EEFIG UNDERWRITING TOOLKIT

Value and risk appraisal for energy efficiency financing

June 2017

Energy Efficiency
Financial Institutions Group

The Energy Efficiency Financial Institutions Group (EEFIG) was established in 2013 by the European Commission Directorate-General for Energy (DG Energy) and United Nations Environment Program Finance Initiative (UNEP FI). It created an open dialogue and work platform for public and private financial institutions, industry representatives and sector experts to identify the barriers to the long-term financing for energy efficiency and propose policy and market solutions to them. EEFIG has engaged 120 active participants from 100 organizations to deliver clear and unambiguous messages.

In February 2015 EEFIG presented its landmark report "Energy Efficiency – the first fuel for the EU Economy: How to drive new finance for energy efficiency investments" which provided a significant advance in the understanding and knowledge about the issues of energy efficiency financing. The findings of the EEFIG Report have contributed to actions such as G20 commitments, and the European Commission has taken the EEFIG report into full consideration in the development of energy efficiency related policies.

In continuation of the EEFIG 2015 findings, the De-risking Energy Efficiency Project Consortium was formed to support EEFIG during 2016-2017 in its work addressing the fundamentals of energy efficiency investments in the buildings and corporate sectors through two main work streams, the creation of an open source database for energy efficiency investments providing performance monitoring and benchmarking, and the development of common, accepted and standardized underwriting and investment framework for energy efficiency investing. In November 2016, the EEFIG's De-risking Energy Efficiency Platform (DEEP) was launched with over 7,800 projects in an open-source, pan-EU database to improve the sharing and transparent analysis of existing energy efficiency projects in Buildings and Industry. In June 2017, the present EEFIG Underwriting Toolkit was launched.

All of EEFIG's reports, analysis and evidence base can be accessed from www.eefig.eu.

ISBN: 978-1-5272-1107-0

EEFIG UNDERWRITING TOOLKIT

Value and risk appraisal for energy efficiency financing

June 2017

THE EEFIG UNDERWRITING TOOLKIT

INTRODUCTION

This Toolkit is designed to assist financial institutions to scale up their deployment of capital into energy efficiency. It was compiled with several objectives in mind:

- to help originators, analysts and risk departments within financial institutions better understand the nature of energy efficiency investments and therefore better **evaluate both their value and the risks.**
- to provide a **common framework** for evaluating energy efficiency investments and analysing the risks that will allow training and capacity building around standardised processes and understanding.
- to help developers and owners seeking **to attract external capital** to energy efficiency projects to develop projects in a way that better addresses the needs of financial institutions.
- to foster **a common language** between project developers, project owners and financial institutions.

Although the focus is on value and risk appraisal, additional material on the size of the potential market, methods of financing and the project life cycle have been included to give a fuller picture and help build capacity within financial institutions. The sections of this EEFIG Toolkit have been designed with several specific audiences in mind:

Senior Management and decision makers: The first section, "Financial institutions and energy efficiency", is aimed at senior management and executives new to energy efficiency or already considering introducing energy efficiency related products or programmes. It sets out the arguments why financial institutions should be interested in deploying capital into energy efficiency, namely: business opportunity, risk reduction, Corporate Social Responsibility, and regulatory pressure.

Origination teams and project developers: The second section, "Financing Energy Efficiency", sets out the different ways in which energy efficiency can be financed and the types of structures and contracts that can be used. It is aimed primarily at origination teams and project developers.

Project developers and risk teams: The third section, "The Project Life Cycle", describes the overall process of developing and executing an energy efficiency project. It is aimed at establishing the foundations for a standardised process and a common language that can be used by financial institutions, project developers and project hosts. As such it is aimed at project developers, originators and risk teams.

Risk teams, project developers and originators: The fourth section, "Value and Risk Appraisal", identifies the various sources of value that can be created by energy efficiency projects, including non-energy benefits such as increased asset value, increased productivity and increased health and well-being. All energy efficiency investments, whatever their size or nature, involve various types of risk including several components of performance risk, as well normal counter-party risks, and this section sets out the categories of risk and how to mitigate them. An overall approach to risk appraisal is set out. This section is primarily aimed at risk teams but should also be of value to originators and project developers in two ways. Firstly, the discussion of the various sources of value resulting from energy efficiency investments may help the selling of energy efficiency projects and products, and secondly, understanding the risk factors from the beginning of the project life cycle should lead to better developed business cases with lower risk and higher performance.

Besides the sections described above, the Toolkit also includes an on-line Resources section which can be used to access more detailed information on specific topics. The Resources section is a "living document" which can be expanded as the energy efficiency financing market develops.

Although the Toolkit is primarily aimed at private providers of finance, the principles of energy efficiency financing, the project life cycle and value and risk appraisal approach described within the Toolkit apply equally to public bodies deploying capital into energy efficiency – even if capital is being deployed at below market rates or in the form of grants – and therefore the Toolkit should also be of assistance to those developing publicly supported energy efficiency programmes. The Toolkit also aims to assist project developers and project hosts to develop projects that are more in line with the requirements of financial institutions.

Finally, the Toolkit could also be useful to Chief Financial Officers and financial teams within corporates who are looking at funding energy efficiency projects using corporate balance sheet funds. In considering proposed energy efficiency investments corporate financial decision makers often face many of the same issues as providers of external finance, including a lack of confidence in the projected results and a lack of capacity to properly evaluate investment projects.

USING THE TOOLKIT

Are you a senior manager or executive considering, or establishing a programme to deploy more capital into energy efficiency?

Focus on:

- Energy efficiency and financial institutions
- Financing energy efficiency

Are you working in valuation and risk assessment or a corporate CFO looking to invest in energy efficiency?

Focus on:

- Value and risk appraisal
- Project life cycle
- Financing energy efficiency

Are you an originator, project developer or project host looking to understand more about the project development process and the appraisal of energy efficiency projects?

Focus on:

- Financing energy efficiency
- Project life cycle
- Value and risk appraisal

For additional detail on the topics discussed here, the on-line Resources volume is available at

http://valueandrisk.eefig.eu/resources.

The Resources section includes material on energy efficiency principles, energy management, energy efficiency technologies, energy efficiency policies, examples of energy efficiency financing, as well as various tools and information on risk mitigation methods.

ACKNOWLEDGEMENTS

The authors would like to acknowledge all members of EEFIG for their input and specifically the following organisations which have made direct contributions to the writing of this Toolkit.

ABN Amro, Adelphi, Amber Infrastructure, Ameresco, Aon, Aurubis, Barclays, BASE, Belifus, Berlin Hyp, Better Building Partnership, BMGI-Consulting, BPCE, Bulgarian Energy Efficiency and Renewable Sources Fund, Caisse des Depots et Consignations, Carbon & Energy Fund, CEN/CENEC, Cycle 7, Danfoss, DENEFF, Deutsche Bank, DG Energy, EFIEES, EEIP, EEP University of Stuttgart, EEVS, Eiffel Fund, EESL, EuroACE, European Energy Efficiency Fund, Eurima, European Investment Bank, Finerpol EPC, Green Investment Bank, Hermes Investment Management , IFFR, Investor Confidence Project, ING, Italcogen, KEA Baden-Wurtenberg, Komercni banka, LABEEF, Lux Nova Partners, Münchener Hypothekenbank, PACENow, PIB Insurance, PostBank, OpenExp, RdA Climate Solutions, Romanian Green Building Council, Saint-Gobain, Santander Group, Serimus, SUSI, Tera srl, The Carbon Trust, The CO Firm, The Curve, Triodos, Turboden, UK Department for Business, Energy & Industrial Strategy, UNEP FI, University of Geneva, University of Stuttgart, Verco Advisory Services, Vesta Conseil & Finance, VIPA.

Any errors or omissions remain the responsibility of the authors.

AUTHORS

Principal Author: Steven Fawkes,
EnergyPro Ltd

EEFIG Derisking Project Consortium:
COWI A/S
EnergyPro Ltd
Climate Strategy and Partners
Fraunhofer
Buildings Performance Institute Europe
National Technical University of Athens

TABLE OF CONTENTS

The on-line Resources section can be found at: http://valueandrisk.eefig.eu/resources

TABLE OF FIGURES

TABLE OF TEXT BOXES

FINANCIAL INSTITUTIONS AND ENERGY EFFICIENCY

This section sets out the reasons why financial institutions are, or should be, active in energy efficiency financing. These include; a large and growing market opportunity, risk reduction, Corporate Social Responsibility, and growing interest from financial regulators.

KEY POINTS

Leading financial institutions are active in energy efficiency for four main reasons:

- *it represents a significant new business opportunity.*
- *it can reduce client risk through improving cash flow and reducing the risk of stranded assets resulting from tightening energy efficiency regulations.*
- *it delivers environmental objectives which are a key component of Corporate Social Responsibility programmes.*
- *banking regulators are increasingly looking at climate risks and energy efficiency is a major factor in mitigating those risks.*

These four reasons should encourage other financial institutions to enter the market.

RECOMMENDATIONS

- *Assess the market potential for energy efficiency in key client sectors addressed.*
- *Assess current and future legislative and regulatory environment for energy efficiency.*
- *Identify any support mechanisms – either government grants or financial instruments such as guarantee mechanisms.*
- *Assign senior management responsibility to drive product development.*
- *Product design needs to be proactive, systematic and address the drivers of demand as well as the provision of capital.*
- *Encourage and assist clients to identify cost-effective energy efficiency improvements which go beyond business-as-usual when considering normal investments such as building refurbishments or new building construction.*
- *Ensure energy efficiency loans and investments are tagged to enable future tracking and measurement of risk and environmental impacts.*
- *Ensure energy efficiency products use best practice technical processes including the use of internationally recognised standards.*
- *Assess potential for improving energy efficiency within own property portfolio and use to develop products and build capacity.*

DISCUSSION

Although there are pools of private sector capital financing energy efficiency projects and programmes outside of those programmes promoted by multi-lateral development and policy banks, (all of which have had a long interest in energy efficiency), these can be considered pioneering or early adopters. Interest and engagement of private finance in energy efficiency was limited until the last decade as the majority of energy financing has been focused on renewable energy and other energy generating assets. Despite growing interest in energy efficiency, aided and supported by the activities of institutions such as the Energy Efficiency Financial Institution Group (EEFIG) and the G20 Energy Efficiency Finance Task Force, the levels of investment to date fall short of both what is possible and what is needed to meet Europe's energy and climate targets. Financial institutions, both lenders and investors, can take positive action to accelerate the flow of capital into this important area which can be both profitable and address key areas of corporate and systemic risk.

FOUR REASONS TO BE INTERESTED IN ENERGY EFFICIENCY

There are four reasons why financial institutions should consider deploying capital into energy efficiency:

- energy efficiency represents a large potential market. The IEA estimates that in 2015 global investment in energy efficiency was USD 221 billion with approximately USD 32 billion being financed through explicit energy efficiency mechanisms such as Energy Performance Contracts or green bonds. To achieve our climate goals this level of investment needs to grow to circa USD 1 trillion per annum by 2050 and the provision of finance can help overcome some of the barriers to energy efficiency investment.

- reducing risks in two ways. Firstly, increasing energy efficiency improves the cash flow of clients, thus reducing their risk. Secondly there is the risk of financing assets that become stranded as energy efficiency regulations are tightened. For example, in England & Wales it will become unlawful to lease a commercial building with an Energy Performance Certificate rating below E on 1st April 2018. This puts owners of low performing buildings, and their lenders, at risk.
- improving energy efficiency has a direct impact on reducing emissions of carbon dioxide and other environmental impacts such as local air pollution and therefore should be a key part of Corporate Social Responsibility (CSR) programmes. Energy efficiency is regarded as one of the key pathways to reducing greenhouse gas emissions.
- bank regulators are increasingly looking at climate related risks. Actions include asking banks to disclose the climate-related risks of their loan portfolios. In France disclosing climate-related risks is already required by law. This will allow financial institutions to be better informed about loan performance and thus the cost of risk and carry out better risk appraisal. Possible future actions may include reducing capital reserve requirements for "green" financing.

Each of these four factors are considered in more detail below.

A LARGE POTENTIAL MARKET

The IEA estimate that that in 2015 total global investment into demand-side energy efficiency was USD 221 billion, USD 118 billion in buildings, USD 39 billion in industry and USD 64 billion in transport. Investment into energy efficiency was less than 14% of the total energy sector investment, but increased by 6% in 2015 whereas investment into energy supply fell. The US, EU and China represent nearly 70% of the total investment into efficiency. Total investment into efficiency can be split into "core" investments, where the motivation is specifically to achieve energy savings, and "integrated" investments which are the regular transactions in which energy efficiency is not the motivation but which improve efficiency because the new product is more efficient than the one it replaces.

To date about 85%, of all energy efficiency investment has been financed with existing sources of finance or self-financing rather than specific energy efficiency products or programmes. The global market for Energy Performance Contracts, which are most often associated with external financing, was USD 24 billion in 2015 and of this USD 2.7 billion was in Europe. In addition, about USD 8.2 billion of green bonds were used to finance energy efficiency.

In order to achieve climate targets the level of investment in energy efficiency, and the level of energy efficiency financing, will need to increase substantially. The IEA and IRENA estimate that to achieve their "66% 2°C" scenario cumulative, global investment in energy efficiency between 2016 and 2050 will need to reach USD 39 trillion of which USD 30 trillion would be in the G20 economies, implying a global level of c.USD 1 trillion a year compared to the current level of USD 221 billion – a five-fold increase.

The business opportunity for financial institutions falls into two categories:

- creating new business lines for specific energy efficiency projects e.g. specific energy efficiency loans, mortgages or funds.
- ensuring normal lending and investing which is being used to finance projects where energy efficiency is not the primary objective, e.g. building refurbishments or production facility upgrades, is leveraged to ensure funded projects achieve the optimum cost-effective levels of energy efficiency which are usually higher than "business as usual" levels.
- Specific mechanisms for addressing these opportunities are discussed in the Financing Energy Efficiency section of this Toolkit.

Energy efficiency projects often have rapid paybacks. In EEIFG's DEEP (Derisking Energy Efficiency Platform) database, which includes over 7,500 projects, the reported median paybacks are 5 years for buildings and 2 years for industrial projects. The average for buildings can be misleading as there are two very different types of projects being considered, relatively simple single technology projects with rapid payback periods, and more complex, multi-technology, whole-building retrofits which achieve deep energy savings. The latter typically have long, but still attractive in the context of infrastructure

TEXT BOX 1.1 DERISKING ENERGY EFFICIENCY PLATFORM (DEEP)

The De-risking Energy Efficiency Platform (DEEP) was developed by the EEFIG De-risking Project consortium and launched in the end of 2016 in close coordination with the Commission's "Clean Energy for All Europeans" package. DEEP is an open source database for energy efficiency investments performance monitoring and benchmarking, based on evidence from implemented projects. The main objective of the DEEP is to improve the understanding of the real risks (especially performance risks) and benefits of energy efficiency investments based on market evidence. At launch the database included more than 7,800 energy efficiency projects in buildings and industry from 25 data providers.

DEEP provides anonymized historical data structured along major project characteristics, (geography, energy efficiency measures, verification status, industry / type of building, multiple benefits, etc.). It provides insight on financial performance indicators such as payback and discounted avoidance cost. Financial institutions can use this evidence in market assessment, performance risks calculation and to benchmark their own individual projects or portfolios against user-selected sub-sets of the projects in DEEP.

For more information see:
https://deep.eefig.eu

TEXT BOX 1.2 CLEAN ENERGY FOR ALL EUROPEANS

In its Winter package, "Clean Energy for all Europeans", published on 30 November 2016, the European Commission put forward three main goals:

- putting energy efficiency first
- achieving global leadership in renewable energy
- providing a fair deal for consumers.

The Winter package proposed that the EU should set a target binding at the EU level of 30% by 2030. Compared to the at least 27% target agreed in 2014, this increase is expected to translate into up to EUR 70 billion of additional gross domestic product and 400,000 more jobs as well as a further reduction in the EU's fossil fuel import bill.

The Commission proposed to update the Energy Efficiency Directive by:

- Extending beyond 2020 the energy saving obligation requiring energy suppliers to save 1.5% of energy each year from 2021 to 2030
- Improving metering and billing for consumers of heating and cooling.

The Commission also proposed updating the Energy Performance of Buildings Directive by:

- Encouraging the use of ICT and smart building technologies
- Strengthening the links between achieving higher rates of building renovation, funding and energy performance certificates as well as reinforcing provisions on national long-term building renovation strategies with a view to decarbonising the building stock by 2050

The Commission also launched a Smart Finance for Smart Buildings initiative to unlock financing for energy efficiency and renewables at a greater rate, by supporting aggregation, de-risking energy efficiency investments and a more effective use of public funds, to leverage in private financing.

investments, payback periods. Despite this economic attractiveness many potential projects do not proceed because of other priorities of the other project host, lack of internal capacity to develop projects, or shortage of investment capital. Furthermore, normal investments in building refurbishments and industrial facilities or new buildings and facilities often do not utilise all of the cost-effective potential for energy efficiency. The provision of third party finance through business models that reduce the overall cost to the host is an important way of overcoming some of the barriers to improving energy efficiency and represents a major business opportunity for financial institutions.

TEXT BOX 1.3 MINIMUM ENERGY PERFORMANCE STANDARDS IN THE NETHERLANDS AND THE UK

In the Netherlands, MEPS for buildings are in place and regularly tightened. The Dutch government has designed an Energy Performance Coefficient instrument, which consists of minimum norms for new-build buildings. Aiming to reduce CO^2 emissions, the instrument reduced the norm (from 0.6 to 0.4) for all new buildings in 2015. In the same year, MEPS were also tightened for renovations in existing buildings. Energy Performance Certificates (EPCs) have become a supporting tool to overcome the challenges of financing energy efficiency measures in the Dutch non-residential buildings. However, in the commercial sector, the EPC as an asset rating is often not regarded as an investment grade instrument by financing institutions. It is also relevant to note that according to the Dutch National Energy Efficiency Action Plan, the EPC of a building could pose a limit to the maximum rent.

In the UK, Minimum Energy Efficiency Standards (MEES) come into effect on 1st April 2018. After that date, a non-domestic property cannot be let or sold unless it meets a minimum standard of an Energy Performance Certificate rating of E (on a scale of A to G). If a property fails to meet the minimum standard then an assessment must be undertaken to identify relevant energy efficiency improvements which must then be carried out. Research in 2016 suggested that one in five commercial properties were at risk of devaluing and that the fall in value of the UK commercial property portfolio could be as much as £16.5 billion [1].

[1] CO^2 Estates (2016) MEES: The implications for rent reviews, lease renewals and valuation http://www.CO2estates.com/mees-the-implications-for-rent-reviews-lease-renewals-and-valuation/

REDUCING RISK

Energy efficiency investments can reduce risks for financial institutions in two ways:

- assisting individual clients, whether they be businesses or individuals, to reduce their energy costs improves their cash flow and profitability, as well as increasing their resilience to energy price rises. Reduced expenditure on energy translates directly to improved cash flow which improves the affordability of loans or mortgages, thus lowering risks to the lender.
- Tightening regulations around energy efficiency, particularly buildings such as Minimum Energy Efficiency Standards, mean that it will become impossible to rent or sell energy inefficient buildings. This is a stranded asset risk for the owner and lender.

Increasing levels of energy efficiency, essentially reducing the amount of energy used for any activity, is a central part of European policy to address concerns about energy security and climate change. European policy is driving tighter energy efficiency regulations for buildings, equipment and appliances as well as vehicles. The main EU policies are the Energy Efficiency Directive (EED) and the Energy Performance of Buildings Directive (EPBD) and in November 2016 the European Commission, in its Winter Package, ***"Clean Energy for all Europeans",*** proposed further tightening of energy efficiency regulations.

Some member states have implemented Minimum Energy Efficiency Standards (MEES) (also known as Minimum Energy Performance Standards (MEPS)) which mean that after a certain date buildings with an energy efficiency below a set level cannot be sold or rented. These regulations mean that significant proportions of existing real estate portfolios could lose their income and asset value if they are not upgraded to a higher level of energy efficiency. For owners of large property portfolios, or banks lending to property owners, this represents a significant risk which needs to be addressed. Text box 1.2 describes the situation in the UK and the Netherlands with regard to MEPS.

THE ENVIRONMENTAL BENEFITS OF ENERGY EFFICIENCY

For many years advocates of energy efficiency have argued that it is the lowest cost source of energy services and a low-cost route to achieving significant reductions in greenhouse gas emissions. This has now been recognised both by policy makers and by many financial institutions. The projects in EEFIG's DEEP (Derisking Energy Efficiency Platform) database suggest that the median avoided cost of energy is 2.5 Eurocents/kWh for buildings and 1.2 Eurocents/kWh for industry, which is significantly lower than consumers' energy costs. Energy efficiency has been described as "the linchpin that can keep the door open to a 2°C future". The IEA estimates that in achieving a 2°C scenario energy efficiency must account for 38% of the total cumulative emission reduction through 2050, while renewable energy only needs to account for 32%. For financial institutions looking to make a positive impact on resolving environmental problems as part of Corporate Social Responsibility programmes supporting energy efficiency should be a high priority. As well as reducing emissions of carbon dioxide that drive global climate change, reducing energy consumption can also have a positive effect on local air pollution.

ENERGY EFFICIENCY AND FINANCIAL REGULATORS

Financial regulators are taking an increased interest in systemic risks including climate change. There is also a growing interest from regulators and governments in encouraging the growth of "green finance". The European Systemic Risk Board in its Scientific Advisory Committee report of February 2016, ***"Too little, too sudden",*** warned of the risks of "contagion" and stranded assets if moves to a low carbon economy happened too late or too abruptly. The report's policy recommendations including increased reporting and disclosure of climate related risks and incorporating climate related prudential risks into stress testing.
In December 2016, the Financial Stability Board (FSB) Task Force on Climate-related Financial Disclosures (TCFD) published its recommendations which included disclosure of organisations' forward looking climate related risks.

In July 2015, France strengthened mandatory climate disclosure requirements for listed companies and introduced the first mandatory requirements for institutional investors as part of Article 173 of the ***Law for the Energy Transition and Green Growth.*** These provisions require listed companies to disclose in the annual report ***"the financial risks related to the effects of climate change and the measures adopted by the company to reduce them, by implementing a low-carbon strategy in every component of its activities."*** Institutional investors will also be required to ***"mention in their annual report, and make available to their beneficiaries, information on how their investment decision-making process takes social, environmental and governance criteria into consideration, and the means implemented to contribute to the energy and ecological transition."*** The law also requires the government to implement stress testing reflecting the risks associated with climate change.
This trend towards greater disclosure and open assessment of climate-related risks is likely to continue across Europe.

ACTIONS THAT FINANCIAL INSTITUTIONS CAN TAKE

All financial institutions can take an **active** role in improving energy efficiency. The specific action will depend on the type of institution and the market sectors that they operate in but suggested actions include the following.

Assess the market potential for energy efficiency in key markets addressed by the institution.
Although the potential market for energy efficiency across the global and EU economies is large, financial institutions need to consider the potential market in those sectors and jurisdictions that they operate in. Different sectors have different potentials as well as differing market needs. Even within the property sector there are large differences between different segments such as owner occupied commercial buildings, commercial real estate for rent and housing with its different tenancy and ownership structures. The links between energy efficiency markets and related existing markets, e.g. the market for home improvement, also need to be considered.

Assess current legislative and regulatory environment for energy efficiency.
Even within the EU Policy framework specific legislation and regulations affecting energy efficiency differ across different sectors and jurisdictions and financial institutions need to understand the specific policy environments for those sectors and geographies they operate in.

Assess availability of support mechanisms – either government grants or financial instruments such as guarantee mechanisms.
Each market has differing support mechanisms such as grants, low interest loans and guarantee mechanisms. These can have a significant effect on consumer behaviour and need to be understood when developing new financial products aimed at energy efficiency.

Assign senior team to drive product development.
Driving through the development of new products requires senior management attention. This is particularly true in areas like energy efficiency which can cut across different departments of a financial institution.

Ensure that product and programme design is proactive and systematic rather than just the provision of capital.
Evidence from the market strongly suggests that simply providing capital does not necessarily

lead to successful deployment of that capital. It is necessary to consider the factors that drive demand for financed energy efficiency and put in place mechanisms to help drive demand such as technical assistance and marketing.

Ensure energy efficiency loans/investments are tagged to enable future measurement of risk and environmental impact.
Energy efficiency loans and investments are believed to be low risk but there is little hard data to support this. To enable measurement of risk, as well as measurement of environmental benefits which will become increasingly important, it is important to tag energy efficiency loans and investments so that future analysis can be carried out.

Ensure everyday lending or investment operations identify opportunities for energy efficiency. Many normal, everyday investments, for instance in building refurbishments or new buildings, result in some energy efficiency because of better technologies or tighter regulations, however, they often miss cost-effective opportunities to further improve energy efficiency beyond business-as-usual. Lenders and investors can take an active role in encouraging and assisting borrowers to identify these opportunities which can both help hosts to reduce risks, through improved cash flow, and to help lenders increase capital deployment.

Ensure energy efficiency products are based on best practice technical assistance including use of internationally recognised standards such as the Investor Confidence Project.
Energy efficiency projects of all sizes require suitable technical expertise to develop and implement them. Financial institutions should ensure that they have access to best-in-class technical assistance and that projects are developed using internationally recognised, best practice standards such as those of the Investor Confidence Project (see Text Box 3.1 and Resources section). This will help to minimize project performance risks as well as due diligence costs.

Assess potential for improving energy efficiency within own property portfolio and using it to develop products and build capacity.
Many financial institutions own significant property portfolios covering a wide range of buildings ranging through local branches, large complex office buildings and data centres. These portfolios represent both a significant opportunity to reduce energy costs and hence improve profitability, but also an opportunity to build capacity and experience in energy efficiency. They can become test beds for developing new products and programmes.

BIBLIOGRAPHY

2° Investing Initiative (2015). ***Decree Implementing Article 173-VI of the French Law for the Energy Transition. Challenges and Recommendations.*** [Online]. Available at: http://2degrees-investing.org/IMG/pdf/energy_transition_law_in_france_-_briefing_note_final.pdf
Accessed 8 June 2017.

Advisory Scientific Panel of the European Systemic Risks Board (2016). ***Too late, too sudden: Transition to a low-carbon economy and systemic risk.*** Reports of the Advisory Scientific Committee. No. 6. [Online]. Available at: https://www.esrb.europa.eu/pub/pdf/asc/Reports_ASC_6_1602.pdf
Accessed 8 June 2017.

American Institute of Architects, Rocky Mountain Institute (2013). ***Deep Energy Retrofits: An Emerging Opportunity. An Architect's Guide to the Energy Retrofit Market.***
[Online]. Available at: http://aiad8.prod.acquia-sites.com/sites/default/files/2016-04/Deep-Energy-Retrofits-EmergingOpportunity.pdf
Accessed 8 June 2017.

Amon, A. & Holmes, I. (2016). ***Leaping the Investment Gap. Energy efficiency as infrastructure.*** [Online]. Available at: https://www.e3g.org/docs/E3G_Energy_Efficiency_as_Infrastructure.pdf
Accessed 8 June 2017.

Better Buildings Partnership. (2017). ***Beyond Risk Management. How sustainability is driving innovation in commercial real estate finance.*** [Online]. Available at: https://yoursri.com/media-new/download/bbp_beyondriskmanagement_insight_final.pdf
Accessed 8 June 2017.

Buildings Performance Institute Europe. 2011b. ***Europe's Buildings Under the Microscope.*** [Online]. Available at: http://www.europeanclimate.org/documents/LR_%20CbC_study.pdf
Accessed 8 June 2017.

Blyth, W., Savage, M. (2011). Financing Energy ***Efficiency: A Strategy for Reducing Lending Risk***. Energy, Environment and Resource Governance Programme Paper EERG PP 2011/01.
[Online]. Available at: https://www.chathamhouse.org/sites/files/chathamhouse/19462_0511pp_blythsavage.pdf
Accessed 8 June 2017.

CO2 Estates. (2016). ***MEES: The implications for rent reviews, lease renewals and valuation.***
[Online]. Available at:
http://www.CO2estates.com/mees-the-implications-for-rent-reviews-lease-renewals-and-valuation/
Accessed 8 June 2017.

Eichholtz, P., Kok, N., Yonder, E. (2014).
Environmental Performance and the Cost of Capital: Evidence from REIT Commercial Mortgages and Green Bonds.
[Online]. Available at:
http://geneva-summit-on-sustainable-finance.ch/papers/yonder.pdf
Accessed 8 June 2017.

Eichholtz, P., Kok, N., Quigley, J. (2013).
The Economics of Green Building.
[Online]. Available at:
http://www.corporate-engagement.com/files/publication/EKQ_RESTAT_2013.pdf
Accessed 8 June 2017.

Energy Efficiency Financial Institutions Group. (2015). ***How to drive new finance for energy efficiency investments. Energy Efficiency – the first fuel for the EU Economy.***
[Online]. Available at:
https://ec.europa.eu/energy/en/news/new-report-boosting-finance-energy-efficiency-investments-buildings-industry-and-smes
Accessed 8 June 2017.

European Commission. (2009). ***Study on the Energy Savings Potentials in EU Member States, Candidate Countries and EEA Countries. Final Report.***
[Online]. Available at: http://ec.europa.eu/energy/efficiency/studies/doc/2009_03_15_esd_efficiency_potentials_final_report.pdf
Accessed 8 June 2017.

European Commission Joint Research Centre. (2015). ***Energy Renovation. The Trump Card for the New Start for Europe.***
[Online]. Available at: http://iet.jrc.ec.europa.eu/energyefficiency/system/tdf/eur26888_buildingreport_executivesummary.pdf?file=1&type=node&id=9069
Accessed 8 June 2017.

G20 Energy Efficiency Finance Task Group (EEFTG). (2017). ***G20 Energy Efficiency Investment Toolkit. [Online]. Available at:*** http://www.unepfi.org/wordpress/wp-content/uploads/2017/05/G20-EE-Toolkit.pdf
Accessed 8 June 2017.

G20. (2016). ***G20 Energy Efficiency Leading Programme.***
[Online]. Available at: https://ec.europa.eu/energy/sites/ener/files/documents/G20%20Energy%20Efficiency%20Leading%20Programme.pdf
Accessed 8 June 2017.
International Partnership for Energy Efficiency Co-operation. (2016). ***G20 Action.***
[Online]. Available at: https://ipeec.org/cms/6-g20-action.html
Accessed 8 June 2017.

IEA. (2016). ***Energy Efficiency Market Report.***
[Online]. Available at: https://www.iea.org/eemr16/files/medium-term-energy-efficiency-2016_WEB.PDF
Accessed 8 June 2017.

IEA & IRENA. (2017). ***Perspectives for the energy transition.***
[Online]. Available at: http://www.irena.org/DocumentDownloads/Publications/Perspectives_for_the_Energy_Transition_2017.pdf
Accessed 8 June 2017.

ING. (2013). ***Saving Energy in the Netherlands.***
[Online]. Available at: https://www.ing.nl/media/EBZ_ING-Saving_Energy_in_the_Netherlands-May_2013_tcm162-33115.pdf
Accessed 8 June 2017.

McKinsey & Co. (2012). ***Lighting the way. Perspectives on global lighting market.*** [Online]. Available at: http://www.mckinsey.com/~/media/McKinsey/dotcom/client_service/Automotive%20and%20Assembly/Lighting_the_way_Perspectives_on_global_lighting_market_2012.
Accessed 8 June 2017.

McGraw Hill Construction. (2009). ***Green Building Retrofit & Renovation.***
[Online]. Available at: http://mts.sustainableproducts.com/Capital_Markets_Partnership/BusinessCase/MHC%20Green%20Building%20Retrofit%20%26%20Renovation%20SMR%20(2009).pdf
Accessed 8 June 2017.

McKinsey & Co. (2007). ***Curbing global energy-demand growth: The energy productivity opportunity.***
[Online]. Available at: http://www.mckinsey.com/insights/mgi/research/natural_resources/curbing_global_energy_demand_growth
Accessed 8 June 2017.

McKinsey & Co. (2008). ***Capturing the European energy productivity opportunity.*** [Online]. Available at: http://www.mckinsey.com/insights/mgi/research/natural_resources/capturing_european_energy_productivity
Accessed 8 June 2017.

Rockefeller Foundation and Deutsche Bank Climate Change Advisers. (2012). U***nited States Building Energy Efficiency Retrofits. Market sizing and financing models.*** [Online]. Available at: http://www.rockefellerfoundation.org/uploads/files/791d15ac-90e1-4998-8932-5379bcd654c9-building.pdf
Accessed 8 June 2017.

Sullivan, R., Bosteels, T., Vines Fiestas, H. (2015). ***Summary for Institutional Investors of the work of the Energy Efficiency Financial Institutions Group (EEFIG). Driving New Finance for Energy Efficiency Investments.***
[Online]. Available at: http://www.iigcc.org/files/publication-files/IIGCC_2015_Driving_New_Finance_for_Energy_Efficient_Investments_final_WEB.PDF
Accessed 8 June 2017.

Task Force on Climate-Related Financial Disclosures. 2016. ***Recommendations of the Task Force on Climate-Related Financial Disclosures.***
[Online]. Available at: https://www.fsb-tcfd.org/wp-content/uploads/2016/12/16_1221_TCFD_Report_Letter.pdf
Accessed 8 June 2017.

The Carbon Trust. (2017).
Available Attractive Too slow?
[Online]. Available at: https://www.carbontrust.com/media/674185/energy-efficiency-finance-available-attractive-too-slow.pdf
Accessed 8 June 2017.

World Business Council for Sustainable Development. (2008). ***Energy Efficiency Buildings. Business Realities and Opportunities. Summary Report.***
[Online]. Available at: http://wbcsdservers.org/wbcsdpublications/cd_files/datas/business-solutions/eeb/pdf/EEB-Facts&Trends-FullReport.pdf
Accessed 8 June 2017.

World Business Council for Sustainable Development. (2008). ***Energy Efficiency Buildings. Executive Brief #2.***
[Online]. Available at: http://wbcsdservers.org/wbcsdpublications/cd_files/datas/business-solutions/eeb/pdf/EnergyEfficiencyInBuildings-Newsletter2.pdf
Accessed 8 June 2017.

World Business Council for Sustainable Development. (2009). ***Transforming the Market.***
[Online]. Available at: http://wbcsdservers.org/wbcsdpublications/cd_files/datas/business-solutions/eeb/pdf/EEB-TransformingTheMarket.pdf
Accessed 8 June 2017.

FINANCING ENERGY EFFICIENCY

This section sets out different ways in which energy efficiency can be financed and the types of structures and contracts that can be used. It is aimed primarily to origination teams and project developers.

KEY POINTS

Energy efficiency can be financed through the following mechanisms:

- *savings and equity*
- *loans/mortgages specifically for energy efficiency upgrades in buildings such as homes, new energy efficient buildings, industry and commerce*
- *leasing for energy efficiency products*
- *ensuring normal lending/investment for everyday building refurbishments or upgrades incorporate the optimum level of cost-effective energy efficiency measures and achieve levels of performance beyond business as usual*
- *specialised energy efficiency funds offering equity or debt for projects*
- *property funds specifically for energy efficient / green buildings*
- *financing through specialised energy service contracts such as Energy Performance Contracts.*
- *secondary financing through forfaiting funds, bonds, yieldcos and securitisation.*

Most existing energy efficiency financing is through equity, savings or normal commercial/residential lending.

Financing of energy efficiency specifically faces a number of barriers compared to financing energy supply projects. These barriers include amongst others:

- *benefits are in the form of savings rather than revenues*
- *savings can be hard to measure without Measurement and Verification protocols*
- *projects are generally small when compared to supply side projects*
- *projects can be embedded into wider projects with other purposes e.g. building modernisation*
- *the split incentive in commercial or residential property whereby the tenant benefits from energy savings whereas the landlord makes the investment.*

Financing of energy efficiency projects, particularly in buildings, needs to consider interactions with existing finance, interactions with existing leases and balance sheet issues.

RECOMMENDATIONS

- *Review existing methods of financing energy efficiency that are most applicable to your market segments.*
- *Review existing lending/investment procedures to identify and develop mechanisms to assist borrowers identify and assess additional cost-effective energy efficiency investments that go beyond business as usual.*
- *Make energy efficiency assessments a required part of Physical Needs Assessment and due diligence procedures for financing or re-financing commercial property.*
- *Banks should identify and tag loans that have an element of energy efficiency to allow future risk analysis.*
- *Depending on sectors of interest:*
    - *identify leading providers of energy efficiency solutions such as Energy Performance Contracts.*
    - *Engage with groups and projects working to standardise energy efficiency mortgages*
    - *Engage with groups and projects working to standardise energy efficiency criteria for green bonds.*

DISCUSSION

The first section of this Toolkit, Financial Institutions and Energy Efficiency, reviewed the size of the energy efficiency investment and financing markets. To recap:

- Total global investment into energy efficiency in 2015: USD 221 billion.
- Global market for energy performance contracts in 2015: USD 24 billion with c.USD 2.7 billion in the EU.

- Green bonds used to finance energy efficiency in 2015: USD 8.2 billion.

To achieve energy security and climate goals investment levels will need to grow by a factor of five.

There are a number of barriers to achieving these elevated levels of investment and finance which are specific to energy efficiency. These barriers include amongst others:

- the benefits are in the form of savings rather than revenues, making it harder to secure cash flows compared to energy supply projects
- savings can be hard to measure due to the difficulties of metering and the influence of variables such as weather and changes of patterns of use
- projects are small compared to supply side projects and the typical investment size required by the debt capital markets
- there is little standardisation in the development and documentation of projects
- project development and due diligence costs can be high relative to investment size
- projects are often part of larger projects with other purposes e.g. building modernisation
- energy efficiency assets are usually embedded into buildings and processes which presents difficulties for asset finance models
- the split incentive in commercial property whereby the tenant benefits from energy savings whereas the landlord makes the investment.

TYPES OF ENERGY EFFICIENCY PROJECTS

Energy efficiency projects can either be:

- retrofits - stand-alone projects where the primary purpose is improving energy efficiency such as changing lighting to LEDs.
- embedded – part of wider renovation projects such as building refurbishments or an upgrade of a production line that is being undertaken for other purposes such as increasing rent or change of product. An example would be replacing heating plant or adding insulation as part of a building refurbishment.
- new build – new buildings and production lines tend to be more efficient than old ones due to improved technology and tighter regulations. Building just to regulation or norms should be considered "business as usual" because in most situations there are cost-effective opportunities to improve energy performance beyond those levels which are neglected.

ENERGY EFFICIENCY TECHNOLOGIES

Energy efficiency technologies are diverse but well proven. They can include technologies in space heating and cooling, building fabric, mechanical and electrical environmental systems, controls technologies, lighting, electric motors and drives, on-site energy generation and distribution systems (including steam and hot water systems), industrial process heating and heat recovery. With a very few exceptions, which should always be made explicitly and with full understanding of the risks, energy efficiency projects utilise proven, well-understood, commercially available technologies and do not involve technology development risks. A glossary of common energy efficiency technologies likely to be encountered by lenders and investors is included in the Resources section.

TYPES OF ENERGY EFFICIENCY FINANCING

The financing of energy efficiency can be achieved in several forms, the choice of which should be dependent on the type and size of the investment, the risk preferences of lenders/investors, and market acceptability. Possible types of energy efficiency financing include:

- savings or equity
- loans/mortgages specifically for energy efficiency upgrades in residential and commercial buildings, industry and commerce
- loans/mortgages specifically for the purchase of energy efficient buildings
- leasing for energy efficiency products
- ensuring normal lending/investment for everyday building refurbishments or upgrades incorporate the optimum level of cost-effective energy efficiency measures and achieve levels of performance beyond business as usual
- specialised energy efficiency funds offering equity or debt for projects
- property funds specifically for energy efficient / green buildings
- financing of specialised energy service contracts including:
    - Energy Performance Contracts
    - Chauffage contracts
    - Efficiency Services Agreements
    - Managed Energy Service Agreements

    - Metered Energy Efficiency Transaction Structure contracts
    - Lighting as a Service contracts
- Secondary financing can be achieved through:
    - forfaiting funds purchasing receivables from energy service contracts
    - bonds
    - yieldcos

With the exception of self-financing through savings or equity, these are described below and examples given here and in the Resources section of this Toolkit.

CONSUMER AND COMMERCIAL LENDING

Most energy efficiency financing is simply through normal lending, either to the residential or commercial sectors. In most cases this activity is not specifically identified as energy efficiency lending as the detailed purpose of the loan is not usually known in sufficient detail, whether energy efficiency is the main purpose or it is embedded into a larger project. In the residential sector for example the loan may only be identified as being for "home improvements". Banks should identify and tag loans that have an element of energy efficiency to allow future risk analysis as well as measurement of environmental results.

Energy efficiency loans should improve customer cash flow and a few banks have begun to take the improved cash flow into effect when considering credit risk. Although this is a positive development as energy saving clearly does improve cash flow, lenders taking into account this improved cash flow need to be aware that they are implicitly taking some performance risk - if the savings are not delivered the consumer risk is higher than anticipated. This is one of several reasons why banks should be concerned about performance risk. This is discussed further in the Value and Risk Assessment section.

Most consumer and commercial loans are recovered from the borrower in the normal way but there are specialised means of loan recovery in the global energy efficiency financing market which have considerable potential for growth in Europe, namely On-Bill Recovery and Property Assessed Clean Energy. They are described in Text Boxes 2.1 and 2.2.

TEXT BOX 2.1 ON-BILL RECOVERY (OBR)

On-Bill Recovery – also known as On-Financing (OBF) – allows customers to repay loans made for energy efficiency improvements on their electricity bills. Typically a customer will apply for a loan for an energy efficiency project, usually one of a defined set of projects that qualify for OBR, and the repayments are then added to the customer's electricity bills. OBR has a number of advantages for customers and financial institutions. For customers OBR:

- means there is only one bill to pay.
- is simple to understand.
- the tariff can be set such as the OBR component is less than the energy cost savings, giving positive cash flow.
- is transferable as it is tied to the property meter and not the individual householder.
- can be long-term debt
- it can reduce the credit barrier as electricity bill default rates are well known.

For financial institutions OBR:

- allows use of existing electricity invoicing system to recover the loan which reduces overheads.
- gives access to large customer base.
- more reliable repayment. Non-payment rates for electricity bills are rare and well known.
- is transferable as it is tied to the property.

OBR is used in several states across the US for residential energy efficiency loans and in some states for commercial and industrial loans.

The most widely known example of OBR in the Europe was the UK's Green Deal which was a failure but generated some useful lessons. The Green Deal was established by the UK government in 2013 but was cancelled in late 2015. An analysis of the failure of the Green Deal in 2016 by the National Audit Office highlighted a number of reasons for its failure including; failure to test the mechanism before a full launch, exclusion of popular measures such as double glazing, and the marketing focus on financial benefits whereas consumers are more driven by benefits such as a warmer home. High interest rates and a bureaucratic process also contributed to the outcome.

For more information see:
http://aceee.org/sector/state-policy/toolkit/on-bill-financing

TEXT BOX 2.2 PROPERTY ASSESSED CLEAN ENERGY (PACE)

Property Assessed Clean Energy (PACE) is a financing mechanism that enables low-cost, long-term funding for energy efficiency, renewable energy and water conservation projects that is widely used in the USA. PACE loans are repaid as an additional payment on a property's regular local property tax. This method has been used for many decades to finance infrastructure upgrades such as sewers and was first applied to clean energy in Berkeley, California in 2008. PACE legislation is active in 33 states plus the District of Columbia (DC) and there are active programmes in 19 states plus DC. Since 2010 PACE has been used to finance USD 3.7 billion of residential home improvements (148,000 projects) and over 1,000 projects in commercial buildings with total capital of USD 400 million, with the largest project being USD 40 million. To date USD 3.4 billion of PACE funded projects have been securitized. These securitizations are the first examples of a secondary market for energy efficiency loans.

PACE needs to be enabled by local legislation at state and municipal levels. It can be used to cover 100% of a project's hard and soft costs and repayments can be spread over up to 20 years. Non-payment of the PACE element is treated the same way as non-payment of property tax which can lead to seizure of the property.

In Europe there is interest in adopting a PACE like mechanism although of course the way that local property taxes are calculated and charged varies from country to country.

For more information see:
http://pacenation.us

GREEN MORTGAGES

A green or energy efficiency mortgage is one that is used to finance purchase of an energy efficient building or refurbish a building to a higher standard of efficiency. Lower energy bills resulting from high levels of energy efficiency improve the building owner's cash flow and improve the building's value and therefore should reduce risk of default and potentially allow lenders to offer higher levels of borrowing and Loan to Value and/or lower interest rates.

Energy efficiency mortgages have been available in the USA since the 1990s through a programme supported by the Federal Housing Administration which provides mortgage insurance for qualifying loans. Borrowers must obtain a home energy assessment and financed measures must pass a cost-effectiveness test. When the home being purchased meets minimum energy efficiency standards the borrowers qualifying debt to income ratio can be stretched two percentage points above standard limits.

At present there is no clear definition of a green mortgage as different lenders are offering consumers different options. To address this issue and help grow the market for green mortgages the European Mortgage Federation and European Covered Bonds Council (EMF-ECBC) have started a project known as the Energy Efficient Mortgages Action Plan (EEMAP), described in Text Box 2.3. In the UK the LENDERS project is seeking to demonstrate that more accurate assessments of energy bills can allow lenders to provide larger mortgages responsibly – see Text Box 2.4. In Romania a consortium of banks, developers and the Romanian Green Building Council, is working to develop a market for green mortgages – see Text Box 2.5.

TEXT BOX 2.3 THE ENERGY EFFICIENT MORTGAGES ACTION PLAN (EEMAP)

The aim of this project, co-funded by the European Commission, is to create a standardised energy efficient mortgage in which building owners are incentivised to improve the energy efficiency of their property, or acquire an already energy efficient property, by way of preferential financing conditions linked to the mortgage. The project will; identify and summarise market best practices, define energy performance, identify the pre-requisites for the assessment of "green value", substantiate the correlation between energy efficiency and the probability of default, and define and design an energy efficient mortgage based on preferential financial conditions.

For more information visit:
http://hypo.org/emf/market-initiative/emf-ecbc-energy-mortgages-initiative/

TEXT BOX 2.4 THE LENDERS PROJECT

The LENDERS project, led by the UK Green Building Council, is working to demonstrate that more accurate fuel cost estimates can be used in mortgage lending decisions that result in lower energy homes being responsibly allowed larger mortgages. Currently UK mortgage lenders use an "Affordability Calculation" that uses Office of National Statistics average fuel bill data to predict a homeowners fuel costs. The idea behind LENDERS is that this forecast can be made more accurate by using data from Energy Performance Certificates (EPCs).

For more information visit:
http://www.ukgbc.org/research-innovaton/lenders-project.

TEXT BOX 2.5 GREEN MORTGAGES IN ROMANIA

Green Homes certified by the Romania Green Building Council represents an opportunity for residential investors & developers to differentiate the quality and environmental performance of their construction projects while educating consumers about the financial and other benefits.

BENEFITS	REDUCED LENDING RISKS
• Paying less for more • Superior Building Quality • Reduced Mortgage Default Risk • Lower Energy and Repair Costs for Homeowners • Better Health for Families and Greater Environmental Responsibility for our Planet	A study of 71,000 homes indicate Green Homes have a 32% reduction in default risk.

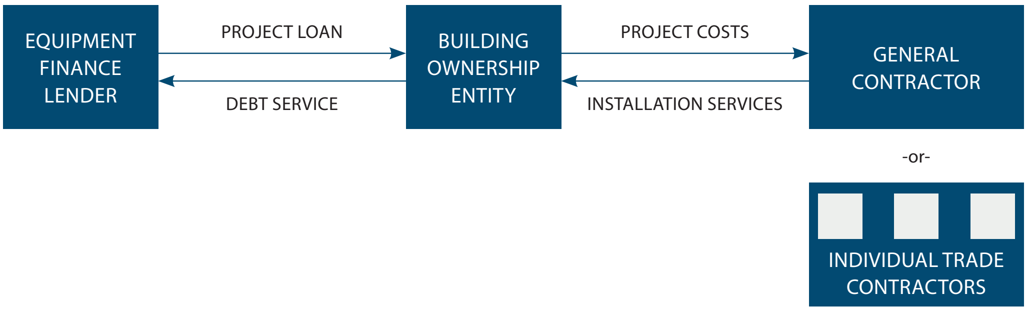
Financial institutions – through the issuance of Green Mortgages tied to certified Green Homes – can reduce their mortgage default risk and raise the asset valuation of the homes they finance and can, therefore, offer a lower cost of financing. Lower finance costs provide the homebuyer with a greater purchasing power to invest in improved construction quality as the Green Mortgage values the reduction in energy, repair and health costs of those who purchase Green Homes. Green Mortgages will also help the Romanian marketplace better appreciate the positive value of sensible borrowing to invest properly at the beginning of the building process.

This initiative creates a consortium between partner banks, the residential investor/developer, the home buyer and the Romania Green Building Council to certify green residential projects that are environmentally-responsible and energy efficient relative to the standard offer in Romania. Increased energy savings and other financial benefits (such as improved occupant health and less frequent and lower home repair costs) substantially reduce the mortgage default risk allowing the lender to lower the monthly interest rate, while maintaining profit margins. This enables the home buyer to invest into a more energy efficient and greener home while lowering the total monthly cost of ownership relative to a standard home.

For more information see:
rogbc.org/en/projects/green-homes

LEASE-PURCHASE/EQUIPMENT FINANCE

Figure 2.1: Lease-Purchase/Equipment Finance



Leasing is a well established method of financing energy efficiency projects. While the term is virtually interchangeable with equipment finance, the contracts typically cover all materials, labour and soft costs associated with an energy efficiency project. However a critical distinguishing feature of equipment leasing is that the equipment is the collateral for the financing. The possibility that an equipment finance lender would repossess the equipment for non-payment puts the lender in a strong position but in practice it may be difficult to remove energy efficiency equipment that is embedded into a building or process.

ENSURING NORMAL LENDING AND INVESTING ENCOURAGES ENERGY EFFICIENCY

Every working day loans, mortgages, leases and investments are made into new buildings, building refurbishments and modernisation as well as upgrade and replacement of industrial processes and production plants. In nearly all cases, energy efficiency is not the primary purpose of the investment being financed but the future levels of energy efficiency are effectively being decided and "locked in", in some cases because of the long life of major assets for many decades. Although new buildings, refurbishments or new production plants generally achieve higher levels of efficiency than the units that they replace due to a) improved technologies and b) tighter regulations and codes of practice, many cost-effective opportunities to improve energy efficiency are missed. This occurs due to a number of reasons including; lack of knowledge on the part of project hosts, time pressure, the conservative nature of engineering design, and treating regulations as a target that have to be achieved rather than a minimum level of performance. Banks and financial institutions can play an active role in ensuring financed projects of all types achieve optimum levels of efficiency over and above business as usual by adjusting the lending/investing process to include queries about energy efficiency and the provision of assistance to identify viable projects. By doing this they can both reduce risks, by financing measures that improve customers' cash flows, and potentially increase lending. The EBRD has long been a pioneer in exploiting the opportunities provided by everyday lending, see Text Box 2.6.

During the due diligence process for acquisition or refinancing of a building an investor or lender will typically review the building's financials, rent roll and history and require a Physical Needs Assessment (PNA) or comparable review. If significant deficiencies exist the lender may even require that certain capital replacements be made as a condition of refinancing. It can be a relatively simple matter to make energy efficiency assessments and ratings such as Energy

TEXT BOX 2.6 INCORPORATING ENERGY EFFICIENCY INTO MAINSTREAM LENDING

The EBRD was established in 1991 to finance reconstruction and development in the former Soviet Union. Due to the extremely low energy productivity of the former Soviet Union, typically one quarter of that of Western Europe at the time, improving energy efficiency and productivity was always a major driver within the EBRD. Having established a specialised energy efficiency unit early on it has financed energy efficiency projects in the power and gas sectors (including reduction of gas flaring), as well as in industry, buildings and transport. In 2012 more than 26% of the EUR 8.8 billion lent was for energy efficiency and renewable energy projects or energy efficiency and renewable energy components of larger projects. As well as specialised efficiency projects the EBRD checks all industrial or commercial loan applications to assess potential for energy efficiency improvements. The bank then works with the client organisation to develop the priority projects and these are incorporated into the loan application. This process ensures that all commercially and financially viable improvements are incorporated, improves the client's cash flow (which reduces the lending risk) and increases the capital deployed. The process is shown in Figure 2.2.

Figure 2.2: The EBRD process

TEXT BOX 2.7 ING REAL ESTATE FINANCE

ING Real Estate Finance (ING REF) set an ambition of reducing CO2 emissions from its Dutch portfolio by 15-20% with a target of energy cost savings of EUR 50 million per year. This entailed targeting 3,000 Dutch clients with 28,000 buildings. ING paid for the development of an app which was offered to all clients – the app provides an analysis of the clients energy use across their portfolio and identifies potential energy savings. If the potential energy savings exceed EUR 15,000 the client is offered a free site energy survey.

ING REF also provides advice to clients on what subsides are available (through a specialist third party) and ING REF offers 100% finance for energy efficiency improvements from ING Groenbank with a 0.5% discount on normal interest rates.

Within the first two years, the app has been used to scan 18,000 buildings with a total floor area of 10 million m2 (65% of ING REF's portfolio). ING aims to empower 5,000 Dutch clients and roll out the app to other European countries.

ING REF has also instituted a new policy – if more than 50% of a portfolio has an energy label of C or above then the acceptable LTV is 5% higher than otherwise. Furthermore, in December 2016, ING announced that they will only offer new financing for office buildings in the Netherlands that achieve an Energy Performance Certificate of C or above. This is in line with Dutch regulations that say from 2023 buildings must have a C rating or above in order to be rented as office space.

For more information see:
https://www.ing.com/Newsroom/All-news/ING-will-only-finance-green-office-buildings-in-the-Netherlands-after-2017.htm

Performance Certificates part of that PNA, and even to make performance standards part of a lender's requirements. Some banks including ING and ABN Amro have implemented these kinds of programmes and going further by providing tools to assist owners to identify energy efficiency measures.

SPECIALISED ENERGY EFFICIENCY FUNDS

The multi-lateral banks, with their long interest in energy efficiency, have established specialised energy efficiency funds in their areas of operations over many years, examples include the World Bank's Renewable Resources and Energy Efficiency (R2E2) Fund in the Western Balkans or the Romania Energy Efficiency Fund (FREE) funded by the World Bank and the Global Environment Facility (GEF). Over the last five to ten years a number of specialised energy efficiency funds have been established using private sector and private-public funding. These funds offer a range of equity and debt financing products to energy efficiency projects, often projects implemented using Energy Performance Contracts.

TEXT BOX 2.8 THE EUROPEAN ENERGY EFFICIENCY FUND (EEEF)

EEEF is a public-private partnership focused on financing energy efficiency, small-scale renewable energy and clean urban transport projects at market rates. It is aimed at municipal, local and regional authorities and public and private entities aimed at serving those authorities. It was capitalised in 2011 with EUR 265m with investments from the EC, the EIB, Deutsche Bank (DB) and Cassa Depositi e Prestiti SpA (CDP). EEEF invests in the range of EUR 5m to EUR 25m through a range of instruments including equity, senior debt, mezzanine debt, leasing and forfeiting loans. The fund is managed by DB. It provides Technical Assistance (TA) to assist potential investees to develop projects through a dedicated TA facility.

For more information see:
www.eeef.lu

Examples include the European Energy Efficiency Fund (described in Text Box 2.8), the London Energy Efficiency Fund (LEEF) and the SUSI Energy Efficiency Fund.

PROPERTY FUNDS SPECIFICALLY FOR ENERGY EFFICIENT BUILDINGS

Property funds based on purchasing properties and making them more energy efficient have been established in a number of countries.

The advent of Minimum Energy Performance Standards (MEPS), and their potential effects on property values identified in the Financial Institutions and Energy Efficiency section of this Toolkit, has led to increased interest in this model of financing energy efficiency. Examples include the Credit Suisse European Climate Value Property Fund (see Text Box 2.9) and the Low Carbon Workplace Fund (see Text Box 2.10).

TEXT BOX 2.9 THE CREDIT SUISSE EUROPEAN CLIMATE VALUE PROPERTY FUND

This fund acquires existing commercial properties that have leased well in promising European markets and implements a system for controlling, measuring, and monitoring energy consumption in cooperation with the Siemens technology group. All properties in the portfolio are continually upgraded in terms of their energy efficiency on the basis of measurement data in order to systematically reduce overall energy consumption as well as CO_2 emissions. This ensures that alongside the sustainability of the investment, the earnings potential for the fund's investors is also strengthened. The remaining portfolio share for which the energy consumption cannot be reduced in a cost-effective manner is made completely "carbon-neutral" once a year through the purchase of CO_2 certificates.

For more information see:
https://www.credit-suisse.com/ch/en/asset-management/solutions-capabilities/real-estate-ch/investments/cs-lux-european-climate-value-property-fund.html

TEXT BOX 2.10 LOW CARBON WORKPLACE FUND

The Low Carbon Workplace Fund is a £208 million unleveraged property fund which invests in commercial office space and invests to improve its energy performance. It is advised by Threadneedle Asset Management Limited, the Carbon Trust and Stanhope plc. It has achieved the following energy efficiency results across the 8 buildings in the portfolio:

- average EPC improvement from E to B
- BREEAM Excellent status awarded to all buildings
- 60% more energy efficient than CIBSE's ECON19 office benchmark
- 35% more energy efficient than Better Building Partnership's Environmental Benchmark.

In November 2015 the fund reported a 60% return after fees in the three years to September 2015. This is an annualised return of 17%, well above the benchmark index for balanced property funds.

For more information see:
http://www.columbiathreadneedle.co.uk/low-carbon-workplace

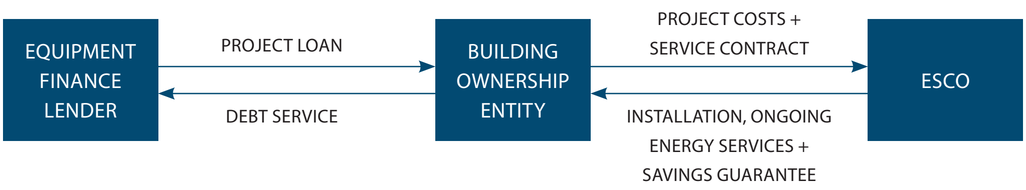
FINANCING OF SPECIALISED ENERGY SERVICE CONTRACTS

The two most common forms of energy service contract are Energy Performance Contracts (EPCs) and Chauffage contracts. Both have been in use in Europe for many years and sometimes the terms are used inter-changeably even though they are contractually different. They are reviewed below. The relative complexity and cost of developing and establishing these contracts means that they are restricted to relatively large capital value projects. Other types of energy services contracts are starting to emerge and these are also described here.

Energy Performance Contract (EPC)

An Energy Performance Contract (EPC) is a contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure in which the provider, an Energy Service Company (ESCO), provides a guarantee of performance for the installed measures . The ESCO does not generally provide the required capital but usually works with established lenders to facilitate provision of finance, although the customer can also decide to directly finance the project with its own equity. ESCOs usually operate as the Main Contractor with turnkey responsibility for the energy assessment, project development, technical design, bidding, construction, commissioning, and provision of a savings guarantee. The ESCO's guarantee is meant to ensure that the savings are sufficient to pay debt service. If there is a shortfall, the host, but not the lender, has recourse to the ESCO. The savings guarantee is the critical element that makes a contract an EPC and binds the various pieces together. Lenders require ESCOs with good track records and strong balance sheets that can ensure construction is completed on time and on budget and can support the performance guarantee.

Figure 2.3: Energy Performance Contract



In addition to the responsibilities above, the ESCO usually maintains an ongoing service contract, tied to the new equipment installed as part of the retrofit. Because of the performance guarantee some form of performance measurement and verification (M&V) is required for the life of the contract and the methodology should be specified in the contract in the form of an M&V Plan. The M&V responsibility should be executed in a way that avoids conflict of interest, i.e. the ESCO effectively measuring its own success and independent third party M&V specialists, expert in the application of recognised standard techniques such as those of the International Performance Measurement & Verification Protocol (IPMVP), can be engaged to ensure independence.

In the USA and Europe the majority of EPC contracts are with the public sector. The complexity of EPCs has led to the emergence of EPC facilitators in some market, as well as procurement frameworks to assist public sector agencies to develop and implement contracts, and link projects to financing. An example is the UK's Carbon and Energy Fund (CEF) which focuses on projects in the National Health Service. CEF is described in Text Box 2.11.

TEXT BOX 2.11 THE CARBON AND ENERGY FUND (CEF)

CEF was established in 2011 specifically to facilitate, develop and fund infrastructure upgrades within the National Health Service using Energy Performance Contracts. It is a procurement framework that works closely with funders rather than a fund itself. CEF has implemented more than 40 projects with capital expenditure of more than GBP 150 million and annual cost savings of more than GBP 21 million. CEF has been expanded into Scotland and recently into Ireland.

An example of a CEF project involves a consortium of three NHS Trusts in Liverpool. The combined capital cost was GBP 13 million with guaranteed energy savings of GBP 1.8 million with a 15 year EPC. The project was developed and delivered by Engie and financed by Macquarie.

For more information see:
http://www.carbonandenergyfund.net/track-record/

Chauffage Contracts (Energy Supply Contracting)

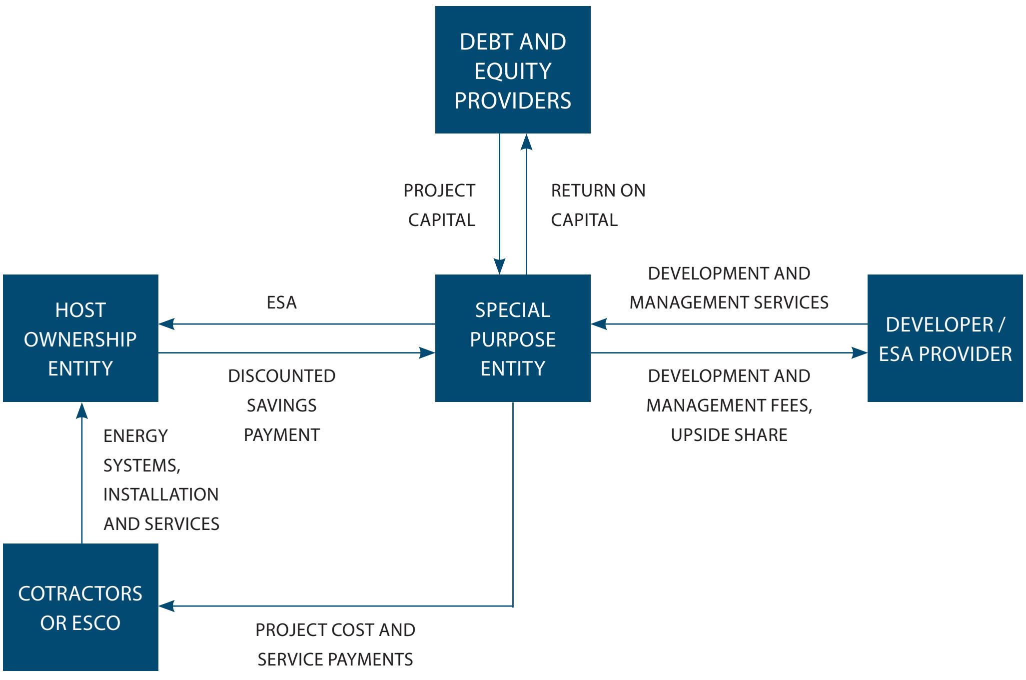
In Europe, Chauffage Contracts are traditionally more common than the EPC described above. Under Chauffage, the contractor takes over the provision of an agreed set of energy services, most often heat (hence "chauffage") but also potentially light, compressed air etc. The host pays to the contractor some historical average of its energy cost. The contractor then takes responsibility for all elements of energy services, including purchasing fuel for the building and upgrading systems. The developer may choose to discount the historical bill charged to the building owner to ensure savings and incentivise the signing of the contract. The building owner has other motivations, however, typically receiving new equipment and a set of energy services that it might otherwise have to purchase. Chauffage contracts are typically long, 15 to 30 years or more, and are best for buildings where an owner is comfortable outsourcing all elements of the energy infrastructure, energy purchasing and Operations & Maintenance.

Efficiency Services Agreement

In an Efficiency Services Agreement (ESA), a developer retrofits the host property, and the host property pays the developer the savings, typically with a negotiated discount to the facility's historical costs. Savings are measured against historical energy usage and operating expense, allowing for adjustment based upon current energy prices, weather and other factors. Where calibrated models and precise measurement are not possible, the savings may be stipulated. In contrast to a Managed Energy Services Agreement (MESA), the ESA provider does not take responsibility for utility payments, which remain in the hands of the host property. The ESA is illustrated in Figure 2.4.

The ESA developer may act as designer and installer of the project, engaging contractors directly, or outsource the function to an ESCO.

Figure 2.4: Efficiency Services Agreement



Managed Energy Services Agreement

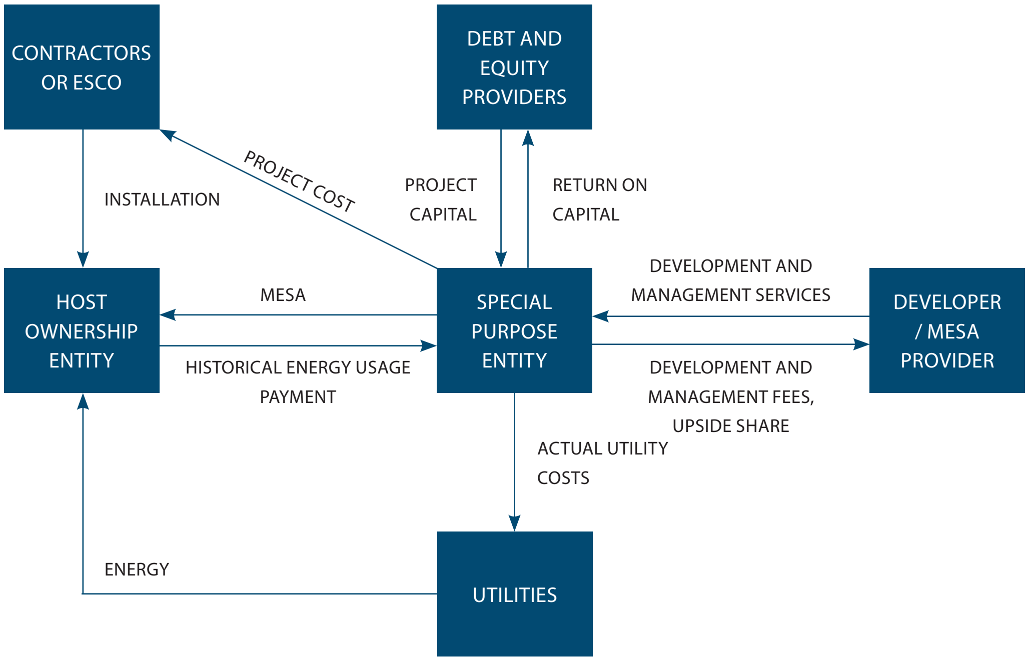
In a Managed Energy Services Agreement (MESA), the developer assumes responsibility for payment of utility bills on behalf of the host asset. Rather than a bill based on savings, the host asset pays the developer an amount equal to the historical energy usage adjusted for current energy rates, weather, and occupancy of the building.

This approach typically requires a fully calibrated model reflecting 365 days of energy usage and capable of replicating historical usage with a high degree of accuracy. The formulae for calculating MESA bills based upon future rates, weather and occupancy are provided in the MESA contract. The MESA structure is shown in Figure 2.5.

The MESA developer does not typically assume responsibility for procuring energy, which otherwise could represent a conflict of interest; since the asset pays the developer based on historical usage multiplied by current rates, the developer would have a natural disincentive to source lower-cost energy. Typically the MESA makes payment of the energy bill a contractual obligation and an administrative function of the MESA developer, but it does not generally require that energy bills appear in the name of the developer. These bills typically remain in the name of the host asset.

The developer may or may not engage a full-service ESCO to implement the project. MESA presents a higher degree of performance risk for the developer, who may wish to manage that risk directly rather than outsourcing project design and construction.

Figure 2.5: Managed Energy Services Agreement



Metered Energy Efficiency Transaction Structure

The fundamental shift in the Measured Energy Efficiency Transaction Structure (MEETS) structure is that energy efficiency is metered. Metering is achieved by combining smart meter consumption data and building modelling to produce a dynamic baseline, against which savings are measured. Units of energy saved are then paid for on a per unit basis. The MEETS structure is illustrated in Figure 2.6.

The model has only recently emerged in the United States in a pilot transaction which funded additional energy efficiency measures in a new build net zero building, the Bullitt Center in Seattle. The utility can fill the role of developer, or the equity provider, or this can be undertaken by an experienced project developer working in partnership with capital providers.

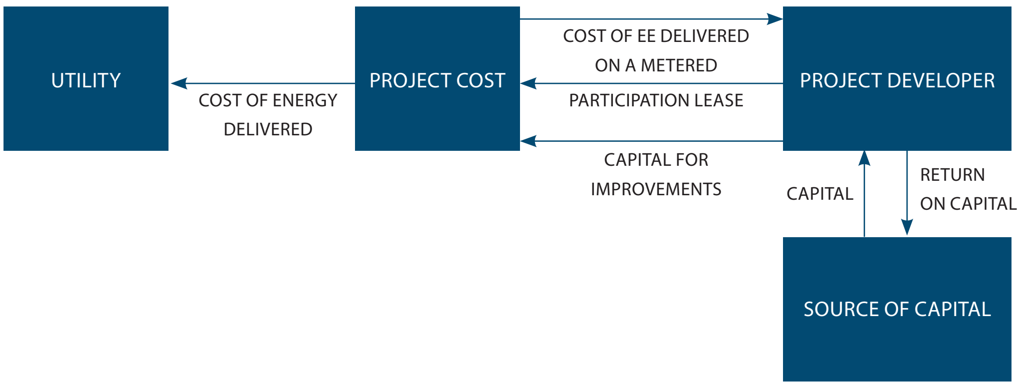
A number of advantages are claimed for the MEETS structure including:

- the deal structure resembles a Power Purchase Agreement, a well understood instrument that can be financed

- it provides an incentive for the utility to sell efficiency
- the energy tenant agreement looks like standard real estate leases and therefore is easy to understand for real estate professionals
- energy efficiency could become a tradable resource.

Despite these apparent advantages the MEETS structure has not yet been replicated although there is growing interest in the concept in the US and Europe.

Figure 2.6: Metered Energy Efficiency Transaction Structure



Lighting as a Service (LaaS)

With the introduction of LED and internet enabled lighting offering rapid paybacks on lighting conversions Lighting as a Service (LaaS) models are growing. In LaaS the provider installs lighting upgrades at no cost to the client and finances the project, usually through leasing or asset finance. They also take on maintenance of the system and lamp replacements and the customer pays a regular service fee. Taken to its logical extreme the customer pays for a set level of lighting – "pay per lux" and has no interest in how that lighting level is produced. The falling cost of LED lighting will continue to improve payback periods for LED conversions however they are financed and presumably help drive LaaS models. Navigant Research estimate that the global LaaS market will grow from USD 35.2m in 2016 to USD 1.6bn in 2025.

OTHER STRUCTURES

Two other structures that may play a role in energy efficiency projects are more associated with energy supply projects, Power Purchase Agreements and Sale and Lease Back. They are relevant here though as many energy efficiency projects may include elements of energy supply, particularly from distributed sources such as Combined Heat and Power or local renewables such as solar. This is likely to become increasingly common with the growth of distributed energy, demand response, energy efficiency and energy storage.

Power Purchase Agreements (PPAs)

PPAs are a vital component of renewables finance and have been used for co-generation projects for many years. A PPA is a long-term contract for the purchase of electricity or some other utility such as steam or chilled water by an off-taker. The PPA allows a lender to underwrite the financing of the renewable or co-generation project. Just as the credit quality of the tenant is fundamental to the mortgage for commercial property, the credit quality of the off-taker has a significant impact on finance for renewable and cogeneration projects. A PPA may cover a single site or a portfolio of sites. The PPA may cover a single site or multiple sites as part of a portfolio. Although PPAs are concerned with the purchase of generated power they can have a role to play in integrated energy efficiency and supply projects.

Sale-leaseback

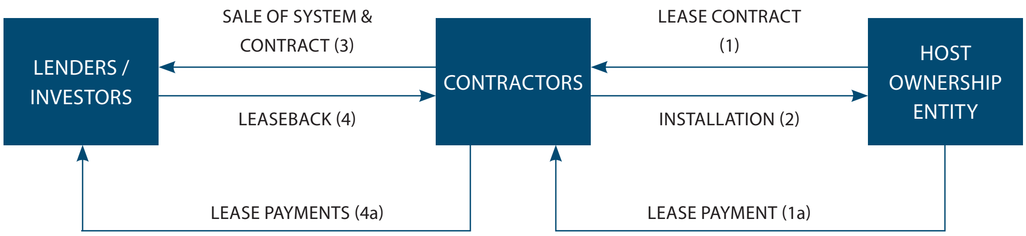
The sale-leaseback structure has become an important piece of transaction architecture for solar installations in some jurisdictions. It grew out of the need for investment vehicles that would allow investors to own the tax attributes of a solar investment in order to receive tax benefits and motivate investment of equity that could benefit from beneficial tax rates. However, the structure also allowed solar contractors to originate projects efficiently by providing surety of financing for the solar projects they install. It also allows for aggregation of power by capital providers and the efficient sale of power to an off-taker.

Rather than signing a PPA with a host, the host signs a lease for the equipment and installation. The contractor then sells the solar installation and the contract for receivables from the host to the capital provider, who promptly leases the equipment back to the contractor. Lease payments flow from host to contractor and thence to capital provider.

SECONDARY FINANCING

In order to grow the energy efficiency financing market it is essential to have an active market in secondary financing in order to recycle capital. The secondary market is only now starting to emerge due to the relatively small scale of the energy efficiency finance market and the lack of standardisation and aggregation of projects. The various secondary financing methods, forfaiting funds, bonds and yieldcos are discussed here.

Figure 2.7: Sale-leaseback



Forfaiting funds

Energy service contracts such as Energy Performance Contracts produce long-term stable cash flows which can be an attractive asset for long-term investors. Forfaiting funds can refinance EPC contracts, thus allowing the primary investors and banks to recycle their capital into new projects.

Bonds (Green Bonds)

Bonds, particularly green bonds, have a large potential role in financing energy efficiency as energy efficiency projects have a clear environmental benefit. Most specific energy efficiency projects are too small for the issuance of a bond on a single-project or single-owner basis, a stand-alone energy efficiency project of EUR 10 million is unusual and still too small for a debt capital market bond. Even if several such projects were identified, the development and execution of those projects and the uncertainty associated with the pace of draws on capital over time would make the use of bonds unwieldy. Green bonds have, however, been used successfully to finance energy efficient buildings, a notable example being Berlin Hyp.

Green bonds are likely to be important for the re-financing of green mortgages and the EMF-ECBC EEMAP project referred to above under Green Mortgages is important in this respect. Bonds are also likely to play an important role even in retrofit projects once a sufficient volume of projects can be aggregated. A set of standardised projects, originated and financed utilising other forms of capital, such as equipment leases or loans, can be aggregated and refinanced through a bond issuance. As a hopeful sign of a market maturing, pooled retrofits have been refinanced by bonds in some instances in the United States.

A secondary bond market would allow primary lenders for energy efficiency to recycle capital and grow their energy efficiency lending portfolios. Important questions regarding bonds for energy efficiency remain including; what characteristics make a bond for energy efficiency projects distinct from other bonds, how to define and measure energy efficiency of the underlying projects, and how to ensure the underlying projects are

TEXT BOX 2.12 THE LATVIAN BUILDING ENERGY EFFICIENCY FUND

A pioneering energy efficiency forfaiting fund in Europe is LABEEF, the Latvian Building Energy Efficiency Fund. LABEEF has been established to purchase the cash flows from Energy Performance Contracts established to finance the upgrade of Soviet era housing blocks. The process is as follows:

- an ESCO signs a 20 year contract with the Home Owner Association
- the ESCO takes on a loan from a financial institution
- the ESCO renovates the building, typically achieving energy savings of 45% to 65%, while sub-contracting to construction companies and equipment providers
- the House Maintenance Company, (which maintains the housing block) bills the same amount as before the renovation works and pays the ESCO a percentage of those bills, based on the realized savings
- the House Maintenance Company pays the reduced energy bill to the heat providers.
- once the project is implemented and savings are proved, an Assignment agreement is signed between the ESCO and LABEEF. The ESCO received discounted cash flow for the future receivables, minus an amount for Operations and Maintenance and a performance guarantee.
- the cash flows from the homeowners, via the House Maintenance Company, to LABEEF which keeps paying the ESCO for Operations & Maintenance.

As well as delivering greater levels of energy efficiency and comfort this model is also addressing the physical deterioration of Soviet era housing, a problem which is extensive throughout Central and Eastern Europe. The LABEEF is designed to be a EUR 30 million fund and in February 2017 signed a EUR 4 million funding agreement with EBRD.

For more information see:
http://sharex.lv/en/latvian-baltic-energy-efficiency-facility-labeef

performing as planned? There are a number of initiatives to develop standards for green bonds including those of the Climate Bonds Initiative which are addressing these questions. For new build projects bond financing could only really be considered energy efficiency if the buildings or industrial facilities financed have an energy performance better than regulations, i.e. better than business-as-usual. Standardised development and implementation protocols at the project level, such as those developed by the Investor Confidence Project, are an important foundation for the growth of future energy efficiency green bond issues.

TEXT BOX 2.13 BERLIN HYP – GREEN BONDS FOR ENERGY EFFICIENT BUILDINGS

Berlin Hyp has a core focus on commercial real estate finance in metropolitan areas in Germany. It's total real estate finance portfolio is EUR 18.1 billion. Berlin Hyp finances energy efficient buildings which means buildings with an energy demand below the levels required by the German energy savings regulations (EnEV0 and/or a good sustainability certification. As of February 2017 the green finance portfolio comprised 42 loans with an aggregate amount of EUR 2.02 bn. The portfolio has been refinanced with issuance of green bonds.

For more information see:
http://www.green-pfandbrief.com/#home4

TEXT BOX 2.14 THE CITY OF GOTHENBURG GREEN BONDS

In 2013 the City of Gothenburg became the first city in the world to issue green bonds with an SEK 500 million issue (USD 77 million) which was rated Aaa by Moody's and AA+ by Standard and Poor's. The City has followed this up with subsequent bond issues which have been over-subscribed. The proceeds are used to finance various environmental projects which have included biogas projects, electric vehicles, district heating and sustainable housing. Although the percentage of proceeds invested into energy efficiency is small some specific projects have been funded including the upgrading of traffic lights with energy efficient lamps and new-build sustainable housing.

For more information see:
http://finans.goteborg.se/wpui/wp-content/uploads/2016/06/Impact-Report-20161.pdf

TEXT BOX 2.15 SECURITISATION OF PACE LOANS

In 2014 Deutsche Bank closed the first ever securitisation of loans for residential energy efficiency with a USD 104 million bond in California. The 11 year, double-AA rated bond was priced at a fixed coupon of 4.75% and was supported by Property Assessed Clean Energy (PACE) loans to householders. Since athen there have been follow-on deals with Renovate America alone making seven bond issues with a total value of USD 1.35 billion.

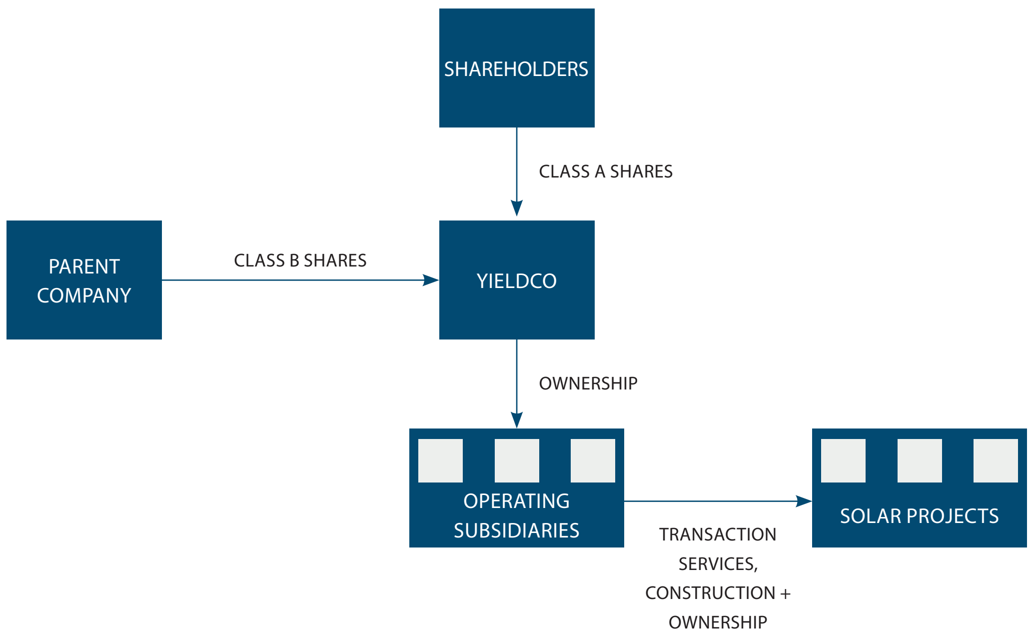
For more information see:
https://www.db.com/cr/en/concrete-energy-efficiency-retrofit-bond-securitization.htm

Yieldco

The emergence of the Yieldco for renewable energy portfolios, while it has had mixed success, represents the maturation of renewable finance and could have future application in energy efficiency. A Yieldco is a company that bundles together a series of renewable transactions such as the sale lease-back shown above.

This aggregation blends risk and allows for steady, relatively predictable returns. It also allows parent companies to raise cheaper capital for established projects and to recycle the capital thus unlocked for new project development. Renewable energy Yieldcos have been quoted on public stock markets such as the London Stock Exchange. As with bonds energy efficiency financings have to date been too small to consider Yieldcos but the emergence of aggregators could make them viable.

Figure 2.8: YieldCo structure



CONSIDERATIONS WHEN CHOOSING FINANCE SOURCE AND STRUCTURE

There are a number of factors to consider when choosing an external financing mechanism for energy efficiency measures which are considered here.

Contract interaction with permanent financing

Covenants prevalent in commercial mortgages present formidable obstacles to the investment of third party capital in energy efficiency. Property is divided into "fixture" physical assets attached to a building that are not generally moved or movable, and "fittings," those items that are generally moved or movable. Fixtures are part of the real property covered by the mortgage, and fittings (or chattel, such as furniture) is not. At the point a mortgage is signed, the lender has a primary secured interest in all of the real property, which includes all of the energy systems in a building that are not part of a tenant's improvements. Mortgage covenants prohibit the facility owner from giving another lender a security interest in the real property without permission. It is this feature embedded in mortgages that makes additional third-party finance difficult and refinance an appealing way for building owners to pursue comprehensive energy efficiency improvements for a building, since covenants applying to the new permanent financing will apply to the new installations. Mortgage covenants affect not only the viability of traditional loans and leases for energy efficiency but any agreement that gives a lender or investor a security interest in real property without mortgage lender consent. The energy service contracts discussed above generally seek to avoid running afoul of the permanent financing by structuring other types of security. In a MESA, for example, non-payment of the MESA bill will result in non-payment of the utility bill and jeopardise the operations of the building. A MEETS allows the same recourse. It is the lack of security in real property, however, that has limited uptake of some of these novel investment structures, since real property investors and lenders struggle to justify security for debt in something other than real property itself.

Balance sheet impacts

An additional consideration that may be important, both for lenders or investors as well as the host properties involved in an energy efficiency project, is where an energy efficiency project resides from a balance sheet perspective. Some of the energy service contracts were developed in such a way as to qualify as an above-the-line operating expense rather than a below-the-line debt. However, these contracts vary considerably, and calling a contract a "services contract" does not make it one. Some services contracts are unambiguously contracts for debt. The International Financial Reporting Standards (IFRS), developed to harmonise accounting standards in the European Union, provide relatively clear guidance for lenders and investors. Specifically, IFRIC 4 gives guidelines for determining whether an arrangement contains a lease. If it does contain a lease, it must appear on the balance sheet as a fixed asset, and payments must be shown against a liability declining over the term of the contract.

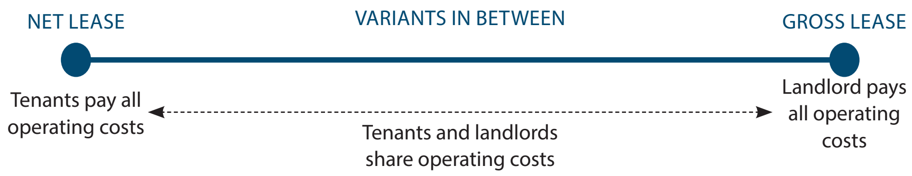
For some firms, the balance sheet treatment of the underlying contract is a critical consideration. They may seek to avoid increasing the balance sheet for any number of reasons including taxation and mandatory distributions to ownership. If a vendor of the energy efficiency project has developed a contract that does not effectively place the transaction on the balance sheet of the host facility, it must necessarily reside on the books of the vendor or the entity it has established to execute the project. This balance sheet treatment has accounting implications for investors and lenders to that project. Accounting review is a critical step in the development and assessment of a large-scale energy efficiency investment.

For public sector bodies in the EU there is an additional accounting issue concerned with Energy Performance Contracts. According to the 2015 Eurostat guidance note on the accounting treatment of EPC, investment has to be accounted on the balance sheet of public authorities. This has been a major impediment to the spread of EPCs in the public sector but efforts are under way to change this. At the beginning of 2017, along with competent national statistical bodies, a review of the current rules and their interpretation was instigated. Options being considered to resolve the issue include:

- the possibility of splitting assets e.g. splitting out the land element of a building's value.
- using a specific contract model (the buy and leaseback model), under which the capital expenditure would be recorded on the government account but would then be leased back to the contractor, thus removing its impact on government debt.

Provided these options receive support from the national statistical bodies (as part of the Excessive Deficit Procedure Statistics Working Group) the

Figure 2.9: Types of building lease



relevant Commission guidance would be amended in 2017. This would facilitate the growth of the energy performance contracting market across Europe.

Contract interaction with existing leases

In some kinds of assets, particularly in multi-tenant commercial buildings, the energy savings from an efficiency project may not flow to a single beneficiary. While it is a consideration that is more important for the host asset than the lender or investor, it is nonetheless important for underwriting to understand how savings flow through the underlying asset.

Operating costs in leases are on a spectrum extending from a net lease where tenants pay for all capital and operating costs to a gross lease where landlords pay for all capital and operating costs (see Figure 2.9). Energy savings from a retrofit in a building with a fully netted lease will flow to the tenants. If the lease makes tenants responsible for capital upgrades (i.e. triple net), the landlord can make the retrofit and charge the tenants pro rata but may have little incentive to undertake the planning and development effort required given that it receives no savings. If the lease makes the landlord responsible for capital expenditures and tenants for operating, there is even less incentive to do so since the tenant will receive the savings having paid nothing for them. This is the problem of split incentives.

In a fully gross lease (also called full service gross) a landlord pays for all operating costs, typically excluding increases in property taxes, meaning that all energy savings from an energy efficiency project would flow to the landlord. In such leases, there is no diminution of landlord incentive to pursue a retrofit.

Most leases, however, exist somewhere in between these two poles. A common formulation makes landlords responsible for all capital costs and for the operating expenses of the building that exist prior to the signing of the lease, also called the "base year operating costs." The landlord can charge tenants only for increases in those operating expenses above the base year. Typically, if the lease allows the landlord to bill tenants for capital costs, it may do so only for improvements that save operating costs and even then only according to the useful life of the equipment. Since operating expenses always rise, any savings to the landlord on the operating side are quickly subsumed by increases in all other operating costs. For deep retrofits where capital equipment installed may have a useful life of 15 to 30 years, the landlord's capital recovery is extremely slow. The landlord may gain as leases turn over and base years for new tenants are lower, but as a general rule roughly half of the energy savings or less accrue to the landlord of a multi-tenant commercial building.

To the extent a contract depends upon payments deriving from savings or upon improvements in the underlying credit resulting from savings, these leasing considerations may have fundamental importance for underwriting. They are the reason that many energy service contracts are tailored in a way to make the services and the provision of capital equipment part of a contract for operations, and therefore chargeable to tenants. How and whether they accomplish this goal is both a legal question and a marketing one, given that tenant perception of the fairness of operating costs may affect lease renewal.

BIBLIOGRAPHY

American Council for an Energy Efficient Economy. (2017). ***On-Bill Energy Efficiency.***
[Online]. Available at: http://aceee.org/sector/state-policy/toolkit/on-bill-financing
Accessed 8 June 2017.

BASE and UNEP. (2006). ***Public Finance Mechanisms To Increase Investment in Energy Efficiency.***
[Online]. Available at:http://www.sefalliance.org/fileadmin/media/base/downloads/pfm_EE.pdf
Accessed 8 June 2017.

Berger, S. (2011). ***Energy Saving Partnership Berlin. Supporting ESCO markets on a regional basis.***
[Online]. Available at:http://www.seai.ie/News_Events/Previous_SEAI_events/Susanne%20Berger.pdf
Accessed 8 June 2017.

BOMA. (2016). BOMA ***Energy Performance Contracting Toolkit.***
[Online]. Available at: http://www.boma.org/sustainability/info-resources/Pages/BEPC-Toolkit.aspx
Accessed 8 June 2017.

Buildings Performance Institute Europe. (2010). ***Financing Energy Efficiency (EE) in Buildings.***
[Online]. Available at: http://bpie.eu/wp-content/uploads/2015/10/BPIE-background-paper.pdf
Accessed 8 June 2017.

Bulgaria Housing Association. (2012). ***Energy Saving Measures in Residential Buildings in Bulgaria.***
[Online]. Available at: http://www.e3g.org/images/uploads/E3G_EEFinance_061112_E-Gaydarova_(Bulgaria).pdf
Accessed 8 June 2017.

Buonicore, A.J., O'Neil. K.E. and Bailey, J. (2013). ***Underwriting Energy Efficiency Financing in The Innovative Connecticut PACE Program.***
[Online]. Available at:http://www.srmnetwork.com/wp-content/uploads/Whitepaper_CT_PACE_Final_01-15-13.pdf
Accessed 8 June 2017.

CICERO (2015). ***Second opinion on City of Gothenburg's Green Bond framework.***
[Online]. Available at: https://www.icmagroup.org/Emails/icma-vcards/Gothernburg_External%20Review%20Report.pdf
Accessed 8 June 2017.

City of Gothenburg. (2016). ***Green Bond Impact Report.*** June 2016.
[Online]. Available at:http://finans.goteborg.se/wpui/wp-content/uploads/2016/06/Impact-Report-20161.pdf
Accessed 8 June 2017.

Department of Energy and Climate Change. (2015a). ***Guide to Energy Performance Contracting Best Practices.***
[Online]. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/395076/guide_to_energy_performance_contracting_best_practices.pdf
Accessed 8 June 2017.

Department of Energy and Climate Change. (2015b). ***Contract Guidance Note and Model Contract. Energy Performance Contract.***
[Online]. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/395240/contract_guidance_note_and_model_contract_energy_performance_contract.doc
Accessed 8 June 2017.

Dreeseen, T.K. (2009). ***Scaling Up Energy Efficiency Financing "A Practitioners Perspective".***
[Online]. Available at:http://www.cleanenergyasia.net/sites/default/files/resources/file_557.pdf
Accessed 8 June 2017.

Energi (2016). ***Energy Savings Warranty.***
[Online]. Available at: https://www.energi.com/alternative-energy/esw.php
Accessed 8 June 2017.

EU-ESCO (2016). ***Energy Contracting. Successful energy services business models.***
[Online]. Available at: http://euesco.org/cms/upload/downloads/brochures/101006_euesco_ContractingFlyer_A4_final_low.pdf
Accessed 8 June 2017.

Eurocontract. (2008). ***Eurocontract. Guaranteed Energy Performance.***
[Online]. Available at: https://ec.europa.eu/energy/intelligent/projects/sites/iee-projects/files/projects/documents/eurocontract_project_report_en.pdf
Accessed 8 June 2017.

European Commission (2015). ***Eurostat Guidance Note. The Impact of Energy Performance Contracts on government accounts.***
[Online]. Available at: http://ec.europa.eu/eurostat/documents/1015035/6934993/EUROSTAT-Guidance-Note-on-Energy-Performance-Contracts-August-2015.pdf/dc5255f7-a5b8-42e5-bc5d-887dbf9434c9
Accessed 8 June 2017.

European Commission Joint Research Centre. (2014). ***Financing Building Energy Renovations. Current Experience and Ways Forward.***
[Online]. Available at: http://iet.jrc.ec.europa.eu/energyefficiency/system/tdf/final_report_on_financing_ee_in_buildings.pdf?file=1&type=node&id=8952
Accessed 8 June 2017.

European Commission. Joint Research Centre. (2016). ***Energy Performance Contracting.*** [Online]. Available at: http://iet.jrc.ec.europa.eu/energyefficiency/european-energy-service-companies/energy-performance-contracting
Accessed 8 June 2017.

European Energy Service Initiative. (2010). ***European Energy Services Initiative. Challenges and Chances for Energy Performance Contracting in Europe.*** [Online]. Available at: https://ec.europa.eu/energy/intelligent/projects/sites/iee-projects/files/projects/documents/eesi_challenges_and_chances_for_epc_in_europe_en.pdf
Accessed 8 June 2017.

European Energy Service Initiative. (2016a). ***Energy Performance Contracting. Modernizing Buildings with Guarantee.*** [Online]. Available at: http://eesi2020.eu/wp-content/uploads/2016/03/EESI2020_brochure_EN_final.pdf
Accessed 8 June 2017.

European Energy Service Initiative. (2016b). ***Standard Documents.*** [Online]. Available at: http://www.european-energy-service-initiative.net/eu/toolbox/standard-documents.html
Accessed 8 June 2017.

European Mortgage Federation-European Covered Bond Council. (2017). ***The Energy efficient Mortgages Action Plan (EeMAP).*** [Online]. Available at: http://energyefficientmortgages.eu
Accessed 8 June 2017.

European PPP Expertise Centre. (2012). ***Guidance on Energy Efficiency in Public Buildings.*** [Online]. Available at: http://www.eib.org/epec/resources/epec_guidance_ee_public_buildings_en.pdf
Accessed 8 June 2017.

Ferante, A. (2013). ***Financing Energy Efficiency: Attracting Capital and Mitigating Risk.*** [Online]. Available at: https://www.aeesocal.org/docs/chapterMeeting/55-aee-ppt-050913-(2).pdf
Accessed 8 June 2017.

Freehling, J. (2011). ***Energy Efficiency Finance 101: Understanding the Marketplace.*** [Online]. Available at: http://aceee.org/files/pdf/white-paper/Energy%20Efficiency%20Finance%20Overview.pdf
Accessed 8 June 2017.

Ghekier, L. (2012). ***ERDF as a lever to mobilise co-financing.*** [Online]. Available at:http://www.e3g.org/images/uploads/E3G_EEFinance_061112_L-Ghekiere_(France).pdf
Accessed 8 June 2017.

IFC. (2011). ***IFC Energy Service Company Market Analysis.*** [Online]. Available at: http://www1.ifc.org/wps/wcm/connect/dbaaf8804aabab1c978dd79e0dc67fc6/IFC+EE+ESCOS+Market+Analysis.pdf?MOD=AJPERES
Accessed 8 June 2017.

Hansen, S.J. (1998). ***Manual for Intelligent Energy Services.*** The Fairmont Press. Liburn, GA.

Hansen, S.J. and Weisman, J.C. (2006). ***Performance Contracting: Expanding Horizons. 2nd edition.*** The Fairmont Press. Liburn, GA.

Institute for Building Efficiency. (2010). ***Energy Performance Contracting in the European Union: Introduction, Barriers and Prospects.*** [Online]. Available at: http://www.buildup.eu/sites/default/files/content/Institute%20BE%20-%20Energy%20Performance%20Contracting%20in%20the%20European%20Union.pdf
Accessed 8 June 2017.

International Energy Agency. (2012a). ***Plugging the Energy Efficiency Gap with Climate Finance.*** [Online]. Available at: http://www.iea.org/publications/freepublications/publication/PluggingEnergyEfficiencyGapwithClimateFinance_WEB.pdf
Accessed 8 June 2017.

International Energy Agency. (2012b). ***The Future of Energy Efficiency Finance.*** [Online]. Available at: http://www.iea.org/media/workshops/2012/energyefficiencyfinance/workshop_report.pdf
Accessed 8 June 2017.

Jollands, N. (2012). ***Sustainable Energy Finance Facilities in the residential sector.*** [Online]. Available at: http://www.e3g.org/images/uploads/E3G_EEFinance_061112_N-Jollands_(EBRD).pdf
Accessed 8 June 2017.

Kapur, N., Hiller, J., Langdon, and Abramson, A. (2011). ***Show Me the Money. Energy Efficiency Financing Barriers and Opportunities.*** [Online]. Available at: http://nicholasinstitute.duke.edu/climate/other/show-me-the-money-energy-efficiency-financing-barriers-and-opportunities
Accessed 8 June 2017.

Kim, C., O'Connor, R., Bodden, K., Hochman, S., Liang, W., Pauker, S. and Zimmermann, S. (2012). ***Innovations and Opportunities in Energy Efficiency Finance.***

[Online]. Available at: http://www.wsgr.com/publications/PDFSearch/WSGR-EE-Finance-White-Paper.pdf
Accessed 8 June 2017.

KlimaProtect (2016). ***Energy Efficiency Protect.***
[Online]. Available at: http://www.klimaprotect.de/wp-content/uploads/2014/07/KlimaProtect_EEP_EN_v2_150dpi.pdf
Accessed 8 June 2017.

Kirkpatrick, A.J. (2012). ***Closing the "Energy-Efficiency Gap": An Empirical Analysis of Property Assessed Clean Energy.***
[Online]. Available at: http://pacenow.org/wp-content/uploads/2012/08/Kirkpatrick_PACE_MP.pdf
Accessed 8 June 2017.

Kuma, S. (2010). ***Promoting Innovative Energy Efficiency Financing Mechanisms.***
[Online]. Available at: http://asiaesco.org/pdf/presentation/6-2.pdf
Accessed 8 June 2017.

Langlois, P. and Hansen S. (2012). ***World ESCO Outlook.*** Fairmont Press. Liburn, GA.

Limaye, D.R. (2009). ***Energy Efficiency Funds – International Best Practice.***
[Online]. Available at: http://www.cleanenergyasia.net/sites/default/files/resources/file_609.pdf
Accessed 8 June 2017.

MacLean, J. (2008). ***Mainstreaming Environmental Finance Markets (I) – Small-Scale Energy Efficiency and Renewable Energy Finance.***
[Online]. Available at:http://www.kfw-entwicklungsbank.de/EN_Home/Sectors/Financial_system_development/Events/Symposium_2008/Pdf_documents_-_symposium_2008/Session_3_Expert_Paper_Final_Version.pdf
Accessed 8 June 2017.

McCaffree, M. (2010). ***Alternative Financing Mechanisms for Energy Efficiency.*** [Online].
Available at:http://www.edisonfoundation.net/IEE/Documents/IEE_AltFinancingMech_McCaffree.pdf
Accessed 8 June 2017.

Micale, V. & Deason, J. (2014). ***Energy Saving Insurance.***
[Online]. Available at:https://climatepolicyinitiative.org/wp-content/uploads/2015/02/Energy-Savings-Insurance-Lab-Phase-2-Analyses-Summary.pdf
Accessed 8 June 2017.

Mills, E. (2003). ***Risk transfer via energy-savings insurance. Energy Policy 31. 273-281.*** [Online].
Available at: http://evanmills.lbl.gov/pubs/pdf/energy_savings_insurance.pdf
Accessed 8 June 2017.

MEETS Accelerator Coalition. (2016). ***The Metered Energy Efficiency Transaction Structure.***
[Online]. Available at: http://www.meetscoalition.org
Accessed 8 June 2017.

Morgado, D. (2014). ***Energy Services Companies and Financing.***
[Online]. Available at:
https://www.iea.org/media/training/presentations/latinamerica2014/8A_Energy_Service_Companies_and_Financing.pdf
Accessed 8 June 2017.

Munich Re. (2016). ***Energy Efficiency Insurance.***
[Online]. Available at: https://www.munichre.com/HSBEIL/products/energy-efficiency-insurance/index.html
Accessed 8 June 2017.

National Audit Office. (2016). ***Green Deal and Energy Company Obligation.***
[Online]. Available at: https://www.nao.org.uk/wp-content/uploads/2016/04/Green-Deal-and-Energy-Company-Obligation.pdf
Accessed 8 June 2017.

PACENation (2017). ***PACE Market Data.***
[Online]. Available at: http://pacenation.us/pace-market-data/
Accessed 8 June 2017.

Rezessy, S. and Beroldi, P. (2010). ***Financing Energy Efficiency: Forging The Link Between Financing and Project Implementation.***
[Online]. Available at: http://ec.europa.eu/energy/efficiency/doc/financing_energy_efficiency.pdf
Accessed 8 June 2017.

Romania Green Building Council. (2017). ***Green Homes & Mortgages. A Toolkit for Residential Investors and Developers.***
[Online]. Available at: http://rogbc.org/Downloads/Proiecte/GreenHomes/RoGBC_Green_Homes_and_Green_Mortgage_Toolkit_for_Residential_Investors.pdf
Accessed 8 June 2017.

State and Local Energy Efficiency Action Network. (2014). ***Financing Energy Improvements on Utility Bills: Market Updates and Key Program Design Considerations for Policymakers and Administrators.***
[Online]. Available at: https://www4.eere.energy.gov/seeaction/system/files/documents/onbill_financing.pdf
Accessed 8 June 2017.

Structured Credit Investor (2016). ***Green Securitisation: harnessing institutional investment to tackle climate change.***
[Online]. Available at: http://www.structuredcreditinvestor.com/pdfs/SCI_2016_Guide_to_Renewables_ABS_Web-2.pdf
Accessed 8 June 2017.

Sustainable Energy Authority Ireland. (2014a). *Energy Performance Contracts Handbook.* [Online]. Available at: http://www.seai.ie/Your_Business/National_Energy_Services_Framework/EPC_Handbook/EPC-Handbook.pdf Accessed 8 June 2017.

Sustainable Energy Authority Ireland. (2014b). *A Guide to Energy Performance Contracts and Guarantees.* [Online]. Available at: http://www.managenergy.net/lib/documents/795/original_A_guide_to_Energy_Performance_Contacts_and_Guarantees.pdf Accessed 8 June 2017.

The Australasian Energy Performance Contracting Association. (2000). *A Best Practice Guide to Energy Performance Contracting.* [Online]. Available at: http://www.eec.org.au/for-energy-efficiency-providers/information-resources/best-practice-guides-2#/best-practice-guides-2 Accessed 8 June 2017.

Transparence Project. (2009). *The European Code of Conduct for Energy Performance Contracting.* [Online]. Available at: http://euesco.org/cms/upload/CoC-EPC/european-code-of-conduct-for-epc.pdf Accessed 8 June 2017.

Transparence Project. (2016). *EU survey on Eurostat guidance note: "The impact of Energy Performance Contracts on government accounts".* [Online]. Available at: http://euesco.org/cms/upload/2016.03.17_Report_EU_survey_on_Eurostat_guidance_note.pdf Accessed 8 June 2017.

United Nations Development Programme. (2009). *Energy Efficiency Financing in Romania. A Training and Best Practice Manual.* [Online]. Available at: http://www.ecnetwork.info/SEC-Tools/UNDP-GEF--EnergyEfficiencyFinancing-Romania-English.pdf

US Department of Energy. (2016). *Model documents for an Energy Saving Performance Contract.* [Online]. Available at: https://energy.gov/eere/wipo/model-documents-energy-savings-performance-contract-project Accessed 8 June 2017.

Velody, M. (2006). *Energy Efficiency – Releasing the Investment Potential.* [Online]. Available at: http://www.ecologic-events.de/climate2012/sofia/documents/8_mark_velody.pdf Accessed 8 June 2017.

White, P. (2010). *An Awakening in Energy Efficiency: Financing Private Sector Building Retrofits.* [Online]. Available at: http://www.johnsoncontrols.com/content/dam/WWW/jci/be/solutions_for_your/private_sector/Financing_PrivateSector_whitepaper_FINAL.pdf Accessed 8 June 2017.

World Economic Forum. (2011). *A Profitable and Resource Efficient Future: Catalysing Retrofit Finance and Investing in Commercial Real Estate.* [Online]. Available at: http://www3.weforum.org/docs/WEF_IU_CatalysingRetrofitFinanceInvestingCommercialRealEstate_Report_2011.pdf Accessed 8 June 2017.

THE PROJECT LIFE CYCLE

This section describes the overall process of developing and executing an energy efficiency project. It is aimed at establishing the foundations for a standardised process and a common language that can be used by financial institutions, project developers and project hosts. As such it is aimed at originators, risk teams and project developers and hosts. Much of the discussion refers to larger scale energy efficiency projects but the basic process for smaller projects is essentially the same.

KEY POINTS

The technical, economic and financial development of energy efficiency projects follows a similar process irrespective of the project type or size.

From the developer's perspective, a project goes through the following stages:

- *Development*
- *Implementation*
- *Operations*
- *From the financial institution's perspective, a project goes through the following stages:*
- *Pre-financing*
- *Operations/servicing.*

The development and the financing processes interact at several points and can be iterative.

RECOMMENDATIONS

- *Developers and financial institutions often do not speak the same language and it is vitally important to engage and establish a common language at the beginning of, or prior to, the commencement of project development.*
- *Developers seeking funding for projects should make contact with potential funders as early as possible, or even prior to the start of the development process.*
- *Developers and funders should establish a clearly defined and commonly understood process with defined inputs and outputs prior to starting project development.*
- *Financial institutions should work with developers to communicate their process, defined inputs and lending/investment criteria as early as possible in the project life cycle.*
- *Financial institutions, and developers, need to standardise the development and evaluation process to reduce costs and decision times.*
- *Financial institutions deploying capital into multiple installations of small projects, for example in the residential sector, must simplify and automate all stages of the project development, assessment and operations life cycle.*
- *Financial institutions should require the use of internationally recognised standards such as those developed by the Investor Confidence Project (ICP).*
- *Financial institutions should require the use of Measurement and Verification (M&V) protocols such as those developed by the International Performance Measurement and Verification Protocol (IPMVP).*
- *M&V reports should be linked to loan/investment servicing as they can provide early warning on lower than expected performance which may affect viability of repayment.*
- *Lenders and investors should utilise M&V reports to feed into risk analysis which can enable better understanding of risks and more accurate pricing.*

DISCUSSION

The full project life cycle for an energy efficiency project, along with associated activities and outputs from each stage, is shown in Figure 3.1. The following sections explain each stage in turn, first from the developer's perspective and then from the perspective of a financial institution.

From the developers or project host's perspective there are three stages to a project;

Figure 3.1: The Project Life Cycle

<table>
<tr><td></td><td></td><td colspan="6">PRE-FINANCING</td><td colspan="4">SERVICING / OPERATIONS</td></tr>
<tr><td>FINANCIAL PROCESS</td><td></td><td colspan="2">ORIGINATION</td><td>DECISION TO PROCEED</td><td colspan="2">UNDER-WRITING</td><td>DECISION TO INVEST / LEND</td><td>ADMINISTRA-TION</td><td colspan="2">DRAW DOWN</td><td>SERVICING</td></tr>
<tr><td>ACTIVITIES</td><td></td><td>Identification of opportunities, assessment of initial data</td><td></td><td>Initial Due Diligence on technical and commercial aspects of proposed investment</td><td></td><td>Full under-writing, modelling value and risk, Due Diligence, leading to recommendation</td><td>Investment Committee review and decision</td><td>Finalising contracts and investment/loan agreement(s)</td><td>Transfer of funds</td><td></td><td>Monitoring of loan / investment performance over life-time</td></tr>
<tr><td>OUTPUT</td><td></td><td></td><td>Viable project/deal concept</td><td>Decision to move to under-writing</td><td></td><td>Recommendation to IC</td><td>IC decision</td><td>Signed contracts, CPs</td><td>Loan or investment completion</td><td></td><td>Monitoring / repayment of loans / return on equity</td></tr>
<tr><td>DOCUMENTS</td><td></td><td>Project outline with initial data</td><td>Project details, technical, commercial</td><td>Term Sheet</td><td>Techncial details, financial analysis, risks, commercial arrangements, counterparty details</td><td>Due diligence reports</td><td></td><td>Contract documentation, financing agreement</td><td></td><td>Commissioning report(s)</td><td>Performance reports, O&M reports</td></tr>
<tr><td>OUTPUT</td><td></td><td>Approved project concept</td><td>Approved basic design</td><td></td><td>Approved detailed design, commercial proposition</td><td></td><td></td><td></td><td>Completed installation, As installed documentation</td><td>Correctly operating and commissioned ECMs</td><td>On-going optimum operation of ECMs & energy savings</td></tr>
<tr><td>ACTIVITIES</td><td>Gathering of energy data, benchmarking, energy audits, Identification of potential ECMs, initial economic analysis</td><td></td><td>Development of ECMs, selection of equipment, detailed economic analysis, outline procurement strategy</td><td></td><td>Detailed design of ECMs, refined economic analysis,identification of suppliers & contractors, procurement strategy</td><td></td><td></td><td>Detailed design taking into account specific site characteristics not identified to date</td><td>Any site specific design needed, Contracting for installation, supply of equipment, installation</td><td>Commissioning programme</td><td>On-going Measurement & Verification reports, on-going Operations & Maintenance activities and reports</td></tr>
<tr><td>TECHNICAL PROCESS</td><td>CONCEPT DESIGN</td><td colspan="3">BASIC DESIGN</td><td>DETAILED DESIGN</td><td></td><td></td><td>DETAILED INSTALLATION DESIGN*</td><td>INSTALLATION</td><td>COMMISSION-ING</td><td>M&V / O&M</td></tr>
<tr><td></td><td colspan="8">DEVELOPMENT</td><td colspan="2">IMPLEMENTATION</td><td>OPERATIONS</td></tr>
<tr><td></td><td colspan="7">ICP PROCESS</td><td></td><td></td><td></td><td></td></tr>
</table>

- Development – consisting of:
    - Concept design
    - Basic design
    - Detailed design
- Implementation – consisting of:
    - Detailed implementation design
    - Installation
    - commissioning
- Operation – consisting of:
    - Measurement and Verification
    - Operations and Maintenance.

From the financial institution's perspective, the stages are:

- pre-financing – consisting of:
    - Origination
    - Decision to proceed to underwriting
    - Underwriting
    - Decision to finance
- operations/servicing – consisting of:
    - Draw down
    - Servicing.

These stages are described in-turn below.

THE PROJECT DEVELOPER'S PERSPECTIVE

DEVELOPMENT

Project developers undertake a technical and commercial development process that leads to a set of information that will allow the project host (where the host is investing their own capital), or a financial institution to make an investment decision. Project development can be carried out by the project host's internal staff, external energy consultants, a specialised energy services company or a combination acting as a development team. The project development process begins with idea generation, which can be driven by an energy audit or a vendor's proposal, and then moves through a process of refining technical and commercial data. The process outputs can include an Investment Grade Audit (IGA), which is more detailed and has more accurate costs and savings estimates than standard energy audits.

The development process should always begin with base lining of energy consumption – determining the base level of energy use against which the resulting energy savings are measured. A projection of energy savings relative to the base line for the specific project or projects will then be calculated. Savings are calculated using standard engineering methodologies, usually contained within national guides from engineering bodies or in some cases in national standards, or for larger building projects calculated using a building simulation model. Simulations, if done well, can more accurately assess annual energy consumption and take into account the interactions between different energy efficiency measures. In some geographies, the use of simulation models is still rare. Smaller and simpler projects will not require a simulation model as energy savings will be calculated using standard engineering practices and codes and the cost of modelling cannot be justified - although it should be noted that the cost of simulation modelling is falling

Development of proposed projects can be an iterative process. As well as the technical parts of the development process and the savings calculations the developer will also gather capital cost and operating estimates. Depending on the complexity of the projects involved the development process can be in two parts, initial analysis and detailed analysis. Initial analysis will have a wider range of error in savings and cost estimates than is required for a final decision but should be sufficient to make a decision to spend additional resources in detailed development. In the early stages of project development cost estimates can have an accuracy of +/- 10-15% but as project analysis is refined a higher degree of accuracy is required. For large projects accuracy is likely to come from obtaining firm quotes from suppliers and sub-contractors. Project development will also address the procurement approach, the financing approach, and on-going Operations and Maintenance and Measurement and Verification plans.

The outputs from the development process should include:

- technical description and specifications of proposed energy efficiency measures
- projected energy savings
- projected energy cost savings using assumed energy prices
- estimates of capital cost obtained from budgeting or contractor/supplier quotations
- estimates of Operations and Maintenance (O&M) cost throughout the lifetime of the project

- estimates of the value of other financial benefits e.g. asset value, increased productivity etc
- an approach to contracting and implementing the project
- an O&M plan
- a Measurement and Verification (M&V) plan.

The use of internationally recognised processes such as those of the Investor Confidence Project (ICP) help to standardise the development process, reduce due diligence costs, and reduce performance risks. The ICP is an international programme to standardise the development of energy efficiency projects which can reduce performance risk, reduce due diligence costs and enable aggregation of standardised projects. The ICP's Investor Ready Energy EfficiencyTM (IREE) certification system requires projects to be developed by accredited project developers and to be independently reviewed by independent Quality Assurance professionals. IREE is available across Europe for tertiary building and apartment block projects, and with the support of the European Commission is being further developed to cover projects in industry, street lighting and district energy. Text Box 3.1 gives more detail on the Investor Confidence Project process and additional ICP resources including the Project Development Specification, the Index of National Resources, and various Project Development templates are referenced in the Resources section of this Toolkit.

For projects that are seeking external financing the output from the development process, along with information on the project host (credit rating etc.), and information on the proposed deal structure, will be shared with financial institutions to elicit offers of finance. Ideally contact should be made

TEXT 3.1 ENSURING THE QUALITY OF PROJECT DEVELOPMENT – THE INVESTOR CONFIDENCE PROJECT

One of the key issues in energy efficiency projects is that until recently there has not been a standard way of developing and documenting energy efficiency projects; even where there are national or international standards every project developer uses different methodologies. This is in contrast to energy supply investments such as oil and gas or wind power, both of which have standardised approaches. This lack of standardisation has a number of important negative effects for financial institutions looking to deploy capital into energy efficiency. These are:

- increased performance risk
- increased due diligence cost
- challenges in aggregating projects for subsequent refinancing
- challenges in building teams around ad hoc processes.

This issue, along with that of varying quality standards between project developers, is being addressed by the Investor Confidence Project (ICP) which was developed by the Environmental Defense Fund in the US, and then brought to Europe with support from the European Commission's Horizon 2020 programme. ICP is now administered by Green Business Certification Inc. (GBCI), a not-for-profit that owns or operates a number of sustainability related indicators including: LEED, GRESB, WELL and EDGE. The ICP has developed a system of project certification – Investor Ready Energy EfficiencyTM (IREE) which requires projects to be developed by an accredited project developer using the ICP Protocols and to be independently assessed by a Quality Assurance professional. IREE cannot guarantee the end result of a project but it certifies that the project developer has a certain level of competency and that a certified project has been developed and documented to an internationally recognised best practice standard.

In Europe, IREE is available in all EU countries (plus Switzerland) and recognises national standards that can be used to achieve IREE certification, thus allowing for local national regulations and standards. IREE is available for tertiary buildings and residential apartment blocks and is under development for industrial projects, street lighting and district energy.

For more information see the ICP resources in the Resources section of this Toolkit and: http://europe.eeperformance.org with potential funders early in, or prior to, the development process to ensure the requirements of funders can be incorporated into project development.

Ideally from the perspective of the project host seeking funds, one or more lenders/investors would provide indicative term sheets which will become firm commitments upon completion of satisfactory due diligence, and the project host then signs an agreement with one of them to finance the project.

IMPLEMENTATION

Once an investment case is built up and an investment decision received a project will move into implementation. For larger projects this can include detailed design followed by construction or installation. For smaller projects, sufficiently detailed design may have occurred prior to the investment decision. Once the project is fully installed it will be commissioned to ensure correct operation and then move forward into its operational lifetime.

Energy efficiency projects can be implemented via several types of contracts and it is important to distinguish the method of energy efficiency project execution from the type of financing.
Many of the types of implementation contract used, with some exceptions, are similar to those used in general construction and engineering contracting. A review of the main types of implementation contracts is included in the Resources section of this toolkit.

OPERATIONS

On commissioning the project will be handed over to the project host and will become operational. Any associated Operations and Maintenance plan or contract will commence and be an important driver of project performance. The energy performance of projects should be tracked through i mplementation of Measurement and Verification as specified in the M&V plan. M&V protocols are defined in the International Performance Measurement & Verification Protocols (IPMVP). For larger projects, especially those implemented under and Energy Performance Contract where project performance drives the fees to the contractor (ESCO) an independent M&V specialist may be appointed. For smaller projects the cost of M&V has to be considered alongside the magnitude of the benefits and traditionally the results of many projects, both small and large, have not been closely measured using M&V. The falling cost of metering, sensors and communications technology make M&V more viable for smaller projects.

TEXT BOX 3.2 MEASUREMENT AND VERIFICATION (M&V)

All energy savings are estimates of a counterfactual, i.e. current consumption compared to how much energy would have been used without the change in equipment or management. In order to evaluate savings methods of Measurement and Verification were formalised in the 1990s under the International Performance Measurement and Verification Protocol (IPMVP), now managed and maintained by the Efficiency Valuation Organisation (EVO). The Investor Confidence Project draws on IPMVP and other sources to establish M&V practices recommended for lenders and seeks to tie those practices to the entire project development, design, construction, commissioning, and monitoring process.

IPMVP sets out different methodologies including: Stipulated savings, Partial or full measurement in isolation, Whole building measurement and Simulation. For an investor or lender to an efficiency project (or indeed for the asset owner) understanding how savings are measured and which party bears the risk is essential to gauging the risk associated with the investment or loan. Further information is included in the Resources section of this Toolkit.

THE FINANCIAL INSTITUTION'S PERSPECTIVE

The project life cycle from the perspective of the financial institution is essentially in two stages; pre-financing and operations/servicing. Pre-financing includes; origination, underwriting and the investment decision. Operations includes; investment administration, draw down of funds and on-going servicing for the life of the investment.

PRE-FINANCING

ORIGINATION

The origination of energy efficiency projects can be complex. For financial institutions, different routes to originating projects are possible; including working with existing customers, specific equipment vendors, energy consultants and ESCOs. In most markets, however, there remains a shortage of well-developed projects relative to available capital. Some funds and institutions have allocated capital to energy efficiency but have had difficulties in deploying it at the rates originally envisaged. If the energy efficiency finance industry is to scale up to the levels required to address energy and climate goals this issue needs to be addressed.

One method that has been used successfully by International Finance Institutions (IFIs) and others is to provide Technical Assistance (TA) to help project owners to develop projects to the appropriate technical and financial standards. TA in some form is considered vital to create a viable deal flow, especially as despite the advantages of improving energy efficiency, demand remains low. At the EU level, the ELENA facility (http://www.eib.org/products/advising/elena/index.htm) aims at helping project developers prepare and launch large-scale investment programmes in sustainable energy. The ELENA facility is funded by the European Union and is managed by the EIB, it has already catalyzed around EUR 4 billion of investments with around EUR 100 million of EU public funds.

During the pre-financing stage, and probably before a formal decision to move to full underwriting, lenders will perform preliminary due diligence on the project. Project developers, like financiers, generally seek to avoid costly analysis at the pre-development stage before the execution of the project is more certain. Nevertheless, in order to proceed a lender or investor will require basic information that will determine whether a term sheet will be offered. With the exception of the energy assessment, the list below could just as well describe the materials prepared for the acquisition or refinance of an existing building:

- Preliminary energy assessment with recommendations for energy system improvements, cost estimates within ± 15%, and savings estimates.
- Expected sources and uses of financing for the project, reflecting planned equity contributions and expected loan size and terms;
- Pro forma showing cash flows over time. The pro forma will be project-specific where the borrower is special purpose vehicle (SPV). The pro forma will show the impact of the energy efficiency project on the cash flow of the building;
- Rent roll (if the asset is commercial or residential rental);
- Historical financials for the host asset if it is multi-tenant; balance sheet and financials for the occupant if it is owner-occupied or single-tenant;
- Financials of guarantors or off takers, likely required in the case of a special purpose entity and absolutely required for a PPA or comparable off take agreement;
- Comparables, a set of projects of similar type that validate projections in the pro forma. In a real property transaction, these comparables might be rents or sale prices for comparable buildings. For energy projects they are benchmarked energy usages for more efficient buildings or documented savings from comparable projects, based on methods described in the Investor Confidence Project standards;
- Narrative and diagram of contract structure showing roles, responsibilities and contractual obligations of the parties.

DECISION TO PROCEED TO UNDERWRITING

On the basis of the information provided by the project developer (listed above) the financial institution(s) will decide whether or not to proceed to full underwriting and due diligence.

UNDERWRITING

Underwriting is the formal process of determining value and risk leading to a decision to lend or invest. Underwriting will require the finalisation of project information, including more accurate cost and savings estimates, as well as the procurement and contracting approach to be used. The first step in underwriting is the elaboration of a detailed financial model which can be used for valuation, pricing and risk analysis and the results of the modelling may sometimes be used to modify technical and commercial proposals in an iterative process. For larger projects the technical information may be subject to independent due diligence. Requiring developers to use internationally recognised standards such as those of the Investor Confidence Project may reduce the need to carry out technical due diligence.

The financial model, coupled with information on the project host's credit rating and any relevant accounting and legal input, will form the basis of underwriting which is described in more detail in the Value and Risk Appraisal section of this Toolkit.

Assuming the outcome of the combined processes meets the investment criteria set by the institution a term sheet or offer will be issued. Following negotiations and any required due diligence and approvals required, financial close will occur, leading to draw down of funds to finance construction and commissioning. Upon completion, there will usually be an inspection to ensure the project is built and is performing to specification and the project then enters a stage of servicing during which loan repayments are made as required by the agreement between the financial institution and the host.

POST-FINANCING

ADMINISTRATION

Upon approval by the investment committee of an investor or the credit committee of a lender, the parties proceed to prepare legal documentation for the loan or the investment. In an energy efficiency project this element of the process varies little from that of any other kind of loan or investment but energy efficiency projects also have specific milestones that lenders and investors should require in order to ensure effective implementation and help to ensure project outcomes match pre-development projections.

Specific documentation ensures that energy efficiency projects are well-executed and should be required as a conditions precedent for draw down. These include:

- Design, Construction and Verification (DCV) standards specific to the project that clearly explain to engineers and contractors the design intent of the retrofits, the standards to which they will be built and the steps that will be taken to verify both of these elements.
- An Operations and Maintenance (O&M) plan to ensure the installations are managed and cared for properly.
- Most external financing entities make provision for their inspections at specific stages of project completion. In energy efficiency projects, these inspections should be performed by experienced engineers familiar with retrofits who inspect not only for completion of the work but the execution according to the prescribed standards.
- A Measurement and Verification (M&V) plan that sets out the M&V methodology and the reporting frequency and format.

These and other elements of effective external financing documentation for energy efficiency projects are more fully described in the Investor Confidence Project protocols (see the Resources section of this Toolkit).

DRAW DOWN

A critical step in any construction project, whether of a new apartment building or an energy project, is the external financing entity's final inspection. For energy efficiency projects like many other construction, mechanical and electrical projects, the last stage of project execution is a process called commissioning. New systems and equipment must be tested under various conditions to ensure they run properly. Loan documentation should require this process as well as a reference standard for executing it and link loan draw down to it.

SERVICING

Servicing of a loan or investment follows the terms laid out in the loan or investment agreements. Energy efficiency projects are no different in this regard from any other loan or investment except that, as described above, the requirements of the borrower may differ.

External financing contracts covenants can and should make borrowers responsible for submitting M&V reports to external financial servicers responsible for ensuring that the project performs, and for calling upon guarantees as necessary for those that underperform. M&V reports can provide useful additional risk management over and above normal management reports as they can highlight problems such as a reduced level of savings as they develop and can be used to trigger corrective action. Maintaining M&V data will also help lenders to begin to assemble reference datasets that can help in underwriting future energy efficiency pr.

BIBLIOGRAPHY

Efficiency Valuation Organisation. (2016). ***International Performance Measurement and Verification Protocol.*** [Online]: Available at: http://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp Accessed 8 June 2017.

European Commission. (2016). ***Project Development Assistance.*** [Online]: Available at: http://ec.europa.eu/energy/intelligent/getting-funds/project-development-assistance/ Accessed 8 June 2017.

Group, Reed, B., Fedrizzi, S.R. (2009). ***The integrative design guide to green building: redefining the practice of sustainability.*** Hoboken, NJ, John Wiley & Sons

Investor Confidence Project Europe. (2016). ***Project Development Specification Version 1.0.*** [Online]: Available at: http://europe.eeperformance.org/uploads/8/6/5/0/8650231/project_development_specification_v1.0_300316_issued.pdf Accessed 8 June 2017.

Investor Confidence Project Europe. (2016). ***Annex A. Index of National Resources.*** [Online]: Available at: http://europe.eeperformance.org/uploads/8/6/5/0/8650231/annex_a_index_of_national_resources_icpeu_v2.0_issued_06_05_2016.pdf Accessed 8 June 2017.

Lovins, A. (2007a). ***Public lectures in advanced energy efficiency. 1. Buildings.*** [Online]. [Online]: Available at: http://www.rmi.org/Content/Files/E07-02_Stanford_1Buildings.pdf Accessed 8 June 2017.

Lovins, A. (2007b). ***Public lectures in advanced energy efficiency. 2. Industry.*** [Online]: [Online]: Available at: http://www.rmi.org/Content/Files/E07-03_Stanford_2Industry.pdf Accessed 8 June 2017.

Lovins, A. (2007c). ***Public lectures in advanced energy efficiency. 3. Transportation.*** [Online]: Available at: http://www.rmi.org/Content/Files/E07-04_Stanford_3Transport.pdf Accessed 8 June 2017.

Lovins, A. (2007d). ***Public lectures in advanced energy efficiency. 4. Implementation.*** [Online]: Available at: http://www.rmi.org/Content/Files/E07-05_Stanford_4Implement.pdf Accessed 8 June 2017.

Lovins, A. (2007e). ***Public lectures in advanced energy efficiency. 5. Implications.*** [Online]: Available at: http://www.rmi.org/Content/Files/E07-06_Stanford_5Implications.pdf Accessed 8 June 2017.

Lovins, A. and the Rocky Mountain Institute. (2011). ***Reinventing Fire.*** White River Junction, Vermont, Chelsea Green Publishing Company.

Sustainable Energy Authority of Ireland. (2013). ***Energy Efficient Design Methodology.*** [Online]. Available at: http://www.seai.ie/Your_Business/Energy_Agreements/Special_Working_Groups/EED_SWG_2008/EED_Methodology.pdf Accessed 8 June 2017.

Sustainable Energy Authority of Ireland. (2016). ***The Project Development Process.*** [Online]. Available at: http://www.seai.ie/Your_Business/Energy-Contracting/Project-Development-Process-Overview/ Accessed 8 June 2017.

US Department of Energy. (2015). ***M&V Guidelines: Measurement and Verification for Performance Based Contracts Version 4.0*** [Online]. Available at: https://energy.gov/sites/prod/files/2016/01/f28/mv_guide_4_0.pdf Accessed 8 June 2017.

VALUE AND RISK APPRAISAL

This section identifies the various sources of value that can be created by energy efficiency projects including non-energy benefits such as increased asset value, increased productivity and increased health and well-being. All energy efficiency investments, whatever their size or nature, have various types of risk including several components of performance risk, as well normal counter-party risks, and this section sets out the categories of risk and approaches to risk mitigation. An overall approach to risk appraisal is set out. This section is primarily aimed at risk teams but should also be of value to originators and project developers.

KEY POINTS

Energy efficiency investments create value in many ways, over and above the value of energy saved. These multiple sources of value, or non-energy benefits, can include many factors such as; increased asset value, reduced operations and maintenance costs, improved productivity and improved health and well-being of employees or building occupants.

These multiple sources of value should be recognised, assessed, and where possible valued as part of appraising energy efficiency investments.

All energy efficiency investments have several types of risk including; performance risk, energy price risk and execution risks.

The risks of energy efficiency investments should be recognised and, where appropriate evaluated and understood. When underwriting projects and considering performance risks, financial institutions should bear in mind that:

- *under-performance of projects may put repayment at risk and if repeated at scale may carry reputational risk;*
- *financial institutions counting the full improved cash flow from energy savings in credit risk assessment are implicitly taking performance risk and energy price risk*
- *re-financing markets, specifically the green bond market, will require assurance that underlying projects are performing and having a genuine environmental impact.*
- *better understanding of performance risk will allow the innovation of new products which take some performance risk for higher returns.*

For large projects, various risk mitigation strategies exist including the use of performance guarantees, performance insurance, and the use of best practice standards such as those developed by the Investor Confidence Project.

For smaller projects, such as residential retrofits, the use of detailed risk appraisal modelling or post-investment Measurement and Verification, is very likely to be too high. In these cases, consider a portfolio approach to risk appraisal.

Energy efficiency financing has been shown to reduce risks but there is still little hard data linking energy efficiency performance and loan/investment performance. Banks and financial institutions can lead the market by putting in place procedures to identify and tag loans/investments with an element of energy efficiency. This will enable assessment of risks and better pricing in future.

Banks should encourage valuers to take energy efficiency into account in their property valuations.

RECOMMENDATIONS

- *Ensure all sources of value of energy efficiency projects are identified and where possible are captured and valued.*
- *Identify the specific risks of energy efficiency investments.*
- *Identify and tag projects that include an element of energy efficiency in order to facilitate assessment of risks in future.*
- *For smaller projects e.g. residential loans, portfolio risk appraisal techniques should be used.*
- *For larger projects implement risk analysis techniques that identify the input factors*

that have the greatest impact on investment performance.

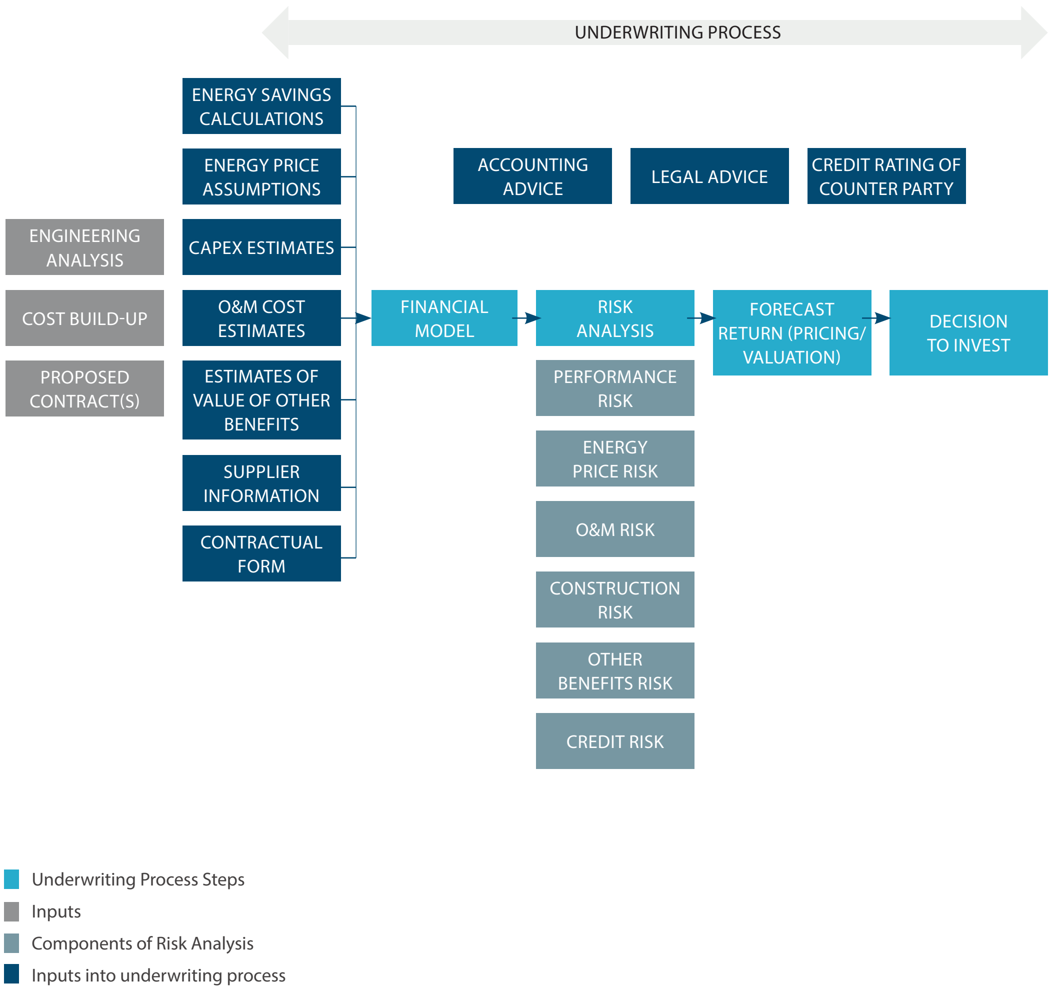
- *Use risk mitigation strategies such as the use of performance guarantees.*
- *Use risk mitigation strategies such as specifying the use of internationally recognised standards such as those developed by the Investor Confidence Project and the International Protocol on Measurement and Verification of Performance.*

DISCUSSION

The underwriting process to assess value and risk takes inputs from the engineering, commercial and contractual development process described in The Project Life Cycle section of the Toolkit. The approach described here is applicable to larger projects but fundamentally all energy efficiency projects, whatever their size, whether they be stand-alone or embedded into larger refurbishment projects can produce multiple benefits and carry the same types of risks. The challenges with small projects is how to cost-effectively appraise value and risks. For projects embedded into larger renovation projects where the primary motivation is not energy saving the challenge is how to incorporate value and risk appraisal into the overall value and risk appraisal of the larger project.

The inputs from the development process are incorporated into a financial model that is used to value the project and carry out risk analysis. The outputs from the model are combined with accounting and legal advice and credit risk assessment. The flow of information from the development process into the underwriting process is shown in Figure 4.1. In practice, there may be interaction as issues raised in financial appraisal and risk analysis for instance may lead to changes in engineering or commercial arrangements.

Figure 4.1: Information flows from development into underwriting



FINANCIAL MODEL

The first task in underwriting is to build a financial model that reflects the costs and benefits of the proposed project. The primary input into the financial model for an energy efficiency project will be the output of engineering and cost-benefit analysis resulting from the project development process described in the Project Life Cycle section of this Toolkit.

VALUING ENERGY EFFICIENCY

Energy efficiency projects can produce many types of benefits beyond just energy cost savings, both energy benefits and non-energy benefits. For any specific project, it is important to recognise all of these benefits and where possible value them and capture the value in any assessment. Benefits of energy efficiency projects also occur on three levels; the level of the project host, the level of the energy system, and the level of the national and international economy. For the purposes of financial institutions underwriting energy efficiency projects only those benefits at the project level that can be valued and captured are relevant, although national and international benefits such as reduced emissions, may be valuable as part of Corporate Social Responsibility (CSR) programmes and policies. In some jurisdictions, some of the benefits that arise in the energy system, e.g. the reduction in maximum electrical load which reduces the need to invest in new energy supply capacity (through larger cables for instance), may be passed back to the project host through payment schemes or special tariffs from the supplier, distribution company or grid company. Where this is the case it is important to identify, value and contractually capture these monetary benefits in order to maximise the returns of the project. In some cases, these benefits may not have been identified or valued by the developer, who is usually focused on energy cost savings, and the financial institution may identify them and propose ways to capture them through implementation contracts. The checklist in the Resources section summarises the benefits most likely to be produced by energy efficiency projects.

ENERGY BENEFITS

Energy related benefits include:

- energy cost savings: the most commonly discussed benefit and the main rationale for stand-alone energy efficiency projects.
- reduction in effects of energy price volatility. Reducing energy consumption reduces the economic impact of energy price volatility which has a value to the project host.
- demand response value. In some jurisdictions reduction in power load at certain times may be economically attractive through incentives payments, often in the form of payments from the grid operator or distribution company.
- reduced need to spend capital on energy infrastructure upgrades. Reducing energy demand can prevent, or delay the need to upgrade energy supply infrastructure such as boilers or cables.

Energy cost savings

The first and primary source of value from investments in energy efficiency is the value that comes from the reduced energy cost – usually called energy savings but more correctly energy cost savings. It is these cost savings that usually drive investment returns. These savings are calculated using the projected energy savings (in kWh or other energy units) multiplied by the assumed price of energy over the investment lifetime. It is important to remember that energy costs are made up of several elements including fixed charges and various levies (e.g. renewable energy levy) and taxes. Particularly in deregulated energy markets tariffs can be complex and large users in the industrial and commercial sectors are increasingly becoming more exposed to the wholesale energy market. All of these elements need to be considered in calculating the appropriate price per kWh used in savings calculations. Projected energy prices ("forward curves") can be taken from various proprietary services. For large consumers exposed to the wholesale electricity market prices can in fact become negative at times – which makes technologies such as energy storage potentially economically viable.

Reduction in the effects of energy price volatility

Another source of value from improvements in energy efficiency is the reduction in the impact of energy price volatility. Energy prices are volatile and this volatility imposes a cost on building operators and industrial facilities alike. Reducing consumption reduces the exposure to energy price volatility.

Being better able to predict input costs also has a value to commercial organisations. One of the advantages of renewable energy sources such as solar or wind is that there is no price volatility – long-term fixed energy prices can be set based on capital cost, project finance costs and Operations & Maintenance costs. This removal of energy price volatility is often under-valued or ignored in assessing on-site renewable energy projects.

Value of demand response

As outlined above in some markets there is potential economic value from implementing demand response measures, either as a result of reduced energy costs at times of peak demand or by payments from the utility. Revenue is usually paid to the project host by the grid operator or distribution company and some demand response project developers take a share of the revenue produced.

Reduced need to invest in energy supply infrastructure

Investment into energy efficiency may reduce or remove the need to invest in additional energy supply infrastructure such as increasing the capacity of power supply. An example of this is given by Costa Coffee's roasting plant in London. In 2012 Costa implemented various energy efficiency measures that reduced energy consumption by 16%. This allowed production to be increased without the need to invest to upgrade the capacity of the electricity supply capacity. Without these measures the company would have had to pay a significant capital cost to the electricity distribution company to install upgraded cables. This type of benefit is likely to be particularly valuable in urban environments where replacing and upgrading electrical infrastructure (cables, transformers and sub-stations) is increasingly difficult and expensive.

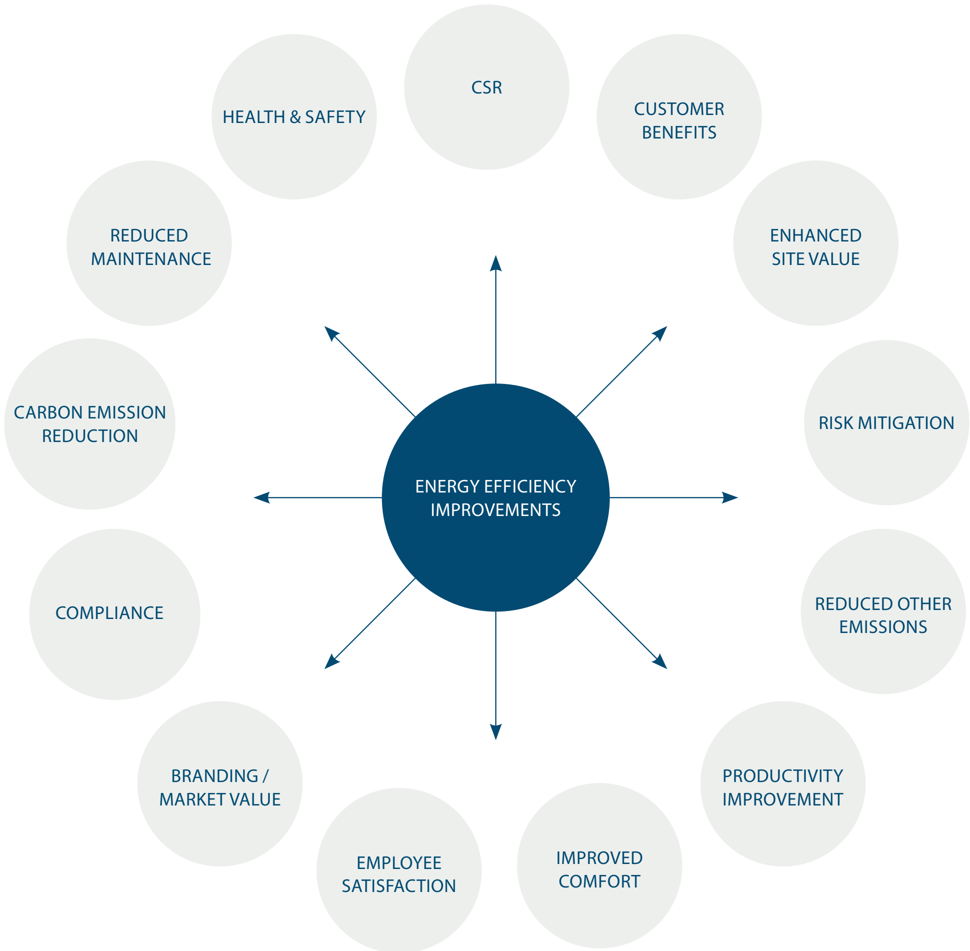
NON-ENERGY BENEFITS

Work by the International Energy Agency and others has identified a whole range of non-energy benefits that may result from energy efficiency projects which are shown in Figure 4.2.

These benefits, and their monetary value, will be very situation specific and the allocation of value will be determined by agreement between the parties but it is important that the project development and underwriting processes identify and where possible captures the value of the benefits that fall to the host or the investor.

Non-energy benefits have an important role to play in selling energy efficiency investments, however

Figure 4.2: Multiple Benefits of Energy Efficiency



they are financed. The EEFIG DEEP database contains some information on non-energy benefits where these have been provided. Often the other sources of value may be considered by decision makers to be more strategic than just energy cost savings and therefore more likely to result in a decision to invest. Some of the main non-energy benefits are explored further below.

Impact of energy efficiency on asset valuation and external financing quality

One of the principal challenges of energy efficiency is that, while its impact on asset value can be real and measurable, energy represents a relatively small part of a building's or company's overall expense, (with the exception of facilities in specific energy intensive sectors), and energy systems a relatively small part of the real property. A common refrain among building owners asked about efficiency is "95% of the value is in the bricks and mortar." As a result, asset owners often feel that returns to investment of staff time and effort may be greater if they are directed at leasing (in multi-tenant or residential property), or improving services (in healthcare or universities), or upgrading production systems and marketing (in industrial firms). Energy efficiency is not a core business or competence and is not regarded as strategic in nature compared to improving service or developing new products.
Nevertheless, in buildings attention to energy systems can have an impact on the building's value that is far from trivial. The level of impact of energy efficiency improvements on asset value will depend on the way that the building is occupied and the nature of tenant leases being used.

In some kinds of assets, particularly in multi-tenant commercial buildings, the energy savings from an efficiency project may not flow to a single beneficiary. While it is a consideration that is more important for the host asset than the lender or investor, it is nonetheless important for underwriting to understand how savings flow through the underlying asset.

Operating costs in leases are best understood on a spectrum extending from a net lease where tenants pay for all capital and operating costs (more common in the UK and Europe) to a gross lease where landlords pay for all capital and operating costs (more common in the USA). Energy savings from a retrofit in a building with a fully netted lease will flow to the tenants. If the lease makes tenants responsible for capital upgrades (i.e. triple net), the landlord can make the retrofit and charge the tenants pro rata but may have little incentive to undertake the planning and development effort required given that it receives no savings. If the lease makes the landlord responsible for capital expenditures and tenants for operating, there is even less incentive to do so since the tenant will receive the savings having paid nothing for them. This is the landlord-tenant problem of split incentives.

In a fully gross lease (also called full service gross) a landlord pays for all operating costs, typically excluding increases in property taxes, meaning that all energy savings from an energy efficiency project would flow to the landlord.

Asset value impacts

Energy efficiency can significantly improve valuation of an asset at sale and leverage ratios for financing. An illustrative example will be helpful. A large real estate firm buys a 25,000 m2 building in Berlin, with a hold period of 3 to 5 years at which point it plans to sell the property. An energy assessment on the 30 year-old property indicates that a comprehensive retrofit would cost EUR 2,500,000 and save at least 35% of energy costs. The building spends EUR 50/square meter on energy, or EUR 1,250,000 per year, meaning the retrofit will save EUR 440,000. See Figure 4.3.

For simplicity in this example, let us assume that all of the energy savings flow to the bottom line of the asset.

Cash flow

The first and most obvious impact of the retrofit appears in the cash flow, where reducing expenses is the net equivalent of increasing revenue. The economics indicate a "simple payback" on the cash outlay of 5.7 years.

Figure 4.3: Building and Retrofit Data

SIZE (SQ M)	AGE	NET OPERATING INCOME	ANNUAL ENERGY EXPENDITURE	RETROFIT COST	RETROFIT SAVINGS
25,000	30	€ 3,750,000	€ 1,250,000	€ 2,500,000	€ 440,000

For commercial or other property, the appeal of this retrofit project may vary considerably based upon the investment strategy of the owner. An increase in asset valuation may not be relevant unless an owner plans to sell or refinance. A long-term holder of property may not find a return of capital in nearly six years as compelling as alternative investment opportunities. Such an owner may prefer to reduce the list of system improvements to those that return capital in three years or less. The owner of this particular asset, however, with a 3 to 5-year hold period, would be well advised to pursue the complete retrofit in light of the impacts discussed below.

Capped valuation

As a general first order estimate, commercial property prices are based upon the capitalised value of the income stream they generate. The capitalisation rate (a discount rate that is a proxy for the opportunity cost or the buyer's cost of capital) at which assets trade rises or falls based upon many factors in the broader economy. In this example a cap rate of 4% is used. Dividing the stream of savings by the going cap rate yields the net value of the retrofit. All other things being equal, i.e. ignoring other factors that might affect valuation such as the credit quality and duration of existing leases, the retrofit will increase the value of the property at sale by 12%, a four-fold return on the capital spent on the retrofit.

Price chipping / re-trade

During the negotiation process for purchase of an asset, a buyer typically adjusts the original offering price based upon information discovered during due diligence. This renegotiation process is called "price chipping" or "re-trading". Deficiencies discovered as part of the Physical Needs Assessment (PNA) are often the source of price adjustments. In the example given here, it is likely that a PNA would identify aging energy systems as liabilities that would be passed on to a buyer, leading to a EUR 2,500,000 discounting of the offering price, as opposed to the three-fold return earned by the owner that retrofits the building. In other words, the change in value due to the retrofit is really closer to EUR 13 million than EUR 11 million.

Figure 4.4: Impact of a Retrofit on Asset Value

PRE-RETOFIT		RETROFIT IMPACT		Total Change in Asset Value
Net Operating Income	€ 3,750,000	Savings	€ 440,000	
Cap Rate	4.0%	Cap Rate	4.0%	
Sale Value	€ 93,750,000	Δ Value	€ 11,000,000	12%

Loan to Value (LTV)

A change in LTV might rightly belong in the discussion of credit quality below, but it is probably more important to the extent it impacts an asset owner's motivation to pursue a retrofit. Assuming an LTV for commercial property of 70% and a value of EUR 93.75 million, the maximum loan available for the buyer of the building, or to the existing owner seeking a refinance, is EUR 65.6 million prior to a retrofit. After a retrofit and the change in valuation, the 70% LTV would allow borrowing of EUR 73.3 million, or a EUR 7.7 million increase in borrowing, nearly three times the cost of the retrofit itself. The additional loan proceeds free up capital that can be applied elsewhere, to distributions or to the purchase of additional assets.

It is important to point out that, in addition to re-trade of the asset with aging systems, the buyer's lender may reduce the amount it is willing to lend, require the buyer to reserve against the improvements, or use loan proceeds to install them, each of which has a similar net effect of reducing the value of the property to a buyer.

Credit quality impacts

While all of the asset value impacts described above have a positive impact on credit quality, lenders look at those changes differently from asset owners. This brief section takes a lender's perspective on the energy efficiency project.

BOX 4.1 ENERGY EFFICIENCY AND THE VALUATION OF BUILDINGS

The examples above show that improved energy efficiency can directly influence property value. This proposition is not universally recognised by valuers who operate on established methodologies that may not take into account improved cash flows. The methodology also of course does not apply to residential buildings where value is driven by many objective and subjective factors. The energy efficiency industry has long argued that a more efficient building – commercial or residential – has additional value.

There have been numerous studies and projects to assess the effect of energy efficiency on valuation and there appears to be growing evidence that a more efficient building is worth more than a less efficient equivalent, but this conclusion remains controversial with many property professionals and valuers ascribing differences in value to other factors. Banks and financial institutions lending to the property market have the opportunity to collect data to evaluate this question but this requires collection of energy performance data, either operational data or more likely asset data such as Energy Performance Certificates. Banks should collect relevant data as well as ensure that they are aware of the latest research. They can also actively encourage valuers to take energy efficiency into account in their valuation. This is now being done by some banks including, amongst others, ABN Amro ING and Berlin Hyp.

Debt Service Coverage Ratio (DSCR)

Lenders pay particular attention to debt service coverage ratios (DSCRs) as a measure of the health of an asset. For commercial property, for example, loan covenants typically require maintenance of a minimum coverage, often 1.25 or 1.3, below which a loan may be accelerated, reserves increased or other penalties applied. A loan that falls below 1.15 or 1.1 may be considered impaired although of course specific DSCRs will vary in each situation.

Cash flow improvements from energy efficiency can significantly improve debt service coverages. An analysis of 550 multi-family residential buildings in the north-eastern United States tested the impact of 30% (hypothetical) energy savings on debt service coverage. On average, those savings would improve DSCRs by 0.245. For 10% of the assets, this improvement would:

- shift them from a DSCR below 1 (i.e. unable to pay debt service) to positive coverage; or
- move them out of an "impaired" coverage status closer to target minimum coverage; or
- lift coverage ratios from at or below minimums typical in loan covenants to healthy coverages exceeding those minimums.

For a lender, an across the board improvement significantly reducing exposure in 10% of its loans is a dramatic result warranting close attention. On this evidence, lenders would be well advised, as discussed further below, to benchmark energy usage in their portfolios and track energy costs. Energy efficiency can be a tool for limiting defaults and improving credit quality across a pool of assets.

Default mitigation

As discussed above, the prices of assets are frequently reduced ("re-trading" or "price chipping") during due diligence when deficiencies come to light. A buyer discounts the original price by the cost of remediating those deficiencies. In a default scenario, a lender seeks to recover as much of the principal and unpaid interest as possible from a disposition. An asset with aging energy infrastructure is vulnerable to re-trade and the lender therefore, vulnerable to lower recovery of capital. Assets with modernised systems are less vulnerable.

Lower tenant turnover/faster leasing or sale

Stable, credit worthy tenants are an important measure of credit quality. Retaining existing tenants is generally far preferable to vacant space in search of new ones and improved levels of energy efficiency can help to ensure that those stable, high quality tenants renew. Increasingly governments, private businesses, institutions and non-profits have made commitments to sustainability and environmental conservation which can affect their choices over property. Energy efficiency improvements by an asset owner may help meet some of those commitments while reflecting stewardship of the building that can help to retain tenants. They can also improve health and comfort, as discussed further below, providing further benefits to tenants. As well as helping to retain tenants a high level of energy efficiency may reduce the time taken to fill voids. Retaining tenants and faster rental/sales both have a direct financial impact.

Modernisation/diminution of building obsolescence

Brokers and management firms often classify buildings according to their physical condition, location, level of amenities and other factors. Some still use labels such as Class A (for new or modernised buildings in good locations with many amenities), Class B (older, less well maintained buildings with fewer amenities), and Class C (old buildings in need of significant renovation). These distinctions have an important impact on perceptions of tenants and potential buyers of property. Modern energy systems are an important element of Class A status. Buildings that cannot maintain an adequate indoor environment, experience system outages or constant repairs, or cannot accommodate supplementary systems from new tenants will struggle to retain top tier marketability. Furthermore, as discussed in the Financial Institutions and Energy Efficiency section of this Toolkit tightening regulations on energy performance may well make less efficient properties unsaleable.

Other non-Energy Impacts

As well as the energy benefits and the non-energy impacts described above, investments in energy efficiency can have other benefits. These need to be identified and valued where possible. The types of benefits that may occur include:

Reduced compliance costs

In some regulatory schemes, notably the EU Emissions Trading Scheme (EU ETS), reducing energy use for a large energy consumer will reduce compliance costs or even produce income, these benefits can be identified and valued. They can also be captured in an energy services contract.

Reduced Operations and Maintenance costs.

New equipment often reduces O&M costs as well as energy costs, the best known example being the long life of LED lamps which greatly reduces relamping costs compared to fluorescent lamps.

Improved health and safety

Better lighting levels for instance can bring about better health and safety. As well as the reduced O&M costs referred to above the longer life of LEDs reduces the need to work at height – therefore reducing on-going health and safety costs as well as reducing the risk of accidents. This will have a value to an organisation and of course there is societal benefit.

Production increase

Some energy efficiency projects can bring about the removal of production bottlenecks. This would have a financial impact that should be captured in the financial assessment of any energy efficiency investment.

Improved productivity

Some energy efficiency projects may bring about an increase in productivity. Improving comfort conditions in an office building for instance can increase worker productivity. The Center for Building Performance and Diagnostics at Carnegie Mellon identified 12 studies linking improved lighting design decisions with 0.7 – to 23 per cent gains in individual productivity. Other studies have shown similar results. Some industrial projects can improve production levels by removing bottlenecks or constraints.

Health and well-being

There is evidence to show that low energy or green buildings can promote health and well being which itself can bring economic benefits through reduced absenteeism or reduced health costs. The value of this in commercial real estate is only just beginning to be recognised and valued. In the residential sector, there is a clear link between poor levels of energy efficiency, resulting in fuel poverty (the condition of being unable to afford to keep one's home adequately heated), and health care costs. Typically, however, energy efficiency capital budgets and health care budgets are not linked although there are some interesting pilot projects where this has been achieved.

The challenge in underwriting these non-energy benefits is three-fold: a) identifying them b) estimating the resultant benefits and c) capturing the cash flow benefits. If they can be identified and estimated, and a contractual means to capture them put in place, then the cash flows should be included in valuation calculations. There is no standard way of calculating the value of these benefits although a number of initiatives are underway.

TYPES OF RISK AND RISK MITIGATION

Having identified sources of value and entered them into a financial model the next stage of the underwriting process is to carry out a risk analysis.

Energy efficiency projects have in the past been presented as no or low risk. In fact, like any investment project they include risks which need to be understood and evaluated. Many of the risks present in energy efficiency projects are familiar to underwriters of other kinds of real property investments. Ultimately all energy efficiency projects, whatever their size, have similar types of risk but obviously for smaller projects the amount available to spend on due diligence and understanding risks is smaller. Better understanding, and ultimately quantification of the risks, should ultimately lead to tighter pricing and the development of innovative finance products. The following section describes the common risks in energy efficiency projects and identifies mitigation strategies.

PERFORMANCE RISKS

Performance risk is essentially the technical risk that the project does not produce as many units of energy saved as forecast and it can occur for a number of reasons which can be split into: intrinsic – those factors that are within the energy efficiency measure or technology itself, and extrinsic – those factors that are external to the project itself. Intrinsic risks include design and equipment risks, extrinsic include factors such as weather or hours of occupancy. The gap between projected savings and actual savings that are achieved in practice is known as the "performance gap".

The reality at present is that for most energy efficiency investment or lending the financial institution is not explicitly taking the performance risk. This either resides with the project host or a contractor through some kind of performance guarantee. Nevertheless, we consider that an understanding of performance risk is important for six important reasons.

TEXT BOX 4.2 THE PERFORMANCE GAP

One of the major issues in energy efficiency is that there is often a significant difference between the projected savings and the actual savings that are achieved in practice. This is known as the "performance gap". A US study on energy efficiency projects in over 230 multi-family housing buildings carried out for Deutsche Bank showed that the realisation rate – the actual savings compared to the projected savings was 61% with a 90% confidence level of +-14%. This comes about due to a number of factors including; poor baselining, poor design, and use of unrealistic assumptions on key parameters such as run time of equipment.

The performance gap can be addressed through careful selection of engineering teams and the use of standardised development processes such as those of the Investor Confidence Project (ICP). ICP's Investor Ready Energy Efficiency™ certification for projects requires trained project developers to follow the ICP Protocols and for the project to be independently verified by an ICP Quality Assurance professional.

For more details: Recognizing the Benefits of Energy Efficiency in Multifamily Underwriting https://www.db.com/cr/en/docs/DB_Living_Cities_Report_-_Recognizing_the_Benefits_of_Energy_Efficiency_in_Multifamily.pdf

1. For consumer loans consumer credit laws may make the provider of finance ultimately responsible for the performance of financed equipment.
2. Even when there is no legal or contractual responsibility for performance risk project under-performance will lead to customer dis-satisfaction and possibly disputes that can put the investment or loan at risk.
3. Some financial institutions are including the full increased cash flow that should result from energy efficiency projects in their risk assessment. This effectively means that they are indirectly exposed to some performance risk. Under-performance will reduce the cash flow improvements expected and therefore the risk of default.
4. Failures of project performance at a large scale may lead to reputational risks. In the US Property Assessed Clean Energy has been receiving

negative press coverage due to a small percentage of under-performing or mis-sold projects. Similarly in the UK there has been recent press coverage of under-performing energy efficiency projects.

5. As the energy efficiency financing market matures and is better understood more investors/lenders will be willing to take some or all of the performance risk in return for an upside. This has already happened in some other energy markets such as wind power where some debt providers are willing to take on shared performance risk for higher returns – effectively a debt/equity hybrid product.
6. Ultimately many financial institutions will want to aggregate energy efficiency loans or investments and re-finance them through securitisation or the growing green bond market. The green bond market, driven by socially responsible investing, requires the underlying projects to have real environmental benefits

For these reasons we consider performance risk to be important and discuss it at length here.

Design risks

Design risks concern the failure of the energy modelling, selection of energy efficiency measures and engineering design to accurately predict the energy savings, all other factors being equal. This failure may come about for a number of reasons including design error and the inaccuracy of design models. A design failure may be difficult to establish unless it involves a clear mathematical error or obvious mis-specification. Design failures can occur in single measure or technology projects but are more likely in complex multi—technology projects where there are interactions between measures, interactions that are sometimes difficult to accurately model or predict. The issue of actual energy performance not matching design performance in buildings is called the performance gap.

Mitigants

Engineers typically will not accept savings risk associated with their designs. Professional Indemnity (PI) (also called Errors and Omissions) insurance will not therefore cover savings, but it will cover mistakes in calculation or specification. There are several standard practices that should be observed that will mitigate design risk including:

- Engineers working for the developer should share all data, calculations and simulation files. Their awareness that this information will be on file will compel a higher degree of care.
- Third party engineers experienced with retrofits should be tasked with review of all design work. For larger projects financial institutions often require independent engineers to carry out technical due diligence.
- The use of appropriate national or international standards in project development and documentation such as the Investor Confidence Project Protocols should be specified. Use of the Investor Confidence Project's Investor Ready Energy EfficiencyTM project certification system brings with it the added confidence of an independent third party verification that best practices have been followed in project development.
- Lenders and investors should consider reducing savings projections, or investigate the methods the developer may have used in the design process to reduce them. Where simulation programs are used to model building physics, the level of confidence in the model calibration needs to be considered. The magnitude of any reduction, or "de-rating", of the savings will depend on the degree of interaction among measures, the difficulty of the retrofit, the extent to which the technologies are proven, and other factors identified by the third-party engineer.

A NOTE ON DESIGN TECHNIQUES, INTEGRATED DESIGN AND OVER-SIZING

Although not a specific technology the choice of design approach can seriously impact on the energy efficiency of buildings and processes. Traditional engineering follows codes and practices which although existing for good reasons, sometimes work against energy efficiency. An example is the separation of architects and building services engineers. The energy efficiency of a new building can be significantly affected by this separation in which traditionally (and to a certain extent this is a stereotype for illustration), the architect designs the building and then "hands it over" to the building services engineers. This may result in lower than optimum efficiency for a number of reasons e.g. the effects of building orientation and massing decisions, or simply the positioning of plant and equipment rooms.

Furthermore, even within building services engineering there is the issue of separation or "silos" where mechanical engineers dealing with HVAC design may be separate to lighting engineers – even though lighting and HVAC can interact to affect energy use. There is also the conservatism factor. Engineers are conservative for good reasons but this often produces the "here is one I did before"

TEXT BOX 4.3 EXAMPLES OF INTEGRATED DESIGN IN BUILDINGS AND INDUSTRY

The 2011 renovation of the Empire State Building in New York has been widely recognised for its use of integrated design. The building was subject to a USD 500m renovation project to bring it up to date and counter increases in voids. The owner of the building made a firm commitment to achieve high levels of energy efficiency but only under a strict rule of achieving a three-year payback period on any capital invested. Conventional engineering approaches were unable to fulfil this return criterion but through the use of integrated design significant gains in efficiency were achieved, as well as reductions in capital costs compared to conventional design solutions, which combined produced the required return. The net result of the energy efficiency measures was an additional capital cost of USD 13m with energy savings of 38%, resulting in a three year payback period on the marginal capital. The level of savings is significant given the historical nature of the building. The use of integrated design techniques as part of a wider renovation project allowed a significant increase in energy savings and reduction in capital costs compared to the conventionally engineered alternatives which were first proposed to the owner.

An example of integrated design in industry is given by Lakeland Dairies in Ireland. The company had a process requirement for additional cooling capacity which was estimated to cost EUR 100,000. Based on advice from SEAI the company undertook a process integration study which used pinch analysis (a technique for identifying the minimum energy requirement of thermodynamic processes). The analysis eliminated the requirement for the additional mechanical cooling plant, saving the EUR 100,000 capital expenditure, optimised the overall performance of the process by investing EUR 90,000 in heat exchangers and piping resulting in an annual saving of EUR 164,000.

syndrome rather than real analysis of problems, opportunities and solutions to reduce energy use. This factor is exaggerated in projects with strict timelines and strong cost pressures. Cost pressures themselves also result in sub-optimal energy use when clients seek to minimise capital cost rather than life time cost. This can result in certain energy efficiency measures being cut out of designs to reduce costs.

Integrated design seeks to find design solutions that fulfil multiple functions and have multiple benefits and has been found to often produce savings in capex as well as opex, which goes against the commonly held view that reducing energy costs inevitably requires increased capital costs.

Another deleterious design phenomenon to be aware of is over sizing of equipment which is extremely common and occurs for a combination of reasons. Engineers make design calculations of loads (thermal or electrical), and then add a safety factor (usually determined by engineering codes and industry practices). Often a second safety factor is added ("just in case") as well as redundancy, and then the next size of equipment up is selected from a catalogue, with the net result of more over-sizing. These technical and cultural factors are further encouraged by traditional contracting and consulting contract structures that incentivise maximisation of capex and not the reduction of long-term operating costs. These engineering and financial factors result in gross over-sizing which is significant because most engineering systems operate at low efficiencies when running at low loads which results in un-necessarily high energy consumption. Careful design techniques, based on data collection on actual demands, coupled with incentive structures that encourage low energy designs can help to reduce the worst effects of over-sizing.

TEXT BOX 4.4 COMBATTING OVER-SIZING

An example of the benefits of questioning over-sizing of plant and equipment is shown by a case study from a brewery where a proposal to replace an existing steam boiler installation with 50 tonne/hour capacity was being considered. Conventional engineers had proposed a straight replacement with new boilers with 50 tonne/hour capacity. Detailed, crticial analysis of actual demand showed that the steam load could actually be met by 2 x 10 tonne/hour boilers. The final investment decision was to install 3 x 10 tonne/hour boilers with one providing backup. This resulted in a) reduced capital cost compared to the original proposal and b) significant energy savings (c.40%) resulting from the plant running at a higher capacity factor.

EQUIPMENT RISKS

Equipment may not perform to the manufacturers specifications or it may fail altogether. In recent years there have been examples of LED lamps not living up to the manufacturers' specified lifetime, sometimes associated with poor choice of supplier. Contractors will not generally assume risks associated with equipment that they were not responsible for manufacturing but instead will pass on manufacturers' warranties. Insurers may take on equipment risk but the premium will be driven by their perception of the specific manufacturers in question.

Mitigants

Contractors or borrowers should negotiate for the longest warranties they can obtain. Suppliers of equipment should be chosen carefully to ensure high quality equipment is procured from reputable manufacturers. Finance providers can specify certain manufacturers. Contracts should ensure that adequate insurance is in place. The contract should also compel operations staff to strictly follow the maintenance requirements established in the operations manual provided with the equipment. The same contract should allow for review of maintenance logs by the contractor or lender to confirm those procedures were followed.

OPERATIONS AND MAINTENANCE RISKS

No energy efficiency project will achieve its savings projections if the new systems are not operated or maintained properly. It is the biggest single risk for contractors and borrowers alike, particularly since contractors installing a retrofit virtually never manage the building and the host asset owner may utilise a third-party facilities management firm. Typically the longest, most detailed section of an Energy Performance Contract is the one governing operator failure. Legal disputes that arise when a host asset calls a savings guarantee frequently hinge on accusations of operator error.

Mitigants

The following essential practices should be followed to manage operational risk.

- Measurement and Verification (M&V) protocols should be put in place as part of the project and maintained during the project life time.
- An Operations Manual should be provided with the retrofit that outlines as clearly as possible how the new systems should be operated and should be accompanied by training.
- The contract must provide for maximum visibility into operational behaviour, via operational logs, uploads of data, or real-time links to the building management system. Operational failure cannot be proven without evidence.
- The contract should include some kind of on-going commissioning to ensure that the level of savings does not decay. On-going commissioning can help identify operator errors and other problems that lead to savings decaying over time.
- Operations and maintenance contracts can be written to include performance warranties based on up-time or even energy performance.

TEXT BOX 4.5 THE IMPORTANCE OF MEASUREMENT & VERIFICATION AND IPMVP

Another issue with many energy efficiency projects is that the quality of Operations & Maintenance and Measurement & Verification can vary from low (or completely absent) to very high and this affects the project outcome itself and of course the ability to monitor the outcome. Many energy efficiency projects do not include M&V and therefore the actual outcome is uncertain. In this case savings may be over or under – stated and may indeed be illusory as they could be caused by other external factors such as weather and changes in production levels.

The International Performance Measurement and Verification Protocol (IPMVP) sets out methodologies for determining energy and water savings. Good practice requires that M&V is integrated into the process of identifying, installing and operating energy efficiency measures. IPMVP methodologies should be used to measure the performance of all energy efficiency measures and for larger projects, and particularly complex energy services contracts, an independent professional firm specialising in M&V should be appointed.

For more details on IPMVP see Text Box 3.1 in the Project Life Cycle section of this Toolkit and:
http://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp

WEATHER RISKS

Weather can have a significant impact on achievement of energy savings. If, for example, a retrofit is designed to dramatically reduce the consumption of fuel for heating and the winter following installation is mild, savings will be less than projected, everything else being equal. While energy bills will remain lower than they would have been without the intervention, and the impact on the host asset is still positive, contracts underwritten based on achieving the savings may experience a shortfall.

Mitigants

An energy performance contract will include formulae accounting for weather and should generally not penalise the contractor if weather limits savings. Where the cash flow from savings is required for return of and on capital, the best insurance against weather risk is a long contract. Most variations in weather will balance out (i.e. upside gains will compensate for downside losses) in contracts longer than three or four years. The weather risk can also be mitigated by careful selection of the baseline, ideally baseline energy consumption will be based on three years data. Where weather risk is considered particularly significant, it is possible to purchase hedges against weather in insurance markets. Finally, the discounting of savings described above will help manage weather variations. An additional option that could be considered is weather insurance or hedging contracts.

CHANGES IN HOURS OF USE, PRODUCTION VOLUME, PATTERNS OF BUILDING USAGE

Any calculation of energy savings will be based on a baseline consumption. As energy use is affected by many factors including: changes in the hours of use, changes in production volume or product mix, changes in number of building occupants etc., any projection of savings is based on an assumption that conditions remain as they were in the baseline, which of course they may not. In this case energy savings will not be as predicted. Normalisation through the use of techniques such as Measurement and Verification may be possible. Any contract based on a projected level of savings must allow for these changes and should specify a method of normalisation or a process to reach a new baseline. The most extreme change that can happen to affect savings performance is of course closure of a building or a facility. This will lead to contract termination and financing contracts must allow for this, usually through the use of termination clauses which result in capital being repaid by the user who has taken the decision to close the facility.

Mitigants

The most common mitigant to address this risk is to have some minimum production level or set pattern of building use that the project host is willing to guarantee. This may affect the balance sheet treatment of associated capital cost and accounting advice should always be sought on this matter. Energy service companies and investors are naturally unwilling to take on risks that really sit with the project host, e.g. their production volumes/sales and it is unreasonable to expect them to do so.

PERFORMANCE RISK PROFILE OVER TIME

The technical performance risk of energy efficiency projects that are well developed and managed tend to become more stable over time. The first year may involve fine-tuning and calibration to optimise performance of the new systems. After two or three years, the average savings are likely to present a fair approximation of the savings that can be expected for the remainder of the contract, assuming that on-going commissioning and any replacements of equipment that age out during the contract period are provided for. For this reason, energy efficiency projects that are mature make good candidates for aggregating and refinancing through securitisation or green bonds.

PERFORMANCE GUARANTEES

Many of the contractual arrangements described in the Financing Energy Efficiency section, of this Toolkit, particularly Energy Performance Contracts and related structures, are designed to address some or all of the risks described above. Performance guarantees should be carefully examined and considered. It is worth noting that:

- contractors will not generally assume risks that they cannot manage in a very direct fashion.
- savings guarantees will shift unbounded risks to other parties.
- savings guarantees will usually be well below the achievable savings in order to build-in risk protection for the contractor.
- guarantees always carry a cost.

As well as performance contracts project hosts and financiers should consider the use of energy efficiency risk insurance which is increasingly available.

THE ROLE OF INSURANCE IN PERFORMANCE RISK

The energy efficiency insurance market is an emerging field. Specialised insurance companies such as HSB (part of Munich Re) offer products to cover some or all of the performance risks including poor design and implementation and the use of these insurance projects is expected to grow in the future. Insurance is available for most commonly used energy efficiency technologies. This insurance can help reduce the cost of capital by providing additional certainty that loan repayments or projected capital returns will be made.

ENERGY PRICE RISKS

Monetary savings will be predicted on the basis of an assumed energy price but of course energy prices change, both up and down, affecting the level of savings achieved. Often the buyer of an energy efficiency project believes savings have failed to materialise when in fact they have been partly or wholly subsumed by rising energy prices. While this perception is unfortunate for the contractor forced to explain the issue, energy price risk is managed relatively easily and reporting systems should include reference to energy price changes.

Mitigants

Energy Performance Contracts guarantee savings and Chauffage-type contracts generate billings in terms of historical energy usage, i.e. in kilowatt hours and BTUs, not in currency. Energy prices are not usually relevant to guarantees of savings. Indeed, as prices rise, savings also increase, meaning the host property may pay more than projected for certain kinds of contracts. It is sometimes possible to procure longer-term fixed price energy contracts. Another option for both the host property and for a contractor managing procurement is to purchase a hedge on the commodities markets or establish caps and collars on the energy price that will be used in the calculation of monetary savings.

CONSTRUCTION RISKS

As with host risk, construction lenders are already well versed in managing risk associated with contractors. This brief section reviews some of those methods with specific reference to how they are typically managed in energy efficiency projects.

Execution Risk – Time, Cost, and Quality

Some retrofit projects may take place in mechanical spaces and cause relatively little interference with the rest of the building. Others may require entry into occupied spaces to replace lighting, wiring, thermostats or other systems which will cause disruption or need to be scheduled for out of operating hours, possibly at extra cost. Energy efficiency projects generally must be scheduled carefully with the host building to ensure the least possible disruption and the fastest possible execution. Host properties that execute their own energy efficiency projects are accustomed to these risks, since many engage contractors for new tenant fit-outs or renovation projects on a regular basis. Indeed, some are more comfortable managing this risk than handing it off to ESCOs.

Mitigants

Energy Performance Contracts generally make the ESCO responsible for delivery of the project on time and on budget. A host property may increase the security associated with the ESCO's commitment by requiring that the project be bonded (i.e. a payment and performance bond gives the host property access to capital to hire an alternative contractor to complete the work should the ESCO fail) or that the contractor pay liquidated damages. Liquidated damages might reflect the expected savings foregone during the period when construction exceeded its schedule completion date. It is also possible for contractor or building owner to purchase insurance policies to mitigate construction risk.

In some cases it may be possible for an ESCO to permit a host property to utilise its preferred contractors and to manage construction, and to take a fee for doing so, but these concessions will require corresponding adjustments in other parts of the contract, e.g. should savings guarantees be compromised by delays in host execution of construction.

Credit Risks during construction/installation

Management of cash flow across different projects is the biggest challenge for most construction contractors. Those with smaller balance sheets are at higher risk of failing to execute a project.

Mitigants

As part of the submission of bids, contractors should be required to submit their financials as well as their ability to post performance bonds or warranties. Management experience and track record in similar projects are important factors that should be considered.

RISKS ASSOCIATED WITH OTHER COSTS AND BENEFITS

If other costs or benefits identified int he discussion of non-energy benefits (NEBs) are valued and included in the project assessment any risks associated with those cash streams should be considered in the underwriting process and mitigation options considered, just as with other risks. As these other costs and benefits tend to be situation specific it is not possible to provide generic guidance on how to assess and mitigate them, only to record that they will exist.

REGULATORY RISKS

Energy efficiency projects do not typically involve a high degree of regulatory risk. Energy efficiency standards for buildings and equipment have generally tightened across the world and this trajectory looks set to continue. Efficiency projects are more likely to bring buildings into compliance than to violate codes or regulations. Nevertheless, some new technologies or management strategies may not yet be anticipated in code. Recycling of indoor air, for example, may be treated differently across jurisdictions. Co-generation projects will sometimes require specific environmental permits that allow for fossil fuel combustion in urban areas.

Another form of regulatory risk that should be considered occurs when there are government subsidies or feed-in tariffs that are essential to ensure the sound economics of the project. In some jurisdictions, retrospective changes to feed-in tariffs for renewable projects have occurred and these have severely impacted project returns for all investors and lenders. As well as the risk of retrospective changes to feed-in tariffs the risks of changes during project development need to be considered. Other regulations may also affect project economics.

Mitigants

There are a set of standard practices that should be followed to address regulatory concerns. First, engineers should perform a comprehensive code review of the retrofits proposed and prepare a schedule of permits or variances that will be required. Second, to the maximum extent possible, permits should be obtained before construction begins and significant funds are expended. Finally, conditions precedent can make receipt of certain permits or regulatory approvals mandatory before releasing funds.

HOST CREDIT QUALITY

Evaluating host credit risk does not need extensive discussion as it is part of the core business of lenders and investors. Real property investing is many decades old and practices for evaluating risk associated with a real estate asset (or corporate debt in the case of an owner-occupied asset) are well established in banking and investing. An energy efficiency guide has nothing to add to these considerations, with two caveats.

Payments for energy efficiency projects will generally come before distributions to equity (contract review should ensure this is the case); they will appear as an above-the-line operating expense in the case of a service contract or a below the line debt service in the case of a loan to the host property. Evaluating a building's capacity to pay operating expenses is very different from evaluating its debt-carrying capacity or its ability to generate returns for investors. Operating expenses are paid before debt service, and are therefore less likely to default than a loan. Debt payments are made before any profits are distributed. For some energy efficiency arrangements, the analysis needs simply to confirm that the building will be solvent long enough to discharge operating or debt service payments, a lower bar than other kinds of credit analysis.

Some banks are beginning to take the improved cash flow from energy efficiency into account in credit analysis. This should be encouraged as there is a real effect. The only caveat is that by taking into account the impact of savings the lender is implicitly taking some performance risk and energy price risk, which therefore suggests that a good understanding of these risks is even more important in this cases.

A challenge for some lenders pursuing efficiency concerns the typical size of the transaction. Many lenders will have a staff devoted to credit analysis of real estate assets, but their typical transaction is likely to be far larger than the staff executing energy efficiency transactions. It may be difficult for them to secure some of the time and expertise of the real estate staff. Lenders and investors may be well advised to develop a streamlined process for analysis of host credit that taps in-house expertise without over-utilising it.

LEGAL REVIEW OF CONTRACTS AND CONTRACT STRUCTURE

Lenders and investors will conduct a legal review of the contracts to be used between host and developer or host and contractors, as the case may be. This review will inform the depth and breadth of other underwriting processes by revealing where investors and lenders have exposure under the proposed contract structure. As the contract structure diagrams presented in the Financing Energy Efficiency section of this Toolkit demonstrate, contractual relationships among the parties may vary considerably. In some cases payment of debt service is the responsibility of the host asset, while in others it is the responsibility of the project developer. In the former case, underwriters will focus more attention on the ability of the host to carry the additional debt. In the latter, they will scrutinise closely the entities that stand behind the project specific entity (the guarantors and the contractors). Contract review should consider carefully how each of the risks detailed in this section is dealt with and which party carries the associated exposure. Other standard considerations include the transferability of contracts and performance guarantees.

CONSUMER CREDIT LAW RISK

In some jurisdictions, where individual consumers are being offered loans, consumer credit protection laws mean that the provider of finance is responsible for failures or defects. This presents a particular problem for financing home retrofits as it means that the finance provider will be responsible for the equipment and systems installed for the life of the loan. This means that credit providers need to either pass on the risk to their supply chain (which is problematic for long-term loans with terms of 7 to 15 years which is longer than most manufacturer/supplier warranties), or find a way to insure the risk. Insurance companies may not be able to take these risks as there is a lack of data on real performance.

ACCOUNTING REVIEW

For some types of contracts, the balance sheet and/or fiscal treatment of the contract may require review. If the host asset owner or developer have not engaged an accounting firm for a review, investors and lenders may do so to assess the balance sheet tretament. With changes in accounting standards this is becoming more important.

RISK ANALYSIS

Having built a financial model and collected all other relevant information a risk analysis can be carried out to test the sensitivity of financial outcome to changes in the input variables. Normally this would be carried out a high level on inputs such as projected energy savings (in kWh or other energy unit), energy prices, capital costs and O&M costs etc.

There is almost a complete absence of real performance data on individual energy efficiency measures but a number of recent initiatives have sought to address this problem. The DEEP database, created with support from the European Commission, (https://deep.eefig.eu) as of 1st June 2017 contains data on more than 7,500 projects across Europe covering both industry and buildings. DEEP, along with other similar databases, does not contain many projects with verified energy performance data. The Curve (thecurve.me) collects information from industrial and building energy users on their efficiency (and related) projects. Again, most of the more than 650 projects in the Curve do not include verified energy consumption data. The industry should move towards collecting verified performance data in a standardised, usable way (as has been done in the US through the Building Energy Data Exchange Specifications - BEDES) and banks and financial institutions can push the industry in this direction.

The advent of cheaper monitoring and computing power and communications opens up the possibility that performance data at an energy efficiency measure level will become more available over time, and as this happens different commercial models that properly consider and price performance risk are likely to emerge.

Even without detailed performance data on individual measures it is possible to carry out a sensitivity analysis on specific energy efficiency measures in order to identify the most critical risk factors which can then be focused on.

The risk analysis should identify those input factors where changes will have the biggest effect on expected return. This information can lead to requesting additional information which could include deciding to spend money on additional temporary monitoring. If for example, the most sensitive input factor is judged to be hours run, consideration should be given to installing temporary monitoring that logs the hours run directly, either a light meter in the case of lighting or electrical monitoring of the specific circuits in question.

BIBLIOGRAPHY

Building Efficiency Initiative. (2013). ***Productivity Gains from Energy Efficiency*** [Online].
Available at http://www.buildingefficiencyinitiative.org/articles/productivity-gainsenergy-efficiency
Accessed 8 June 2017.

PWC (2008). ***Building the case for wellness***.
[Online]. Available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209547/hwwb-dwp-wellness-report-public.pdf
Accessed 8 June 2017.

Burns, P. & Coxon, J. (2016). ***Boiler on Prescription Trial Closing Report***. [Online].
Available at http://www.gentoogroup.com/media/1061811/boiler-on-prescriptionclosing-report.pdf
Accessed 8 June 2017.

Bell, C.J. (2012). ***Energy Efficiency Job Creation: Real World Experiences.***
[Online]. Available at: http://www.aceee.org/files/pdf/white-paper/energy-efficiency-job-creation.pdf
Accessed 8 June 2017.

British Council of Shopping Centres and CBRE. (2015). ***Sustainable Shopping Centres. Energy, Performance and Value.***
[Online]. Available at: http://www.cbreproperties.cz/uploads/media/properties/0001/04/b21096094065074d9f9b471b3d68b97db9c142db.pdf
Accessed 8 June 2017.

Burns, P. & Coxon, J. (2016). ***Boiler on Prescription Trial Closing Report.*** [Online]. [Online]. Available at: http://www.gentoogroup.com/media/1061811/boiler-on-prescription-closing-report.pdf
Accessed 8 June 2017.

Community Preservation Corporation. (2017). Underwriting Efficiency.
[Online]. Available at: http://communityp.com/wp-content/uploads/2017/05/CPC_Underwriting_Efficiency_Handbook_Full_Interactive_FINAL.pdf
Accessed 8 June 2017.

Consumer Focus. (2012). ***Jobs, growth and warmer homes. Evaluating the Economic Stimulus of Investing in Energy Efficiency Measures in Fuel Poor Homes.***
[Online]. Available at: http://www.consumerfocus.org.uk/files/2012/11/Jobs-growth-and-warmer-homes-November-2012.pdf
Accessed 8 June 2017.

Curwin, T. (2011). ***Energy Price Volatility Now A Major Factor in Corporate Efficiency Drive.*** [Online 23 August 2011]. [Online].
Available at: http://www.cnbc.com/id/44072900/Energy_Price_Volatility_Now_A_Major_Factor_In_Corporate_Efficiency_Drive
Accessed 8 June 2017.

Deutsche Bank. (2012). ***Recognizing the Benefits of Energy Efficiency in Multifamily Underwriting.***
[Online]. Available at: https://www.db.com/cr/en/docs/DB_Living_Cities_Report_-_Recognizing_the_Benefits_of_Energy_Efficiency_in_Multifamily.pdf
Accessed 8 June 2017.

Edwards, B.W. and Naboni, E. (2013). ***Green Buildings*** Pay. Design, Productivity and Ecology. Routledge, London.
Ellison, L. and Sayce, S. (2006). ***The Sustainable Property Appraisal Project.***
[Online]. Available at: http://kueprints3.kingston.ac.uk/1435/1/Sustainable_Property_Appraisal_Project.pdf
Accessed 8 June 2017.

International Energy Agency (2014). ***Capturing the Multiple Benefits of Energy Efficiency.***
[Online]. Available at: http://www.iea.org/publications/freepublications/publication/Captur_the_MultiplBenef_ofEnergyEficiency.pdf
Accessed 8 June 2017.

International Well Building Institute (2017).
A comprehensive approach to health and well-building.
[Online]. Available at: https://www.wellcertified.com/our-standard

Institute for Building Efficiency (2012). ***Productivity Gains from Energy Efficiency.*** [Online]. Available at: http://www.institutebe.com/Existing-Building-Retrofits/Productivity-Gains-from-Energy-Efficiency.aspx
Accessed 8 June 2017.

Institute for Market Transformation & Appraisal Institute. (2012). ***Recognition Of Energy Costs and Energy Performance in Real Property Valuation.***
[Online]. Available at: http://www.imt.org/uploads/resources/files/Energy_Reporting_in_Appraisal.pdf
Accessed 8 June 2017.

Jackson, J. (2010). ***Promoting energy efficiency investments with risk management decision tools.***
Energy Policy. 38 (8). 3865-3873.
[Online]. Available at: http://www.sciencedirect.com/science/article/pii/S0301421510001692
Accessed 8 June 2017.

Jackson, J. (2015). ***Risk Management Identifies Overlooked Efficiency Investment Profits.***
[Online]. Available at: http://www.energycentral.com/utilitybusiness/riskandoperations/articles/3170/Risk-Management-Identifies-Overlooked-Efficiency-Investment-Profits/
Accessed 8 June 2017.

Jones, R.B. & Tine, D.R. (2014). ***Quantifying the Financial Value of Insurance for Energy Savings Projects.*** [Online]. Available at: http://aceee.org/files/proceedings/2014/data/papers/4-180.pdf
Accessed 8 June 2017.

Kats, G. (2003). ***The Costs and Benefits of Green Buildings. A Report to California's Sustainable Building Task Force, Capital E Analytics.*** [Online]. [Online]. Available at: http://www.calrecycle.ca.gov/greenbuilding/design/costbenefit/report.pdf
Accessed 8 June 2017.

Kats, G. (2006). ***Greening America's Schools. Costs and Benefits.*** Capital-E.
[Online]. Available at: Available at: http://www.usgbc.org/ShowFile.aspx?DocumentID=2908
Accessed 8 June 2017.

Kaza, N., Quercia, R., Sahadi, R. (2014). ***Home Energy Efficiency and Mortgage Risks: An Extended Abstract.*** Community Development Investment Review. 63-69. [Online]. Available at: http://www.frbsf.org/community-development/files/cdir_vol10issue1-Home-Energy-Efficiency-and-Mortgage-Risks.pdf
Accessed 8 June 2017.

Kok, N., Miller, N., Morris, P. (2011). ***The Economics of Green Retrofits.***
[Online]. Available at: http://www.normmiller.net/wp-content/uploads/2012/08/Economics-of-Green-Retrofits-Draft-212-1-2011.pdf
Accessed 8 June 2017.

Krhounek, K. (2016). ***Fannie Mae Multifamily Green Initiative: Green Financing for Investments in Multifamily Sustainability.*** US DOE Better Buildings Summit. 10 May 2016.
[Online]. Available at: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/Underwriting-Energy_Are-Commercial-Mortgages-Ignoring-Energy-Related-Risks-and-Benefits-Commercial-TUES.pdf
Accessed 8 June 2017.

Langner, R., Hendron, B., Bonnema, E. (2014). ***Reducing Transaction Costs for Energy Efficiency Investments and Analysis of Economic Risk Associated With Building Performance Uncertainties. Small Buildings and Small Portfolios Program*** (National Laboratory of the U.S. Department of Energy).
[Online]. Available at: http://www.nrel.gov/docs/fy14osti/60976.pdf
Accessed 8 June 2017.

Lazar, J. and Colnurn, K. (2013). ***A Layer Cake of Benefits: Recognizing the Full Value of Energy Efficiency.***
[Online]. Available at: http://www.raponline.org/wp-content/uploads/2016/05/rap-lazarcolburn-layercakepaper-2013-sept-9.pdf
Accessed 8 June 2017.

Loftness, V., Hartkopf, V., Gurtekin, B. Hansen, D. and Hitchcock, R. (2003). ***Linking Energy to Health and Productivity in the Built Environment. Center for Building Performance and Diagnostics, Carnegie Mellon.***
[Online]. Available at: http://www.usgbc.org/Docs/Archive/MediaArchive/207_Loftness_PA876.pdf
Accessed 8 June 2017.

L'Union Social pour l'Habitat. (2011). ***Plan européen pour la relance économique COM(2008) 800 final Mesure n°6 : Améliorer l'efficacité énergétique dans les bâtiments. Reprogrammation des programmes opérationnels régionaux des Fonds structurels en faveur des logements sociaux.***

[Online]. Available at: http://union-habitat.eu/IMG/pdf/Plan_de_relance_evaluation_FEDER_logement_social_FR_synthese.pdf
Accessed 8 June 2017.

Mathew, P., Kromer, S., Sezgen, O., Meyers, S. (2003). ***Actuarial pricing of Energy Efficiency Projects: Lessons Foul and Fair.*** [Online]. Available at: http://www.rationalenergy.net/pdf/actuarial_dsm_pricing.pdf
Accessed 8 June 2017.

Mills, E., Kromer, S., Weiss, G., Mathew, P. (2006). ***From volatility to value: analysing and managing financial and performance risk in energy savings projects.*** Energy Policy 34. 188-189.
[Online]. Available at: http://evanmills.lbl.gov/pubs/pdf/volatility_to_value.pdf
Accessed 8 June 2017.

Muldavin. S. (2010). ***Value Beyond Cost savings. How to Underwrite Sustainable Properties. Green Building Finance Consortium.***
[Online]. Available at: http://www.greenbuildingfc.com/Documents/Value%20Beyond%20Cost%20Savings--Final.pdf
Accessed 8 June 2017.

Newsham, G.R., Veitch, J.A., Arsenault, C., and Duval, C. (2004). ***Effect of dimming control on office worker satisfaction and performance.*** Proceedings of the Annual Conference of the Illuminating Engineering Society of North America, Tampa, Florida.

Philips Lighting. (2008). ***Lighting Upgrades Boost Workplace Productivity.*** Philips. [Online]. Available at: http://www.graybar.com/documents/philips-wp-lighting-upgrades.pdf
Accessed 8 June 2017.

PWC (2008). ***Building the case for wellness.***
[Online]. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209547/hwwb-dwp-wellness-report-public.pdf
Accessed 8 June 2017.

Rickard, S., Hardy, B., Von Neida, B. and Mihlmester, P. (1998). ***The Investment Risk in Whole Building Energy-Efficiency Upgrade Projects.***
[Online]. Available at: http://gaia.lbl.gov/federal-espc/working-groups/SavingsVerification/The-Investment-Risk-in-Whole-Building-Energy-Efficiency-Upgrades.pdf
Accessed 8 June 2017.

Ries, R.B, Melissa M. G, Nuri M. N, Kim L. (2006). *The economic benefits of green buildings a comprehensive case study. Engineering Economist.*

Rocky Mountain Institute (2014). ***How to Calculate and Present Deep Retrofit Value. A Guide for Owner-Occupants.***
[Online]. Available at: http://www.rmi.org/retrofit_depot_deepretrofitvalue
Accessed 8 June 2017.

Seppanen, O., Fisk, W. J. and Faulkner, D. (2004). ***Control of Temperature for Health and Productivity in Offices. Lawrence Berkeley National Laboratory.***
[Online]. Available at: http://www.escholarship.org/uc/item/39s1m92c#page-1
Accessed 8 June 2017.

Seppänen, O., Fisk, W.J. and Lei, Q.H. (2006). ***Effect of Temperature on Task Performance in Office Environment.***
[Online]. Available at: http://www.osti.gov/bridge/servlets/purl/903490-F5SQYA/903490.pdf
Accessed 8 June 2017.

Shih, K. (2010). ***Improve Energy Efficiency and Weld Quality by Eliminating Expulsion Welds on Automobile Assembly Line.*** [Online]. Available at: http://www.autosteel.org/~/media/Files/Autosteel/Great%20Designs%20in%20Steel/GDIS%202011/25%20-%20Kelvin%20Shih%20-%20Improve%20Energy%20Efficiency%20and%20Weld%20Quality.pdf

Singh, A., Syat, M. Grady, S.G. and Korkmaz, S. (2010). ***Effects of Green Buildings on Employee Health and Productivity. American Journal of Public Health.*** July 15th, 2010. [Online]. Available at: http://news.msu.edu/media/documents/2010/08/840514e8-0b32-4aa4-9fc8-276b688dfed4.pdf
Accessed 8 June 2017.

Tohn Environmental Strategies Team (2016). ***Occupant Health Benefits of Residential Energy Efficiency.***
[Online]. Available at: http://e4thefuture.org/occupant-health-benefits-of-residential-energy-efficiency/
Accessed 8 June 2017.

US Department of Energy. (2016). ***Underwriting Energy: Are Commercial Mortgages Ignoring Energy Risks and Benefits?***
[Online]. Available at: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/Underwriting-Energy_Are-Commercial-Mortgages-Ignoring-Energy-Related-Risks-and-Benefits-Commercial-TUES.pdf
Accessed 8 June 2017.

Wallace, N. (2016). ***Underwriting Energy Efficency in Commercial Mortgages: Challenges and Possible Interventions.*** US DOE Better Buildings Summit. 10 May 2016. [Online]. Available at: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/Underwriting-Energy_Are-Commercial-Mortgages-Ignoring-Energy-Related-Risks-and-Benefits-Commercial-TUES.pdf
Accessed 8 June 2017.

Williamson, T., Grant. E., Hansen, A., Pisaniello, D. and Andamon, M. (2009). ***An Investigation of Potential Health Benefits from Increasing Energy Efficiency Stringency***
http://www.ieppec.org/wp-content/uploads/2016/05/Paper-Reid.pdf
Accessed 8 June 2017.

Wyon, D.P. (2004). ***The effects of indoor air quality on performance and productivity.*** Indoor Air. 14, 92-101

ABBREVIATIONS

A	Ampere – unit of current
A&E	Architecture and Engineering (as in A&E firms)
AC	Alternating Current
ADEME	Agence de l'environnement et de la maîtrise de l'énergie
aM&T	Automated Monitoring & Targeting
AMR	Automated Meter Reading
BAS	Building Automation System
BAU	Business as Usual
BEDES	Building Energy Data Exchange Specification – a common language for building energy data developed by the US Department of Energy
BIM	Building Information Modelling - a process involving the generation and management of digital representations of physical and functional characteristics of places
BMS	Building Energy Management System (synonymous with BAS)
BOE	Barrels Oil Equivalent
BOO	Build, Own and Operate
BPIE	Buildings Performance Institute Europe
BREEAM	Building Research Establishment Environmental Assessment Method
BTU	British Thermal Unit
°C	Unit of temperature
CEM	Contract Energy Management
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
CFL	Compact Fluorescent Lamp
CHP	Combined Heat and Power
CO_2	Carbon dioxide
COP	Coefficient of Performance – measure of performance usually applied to heat pumps
COP21	21st session of the Conference of the Parties, referring to the countries that have signed up to the 1992 United Nations Framework Convention on Climate Change
CSR	Corporate Social Responsibility
Cx	Continuous commissioning
DB&M	Design, Build & Maintain
DBO	Design, Build, Operate
DBOM	Design, Build, Operate, Maintain
DC	Direct Current
DCF	Discounted Cash Flow
DCV	Demand Controlled Ventilation
DCV	Design. Construction & Verification standards
DEEP	Derisking Energy Efficiency Platform
DG	Distributed Generation
DG ENER	Directorate-General for Energy of the European Commission
DH	District Heating
DM	Demand Management – permanent reduction of load through energy efficiency
DR	Demand Response – short-term reduction in load or time shifting of load
DSCR	Debt Service Coverage Ratio – the ratio of free cash flow to debt interest and principle payments
DSO	Distribution System Operator
EBRD	European Bank of Reconstruction and Development
ECBC	European Covered Bond Council
ECEEE	European Council for an Energy Efficient Economy
ECM	Energy Conservation Measure
ECM	Electrically Commutated Motor
ECO	Energy Company Obligation (UK scheme to mandate spending on energy efficiency by energy suppliers)
EDF	Électricité de France
EDGE	Excellence in Design for Greater Efficiencies – green building certification system for new designs, initiated by IFC and administered by GBCI
EDR	Electricity Demand Reduction
EE	Energy efficiency
EEC	Energy Efficiency Certificate
EED	Energy Efficiency Directive
EEEF	European Energy Efficiency Fund
EEFIG	Energy Efficiency Financial Institutions Group
EEM	Energy Efficiency Measure
EEMAP	Energy Efficient Mortgages Action Plan – an EU funded project created by the EMF-ECBC
E-FiT	Energy Efficiency Feed-in Tariff

EIB	European Investment Bank
EL	Expected Loss
ELD	Energy Labelling Directive
ELENA	European Local Energy Assistance – an initiative of the European Investment Bank and the European Commission
EMF	European Mortgage Federation
EN 16247	European standards for energy auditing
EN 16247-1	European standard specifying the general requirements, common methodology and deliverables for energy audits
EN 16247-2	European standard covering energy auditing for buildings
EN 16247-3	European standard covering energy auditing for processes
EN 16247-4	European standard covering energy auditing for transport
EN 16247-5	European standard for the competences and qualifications of energy auditors
EnB	Energy baseline – ISO definition
EnMS	Energy management system – ISO definition
EnPI	Energy performance indicator – ISO definition
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Contract
EPC	Energy Performance Certificate
ERDF	European Regional Development Fund
ESA	Efficiency Services Agreement
ESCO	Energy Service Company
ESF	European Social Fund
ESG	Environmental, Social and Governance
ESPC	Energy Saving Performance Contract (alternative term for EPC)
EU ETS	EU Emissions Trading Scheme
EVO	International not-for-profit providing IPMVP
FiT	Feed-in Tariff
FM	Facilities Management
FSB	Financial Stability Board
GBCI	Green Business Certification Inc.
GHG	Greenhouse Gas
GJ	Gigajoule – unit of energy
GRESB	Industry-driven organisation committed to assessing the ESG performance of real assets globally, including real estate portfolios and infrastructure assets
GSHP	Ground Source Heat Pump
GWP	Global Warming Potential
HVAC	Heating, Ventilation and Air Conditioning
ICP	Investor Confidence Project
IEA	International Energy Agency
IEEN	Industrial Energy Efficiency Network
IFC	International Finance Corporation
IFI	International Financial Institution
IGA	Investment Grade Audit
IIGCC	International Investors Group on Climate Change
IPEEC	International Partnership for Energy Efficiency Cooperation
IPMVP	International Performance Measurement & Verification Protocol
IREE™	Investor Ready Energy EfficiencyTM – project accreditation system developed by the Investor Confidence Project
IRENA	The International Renewable Energy Agency
IRR	Internal Rate of Return
ISO	International Organisation for Standardisation
ISO 14000	A family of ISO standards related to Environmental Management
ISO 50001	ISO standard 50001 Energy management systems – Requirements with guidance for use specifies requirements for establishing, implementing, maintaining and improving an energy management system.
ISO 50002	ISO 50002:2014 specifies the process for carrying out an energy audit in relation to energy performance.
ISO 50003	ISO 50003:2014 specifies requirements for competence, consistency and impartiality in the auditing and certification of energy management systems (EnMS) for bodies providing these services.
ISO 50004	ISO 50004:2014 provides practical guidance and examples for establishing, implementing, maintaining and improving an energy management system (EnMS) in accordance with the systematic approach of ISO 50001.
ISO 50006	ISO 50006:2014 provides guidance to organisations on how to establish, use and maintain energy performance indicators (EnPIs) and energy baselines (EnBs) as part of the process of measuring energy performance.
ISO 50015	ISO 50015:2014 establishes general principles and guidelines for the process of measurement and verification (M&V) of energy performance of an organisation or its components.
ISO 50044	ISO 50044 is developing a standard for Energy Savings Evaluation -- Economics and financial evaluation of energy saving projects
J	Joule – unit of energy
JESSICA	Joint European Support for Sustainable Development in City Areas
K	Kelvin – unit of temperature

KPI	Key Performance Indicator
kW	Kilowatt – unit of power
kWh	Kilowatt hour – unit of energy
LaaS	Lighting as a Service
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design – global certification system developed by the Green Building Council
LGD	Loss Given Default
LNG	Liquefied Natural Gas
LTV	Loan to Value
Lumen	Unit of luminous flux, a measure of the total quantity of visible light emitted by a source
Luminous efficacy	Ratio of luminous flux to power, a measure of efficiency of a light source
Lux	Unit of illumination – 1 lumen per square meter
M&T	Monitoring and Targeting
M&V	Measurement and Verification
mCHP	Micro-Combined Heat and Power
MD	Maximum Demand
MEES	Minimum Energy Efficiency Standard (also known as MEPS)
MEPS	Minimum Energy Performance Standard (also known as MEES)
MESA	Managed Energy Services Agreement
MJ	Megajoule – unit of energy
MLEI	Mobilising Local Energy Investment
MURE	Mesures d'Utilisation Rationelle de l'Energie (Measures for rational use of energy)
MW	Megawatt – unit of power
MWh	Megawatt hour – unit of energy
NEB	Non-energy benefits - benefits of energy efficiency that are not energy related
NEEAP	National Energy Efficiency Action Plan
Nm^3	Normal cubic meter (measured at standard temperature and pressure)
NPI	Normalised Performance Indicator
NPV	Net Present Value
NZEB	Nearly Zero Energy Building
O&M	Operations and Maintenance
OBR	On Bill Repayment
OEM	Original Equipment Manufacturer
ORC	Organic Rankine Cycle
P90	Exceedance Probability of 90% - value with a 90% probability of being exceeded, usually applied to wind farm output. There is a 10% probability that this output will not be exceeded.
PACE	Property Assessed Clean Energy
PCG	Partial Credit Guarantee
PD	Probability of Default
PDA	Project Development Assistance
PE	Private Equity
PF4EE	Private Financing for Energy Efficiency (EIB programme)
PNA	Physical Needs Assessment
ppm	Parts Per Million
PV	Photovoltaic
QA	Quality Assurance
R & D	Research & Development
R, D & D	Research, Development and Demonstration
RE: FIT	UK programme to encourage use of Energy Performance Contracts
REN	Renewable energy
ROI	Return on Investment
SAAS	Software as a service
SCFM	Standard cubic feet per minute – unit of volume sometimes used in HVAC design
SEC	Specific Energy Consumption
SEFF	Sustainable Energy Financing Facility – an EBRD programme
SOx	Oxides of sulphur
STP	Standard Temperature and Pressure – defined as 0oC and 100 kPa
TA	Technical Assistance
TCFD	Task Force on Climate-Related Financial Disclosures
TPF	Third Party Financing
TWh	Terawatt hour
therm	a unit of heat, especially as the former statutory unit of gas supplied in the UK equivalent to 100,000 British thermal units or 1.055 × 108 joules.
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework on Climate Change
USGBC	United States Green Building Council
V	Volt – unit of electric potential, difference in electric potential or electro-magnetic force
VO	Voltage Optimisation
VSD	Variable Speed Drive
W	Watt – unit of power
WELL	An international evidence-based standard for the wellness of buildings, which sets performance requirements in seven categories: air, water, nourishment, light, fitness, comfort and mind
WGBC	World Green Building Council
WHP	Waste Heat to Power

The development of the EEFIG Underwriting Toolkit was funded by the European Commission.

The EEFIG Derisking Project Consortium consists of: COWI A/S – Carsten Glenting, Ivo Georgiev; EnergyPro Ltd – Steven Fawkes (Principal Author of the Toolkit); Climate Strategy and Partners – Peter Sweatman; Fraunhofer – Clemens Rohde; BPIE – Mariangiola Fabbri; NTUA – Spyros Mouzakitis