It can be seen that the lower heating costs of the most ambitious renovation more or less compensate for the higher loan repayments of the lower grant levels.

After renovating his associated apartment block, **Enn Kruuse**, head of a housing association, said: "Our heating costs are now half of the neighbouring house. They went down roughly as much as the estimate of the energy savings"⁵².

Figure 10 – Breakdown of monthly payments for a typical building of 2000m², interest 3.8%, loan 20 years (Source: KredEx)



⁵² http://www.aeid.eu/images/stories/50bestpractices/ee_tartu_case-study.pdf

Impact and potential for replicability

Loan Scheme: Between 2009 and 2013, 533 apartment building renovations, comprising 20,350 apartments with a total of 47,000 inhabitants, were financed through loans from the revolving fund, amounting to a total of €57.3M, supporting a total investment of €79.6M. Since the scheme began, the loans are estimated to have achieved average savings of 39%.

Grant Scheme: Between 2010 and 2013, the grant scheme renovated 553 buildings affecting the lives of 48,300 inhabitants and producing expected average energy savings of 40%.

Table 2 – Results of the loan and grant KredEx schemes (Source: Kredex, October 2013)⁵³

	LOAN	GRANT
Starting date	24.06.2009	30.09.2010
Number of buildings renovated	533	553
Number of appartments involved	20,350	21,000
Number of inhabitants involved	47,000	48,300
Renovated area/surface m ²	1,330,000	1,370,000
Total investment million €	79,6	98,9
Total loan/grant million €	57,3	26,8
*15% million €/ applications		4/289
*25% million €/ applications		6/189
*35% million €/ applications		16,3/155
Average loan/grant 2013 €	190,400	104,392
Expected savings	39%	40%

The country and city population and the government of Estonia reap multiple benefits from the KredEx renovation scheme. These include:

- Apartment buildings being improved, both in terms of energy consumption and overall appearance;
- Reduced carbon footprint;
- Energy security and lower need for fuel;
- Increased building value;
- Improved local air quality;
- Opportunity for increased employment in the construction sector.

Some of the lessons learned are detailed below:

- The programme is a relatively complex financial instrument, so adequate time and due consideration of suitable governance and management arrangements are key during the development phase.
- Having the flexibility to amend the scheme operation, eligibility criteria, funding levels and other operational parameters is important so the scheme can evolve to the point where it operates smoothly and successfully.
- An energy renovation of an apartment building requires a large investment. This is challenging when developing incentives, as the owner income within an individual apartment block can vary significantly and not everyone can afford the investment. The grant scheme was launched a year after the loan scheme to motivate owners to take on longer-term loans.

⁵³ http://www.renovate-europe.eu/uploads/RE%20Day%202013/PDF%20-%20Speakers/16_M_Adler_REDay2013.pdf

- In order to minimise administrative costs, loans are administered by the banks, this being a more efficient and effective solution than if KredEx was to take over the task.⁵⁴
- The economic situation in the country can impact the uptake and commitment of beneficiaries to the loan schemes. This must be taken into account when designing the scheme and measures to encourage participation.

A new period of Structural Funds 2014-2020 was made available, providing an opportunity to use this funding source to develop similar energy efficient renovation projects in other European countries. The lessons learned and good practices of the KredEx project can be used to support these countries in implementing similar programmes.

In a Nutshell

Scheme name	Kredex
Location	Estonia
Target sector(s)	Residential
Building types	Mainly multi-family apartment blocks
Duration	2001 – ongoing
Investment	Fund capitalisation of €72M
Energy/carbon saving	40% reduction in energy use
Key features	Revolving fund; Long-term loan; Grant is staged according to level of energy saving.

⁵⁴ http://www.wec-policies.enerdata.eu/Documents/cases-studies/Financing_energy_efficiency_buildings.pdf

CASE STUDY 3 LARGE-SCALE NATIONAL PROGRAMME INCENTIVISING DEEPER RENOVATION

Germany: KfW



Political Context

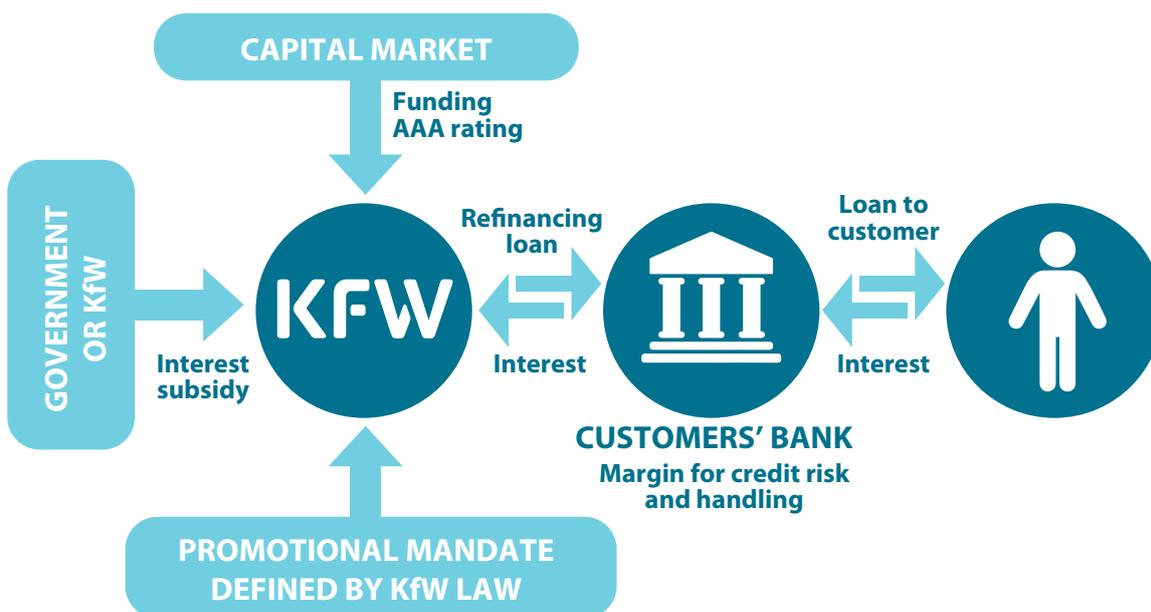
The long-term goal of the German energy and climate policy includes an ambition to achieve an almost climate-neutral building stock by 2050. The financial promotion of energy efficiency measures is one of the three pillars, alongside legal requirements and information campaigns, towards this objective, and key to a successful energy transition (“Energiewende”) – the long-term shift to renewable energy and energy efficiency, including nuclear phase out⁵⁵. Goals for 2020 include a reduction in greenhouse gas emissions of 40% and an overall reduction in the heating demand of residential buildings of 20%.

Scheme Overview

On behalf of the German Government and the Federal States, the KfW Development Bank⁵⁶ provides a bundle of programmes, including subsidies and low-interest loans, to encourage energy renovation of buildings as well as the construction of new buildings with very low energy requirements.

KfW obtains its funding from the capital markets, where it benefits from an AAA credit rating and a 100%-guarantee from the German government. KfW doesn't have branches of its own, but instead distributes its products via private retail banks and insurance companies (Figure 11). The KfW business model is competition-neutral. Clients benefit from a transparent scheme with clear conditions. As private banks are in charge of risk assessment, the credit risk is spread and as limited as possible within a nationwide financial scheme. In most cases, local banks know their clients before they apply for funding, which makes the risk assessment much easier.

Figure 11– KfW's business model (Source: KfW)



⁵⁵ Details at: www.bmwi.de

⁵⁶ Formerly “Kreditanstalt für Wiederaufbau”, whose shareholders are: 80% federal republic, 20% federal states. www.kfw.de

The funding programmes set up by KfW target residential, municipal and social service buildings. They offer long-term, low-interest loans for comprehensive (deep) refurbishment as well as single measures, as long as they meet minimum technical requirements. Funding is also available for the acquisition of a newly refurbished building.

Figure 12 – How the KfW promotional scheme works in detail (Source: KfW, revised by BPIE)



Technical features

The staged funding and subsidised energy consulting aim to encourage owners to consider optimising the whole building at once. However, most house-owners in Germany (82% in 2013) do not start with deep refurbishment; they rather prefer individual measures. In 2014, replacing heating systems was the most frequently supported individual measure as shown by the German Energy Agency (dena) based on KfW statistics. The table below presents the top 5 individual measures supported by KfW⁵⁷.

Table 3 – Top 5 individual measures supported by KfW (Source: German Energy Agency (dena) based on KfW statistics)

TOP 5 SINGLE MEASURES SUPPORTED BY KFW IN 2014		NUMBER OF IMPLEMENTATIONS IN 2014
1	Heating technologies (new condensing boilers, heat pumps, solar thermal systems, pellet heaters, etc.)	56,500
2	Upgrade of windows	54,500
3	Insulation for roofs	26,800
4	Façade insulation	13,300
5	Evaluating and optimising of old heating systems	3,200

⁵⁷ German energy agency, dena based on KfW statistics

Quality assurance and building confidence are instilled by supporting the energy consulting and planning phase, improving the qualifications of the market players and, ultimately, ensuring compliance with the delivered standards.

The KfW initiative contributes significantly to establishing technically demanding standards. In doing so, it also serves as a stimulus for the further development of the Energy Saving Ordinance's standards.

Financial features

The KfW schemes are designed to specifically promote deep renovation following the motto: "The deeper the renovation, the higher the incentive". To illustrate this point, a grant of 25% is offered if the refurbishment reaches the most ambitious KfW Efficiency House 55 standard, while the slightly less ambitious level of KfW Efficiency House 70 attracts a lower grant of 20%.

KfW Efficiency House Definitions

The numbering of KfW Efficiency House standards refers to the energy performance compared to the prevailing Energy Saving Ordinance. For example, a KfW Efficiency House 55 must achieve an overall heat loss target that is 55% of the standard for new buildings. Therefore, the lower the number, the better the energy performance.

The close link between the legislation and the promotional scheme plays an important role in the success of the KfW Efficiency House standards, which have become a frequently used brand in the housing industry, serving as a marketing tool.

Loans are encouraged by means of a repayment bonus which is higher than the grant option, and through subsidising the low interest loan (currently 0.75%⁵⁸) with a maturity of up to 30 years. This includes up to 5 repayment-free start-up years and a fixed-interest period of up to 10 years. The loan can cover up to 100% of eligible costs, to a maximum of €100,000 per housing unit for a KfW Efficiency House, and up to €50,000 for individual measures.

Details of the scheme's current conditions are illustrated in Figure 13.

⁵⁸ As of July 2015

Figure 13 – Promotional programme “Energy-Efficient Refurbishment” for residential buildings, Conditions as of August 2015 (Source: KfW, revised by BPIE)

LEVEL OF ENERGY EFFICIENCY	INTEREST-SUBSIDISED LOAN AND REPAYMENT BONUS	OR GRANT
ENERGY EFFICIENCY HOUSE 55	0,75% P.A. EFFECTIVE	27,5%
ENERGY EFFICIENCY HOUSE 70		22,5%
ENERGY EFFICIENCY HOUSE 85		17,5%
ENERGY EFFICIENCY HOUSE 100		15%
ENERGY EFFICIENCY HOUSE 115		12,5%
ENERGY EFFICIENCY HOUSE MONUMENT		12,5%
ENERGY EFFICIENCY HOUSE 70		7,5%
		25%
		20%
		15%
		12,5%
		10%
		10%
		10%

KfW also supports the planning of integrated concepts and supervision of independent experts. The programme “Construction Supervision” can complement a funded energy refurbishment, offering grants of up to 50% of the costs for the supervision of construction, to a maximum of €4,000.

Impact and potential for replicability

KfW illustrates a best practice approach to deliver a high leverage of private investment from public funds⁵⁹. The annual public budget for KfW schemes targeting the building sector (including new buildings) was €1.8bn on average from 2012 to 2014. According to Germany’s building renovation strategy, the average leverage effect is 1:12. In other words, for every €1 of public support, private individuals and companies have invested €12.

In order to monitor the appropriate use of public money, the KfW programmes are evaluated annually by independent experts, financed by the Federal Ministry of Economics and Technology (BMWi) and KfW. An overview of the main indicators of the latest monitoring from December 2014 is provided in Table 3. The results demonstrate, among other things, the large savings in heating costs which amount to around €200M per year for refurbishments funded in 2013 alone.

⁵⁹ Funds for interest rate subsidy and investment grants were provided by the national budget until 2010; in 2011 funds were provided by national budget as well as by the Energy and Climate Fund and since 2012.

Table 4 – Key characteristics of the years 2005 to 2013 “Energy-Efficient Refurbishment” / “CO₂ Building Rehabilitation Programme” (Source: Monitoring der KfW-Programme „Energieeffizient Sanieren“ und „Energieeffizient Bauen“ 2013, December 2014)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Affected housing units	70,000	155,000	89,000	134,000	36,000	344,000	181,000	242,000	276,000
Carbon reduction [tonnes per year]	340,000	700,000	330,000	546,000	955,000	847,000	457,000	576,000	650,000
Energy savings [GWh/a], delivered energy	670	1,520	940	1,530	2,680	2,450	1,250	1,720	1,750
Overall job creation [man years]	27,000	65,000	35,000	51,000	111,000	92,500	52,000	69,000	79,000

Between 1990 and the end of 2013, roughly 4.5 million homes received KfW funds in the form of low-interest loans or grants for energy-saving measures.

Energy savings from 2013 led to a reduction of around 800,000 tonnes CO₂ annually. This equates to around a third of the annual reduction required from private households, assuming they have a proportional role to play in achieving Germany’s GHG reduction target⁶⁰.

Dr. Jörg Zeuner, Chief economist of KfW, states that *“the investments promoted by KfW guarantee 200,000 to 300,000 jobs per year, primarily in handicraft enterprises and the construction sector. This results in additional revenues of public budgets of around 95 billion Euros. Investments therefore count for 0.4% of Germany’s GDP.”*⁶¹

Another positive effect is calculated for the job market, where SMEs benefit in particular. To determine the effects funding has on employment, the total investment costs of energy-saving modernisation measures have been used. For 2013, a total investment of €6.5bn resulted in an employment effect accounting for 79,000 man-years. From this total investment, around €1bn flows directly back to the state in the form of increased VAT from equipment sales.

According to the German National Energy Efficiency Action Plan, the KfW funding instrument for building refurbishment will continue to evolve according to the development of technology, the market, the Energy Saving Ordinance and in light of the findings from the accompanying monitoring.

The KfW scheme is noteworthy by virtue of its scale, reach, longevity and its gearing towards deep renovation. According to an analysis undertaken in 2012 by the French energy agency ADEME⁶², the level of support equates to €16 per head of population, compared to €10 or less for support schemes in

⁶⁰ KfW Economic research, No. 47, 29th April 2014

⁶¹ Interview conducted by Bernd Salzmann published on KfW website, quoted figures are based on Prognos study, „Ermittlung der Wachstumswirkungen der KfW-Programme zum Energieeffizienten Bauen und Sanieren“ <http://www.ademe.fr/sites/default/files/assets/documents/efficacite-soutiens-publics-investissements-maitrise-energie-dans-ue-2012.pdf>

⁶² <http://www.ademe.fr/sites/default/files/assets/documents/efficacite-soutiens-publics-investissements-maitrise-energie-dans-ue-2012.pdf>

other Member States. As such, it provides by far the largest level of funding per capita of any renovation support scheme in the EU. Even so, and while the level of uptake is quite good, there is certainly scope for this to increase yet further.

Another strength is its flexibility – adapting to changes in the Energy Saving Ordinance legislation, and to market conditions. With support levels linked to energy performance, the scheme encourages consumers to achieve deeper renovation while acknowledging that not everyone will be in a position to do so.

In summary, while the German KfW model benefits from a long tradition and the high financial reputation of the bank, the principles could readily be adapted to suit the prevailing conditions in other EU Member States. Indeed, in the Czech Republic, the New Green Savings Programme⁶³ has been modelled, to a certain degree, according to the KfW principles. While some aspects of the Czech delivery mechanism are different (for example, the scheme is administered centrally, rather than through retail banks), the loan/grant structure geared towards deeper renovation is broadly comparable.

Below is a list of 10 critical factors behind the success of the KfW initiative:

1. Long-term horizon and stability of funding conditions;
2. On-lending principle promotes scale-up;
3. A 100% guarantee by the Government and a high credit rating for the funding body allows access to capital at favourable rates;
4. Applicants have the choice between a grant and a loan. Loans are the preferred route, as funds are recycled, and they better match the business model of participating banks;
5. The scheme is available nationally, through a broad retail-distribution-network of private banks, though based on a single, standardised model with a simple application and approval process with local risk assessment;
6. Encouragement of deep refurbishment following the philosophy: the better the energy performance after refurbishment, the higher the incentive;
7. Interrelation of energy performance regulation as a baseline and promotion scheme (KfW Efficiency House), a brand for energy efficiency that is used as marketing tool in the housing industry;
8. Transparency and simplicity: all groups of investors can apply under equal conditions;
9. Incorporation of independent experts provides trust and confidence in the process for both the client and the investor;
10. High levels of ex-post evaluation on realised energy and financial investment performance.

In a Nutshell

Scheme name	KfW
Location	Germany
Target sector(s)	KfW schemes exist for residential, commercial and public-sector buildings
Building types	All
Duration	2005 – ongoing (similar schemes existed previously)
Investment	€1.8bn/a on average from 2012 to 2014 (all buildings, including new construction)
Energy/carbon saving	1,750 GWh/a; 650,000 tCO ₂ /a
Key features	Largest per capita funding scheme in Europe; High level of gearing; Support geared towards level of energy performance achieved.

⁶³ <http://www.novazelenausporam.cz/en/>

CASE STUDY 4 TACKLING FUEL POVERTY

France: Habiter Mieux



Political Context

In France, the Grenelle 2 Act (July 2010) enabled the establishment of a legal framework to tackle fuel poverty.⁶⁴ In March 2013, the Plan for Energy Retrofit Housing (PREH), in which the President of the Republic publicly committed to the renovation of 500,000 dwellings p.a. by 2017, was announced. The programmes within the PREH are intended to operate as a cohesive package to reduce energy poverty and promote job creation, whilst up-scaling deeper renovations. Energy poverty is tackled in particular through the actions of the French National Housing Agency's (ANAH) "Habiter Mieux" (literally – Live Better) programme.

More recently, the Senate passed the law "energy transition towards green growth"⁶⁵ in August 2015, which particularly focuses on the building sector. Its goals are:

- To halve energy consumption by 2050;
- To bring the building stock to a high energy performing level ("BBC" or "Bâtiment Basse Consommation") by 2050;
- To realize deep renovations for 500,000 building units per year from 2017 onwards, of which at least half are occupied by low-income households;
- To reduce the number of households in fuel poverty by 15% by 2020; and
- To create 75,000 jobs in the sector throughout the territory.

Scheme Overview

With some 3.4 million French households in fuel poverty and three quarters of homes falling into the least efficient D-G energy rating categories, Habiter Mieux was launched by the Government in January 2010 to tackle the problems. The programme is supervised by ANAH, the national housing coordinator, in charge of funding for thermal renovations and managed at a sub-regional level within each "département".

The 7-year programme offers grants to residents engaging in thermal renovation activities, under strict income threshold conditions and anticipated efficiency gains.

Eric Alauzet, ANAH vice-president in charge of the Habitat, Buildings and City Policy, said: "this new programme concerns people with modest incomes and they will be subject to a means test undertaken by ANAH. Habiter Mieux is fully integrated in the departmental Action Plan for housing of disadvantaged people".⁶⁶

Over the period from 2010 to 2017, the programme aims to support 300,000 low-income households to achieve thermal renovation, improving residents' housing, quality of life and purchasing power. Habiter Mieux intends to refurbish 50,000 houses each year. Dwellings will receive a comprehensive renovation, including thermal insulation (roof, walls, windows) and replacement of heating and hot water equipment to improve the energy performance of the building. Technical operators provide personalised guidance on the types of renovation required and achievable.

⁶⁴ http://www.cdclimat.com/IMG/pdf/13-09_climate_report_41_-_combating_fuel_poverty.pdf

⁶⁵ Loi relative à la transition énergétique pour la croissance verte <http://www.legifrance.gouv.fr/eli/loi/2015/8/17/2015-992/jo/texte>

⁶⁶ http://www2.doubs.fr/index.php?option=com_content&view=article&id=590:habiter-mieux-des-aides-pour-vos-travaux-disolation-et-de-chauffage&catid=24:actualites&Itemid=197

Habiter Mieux's implementation process follows three steps:⁶⁷

- Identification of households by members of the network (ANAH);
- Thermal diagnosis (technical visit);
- Realisation of thermal renovations – project engineering and financial engineering by a specialised operator who supports:
 - a. Development of project work;
 - b. Collection and comparison of quotes from professionals;
 - c. Funding applications;
 - d. Smooth running of the renovation installation.

In order for a household to be eligible to receive funding from ANAH, several conditions must be met, including:

- The housing must be over 15 years old at the date of submission;
- Income conditions must be under the minimum threshold for each region;
- The energy performance of the building should be improved by at least 25%;
- Professionals must perform the renovation work.

The Habiter Mieux programme is directly linked to a one-stop-shop for energy renovation, responsible for assisting all households in France experiencing fuel poverty and wishing to embark on energy efficiency improvements. The national help website directs individuals to ANAH's website. The website provides interested parties with step-by-step guidance and support for projects⁶⁸ – see Figure 14.

Figure 14 – ANAH's step-by-step guide to renovating a house (Source ANAH, 2015)

1	2	3	4
Check if your project is feasible by contacting your Renovation Info Service point (the search engine on this page or by calling 0820151515).	After this first step, you are directed to your local ANAH contact to whom you present your project. They will provide you with any additional information you might require.	A habitat specialist ("the operator") diagnoses your home to assess the works required. The specialist can then support you till the end of your project.	The operator helps you prepare the case and file it with your local ANAH contact. Your request for help can be studied.

Habiter Mieux has two income thresholds to enable owner-occupiers with very modest incomes to receive more financial aid than those with slightly higher incomes. The thresholds are derived from the end-of-year tax returns and differ from region to region. The resource limits in the region of Ile-de-France can be seen in Table 5 below.

⁶⁷ https://ec.europa.eu/energy/sites/ener/files/documents/2014_neeap_en_france.pdf

⁶⁸ <http://www.anah.fr/proprietaires/proprietaires-occupants/etre-mieux-chauffe/>

Table 5 – Habiter Mieux income thresholds in Ile-de-France (Source ANAH, 2015)

Number of people per household	Households with very modest revenues (€)	Household with modest revenues (€)
1	19,792	24,094
2	29,050	35,362
3	34,887	42,471
4	40,735	49,592
5	46,604	56,733
Each additional person	+5,857	+7,132

Technical features

For a project to be funded by the programme Habiter Mieux, the predicted energy savings of the renovation work must be greater than 25%. The operator will provide recommendations to the beneficiary undertaking a renovation as to what kind of energy improvement is best suited to their household. A vast range of technical solutions is offered by the scheme. Of the homes that have been renovated under the scheme since June 2013, two-thirds involved the insulation of roofs and walls and change of heating systems – see Table 6.⁶⁹ Most home-owners have renovated more than one aspect of their homes using Habiter Mieux's finance.

Table 6 – Types of home improvement undertaken by home-owners (Source: CALD records of renovation work after June 2013)

	Change of boiler	Heating system	Installing heating system	Solar hot water	Insulation	Wall insulation	Roof insulation	Woodwork	Ventilation/airflow	Grand total
A single measure	19	3	2	0	1	5	2	2	0	34
Several measures	160	74	17	22	76	95	245	274	119	379
Total	179	77	19	22	77	100	247	276	119	413
	67%			5%		24%	60%	67%	29%	

Financial features

The 7-year programme has a total budget of around €1.4bn⁷⁰, of which €500 million is state-funded, €600 million is provided by ANAH and €250 million come from energy suppliers within the framework of the energy-saving certification system.⁷¹ The finance structure of Habiter Mieux looks as follows (see Figure 15):

- **ANAH provides subsidies** for owner-occupiers/landlords to finance up to 50% of the renovation;
- **Government grants** financed by the Insulation Improvement Assistance Fund (Fonds d'aide à la rénovation thermique "FART") are provided in the form of a fixed-rate grant of up to €3,000;
- ANAH provides **increased aid** equal to that of the community, capped at €500 per household;

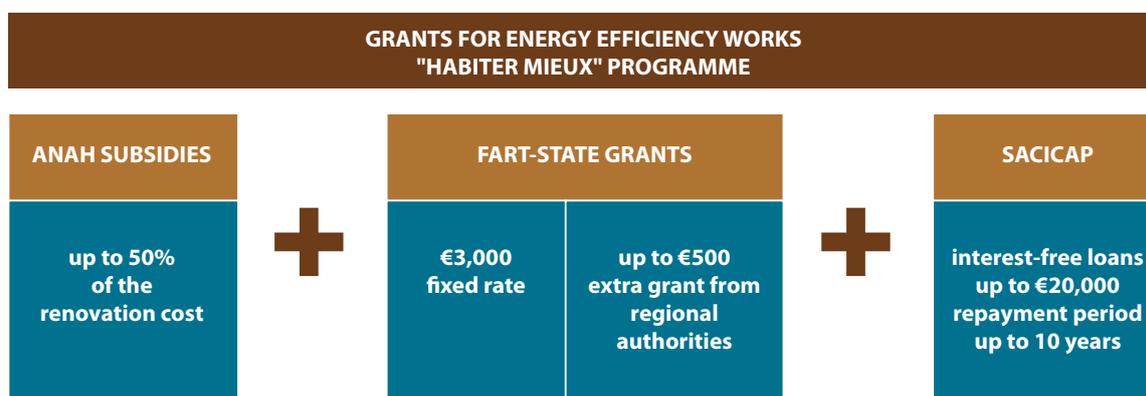
⁶⁹ http://www.anil.org/fileadmin/ANIL/Etudes_ADIL/2014/ADIL_26_Habiter_mieux_Drome.pdf

⁷⁰ http://www.anah.fr/fileadmin/anh/Mediatheque/Publications/Les_chiffres_cles/chiffres-cles-anah-2014.pdf

⁷¹ <http://www.energie.sia-partners.com/20130415/habiter-mieux-un-bilan-mitige-illustrant-lenjeu-de-la-rehabilitation-thermique>

- Additional support from social departments of socially beneficial cooperative companies for home ownership ("SACICAP")⁷² for households having no equity and requiring access to bank loans provide **interest-free loans** with no management fees up to a maximum amount of €20,000 with a repayment period of up to 10 years, or pre-financing of subsidies.

Figure 15 – Habiter Mieux grants for energy efficiency works (source: Eurima)⁷³



Impact and potential for replicability

The uptake of the programme has increased year-on-year:

- 12,786 homes in 2012;
- 31,235 in 2013;
- 38,000 (estimate) in 2014.⁷⁴

The average household's energy saving amounts to 41%, meaning the minimum savings threshold of 25% has been considerably exceeded. The average cost incurred for these improvements is €17,000. Table 7 shows the energy-saving characteristics of homes built over different periods of time. The fact that the average considerably exceeds the minimum suggests there is scope for the minimum threshold to be revisited in order to require deeper renovation.

Table 7 – Characteristics of homes renovated by Habiter Mieux since June 2013 (Source: ANAH, 2013)⁷⁵

Year of construction	Total		Percentage of single family houses	Average amount of work	Average energy efficiency gain	Part of very low-income home-owners
	Number	Percentage				
Before 1949	10,887	47%	97%	22,056 €	40%	65%
From 1949 to 1975	9,151	39%	88%	13,879 €	37%	58%
After 1975	3,184	14%	89%	13,763 €	35%	56%
Total	23,222	100%	92%	17,679 €	37%	61%

⁷² SACICAP – Sociétés anonymes coopératives d'intérêt collectif pour l'accèsion à la propriété

⁷³ <http://www.energie.sia-partners.com/20130415/habiter-mieux-un-bilan-mitige-illustrant-lenjeu-de-la-rehabilitation-thermique>

⁷⁴ https://ec.europa.eu/energy/sites/ener/files/documents/2014_neeap_en_france.pdf

⁷⁵ <http://www.nyserda.ny.gov/-/media/Files/EDPPP/LIFE/Conferences/2014/4A-fuel-poverty-energy-affordability-france-dubois.pdf>

The energy gain varies depending on the energy class of the building before renovation. The main success of the programme is the positive energy class change of the renovated households from the lower two categories G and F (62% of buildings pre-renovation) to D+ (45.5% of the renovated buildings). Figure 16 below shows the improvements in energy class of the buildings renovated under the programme. Overall, buildings have improved their energy class by at least one category.

Figure 16 – Energy class of the Habiter Mieux buildings before and after renovation (Source: ANAH, 2013)⁷⁶

Energy class (kWh/m ² /yr)	Percentage of homes	
	Before thermal renovation	After thermal renovation
A (less than 50)	0%	0%
B (from 51 to 90)	0%	2%
C (from 91 to 150)	1%	14,5%
D (from 151 to 230)	10,5%	29,0%
E (from 231 to 350)	23,0%	29,0%
F (from 351 to 450)	26,5%	16,5%
G (more than 450)	39,0%	9,0%

Habiter Mieux started in 2011, but initial uptake was slower than planned. This created some issues with the energy suppliers supporting the scheme, since their financial contribution was linked to achievement of their energy efficiency obligations⁷⁷. The initial two years (2010 to 2012) of the project provided ANAH with important lessons to help them in further developing the scheme to suit the needs of the fuel-poor housing sector. The main problems observed in attempting to identify households and encourage participation were:

- A lack of commitment to renovate;
- Fear of a long-term financial burden on households;
- Payback periods on investment.

In June 2013, the programme was modified, making it more attractive to potential participants and up-scaled. The reform increased the number of qualifying households to 45% of the residential building stock.⁷⁸ One of the main changes to the scheme involved the employment of “Energy Efficiency Ambassadors”, trained to identify low-income households. The subsidy for the initial diagnosis was increased, together with a subsidy offered to finance a larger share of the total cost of renovation, allowing people without financial resources or savings to participate in the programme – see Table 8.

⁷⁶ <http://www.nyserda.ny.gov/-/media/Files/EDPPP/LIFE/Conferences/2014/4A-fuel-poverty-energy-affordability-france-dubois.pdf>

⁷⁷ “Alleviating fuel poverty through energy efficiency measures: the French programme: Habiter Mieux”, Dubois, eceee Summer Study 2015

⁷⁸ <http://www.nyserda.ny.gov/-/media/Files/EDPPP/LIFE/Conferences/2014/4A-fuel-poverty-energy-affordability-france-dubois.pdf>

Table 8 – Situation before and after the changes to the Habiter Mieux programme (Source: French National Housing Agency)

	Owner occupier		Owner landlord		Joint ownership association	
	Before	After	Before	After	Before	After
% of the works is funded by the ANAH (depending on the project)	20 to 35%	35 to 50%	Not eligible	25 to 35%	Not eligible	35 to 50%
Government Habiter Mieux grant	€1,600	€3,000 for 2 years	n.a.	€2,000	n.a.	€1,500 per unit
Energy savings required	>25%	>25%	n.a.	>minimum of 35% at least and Label D certification	n.a.	>35%
% of the works financed (ANAH, FART & local authority grants)	35 to 80% depending on the local authority	65 to 100% depending on the local authority	n.a.	>35% depending on the local authority	n.a.	>35% to 50%, depending on the scheme

In a Nutshell

Scheme name	Habiter Mieux
Location	France
Target sector(s)	Social housing
Building types	Residential – single-family and multi-family housing
Duration	2010 – 2017
Investment	€1.4bn (budget)
Energy/carbon saving	37% average energy saving achieved
Key features	Large-scale national programme funded by public budget tackling low-income housing sector; Aim for long-term eradication of fuel poverty; Energy Efficiency Ambassadors used to identify low-income households.

CASE STUDY 5 STREAMLINING PUBLIC BUILDING RENOVATION THROUGH ENERGY PERFORMANCE CONTRACTING

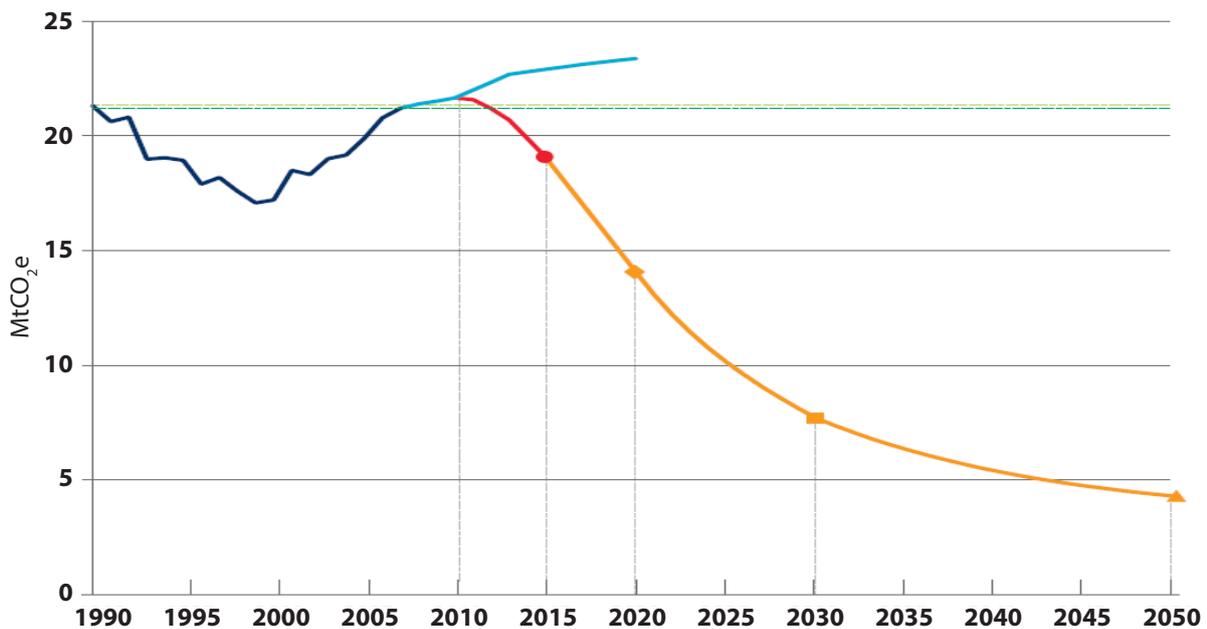
UK: NHS ESCO – Carbon and Energy Fund



Political context

The National Health Service (NHS) is one of the largest energy consumers in the UK. It has adopted a short-term target to reduce its 2007 carbon footprint by 10% by 2015, on a path to long-term target reductions of 34% in 2020 and 80% in 2050, in line with the UK's emission targets (see Figure 17)⁷⁹. The NHS spends more than £600M (c. €850M) on energy costs each year.⁸⁰ The resulting annual carbon footprint is around 25 million tonnes of carbon dioxide equivalent (tCO₂e)⁸¹. Hospitals are particularly energy intense as they are required to ensure thermally comfortable conditions for patients 24 hours a day, 365 days a year, with high operational requirements for heating, cooling, hot water and ventilation.

Figure 17 – NHS England CO₂ emissions from 1990 to the present day and the required trajectory
(Source South Bank University, 2015)⁸²



Scheme overview

The Carbon and Energy Fund (CEF) has been set up as a non-profit making venture and is a NHS initiative available for any qualifying NHS Trust (and other bodies within the UK health sector) wishing to improve the energy performance of their buildings. The CEF is the most widely used framework across the UK⁸³ that assists the NHS in meeting its energy efficiency and carbon targets. A fund of over £300M (€425M) is available for any qualifying NHS body to apply for. Participants do not pay any upfront costs as the investment is repaid through energy savings.

⁷⁹ "Carbon reduction in the NHS: a role for finance." Hfma briefing paper published in December 2009.

⁸⁰ <https://www.gov.uk/government/news/new-nhs-efficiency-schemes-set-to-save-137-million-per-year-on-hospital-energy-bills>

⁸¹ <http://www.greeninvestmentbank.com/media/5242/gib-nhs-market-report-final.pdf>

⁸² <http://www.cibse.org/getmedia/2b757be1-fb0b-422d-8cf9-6c431e14f345/106-Chaer-Slides.pdf.aspx>

⁸³ Made up of a team including the: Dept of Health, NHS, Carbon Trust, National Services Scotland, National Procurement, NHS Strategic Buying Solutions and HealthCare Solutions, http://carbonandenergyfund.net/content.php?page=who_we_are

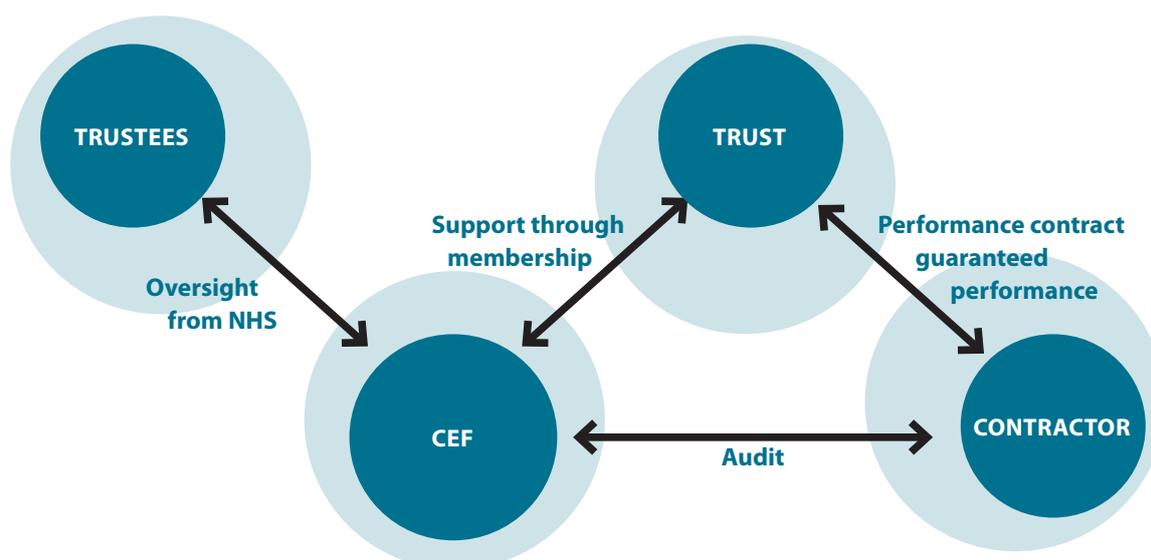
The main objective of the Fund is to finance and support projects within the NHS that ensure a certain level of carbon savings for a given level of investment.⁸⁴ The idea came from 28 Trusts that had previously undertaken and implemented energy services performance contracts underwritten by guaranteed savings. They saw the opportunity to share their experience with other Trusts, to reduce costs and speed up what can be quite complex procurement processes. A board of trustees from the NHS and the Department of Health procurement hub was established to supervise the CEF.

Since its launch in 2011, over 40 NHS sites have renovated their energy facilities using the CEF.

The CEF provides Trusts with an energy services performance contract that guarantees an agreed level of energy and carbon savings. The contract carries the costs of the design and procurement process and pays the up-front costs of installing energy-efficient improvements. The costs of the improvements are then repaid throughout the life of the contract with guaranteed energy savings endorsed by the contractor in the CEF contract.

To access the Fund, a Trust must first seek membership within the CEF. When this is approved, it is provided with CEF support over the duration of the entire project from the procurement process, installation of measures and through to monitoring of energy savings – see Figure 18 below.

Figure 18 – Overview of how Trusts are supported by CEF (Source: CEF)⁸⁵



The CEF is not solely a provider of funding – it is also a vehicle to bring together specialist expertise in and around the NHS, acting as a central hub that ensures the Public Sector can benefit from knowledge gained from previous projects. The CEF has been set up to:

- **Simplify the procurement of energy efficiency projects** – a framework was set up to halve procurement timescales⁸⁶.
- **Reduce advisor costs** – a “ready-to-wear” contract is provided to all member Trusts.
- **Acquire suitably skilled advisors** – a full range of skilled advisors is hired to assist members.
- **Provide support during installation and operation** – the entire project from feasibility to termination is supported by the CEF.
- **Provide 15-25 year funding** – the Fund obtained an initial £100M funding that has been increased by a further £200M, at a better rate due to the combined purchasing power of all qualifying NHS bodies.
- **Procure advisors and pay lower fees** – the Fund charges no fees and recovers only administration costs from successful projects, and these costs are covered by guaranteed savings.

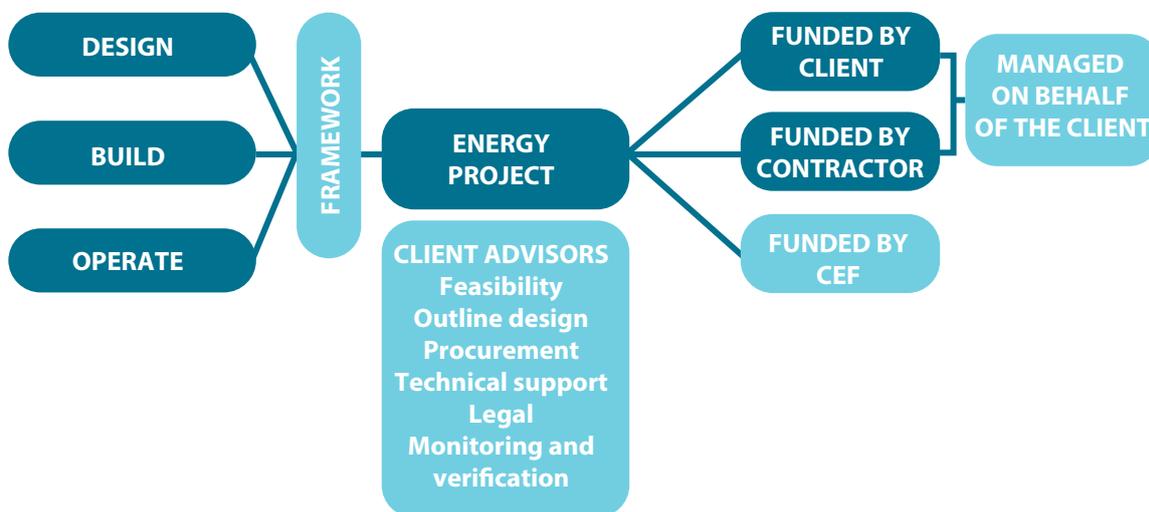
⁸⁴ <http://carbonandenergyfund.net/>

⁸⁵ <http://carbonandenergyfund.net/The%20Carbon%20and%20Energy%20Fund%20and%20how%20it%20works.pdf>

⁸⁶ All public tenders above a certain size in the EU must be posted Official Journal of the EU (OJEU)

In short, the CEF brings together the required supply chain of advisors, contractors, lawyers and building stakeholders with a source of long-term funding at preferential rates to realise large-scale energy saving investments – see Figure 19.

Figure 19 – Typical CEF Project (Source NHS SBS)⁸⁷



*The light blue boxes represent the “CEF added value”.

Previously, Trusts needed to follow a time-consuming and expensive process and issue a public tender to upgrade their energy infrastructure. The CEF set up a framework that offers Trusts a simple, 6-month arrangement for the selection of a contractor, called the “mini-competition Phase” (Figure 20). It is used as a method to shortlist companies for tendering purposes. So far, 17 ESCO companies (“bidders”) have been approved by the framework⁸⁸. Each of the 17 contractors must pass strict capability, competence and financial checks in order to be accepted as an NHS CEF partner. Furthermore, if the contractor fails to deliver, the CEF framework supports the Trusts with technical, procurement and legal teams until the problem is resolved.

Figure 20 – Bidding steps for contractors in the CEF Framework (Source: CEF, 2014)⁸⁹



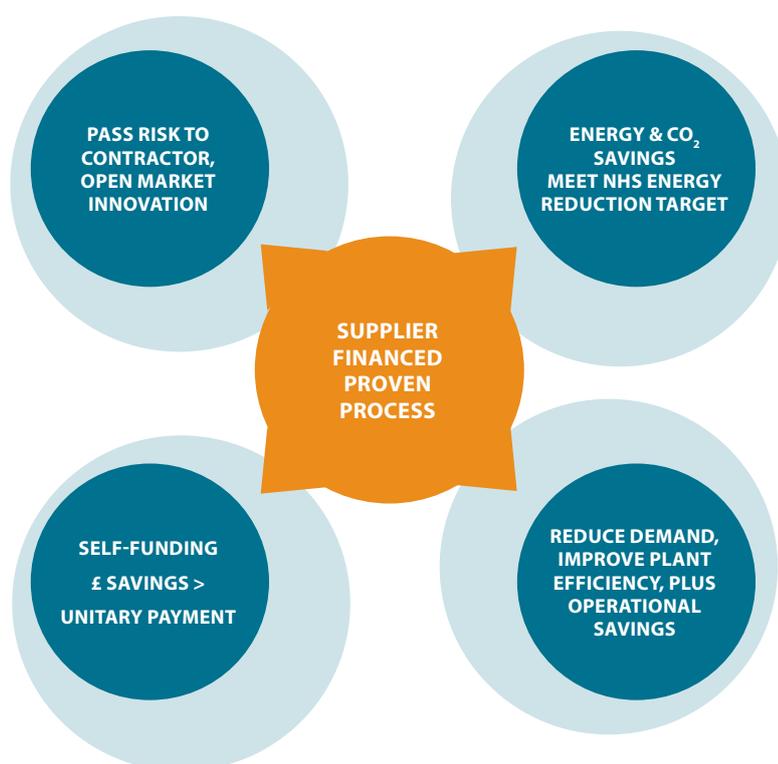
⁸⁷ http://carbonandenergyfund.net/public_docs/CEF%20-%20Master%20Pres%20Open%20Day.pdf

⁸⁸ The CEF Framework Contractors are: BBW, Bilfinger Ireland Group, Bouygues Energies & Services, Breathe Energy, British Gas, Cofely, Cynergis, Dalkia, EnerG, Energy Services Partnership, E.ON, Finning (UK) Ltd, Imtech, Interserve, MCW, Mitie, Skanska and Vital Energi.

⁸⁹ <http://carbonandenergyfund.net/Quarterly%20briefing%2019%201.pdf>

The type of energy infrastructure projects undertaken by the CEF model require substantial expertise and, considering that a hospital is open on a 24-hour, 365-days-a-year basis, people’s lives can be at stake. It is possible for Trusts to undertake this kind of infrastructure upgrade on their own, however, it is both protracted and costly for the Trust and for the bidding energy service companies. Current constraints on capital have made it increasingly hard for Trusts to invest in their core energy infrastructure.⁹⁰ The CEF’s procurement framework reduces associated fees and cuts the time taken to go through the process by over a year. The standardised Energy Saving Performance Contract (ESPC) (Figure 21) provides guaranteed savings and risk transfer, with off balance sheet benefits.

Figure 21 – The Energy Saving Performance Contract (ESPC) Principle (Source: CEF, 2014)⁹¹



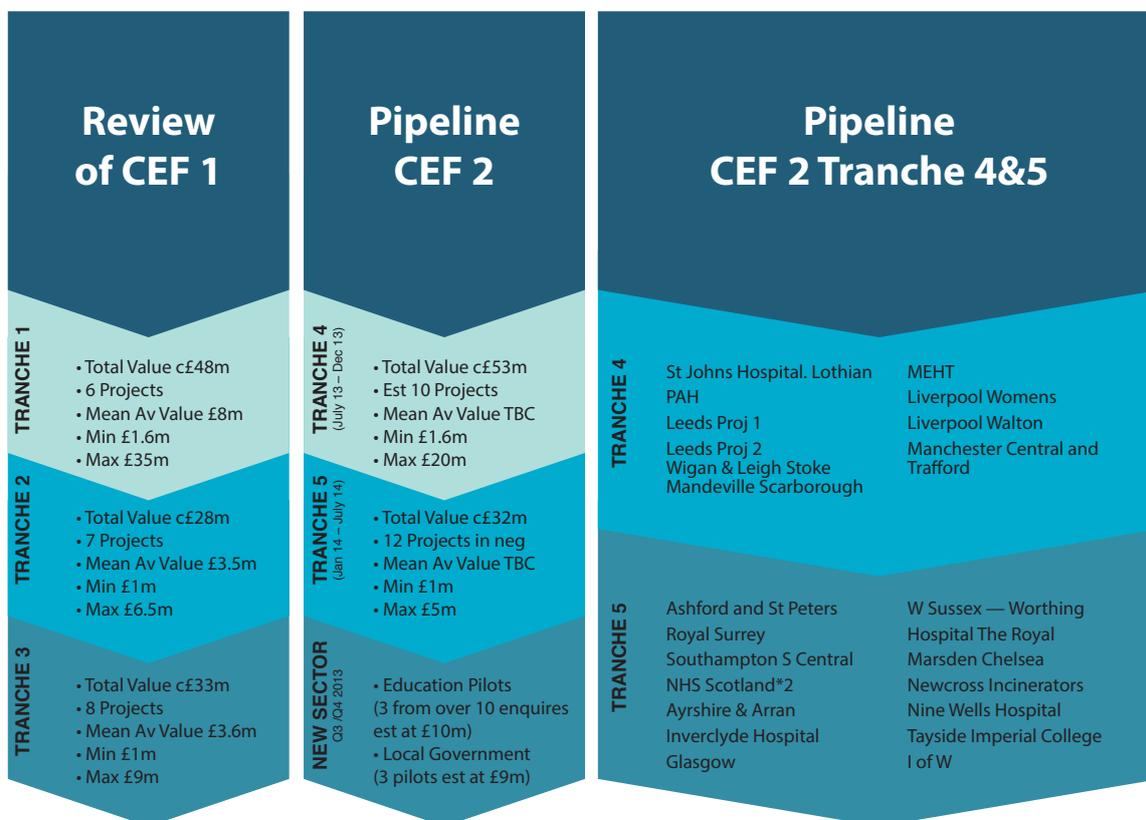
Since the CEF began in July 2011, projects have been released in “Tranches” that are approximately 7 to 9 months long. The reason for having tranches is to ensure that the Fund and the specialist contractors can all cope with the increased number of projects in the most efficient way⁹². Figure 21 shows the development of the CEF by tranche, showing the total amount of money invested, the total number of renovated projects, the mean average value per contract and the minimum and maximum amount spent on a contract.

⁹⁰ <http://carbonandenergyfund.net/Quarterly%20briefing%2019%201.pdf>

⁹¹ <http://carbonandenergyfund.net/Quarterly%20briefing%2019%201.pdf>

⁹² http://carbonandenergyfund.net/public_docs/pp45-53%20HEJaug13.pdf

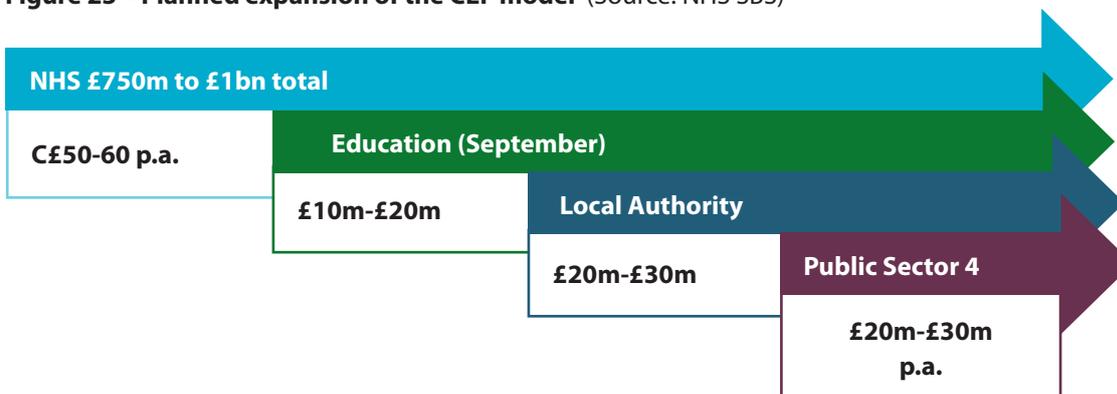
Figure 22 – Progress of CEF since July 2011 (Source: BPIE based on CEF data)



The success of the first few phases of the CEF has encouraged the UK to scale up the project across different sectors. Figure 23 shows the planned development of the CEF, advancing into different sectors with differently sized portfolios and buildings.

When discussing the increasing uptake by organisations and Trusts through the cost- and time-saving Carbon and Energy Fund, CEO **Clive Natrass** said: *“We’re very busy. People like the CEF and are wanting it to carry on elsewhere outside the NHS. So we’re looking for it to become the preferred model for the Public Sector.”*⁹³

Figure 23 – Planned expansion of the CEF model (Source: NHS SBS)⁹⁴



⁹³ http://carbonandenergyfund.net/public_docs/CEF_page_from_HB_January_2014.pdf

⁹⁴ http://carbonandenergyfund.net/public_docs/CEF%20-%20Master%20Pres%20Open%20Day.pdf

Technical features

The technical aspects of each project will differ depending on the needs of the site and the proposal of the contractor. Normally, the contractor is chosen based on a weighted score, however, bids demonstrating the greatest energy and carbon savings are more likely to win.

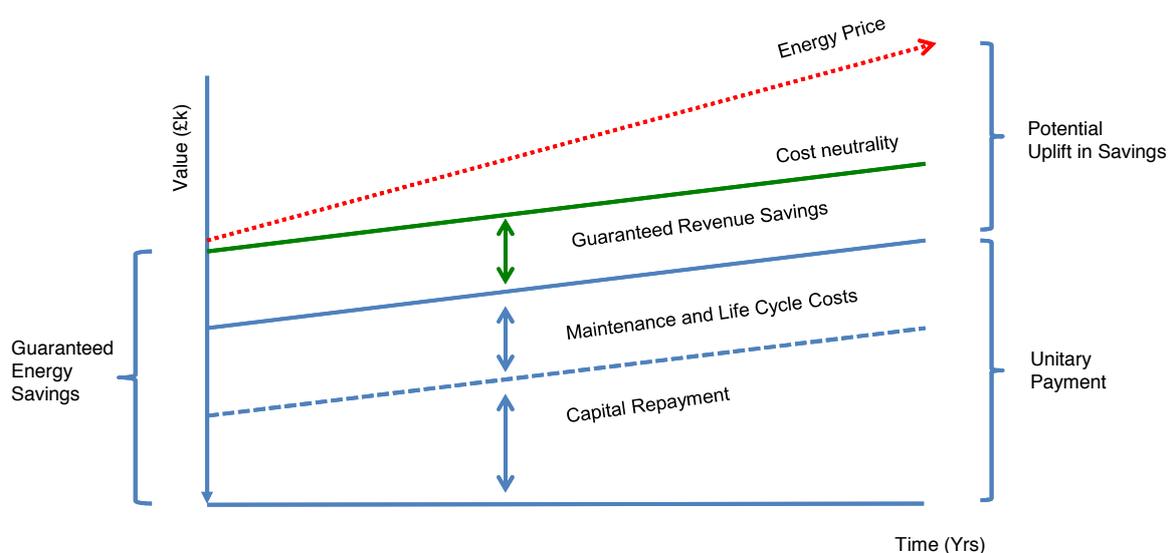
A CEF project will involve having an infrastructure upgrade or installation, normally over £1M over the lifetime of the project, between 15 to 25 years. The balance contract typically has a procurement period of 7-9 months. Some of the technical solutions offered by the contractors include:

- Insulation improvements and other fabric measures;
- Lighting retrofit;
- New HVAC systems/plants and Variable Speed Drives;
- Controls/BEMS, Metering⁹⁵;
- CHP including CHPQA compliance⁹⁶;
- Renewables (including solar PV and biomass);
- Energy distribution systems.

Financial features

The CEF provides Trusts with a contract to upgrade their energy consumption that includes project management, technical solutions, legal, procurement and financial balance sheet support free of charge. When a Trust decides to upgrade a facility, the CEF framework is used to select a contractor for the project. Then, when the Trust's board agrees to appoint a bidder, all project costs (including the CEF administration and contract costs) are included within the bid and are guaranteed by the energy savings of the project. The Trust does not pay for any of the project costs until it is procured, installed, and generating guaranteed savings.⁹⁷ The CEF finance model of investment and energy savings can be seen in Figure 24 below.

Figure 24 – The CEF Funding Overview (Source NHS SBS)⁹⁸



⁹⁵ http://carbonandenergyfund.net/public_docs/CEF%20-%20Master%20Pres%20Open%20Day.pdf

⁹⁶ Combined heat and power quality assurance (CHPQA). For more information go to: <https://www.gov.uk/chpqa-guidance-notes>

⁹⁷ http://carbonandenergyfund.net/public_docs/The_Carbon_and_Energy_Fund_and_how_it_works.pdf

⁹⁸ http://carbonandenergyfund.net/public_docs/CEF%20-%20Master%20Pres%20Open%20Day.pdf

In order to understand the economics of a project accepted by the CEF, it is helpful to look at an example project such as in Figure 6 below. It is important to note that not all CEF projects are funded by the CEF. Instead, each project using the CEF framework has the choice of proceeding using (i) its own funding, (ii) that of the contractor, or (iii) that of the CEF. If CEF members decide to fund their own project, they are still able to use the CEF expertise, contract, payment and audit mechanisms.⁹⁹

Figure 25 compares the different funding options to the right of the figure:

- The first column highlights a project using CEF funding;
- The second shows a conventional ESPC PPP;
- The last column shows a self-funded cost model.

Figure 25 – Feasibility example of a real CEF project with three funding options (Source: CEF 2015)

Core Energy Scheme	Funding options available to the trust		
	CEF funded	Contractor funded	Trust funded
Finance rate	£/1000 invested	£/1000 invested	
CEF funded – Cost of finance incl. capital repayment per £1000 capital	£86.37	£92.00	
Indexation assumed in funding/ sloped finance rate			2,5%
Unitary Payment Breakdown year 1	£ p.a.	£ p.a.	£ p.a.
Capital repayment element	£275,618	£293,584	£111,689
Operation and maintenance costs	£221,143	£221,143	£221,143
Total annual unitary payment CEF funded (incl VAT if on)	£496,761	£514,727	£332,833
Duration of contract after practical completion	15 years	15 years	15 years
Amount of grant funding included	£ -	£ -	£ -
Amount of capital funding required	£3,191,127	£3,191,127	£3,191,127
Simple affordability calculations	£	£	£
Total guaranteed savings	£523,754	£523,754	£523,754
Unitary payment	£496,761	£514,727	£332,833
Amount by which guarantee exceeds cost yr1	£26,993	£9,027	£190,922
NPV of proposal over 15 years	£1,041,094	£797,611	£734,537
Investment per tonne of carbon saved	£84.74	£84.74	£84.74
Is the proposal no service no fee throughout?	Yes	Yes	Yes

Impact and potential for replicability

The estimated carbon savings per year of all of the CEF projects either in procurement, construction or in operation are c160,000 tCO₂p.a.¹⁰⁰ They are expected to provide £200M of infrastructure replacement, creating gross savings of c£40M pa.

Carbon and Energy Fund CEO **Clive Nattrass** says: “We [the CEF] are designed for the NHS. Many think the CEF is too good to be true, but there’s no catch. What people do is get new for old and cash back”.

Alongside the anticipated energy and carbon savings, the CEF offers members and contractors networking opportunities and supports the sharing of experiences. The reassuring depth of experience offered by the CEF and its partners is one of the key advantages for Trusts wishing to embark on a secure energy upgrade. The framework of the CEF provides a protected and facilitated cradle-to-grave contract for energy improvements, with fewer administrative burdens and an energy guarantee.

⁹⁹ http://cefscotland.net/content.php?page=how_it_works

¹⁰⁰ <http://www.carbonandenergyfund.net/blog/>

Adrian Evans, deputy head of estates, of New Cross Hospital said: “we’re only going to do this [energy improvement] once. We don’t want to have to learn by our mistakes. We wanted the reassurance of working with an experienced team — that’s the reason we went with CEF. They have the experience and expertise we lacked. They were the voice of reason and experience.”¹⁰¹

Positive results so far have given the CEF framework more visibility as Trusts take the opportunity to use the system. The success of the first few phases of the NHS’s CEF funding model has led to the expansion of the fund in different sectors, such as the education sector (receiving £10-20M per year). Furthermore, £25M of funding has been ring-fenced to target smaller-scale demand-side projects in Local Authorities.

In a Nutshell

Scheme name	Carbon & Energy Fund
Location	UK
Target sector(s)	Health Sector, expanding into other parts of the public sector
Building types	Hospitals and other public buildings
Duration	2011 – ongoing
Investment	£300M+
Energy/carbon saving	160,000 tCO ₂ p.a.
Key features	Energy Service Performance Contracts deliver guaranteed savings for large, complex public buildings with no upfront costs; Dedicated team ensures learning is retained to benefit future applicants; Streamlining of procedures accelerates the tendering process by up to one year.

¹⁰¹ <https://hospital-bulletin.co.uk/energy-efficiency/93-a-big-year-for-carbon-savings>

CONCLUSIONS & RECOMMENDATIONS

This brief review of initiatives targeting the energy performance of the existing building stock has illustrated a diversity of approaches – some mandatory, some voluntary – to address the challenge of renovating buildings. These examples can serve as inspiration and motivation for policy makers, scheme administrators, investors, industry and indeed any stakeholder to use the experience outlined here to influence the renovation market in a positive way. And, while the schemes described here are good examples of renovation, each has been through a learning process, and indeed there is scope for further improvement so as to increase the depth of renovation (to avoid lock-in) and to increase uptake rates.

As governments and multi-national bodies around the world consider their response to the challenges of climate change energy security and provision of affordable energy, the ability to point to replicable schemes that are successfully delivering results is of paramount importance.

Member States should consider what further improvements could be made in the next versions of national renovation strategies due by April 2017, as required under Article 4 of the Energy Efficiency Directive. And, as EU policy makers consider the scope for revising the Energy Performance of Buildings Directive and the Energy Efficiency Directive, the exemplary roles of those countries or regions that have already introduced mandatory renovation requirements should inspire their inclusion within the ongoing debate on how to improve the policy framework in favour of higher energy performance across the existing European building stock.

Based on the examined schemes, the following key success factors can be drawn out:

- **Stakeholder engagement** – convening all relevant participants in the renovation process from the first stages of developing a renovation scheme and then keeping them in the loop when deploying the scheme maximises buy-in and the overall success of the initiative.
- **Provide support** – the ease with which some of these schemes can be applied is key to their uptake. Most building owners do not have the know-how to go through a procurement process, or the ability to determine the most appropriate measures to implement. Support bodies are needed to provide the necessary expertise and guidance to make the right energy-efficient choice.
- **Make financing easy** – the most common barrier to renovation is access to finance due to the complexity of most schemes. These schemes illustrate a variety of ways in which the financial barrier is being overcome.
- **Efficient implementation** – opting for standardised procedures enables replication and repeatability for the next building, district or scheme.
- **Operating at scale** – whether it's finance or the interest of construction companies, the larger the project, the greater the potential of attracting significant players and achieving the best economies of scale. Also, the more widely renovation solutions are deployed, the greater the chance for cost reductions through learning and increasing sales volumes.
- **Focus on quality** – buildings are major assets, so renovation should be treated as an opportunity to increase the value of the asset. This can only be done through quality work, delivered by appropriately trained and skilled designers, project managers and craftsmen.
- **Communication is key** – develop strong campaigns to motivate stakeholders and provoke interest in the scheme.

- **Incentivise a holistic approach and deeper renovation** – encourage more ambitious projects by offering higher levels of support depending on the final energy performance achieved. Or make deep renovation the only option.
- **Adapt to the needs of applicants** – every building is different and every occupant (household, business, and organisation) has his or her own particular circumstances and needs. Within a standardised approach, it is important to offer the flexibility to meet the specific needs of each situation and thus ensure the buy-in of applicants throughout the process.
- **Political commitment** – provides the essential underpinning support for scheme developers to design ambitious and efficient renovation schemes.



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