Low Energy
APARTMENT FUTURES

Low Energy Apartment Futures (LEAF)

Project Brochure





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Introduction

Low Energy Apartment Futures (LEAF) was a Europe-wide project which aimed to improve the energy efficiency of apartment blocks.

Funded by the European Union's Intelligent Energy Europe (IEE) programme and local organisations in each country, the project ran for three years: March 2013 to March 2016. It consisted of eight organisations from seven different countries:

1	**Changeworks**	Scotland, UK
2	**ALE Lyon and FLAME**	France
3	**Uppsala University**	Sweden
4	**Centre for Sustainable Energy**	England, UK
5	**Energiaklub**	Hungary
6	**e7**	Austria
7	**Fraunhofer Institute of Building Physics (IBP)**	Germany

The aim of LEAF was to identify and overcome key barriers to retrofitting apartment blocks, including shortcomings of Energy Performance Certificates (EPCs) and the difficulties of engaging multiple owners. We achieved this by working with case study buildings, creating resources for others to use and forming policy recommendations.

This brochure provides an overview of the project - our approach, example case studies, lessons and key findings.

Background

The challenge

With rising energy prices and international efforts to tackle climate change, improving the energy efficiency of homes is increasingly important across Europe. As such, the EU has committed to a 20% reduction in EU emissions by 2020 from 1990 levels[1].

Energy use in homes currently makes up a quarter of energy-related greenhouse gas emissions in Europe[2]; reducing this can be achieved through energy retrofit and behaviour change. Reducing household energy consumption benefits residents by making their homes cheaper and easier to heat. This is particularly significant as almost 10% of households in Europe cannot afford to heat their home adequately[3].

43% of all Europeans live in apartments[4], so addressing energy efficiency in these buildings is essential in meeting climate change, energy efficiency and fuel poverty targets. However these buildings are notoriously difficult to retrofit.

[1] European Commission (2013)
[2] European Environment Agency (2011)
[3] EU Fuel Poverty Network (2013). This refers to the 27 EU member states.
[4] Eurostat, European Union (2011)

Key statistics

Population 43

43% of Europeans live in flats.[4]

9.8% of households in Europe cannot afford to heat their home adequateley.[3]

Energy use in the home makes up **25%** of energy-related greenhouse gas emissions in Europe.[2]

Why are apartment blocks difficult to retrofit?

As with all domestic properties, householders looking to retrofit their properties face numerous barriers such as a lack of finance or accurate information on improvement measures. For apartment blocks these issues are often compounded by other factors including complexities of engaging multiple residents and shortcomings of EPCs.

EPCs provide information on how energy performance ratings of properties can be improved but in some countries they have limitations especially where multi-occupancy homes are concerned:

- **In the UK and France** whole building EPCs are not available for all buildings meaning that EPCs do not address the building as a whole or incorporate communal areas;
- **In Sweden and Germany** EPCs are only created for the building and cannot be created for individual apartments, meaning that dwelling specific measures are often overlooked.

Combined with issues such as obtaining planning permission and legal agreements, maintenance liabilities and engaging owners; retrofit becomes particularly challenging. Whilst the contexts in different European countries varies (for example, management arrangements), the key challenges and barriers are fundamentally the same.

These barriers highlighted to the LEAF consortium the need to improve the effectiveness of EPCs in these situations and to provide a support framework for owners through the retrofit process.

Further Information

Further information about the project background is outlined in the **Background reports**

The LEAF toolkits

Central to the LEAF project was the creation of resources to help building owners and managers undertake energy retrofit projects. The toolkits provide advice and information on retrofit and were designed to overcome a number of known barriers.

The toolkits:

A technical toolkit which provides organisations with a greater understanding of the measures that can improve the energy efficiency of their buildings. It features information on costs, savings, subsidies and user behaviour. For the French and UK version, it also includes a Communal EPC tool to bring together EPCs from individual apartments.

An engagement toolkit which provides a framework to manage the retrofit process and aid decision-making. It takes the form of a step-by-step guide which includes advice and information on communicating with residents, decision-making, obtaining legal agreements and gaining planning permission.

The LEAF toolkits are designed to be used by organisations such as building managers, housing associations, local authorities/municipalities, energy agencies, charities, residents' associations and private landlords.

We developed these toolkits using experience of the LEAF case study buildings (see pages 7-14) and tested them with our case studies and other stakeholders.

Country specific versions of the technical and engagement toolkits are available for: Austria, France, Germany, Hungary, Sweden and the United Kingdom. The engagement toolkit is also available as a Europe-wide version.

Further Information

Download the **toolkits** free of charge:
Technical Toolkit
Engagement Toolkit

Case study buildings

The LEAF project worked towards energy retrofit with 24 case study buildings across Europe. This provided invaluable lessons on the successes, challenges and barriers to retrofit, and informed our policy recommendations. The buildings included a range of different ages, tenures, management structures, planning situations, recommended measures and property sizes.

We worked with each of the case study buildings to:

- **Engage residents in the retrofit process**
- **Carry out EPCs and identify suitable energy efficiency measures**
- **Advise on funding options and availability**
- **Encourage residents to sign up to installation**
- **Support other requirements for installation (where residents agreed to installation)**
- **Provide behaviour change advice where appropriate**

Further Information

Details of all the LEAF case studies can be found in the **Case Study Report**

Scotland

Based in the Telford area of Edinburgh these two six-in-a-block buildings were built in the 1950s-60s and are of no fines concrete construction. The buildings are largely occupied by housing association tenants but include some private owners and tenants. Residents were motivated to improve the appearance of the blocks, reduce energy consumption and take advantage of Government funding which meant certain energy efficiency measures could be installed free of charge.

£208 savings per flat

External solid wall insulation and loft insulation were installed in these buildings and are **projected to reduce residents' annual fuel bills by an average of £208 (approximately €295) per flat**.

The main challenge with this project was the short timescale of the available funding, which left little time to raise awareness and build confidence in the scheme amongst residents. However, intensive engagement through a variety of means and trusted bodies encouraged residents to sign up.

Case study building during retrofit

The completed solid wall insulation

Further Information

Details of all the LEAF case studies can be found in the **Case Study Report**

Sweden

This 100 year old Art Nouveau building in Visby is owned by a housing cooperative and comprises 16 apartments and one shop; it is heated by a district heating system. The building is listed and located in a UNESCO World Heritage site and as a result, the energy efficiency measures that can be installed are restricted. Identifying suitable measures was therefore the main challenge of the project. Despite this the continued enthusiasm of the cooperative to improve energy efficiency, whilst finding measures which were sympathetic to building's cultural heritage, meant that they were able to progress with the help of LEAF.

A previous energy survey had identified problems with the distribution of heat in the district heating system. This prompted the cooperative to replace the circulation pump. Residents were keen to improve the heating system further and with the help of LEAF, have re-balanced the system and started to replace the radiator thermostats. In addition, they have begun renovating the windows and terrace doors and have received behaviour change advice. One particularly pleased resident said the following about the renovations: **"The new door to the terrace is fantastic! It used to be so draughty my hair would actually flutter!"**.

"The new door to the terrace is fantastic! It used to be so draughty my hair would actually flutter!"

Case study building viewed from the front

Bay window before renovation work

Further Information

Details of all the LEAF case studies can be found in the **Case Study Report**

England

College Court, located in Bristol, is a 1950's built apartment block of brick cavity wall construction. The building is comprised of 19 dwellings occupied by a mix of private tenants and owner occupiers. The residents were motivated to take part in the LEAF project to reduce their fuel bills and improve comfort in their apartment. Energy surveys showed that the majority of apartments had energy efficiency ratings below the national average.

Potential to save £2,679 per year

Cavity wall insulation was the main measure recommended to residents to reduce heat loss in the block. This was progressed but could not be installed due to a partial roof collapse during the project. However, it is hoped that it will be installed at a later date once the roof has been repaired. The key to this project was the identification of one passionate resident who was able to act as a champion driving the retrofit process forward.

If installed, it is predicted that cavity wall insulation would **reduce fuel bills for the whole block by approximately £2,679 (€3,523) a year**. LED lightbulbs were also installed in three of the apartments.

Street view of the case study building

Installer checking feasibility of cavity wall insulation

Further Information

Details of all the LEAF case studies can be found in the **Case Study Report**

Austria

Potential to save €4,180 per year

Based in Vienna, these two apartment blocks comprise 30 dwellings, including both owner occupiers and private tenants. In 2008, the blocks' heating system was renewed and windows were replaced; however, the blocks still required major maintenance work. Residents were encouraged to look into energy efficiency retrofit in order to improve comfort and alleviate damp and mould in their properties. They were keen to make cost efficiencies by combining the necessary maintenance work and energy efficiency improvements wherever possible.

Measures recommended for these properties were roof, external wall and basement ceiling insulation. Residents decided via a vote at a residents meeting that they would install roof and basement ceiling insulation. **Together these measures are anticipated to save €4,180 a year on fuel bills across the two blocks.**

The main barrier in this case study was motivating residents to install energy efficiency measures at a time when energy costs were relatively low in Austria, as this meant energy savings from the measures were relatively small. However the resident meetings enabled discussions around energy efficiency to take place regularly and for the full benefits of measures (i.e. increased comfort, reduce damp) to be highlighted to residents.

Case study building as viewed from the street

View of building from the back garden

Further Information

Details of all the LEAF case studies can be found in the **Case Study Report**

Hungary

This multi-storey building in Budapest is constructed of very thin concrete walls and is heated by district heating. All 36 of its dwellings are privately owned; however, the communal areas are owned by a housing association.

Reduce CO_2 emissions by an estimated 62%

Residents of this block were motivated to become involved in the LEAF project in order to reduce their high energy bills. They hoped the project would identify appropriate technical solutions and help them access finance to install such measures.

Prior to the LEAF project, the residents had recently decided to install thermostatic radiator valves. Further measures recommended to them in the project were: external wall insulation, flat roof insulation and double glazing.

Unfortunately at the time of the project, high investment costs and lack of Government funding prevented any installations from proceeding. However the case study highlights the high energy saving potential in a typical multi-occupancy building in Hungary: if installed, these measures would **reduce CO_2 emissions by an estimated 62%.**

Case study building

Energy assessors at the building

Further Information

Details of all the LEAF case studies can be found in the **Case Study Report**

France

This 1951 built apartment building, located in Saint Etienne, is of concrete construction and had no insulation prior to the retrofit process. The block contains four apartments, two of which are owner-occupied and two are privately rented. In Saint Etienne, supply of apartments far outstrips demand; therefore the landlord of the rented properties was keen to improve the attractiveness of the properties to potential tenants. The owner-occupiers were keen to reduce their energy bills.

Reduce energy consumption by as much as 72%

The building had a high energy consumption and therefore great potential for energy savings. Whilst the lack of consistent Government funding made securing finance a challenge, the owners could afford to contribute towards the measures. This resulted in a package of measures being installed: external wall, loft and floor insulation, a new ventilation system, replacement double glazing and an upgrade of two older boilers. Overall these measures are projected to **reduce energy consumption by as much as 72%.**

Case study building before retrofit

Case study building during retrofit

Further Information

Details of all the LEAF case studies can be found in the **Case Study Report**

Germany

Located in Aachen, Klosterweiher is a residential complex made up of 60 privately owned apartments. These are occupied by a mix of owner-occupiers and private renters, who were keen to retrofit their building in order to improve comfort and increase marketability for private landlords.

Problems with heat loss in the building prompted the recommendation and installation of loft insulation and double glazed windows and insulated doors in the stairwells. This combination of measures should improve the energy efficiency of the building, improving indoor comfort in the process.

Decision-making amongst the residents was difficult, largely due to existing internal conflicts between residents. However, representatives from the building's management team and Fraunhofer IBP were able to engage residents, mediate discussions and ultimately help them reach a decision on which measures to take forward.

Case study buildings viewed from the front

Glass-brick façade in the staircase, before retrofit

Further Information

Details of all the LEAF case studies can be found in the **Case Study Report**

Results

This section outlines the savings achieved through the 24 case study buildings. During the course of the project:

- **Five successfully agreed and installed energy efficiency measures.**
- **Five had agreed on, but not yet installed, measures.**
- **Nine were still in the decision-making process.**
- **For the remaining five, the barriers (see Lessons, page 16) experienced during the retrofit process proved too great and as such they decided not to continue, at least for the time being.**

The table below shows how the primary energy and carbon dioxide (CO_2) emissions savings achieved from the case study buildings compare to the LEAF targets which were set at the start of the project. The projected savings are from the ten buildings where measures have been installed or agreed. These savings are displayed as 'per building' and 'per dwelling'; which is based on all case study buildings[5]. It is expected that many of the buildings, where measures were not agreed during the project, will agree to do so in the near future. This would increase the savings achieved through LEAF considerably.

Savings	Per building		Per dwelling		Total
	Target	Result (projected)	Target	Result (projected)	
Primary energy (kWh/year)	24,000	35,199	2,300	1,180	844,767
CO_2 emissions (tCO_2/year)	6.00	9.71	0.55	0.325	233

The table shows that the case studies exceeded the 'per building' targets but fell below the 'per dwelling' target. This is because many of the buildings were considerably larger (i.e. had greater numbers of dwellings) than had been anticipated.

The savings illustrate that considerable energy and CO_2 savings are possible from apartment blocks. However agreeing measures is challenging and in many cases will take longer than a three year timescale (as was the case with LEAF).

[5] This includes 24 buildings with a total of 716 dwellings.

Further Information

Full results can be found in the **Results and Evaluation report**

Lessons

Working closely with the case study buildings enabled us to identify key challenges to improving the energy efficiency of apartment blocks across the partner countries. They also highlighted best practice, successes and supportive policies that enabled retrofit to take place.

The main challenges and barriers are outlined below. Alongside are examples of successes where these potential barriers were overcome.

Information provision

Challenges and barriers	Examples of success
• Residents' lack of understanding of energy consumption and how to reduce it.	• Support and encouragement from an impartial third party energy advice organisation improves understanding and awareness, prompting residents to explore and progress options.
• In some instances the quality of information provided through EPCs was poor or not user-friendly.	• Additional support from energy agencies and the creation of engaging resources increases residents' understanding.
• EPCs in some countries (e.g. France and UK) do not include possible improvements to communal areas.	• Other partner countries have this facility resulting in more of a whole building approach to retrofit.

Further Information

Details of these lessons can be found in the **Case Study Reports** and the **Policy Recommendations report**

Demand-side factors	
Challenges and barriers	**Examples of success**
• Lack of interest in energy efficiency improvements from residents, owners and/or property managers.	• Regular resident meetings facilitate discussion and increase resident engagement. • Short-term contracts for building management companies (e.g. Germany) increases competition, prompting companies to look into building improvements. • Longer term leases mean residents have a greater willingness to improve properties which they do not own (e.g. Germany). • Providing case studies of similar retrofit examples can encourage residents to sign-up to proposals. • Engaging one motivated resident to act as a champion can help to engage others.
• A lack of decision making procedures (e.g. UK), and equally in some cases, overly structured procedures (e.g. France) can delay the retrofit process. This is especially important where funding is time limited.	• Having an agreed decision making process (e.g. majority vote, Austria) increases speed at which decisions are made.

Further Information

Details of these lessons can be found in the **Case Study Reports** and the **Policy Recommendations report**

Funding and finance	
Challenges and barriers	**Examples of success**
• Lack of consistency and simplicity in funding schemes. This makes planning ahead difficult, especially for multi-occupancy buildings which require considerable time to develop plans.	• Schemes which provide long-term certainty of funding and/or where criteria do not change.
• Funding criteria can add an additional layer of complexity for multi-occupancy buildings. For example, where different owner types (i.e. owner occupier, social landlord, private landlord) have access to different levels of funding.	• Schemes which are designed to meet the needs of areas or typical building types (e.g. the HEEPS:ABS scheme, Scotland, funds measures in private dwellings in multi-occupancy buildings which complements funding for social housing in these blocks).
• Lack of financial arrangements and funding for maintenance, which means energy efficiency improvements are less likely to happen. • Residents being unable to contribute towards measures.	• Existing maintenance and improvement funds which are regularly paid into by residents.

Further Information

Details of these lessons can be found in the **Case Study Reports** and the **Policy Recommendations report**

Supply chain

Challenges and barriers	Examples of success
• Project management - complex projects require a level of co-ordination which often isn't possible for owners to resource.	• Having a dedicated and experienced project manager (internal or external agency).

Regulation

Challenges and barriers	Examples of success
• Lack of regulation for multi-occupancy buildings results in a lack of incentive to progress energy efficiency improvements.	• Requirement to make energy efficiency improvements alongside maintenance improvements (e.g. France). • Minimum EPC ratings for properties being rented and or sold (e.g. social housing in Scotland).
• Buildings with no formal management arrangement have no clear procedure or framework to progress improvements.	• Having a good quality, regulated, factor or management company in place.
• Planning and building regulations limit the types of improvements that can be made.	• Detailed information on which changes can be made in protected areas proved successful (e.g. Visby, Sweden).

Further Information

Details of these lessons can be found in the **Case Study Reports** and the **Policy Recommendations report**

Policy recommendations

Lessons from the LEAF project were used to create a series of policy recommendations designed to make retrofit more achievable in multi-occupancy buildings. Recommendations at a European level are summarised below.[6]

The full set of recommendations is available in the **Policy Recommendations report**

Information provision

- Develop and maintain a publicly available database of all EPCs
- Improve the:
  - quality of energy saving calculations presented in EPCs
  - communication of recommended measures on EPCs
  - overall clarity and explanation of content of EPCs
  - comparability of EPCs between different Member States
- Ensure there are whole building EPCs in all Member States (with minimum standards linking to communal areas)

Demand-side factors

- Improve the provision of information on low carbon retrofit
- Expand local energy advice services

Further Information

Full European and national policy recommendations are available in the **Policy Recommendations reports**

Funding and finance

- Improve the availability, design and management of public funding schemes
- Expand the level and type of financial support initiatives
- Develop the role of EPCs in financial support initiatives for energy efficiency improvements

Supply chain

- Implement accreditation schemes for installers and EPC assessors
- Upskill the workforce, with a focus on developing local networks and improving ambition and quality of retrofit projects
- Improve integration between low carbon retrofit and maintenance and renovation work

Regulation

- Introduce minimum requirements at the point of renovation, and at the point of sale and/or lease
- Require management arrangements for multi occupancy buildings which include communication structures and decision making processes
- Require maintenance plans and funds for multi occupancy buildings

[6] These recommendations should be read in the context of the full discussion of issues and opportunities identified during the LEAF project, and specifically local considerations should be taken into account when considering suitable policy changes.

Further Information

Full European and national policy recommendations are available in the **Policy Recommendations reports**

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Further Information

LEAF website including the final report
lowenergyapartments.eu

Background reports
lowenergyapartments.eu/about-leaf/background/

The technical toolkit
lowenergyapartments.eu/the-leaf-toolkit/the-toolkit/

The engagement toolkit
lowenergyapartments.eu/the-leaf-toolkit/engagement-toolkit/

Case study reports
lowenergyapartments.eu/case-studies/

Results and evaluation report
lowenergyapartments.eu/project-findings/results-and-evaluation/

Policy recommendations
lowenergyapartments.eu/project-findings/policy-recommendations/

Partner websites

ALE Lyon | ale-lyon.org

Centre for Sustainable Energy | cse.org.uk

Changeworks | changeworks.org.uk

e7 | e-sieben.at/en

Energiaklub | energiaklub.hu/en

FLAME | federation-flame.org

Fraunhofer Institute of Building Physics (IBP) | ibp.fraunhofer.de/en

Uppsala University | uu.se/en

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Project Brochure

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