



SCALING UP FINANCE FOR BUILDING ENERGY RENOVATIONS IN CHINA

European and global experiences



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SusBuild - Up-scaling and mainstreaming sustainable building practices in western China

The SusBuild project, funded by the EU Switch-Asia Program, aims to foster sustainable building practices among SMEs in Chongqing City and Yunnan province in western China, through capacity building, facilitating SMEs' access to finance, supporting the development of an enabling policy framework, and stimulating dialogues and enhancing business networking among SMEs.

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Report: Scaling up finance for building energy renovations in China:
European and global experiences

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Summary

In China, the building sector accounts for about 30% of total final energy consumption. Building energy efficiency thus plays a key role in achieving the national climate target. The ambitious target has substantially driven the demand for energy refurbishment in the building sector. In the last decade, the Chinese government has rolled out a number of policies, including a significant amount of subsidies, to improve building energy performance and sustainability. Public financing has provided a major incentive for various market actors. However, given the huge financing gap, public subsidies alone are far from sufficient to mainstream sustainable building development and refurbishment in China. Thus, it is essential to develop innovative financing mechanisms for attracting private investment to fill in the immense financial gap to reach the national greenhouse gas reduction target. Energy Performance Contracting (EPC) provided by Energy service companies (ESCOs) is a popular market-based mechanism for building energy retrofiting. ESCOs in China however, especially, those of MSME size, have limited access to financing, which represents a key challenge for realizing energy efficiency projects in the building sector at a substantial scale. At the same time, financing energy efficiency projects in the building sector

represents an attractive investment opportunity for financial institutions due to the high overall investment volume and the decreased risks due to energy efficiency improvements. However, financial institutions also face substantial barriers to seize these benefits and accelerate green financing for building energy refurbishment and ESCOs.

Against this background, this report draws lessons from European and global examples that address various barriers faced by ESCOs and financial institutions. The presented instruments and financing products have supported access to financing of ESCOs in several countries worldwide and may inspire market actors in China. Examples include financing products for building energy refurbishment as well as various toolkits that support financial institutions in financing energy refurbishment projects.

Based on the key lessons drawn from each example and the current market situation in China, the report ends with a set of recommendations on green credits, green securities, and other supportive mechanisms for financial institutions, which could be beneficial to seize the opportunity to scale up sustainable building development and refurbishment in the future.



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1. The ESCO market situation in China for building energy efficiency projects

In China, the building sector accounts for about 30% of total final energy consumption. Building energy efficiency is essential for achieving the national climate target. In the last decade, the Chinese government has rolled out a number of programs to improve building performance and its sustainability. For example, during the 12th Five-Year Plan period (2011-2015), over 700 million m² of existing residential buildings in northern China were retrofitted, in which public financing has played a major role. However, it is estimated that more than 196.28 billion € would be needed for sustainable building development in China.¹ Public subsidies alone are far from sufficient to mainstream sustainable buildings in China. Thus, the development of innovative financing mechanisms is essential for attracting private investment to fill in the immense financial gaps to reach the national targets.

Energy Performance Contracting (EPC) is a popular market-based mechanism for building energy retrofitting. In this model, Energy service companies (ESCOs) provide performance guarantees to their clients, i.e. a guaranteed level of energy service or level of cost reductions and/or energy savings. Although EPC has been introduced in China since 1998, the ESCO market is still in an early stage. Currently, most ESCOs in China possess small assets and working capital.

There are two major types of EPC models: the guaranteed savings model and the shared savings model. In the guaranteed savings model, the client finances the energy efficiency project. In the shared savings model, the ESCO finances the project. The ESCO and the client share the cost savings based on a predetermined percentage for a certain time frame. The latter is most common in China, partly due to the government's support in this model through financial incentives.² In the

shared savings model, the limited access to financing of ESCOs, especially of MSMEs, represents a key challenge for realising deep building refurbishment projects.

Key financing barriers of ESCOs^{3,4,5,6}

- Limited assets and weak balance sheets: Banks often provide only asset-based loans, but ESCO projects usually involve insufficient assets and working capital. Banks usually regard future cash flows from energy savings as intangible and uncertain as collateral
- Lack of financial track records: Many SMEs do not exist long enough to provide adequate credit histories to banks
- Lack of financial literacy: For many MSMEs, application for loans is difficult due to a lack of accounting and financing knowledge
- Low awareness and knowledge on funding opportunities: MSMEs often do not have enough capacities to systematically assess suitable green financing and funding opportunities dedicated to them
- High financial risk: Shared savings contracts require that ESCOs provide the project financing, thus bearing the financial risk

More recently, green financing has been developing rapidly in China. Banks and other financial institutions are encouraged to provide green financing to support sustainable development including building energy efficiency. A set of green financing policies has been implemented since 2015. All of these policies include buildings as a key component. Financing energy efficiency and SMEs in the building sector

¹ China Energy Efficiency Association (2017)

² Evans et al. (2015)

³ Suerkemper et al. (2014)

⁴ Taylor (2012)

⁵ Institute for Industrial Productivity (IIP) (2012)

⁶ Agster et al. (2016)

thus create various opportunities for financial institutions:⁷

- Energy efficiency investments represent a significant new business opportunity for financial institutions. The IEA estimates that global investment in energy efficiency was 195.9 billion € in 2015, of which nearly 28.37 billion € has been financed by mechanisms like energy performance contracting or green bonds. To achieve global climate goals, investments have to increase to about 886.5 billion € per year by 2050.
- Increased energy efficiency can reduce client's credit risk through lower running (and lifecycle) costs of buildings, therefore decreasing the risk of payment default for the borrowers.
- Improved building energy efficiency increases the property value of the refurbished building, ensuring wealth conservation and loss mitigation by preventing "brown discount".⁸
- Improving energy efficiency directly reduces CO₂ emissions and other negative environmental impacts such as local air pollution and thus substantially contributes to the achievement of environmental objectives, which are key components of Corporate Social Responsibility.
- Banking regulators are increasingly looking at climate risks and energy efficiency is a major component for mitigating those risks.
- There is a large number of SMEs in the building sector and energy efficiency field: SMEs account for 70% of the total ESCO business and thus represent an important target group for financial institutions.

However, financial institutions face substantial barriers to seize the above-mentioned benefits and to accelerate green financing for building energy refurbishment and ESCOs.

Key barriers of financial institutions to finance building energy efficiency

- Lack of transparency of the ESCO market and a general lack of trust in the energy service business
- High lending risk due to low collateral asset value, a long project lifetime, and often high performance risks of energy efficiency projects;
- Lack of technical knowledge, which makes it difficult to assess risks and future cash flows of energy service projects
- Lack of tools to assess ESCOs' credit default risk
- Lack of generally accepted M&V standards: ESCOs often have their own M&V systems making it difficult for financial institutes to evaluate projects
- High transaction costs: ESCO projects are often small and transaction costs are relatively high if the projects cannot be effectively aggregated

Removing the above-mentioned barriers faced by both ESCOs and financial institutions in China is essential for ESCO market development and scaling-up deep energy refurbishment projects in China. Against this background, this report draws lessons from European and global experiences that address these barriers. The presented instruments and financing products can potentially support access to financing of ESCOs in China. Examples include financing products for building energy refurbishment as well as various toolkits that support financial institutions in financing energy refurbishment projects.

⁷ Energy Efficiency Financial Institutions Group (EEFIG) (2017)

⁸ Bertalot (2017)

2. Financial Institutions: Financing ESCO building energy efficiency projects

In order to overcome the barriers for financing building energy refurbishment projects, financial institutions in Europe and globally have developed different financial mechanisms and products. This section focuses on two mechanisms: forfeiting and potential access to capital markets.

Recognising future receivables from energy savings

Service-oriented MSMEs including many ESCOs often have limited collateral and rely primarily on cash flow from energy savings, which are not conventional revenues in an asset-based financing culture.⁹ Thus, financial institutions' recognition of future receivables is especially important for them. It allows ESCOs to free up the limited balance sheet so that they can originate more EPC projects. In general, there are two different approaches:

In the first approach, ESCOs sell future receivables to a financial institution or a fund. In return, the financial institution makes a one-time payment directly to the ESCO (liquidity transfer from bank to ESCO) based on a discounted present-value. The discount is calculated based on the refinancing costs over the whole contract duration, provision and administration costs, and profit margin of the financial institution.¹⁰ Financial institutions can purchase all or only a certain part of receivables. The beneficiary (building owner)

pays directly to the bank or the fund according to a fixed instalment plan. This approach is usually advantageous if the creditworthiness of the beneficiary is better than that of the ESCO, which is often the case for ESCOs that are of MSME size. Thus, at the outset, the financial institution assesses the creditworthiness of the beneficiary. The ESCO guarantees the project savings. If the savings are below the guaranteed level, the beneficiary still pays the same fee to the bank, but the ESCO must pay the beneficiary the difference between the actual and guaranteed savings.¹¹ This approach is a common practice in the most developed EPC markets, for example, in Germany.

The second approach is that financial institutions recognise the future cash flow from energy savings as a kind of collateral for the lending to ESCOs and cover the upfront costs of the project. It is not a stand-alone financial product but serves as an additional security for financial institutions.

⁹ Rezessy & Bertoldi (2010)

¹⁰ Eurocontract (2007)

¹¹ Schlein et al. (2017)

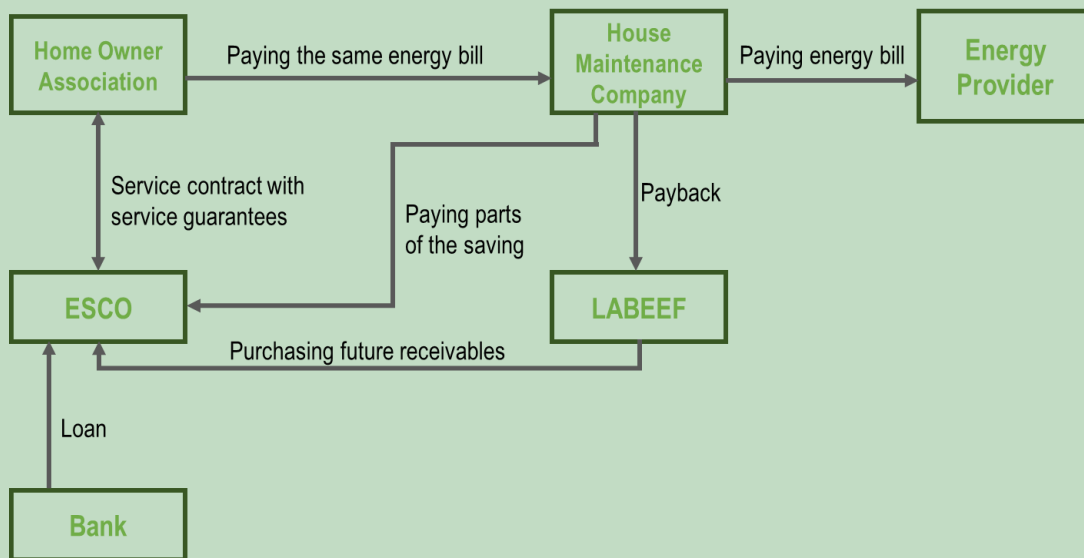
LABEEF

The Latvian Building Energy Efficiency Fund



LABEEF, the Latvian Building Energy Efficiency Fund, is a successful forfeiting fund in Europe with the objective to finance the refurbishment of Soviet era apartment blocks in Latvia. In the past, ESCOs have already funded in-depth renovations of these housing blocks using the standard EPC model, in which the apartment owners repaid the investments over a 20-year period. However, the ESCOs were unable to use these payments as collateral for new loans in order to finance further projects since banks considered their business model too risky.

LABEEF has been established to overcome this financing barrier by purchasing the discounted future cash flows from the ESCOs. In other words, the projects are funded through bank loans taken by the ESCOs, which are then refinanced as discounted future cash flows through the forfeiting facility LABEEF. The ESCOs thus take the implementation and performance risk of the projects, and LABEEF takes the long-term payment risk. LABEEF purchases receivables of ESCO projects that are based on its own guidelines and contracts and which are completed and certified. LABEEF establishes a model, in which it purchases only 80% of the future receivables and 20% remain with the ESCOs. This model provides incentives to ESCOs to renovate buildings with a low default payment risk and a high energy saving potential, and to use the highest standards of technical design as well as material and installation quality in their renovation projects. The typical savings of these projects are range from 45% to 65%.^{12,13,14}



¹² CityInvest (n.a.)

¹³ Stancioff (2017)

¹⁴ Ecofys (2018)

Key Messages

- » Forfeiting will enable ESCOs to finance further renovation projects by **freeing-up their balance sheets** through the sale of future receivables (de-risking the investment).
- » In the forfeiting setting, financial institutions can **purchase only a part of the future receivables from ESCOs 1-2 years after the project starts**. In this way, they share the risk with ESCOs. ESCOs will select best-suited buildings with a high energy saving potential and low default risks of building owners and implement EPC projects with highest technical standards.¹⁵
- » **Forfeiting is applicable if ESCOs are experienced and qualified**, and energy savings of the proposed projects are significant. As financial institutions assume credit risk of beneficiaries (building owners) instead of ESCOs in the forfeiting setting, the creditworthiness of beneficiaries needs to be high.
- » The **transaction costs** of setting up a forfeiting contract **can be high**. **Standardisation processes** can help to reduce the costs. In addition, **an insurance or guarantee** of future energy savings can address banks' uncertainties about future receivables.

Access to capital markets through green securitisation

Although banks' recognition of future receivables from energy savings is important for ESCOs, banks are more financially constrained after the financial crisis, which could limit lending to low carbon assets such as building energy renovation projects. On the other hand, institutional investors have been increasingly interested in green investments. Securitisation can be a promising means to tap into the capital from the institutional investors. Green securitisation is the process of transforming a pool of liquid revenue assets, e.g. future receivables from energy savings, into tradable financial instruments (securities). Loans to small-scale building energy renovation projects can be securitised and then sold to the capital market, for example, in the form of green bonds. As a result, the originators, for example, banks, can use the capital raised through securities sale to create a fresh loan portfolio. This in turn enhances the incentives for banks to further expand their green loan program. In addition, green securities market also addresses the maturity mismatch challenge of financing sustainable building projects faced by banks. Furthermore, since building energy renovation and green building projects have a long-term

investment horizon, green securities originated from these projects match the long-term liabilities of many institutional investors.¹⁶

Asset-backed securities (ABS) and mortgage-backed securities (MBS) are the most established securitisation instruments in the capital market. MBS are created from a mortgage or a pool of mortgages that are sold to interested investors and issued by a special purpose entity (SPE) or a bank. ABS evolved from MBS and are collateralized by non-mortgage assets, i.e. a pool of assets such as loans, leases, receivables from future energy savings, etc. From the perspective of the financial process, the securitisation of green buildings and energy renovation projects does not differ from other assets (Figure 1). The only difference is that the money raised from the green ABS and MBS issuance needs to be used for financing green projects. These two instruments have already been used in financing sustainable buildings in Europe and globally.

¹⁵ Stancioff & Rochas (2017).

¹⁶ Kidney et al. (2017)

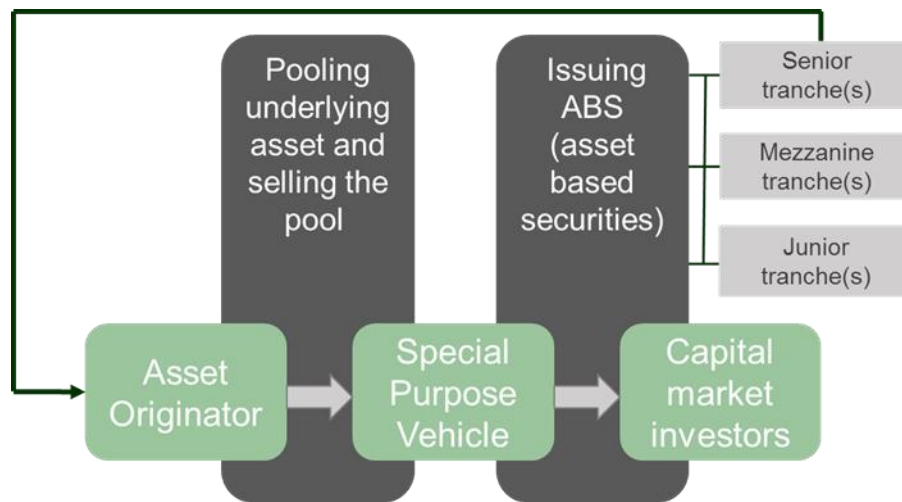


Figure 1: Asset-backed securitisation process, adapted from Kidney et al. 2017

Renovate America Green bonds for residential buildings



Property Assessed Clean Energy (PACE) is an innovative mechanism for financing clean energy and energy efficiency projects. Building owners, who participate in a PACE program, repay the costs through a higher property tax. Local governments can raise capital to fund the upfront costs of these projects through issuances of PACE bonds enabled by PACE legislation. The PACE Bonds are secured by the properties of the projects and the levied property tax.

Renovate America, a technology-focused finance company, is the country's leading provider of residential PACE financing and has financed over 90% of all residential PACE projects in California. Partnering with the local government of California, Renovate America created the HERO Program (Home Energy Renovation Opportunity) to administrate the PACE Program and PACE bonds. The Program directly pays contractors for implementing the eligible projects. Renovate America has more than 8,000 registered licensed contractors participating in its HERO program. Renovate America's revenue mainly stems from the difference in interest rates between its provision of funds to the issuers for their PACE programs and borrowing activities, and origination fees. In 2016, Renovate America issued a series of notes as green bonds under an ABS Framework called the HERO Funding Trust. These green bonds are secured by a pool of PACE bonds under the HERO Program. The Program also ensures compliance of these projects through rigorous review and assessment processes. In addition, Renovate America reports the impacts of the proceeds from the green bonds, i.e. energy savings, renewable energy generation and GHG emission reduction in a detailed manner based on the data collected through the HERO Program. The methodologies used for calculating impacts are all based on credible third-party sources.¹⁷

¹⁷ Slim & Peyraud (2016)

Residential mortgage backed securitisation in the Netherlands

The Dutch mortgage provider Obvion successfully issued the first residential mortgage backed securitisation (RMBS) globally, Green STORM, at the value of 500 million € in 2016. Obvion is a subsidiary of the international cooperative bank Rabobank, which has the largest mortgage-lending business in the Netherlands. In 2017 and 2018, Obvion issued another two Green STORM bonds, which attracted new investors. The securities refinance mortgage loans from energy efficient residential buildings in the Netherlands. The buildings that were eligible for Green STORM 2018 are those which obtained a 'provisional' Energy Performance Certificate of "A" (i.e. among the top 15% energy efficient buildings) or refurbished buildings with at least a 30% improvement in energy efficiency. The Green STORM 2018 was aligned with the four components of Green Bond Principles: the use of proceeds, project evaluation and selection process, management of proceeds and reporting requirements. It was also certified under the Climate Bonds Standard. For this purpose, Obvion appointed a third party to conduct a CO₂ savings assessment to demonstrate the climate impact of Green STORM 2018 based on a breakdown of the portfolio by Energy Performance Certificates. The assessment report is included in the investor package and made available to potential investors.¹⁸

Key Messages

- » **Standardisation of green loan contracts** can significantly reduce the transaction costs and is thus essential for securitising diverse small loans.¹⁹
- » A pipeline of outstanding loans for green buildings and building energy renovation projects needs to be large enough to be tradable on the capital market. **A warehouse entity**, established as a public-private partnership, which collects an inventory of loans from different lenders until the pool is sufficiently large to be sold on the capital market, can be very helpful. Such a warehouse can be hosted also by commercial banks with good understanding of green assets and green financing. The warehouse approach can also push the standardisation of green loan contracts, for example, by only accepting standardised loans.²⁰
- » **Public credit enhancement** is valuable for the development of green ABS and MBS due to their short and limited credit history and pools of green assets backing them.²¹
- » Both Obvion and Renovate America **have clear criteria of eligible projects** in the asset pool. The existing green building and energy efficiency certificates can be used for setting up eligible criteria, for example, Energy Performance Certificates being implemented in Europe.
- » In both examples, **reporting of the impacts of green ABS and RMBS proceeds** is detailed and rigorous. For investors it is essential to be aware about the impacts of their investments. In the Obvion case, the impact report is also open to potential investors, which may help to levy more investments. The impact assessment in both cases is based on sound methodologies.

¹⁸ Sustainalytics (2018)

¹⁹ Kidney et al. (2017)

²⁰ Kidney et al. (2017)

²¹ Kidney et al. (2017)

3. Supporting financial institutions to finance building energy efficiency projects and green buildings

Dedicated financing products developed by financial institutions are essential for financing building energy efficiency projects and green buildings. However, financial institutions still face multiple barriers such as lack of trust in ESCOs, technical knowledge of the energy service business, and assessment tools as well as high lending risk and transaction costs associated with building energy refurbishment projects. Addressing these barriers requires a collaboration of multiple stakeholders to identify suitable measures and develop effective toolkits. This section illustrates four mechanisms that can be implemented by different stakeholders, including policy makers, intermediary organisations and third-party assessment bodies to address the barriers above.

Standardising the underwriting process of financing energy refurbishment projects

The lack of standardised underwriting procedures results in high transaction costs for financial institutions and makes aggregation of projects for subsequent refinancing challenging.²² This discourages financial institutions to engage in energy efficiency financing. Some banks have standardized underwriting procedures internally. There are also initiatives implemented by external actors that support banks in evaluating energy efficiency projects in a standardised manner.

For example, the Investor Confidence Project (ICP) Europe aims to facilitate energy renovation financing by standardizing the development, documentation, and measurement of energy efficiency projects.²³ The ICP system provides three inter-linked credentials to enhance investors' confidence in energy retrofit projects:²⁴

Investor Ready Energy Efficiency™ (IREE™) certification



IREE is an international certification for qualified energy retrofit projects. It ensures that projects conform to the requirements of the ICP Energy Performance Protocols. The Protocol defines a standardised road map of best practices for developing projects, estimating savings, and documenting and verifying results, based on existing best practices and technical standards of energy retrofits. It is divided into five categories, which represent the entire lifecycle of a well-executed energy efficiency project: baseline setting, savings calculation, design, construction and verification, operations, maintenance, and monitoring (OM&M), and Measurement and Verification (M&V). ICP provides project developers templates to facilitate the fast creation of key components required by the ICP Protocols including Operational Performance Verification, OM&M, and M&V plans. The certification assures investors that an energy retrofit project meets best practices at

²² Energy Efficiency Financial Institutions Group (EEFIG) (2017)

²³ ICP Europe is a sister project of ICP implemented in the United States.

²⁴ Investor Confidence Project (ICP) (2017)

each step of the retrofit process, from project inception to MRV. For each of these categories three components are included:

- **elements:** required standards, data, qualification of the professionals conducting specific activities
- **procedures:** best practice workflow and standard industry practices
- **documentation:** standard documentation package and required outputs

In total, six types of Protocols are being developed, based on the project capital size (above 1 million €, below 1 million €, single or limited number of energy efficiency measures) and building types (tertiary or apartment). It is worth noting that the Protocol was not developed in isolation. A range of stakeholders, including financiers, building owners, developers/installers/ESCOs, government agencies, and utilities, were involved to provide inputs.

Project Developer Credential



It designates that a project developer is qualified to develop IREE projects. Only project developers with the Credential are eligible to apply for the above-mentioned IREE certificate.

Quality Assurance (QA) Provider Credential



It designates that an organization has the qualifications and certifications necessary to perform a QA review, which determines whether a project can earn an IREE™ certificate. Specific requirements for QA providers include relevant technical qualifications and project development, and QA review experiences of their staff and those under contract. They shall also complete an ICP-related training, which is provided free of charge. More info: <http://www.eepformance.org>

A major advantage of ICP is the development of a standardised documentation package to allow all stakeholders to validate underwriting criteria and thus to reduce transaction costs. This is supported by the so-called „ICP Virtual Documentation Package“ software, which enables standardised documentation to be achieved at scale through automation. In addition to certification and standardization, ICP Europe has reached out key stakeholders from both the technical and financing side. It has an Ally Network of about 150 market leaders in the field of energy efficiency and a network of investors with 1 billion € in assets under management looking for energy efficiency financing opportunities. The first ICP was awarded to a project in Liverpool valued 14.8 million €, which aims to improve the energy and carbon performance of three hospitals, through the installation of a number of energy efficiency and low carbon measures.

Another initiative in Europe is an underwriting toolkit recently published by the Energy Efficiency Financial Institutions Group (EEFIG), a work platform for energy efficiency financing, established by the European Commission and UNEP FI. It aims to support financial institutions in scaling up their energy efficiency financing by supporting them to understand the nature of energy efficiency investments and thus to better evaluate both their value and the risks. The platform provides a common language that can be used by financial institutions, project developers and project hosts. To support financial institutions in valuation and risk analysis, the toolkit presents various sources of values and risks associated with energy efficiency investment. The Toolkit can be accessed at: <https://valueandrisk.eefig.eu/>

Key Messages

- » **Standardised** underwriting procedures are essential to **reduce transaction costs** of financial institutions and thus to drive financing of building energy efficiency projects.
- » **The use of internationally recognized standardization processes** can help financial institutions to assess building energy efficiency projects, will reduce due diligence costs and performance risks, and provides access to high-quality projects.
- » Standardized project documentation **supports the aggregation** of projects for subsequent refinancing/securitization.
- » The standardization process can be **combined with other instruments such as energy savings insurance to effectively enhance investors' confidence**.

Enhancing confidence in ESCOs and recognizing values of sustainable building projects

Financial institutions' lack of confidence in the energy service sector and in energy efficiency investment in general is a major barrier for them to finance energy saving projects operated by ESCOs. Prequalification certificates for ESCOs that provide an objective description and assessment of ESCOs can help to enhance financial institutions' confidence in ESCOs.

For example, in Austria Graz Energy Agency, a public-private partnership company, set up the Thermoprofit® program promoting energy services such as energy performance contracting and third party financing.²⁵ The Thermoprofit® program issues a certificate to their partners declaring that they are well qualified to deliver reliable projects. Thermoprofit® is a quality label for energy service providers of comprehensive

service packages, which cooperate with regional firms in the execution of projects. The Thermoprofit® program established the first certification process for ESCOs in Europe. ESCOs are assessed and certified by Graz Energy Agency and an independent Thermoprofit Commission as qualified and professional contractors. Only certified ESCOs are entitled to use the Thermoprofit® quality label. The label is a competitive advantage for them, because it proves outstanding quality of service providers. The Thermoprofit® program also offers a range of services to ESCOs including the provision of guidelines and model contracts, best-practice documentation, trainings, experience exchange (conferences, presentations), and PR activities (newsletters, brochures, etc.).

²⁵ Eurocontract (n.d.).

Thermoprofit



The Thermoprofit® quality label enhances the confidence of clients by assuring the quality of the service providers through

- a Thermoprofit® guarantee in terms of energy cost reduction or upper limit of energy costs or guaranteed energy price for heat delivery (energy supply contracting) and maintenance of comfort and service;
- a satisfaction guarantee with the service of the Thermoprofit® partner in terms of project implementation, maintenance, service, etc.;
- a contract with a coherent description, transparent costs and balanced risks;
- integration of regional companies as partner or subcontractor in Thermoprofit® projects.

Evaluation criteria for a Thermoprofit® certification of energy service providers²⁶

- technical competence in diverse fields proved through references, projects and qualification of staff: building analysis; technical planning of energy saving measures and renewable energy sources; structural engineering of energy saving measures; maintenance, service, motivation of users;
- capability to be a general contractor of comprehensive energy services (planning, implementation, maintenance, operation and financing) proved through brochures, projects and offers;
- prove of stable economic development of the company, long-term reliability and economic stability: annual accounts of the three last completed business years; turnover of the last completed business year in a similar business area to Thermoprofit®; audit of credit-worthiness; appraisal of the annual terminations of the last three years;
- staff: staff number in the last three completed business years involved in EPC, heat supply or similar services; nomination of staff for Thermoprofit® projects and qualification of staff;
- compliance of legal requirements and official regulations during business activity;
- at least one reference project corresponding to the Thermoprofit® quality criteria with the following information requirements: investment volume, realised measures, proof of fulfilment of the Thermoprofit® quality criteria, contact information of the client; alternative if no reference project is available: attendance of Thermoprofit® basis seminar to achieve qualification.

²⁶ Amann & Leutgöb (2015)

Besides confidence in ESCOs, lack of evidence on the performance of energy efficiency investments makes it difficult for financial institutions to assess the benefits and the financial risk. The Energy Efficiency Financial Institutions Group (EEFIG) launched the De-risking Energy Efficiency Platform (DEEP). DEEP is an open-source database containing detailed technical and financial information and analysis of over 5,000

energy efficiency projects in buildings and industry in different EU countries. The data has been provided by public and private investment funds and financial institutions, national and regional authorities, as well as energy efficiency solution providers. With the market evidence, the platform supports financial institutions in conducting risk assessment and understanding the benefits of energy efficiency investments.

Key Messages

- » **Certification schemes increase transparency** in the market and enable clients to differentiate between “good quality” and “bad quality” ESCOs or the specific services provided, and may increase competition in the ESCO market.
- » A certification system contains **a set of criteria to determine technical, economic and organisational aspects, legal eligibilities and competences of ESCOs**. The technical aspects include, for example, technical experiences of the ESCO, the technical competences of the team members, coverage of specific services, and the technical approach employed. The economic aspect concerns the economic strength of the ESCO, e.g. level of registered capital, turnover and solvency. The organisational aspect addresses the management system of the ESCO to ensure effective operation including quality management and assurance as well as risk management.²⁷
- » Certification schemes, that **include regular certification renewal/limited certificate validity and notification obligation for changes** (e.g. significant changes in the financial situation or in the composition of the company staff), could have a positive influence on the quality of services provided and **ensure a continuous qualification of certified ESCOs**.
- » **Intermediaries**, such as industry associations or energy agencies, can play an important role in **developing and implementing pre-qualification systems**. It has to be ensured that the selected certification bodies are absolutely independent.
- » The certification should be possible **at reasonable costs and efforts for ESCOs** and not represent an entry barrier for new market actors particularly SMEs. Also, the evaluation criteria should **not disadvantage ESCOs that are of MSME size**, e.g. by setting thresholds in relation to the company size.
- » Collecting **evidence on the risks and benefits of energy efficiency projects already implemented** by, for example, establishing an open-source data platform, can be essential for **increasing the confidence of financial institutions**.

Reducing transaction costs and risks: the role of facilitators

Critical challenges for financial institutions to finance energy efficiency projects include the high transaction costs of energy efficiency investments arising from the small size and distributed nature of these projects. Besides, they generally lack

technical competence for identifying qualified projects. Building owners and ESCO SMEs may lack information about financing/funding possibilities and application procedures.

²⁷ Amann & Leutgöb (2015)

Intermediary organisations, such as local energy agencies or super ESCOs, can play an important role here. Intermediary organisations could facilitate the comprehensive and complex energy contracting process between ESCOs, their clients and financial institutions.²⁸ They can serve as or establish a “One-Stop-Shop” with a facilitator role offering diverse services for multiple stakeholders such as project management (marketing, tender preparation & evaluation, contract/legal advice), project aggregation/bundling, financial advice (financing, subsidies), certification of ESCOs or energy services, and energy auditing.

Project aggregation or bundling is one of the key services provided by these “One-Stop Shops”. Aggregation means identifying and pooling buildings with different levels of energy consumption, functions, construction materials, cost-effectiveness of renovations, etc. into a sufficient size for financing. It represents a promising approach for reducing transaction costs and risks (higher diversification) for financial institutions and accessing the capital market through securitisation. Building pools may include renovation projects that are not economically feasible, but still considered by the client as important to be implemented.

Berlin Energy Saving Partnership

Berlin Energy Saving Partnership, set up by Berlin Energy Agency (BEA), a well-known facilitator between ESCOs and public institution clients, has played an important role in energy renovation of public buildings in Berlin. Berlin Energy Saving Partnership was established in 1996. It is a public-private partnership between Berlin government, the governmental development bank KfW Bankengruppe and private energy suppliers (Vattenfall Europe Wärme AG and GASAG Berliner Gaswerke AG). BEA acts as a project facilitator, financial advisor, and project aggregator for property owners of public buildings. As a project facilitator, BEA manages the whole process from baseline assessment to contract negotiation with ESCOs. As a financial advisor, BEA assists both building owners and ESCOs to find a proper reimbursement model. As a project aggregator, BEA brings together a number of public buildings to be tendered, ranging from four to 150. Each of the building pools issues an EPC-tender. The annual energy savings of such a building pool should not be lower than 300,000 €. Pooling of buildings with different conditions encouraged investments in diverse building complexes and reduced transaction costs substantially. As a public-private partnership, BEA only charges 50% of the normal service fee.²⁹

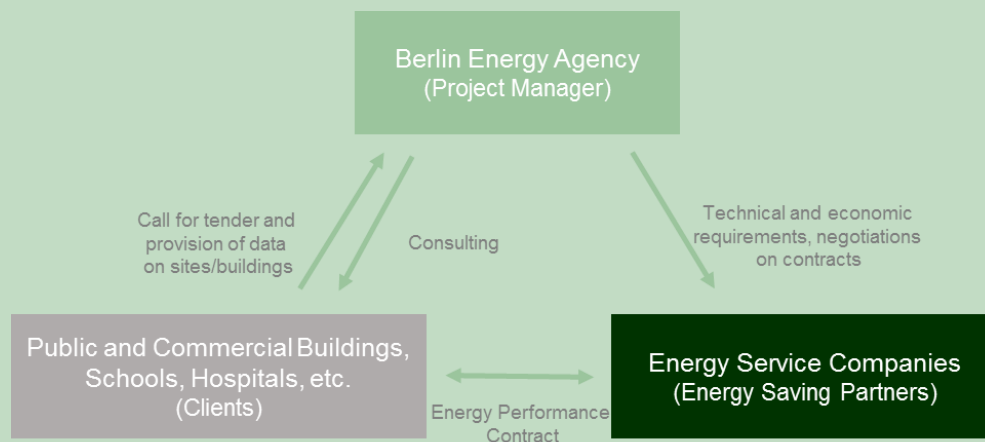


Figure 2: The operation of BEA (adapted from CCAP, n.a.)

²⁸ GIZ (2013)

²⁹ Berlin Energy Agency (BEA). (no date).

One-Stop-Shop RenoWatt and its identification of building pools



The region of Liège and its local authorities have been committed to improving energy efficiency in public buildings. To achieve this objective, they developed the One-Stop-Shop RenoWatt, which facilitates scaling up of energy efficiency renovation projects in the region by assisting their public contracting authorities to analyse the economic feasibility of their projects and to designate the contractor. RenoWatt also identifies financing options (financing models and funds) and building pools, provides energy audits for a selection of suitable buildings, prepares the financial plan for the municipalities (financing options, return on investment, etc.) and assists in the procurement process and in awarding the contract. The role of the One-Stop-Shop RenoWatt ends when the tenderer is chosen and notified.³⁰

The innovative element of RenoWatt is that buildings with the same function from different public authorities and cities are aggregated to multiple building pools in order to

- reach a sufficient size for the EPCs,
- diversify the risk for the financiers resulting in more attractive financing conditions,
- diversify the risk for the ESCOs,
- reduce the contract number and transaction costs, and,
- enable the refurbishment of less cost-effective buildings with lower savings potential.

The following five steps are taken to pool the buildings:

- Step 1: Establishing an energy cadaster of buildings, which contains detailed information of the buildings (function, energy consumption, etc.) and eliminates non-feasible sites to reduce the number of buildings by excluding sites that are not cost-effective;
- Step 2: Sorting and documenting the remaining buildings with technical details;
- Step 3: Conducting a quick scan of the potential energy retrofits by local energy audit companies (performing on-site visits) to decide which buildings will be renovated;
- Step 4: Financial assessment of identified renovation projects to estimate the profitability of the renovation projects (net present value). After Step 3 and 4, buildings are distributed into different pools and the return on investment of each pool is assessed;
- Step 5: Performing a detailed technical inventory of different building elements to decide whether a renovation is appropriate and an economic assessment of replacing existing elements for each pool.

³⁰ CityInvest. (n.a.)

eQuad Platform

eQuad



The eQuad platform acts as a marketplace for energy efficiency and renewables project developers and financiers in Europe. Developed under the SEAF H2020 (Sustainable Energy Asset Framework), a European Commission funded project led by Joule Assets Europe that ran from 2016 to 2018, eQuad is a holistic online platform and provides a set of services to support both project developers and financiers:

- For project developers, projects are vetted and swiftly matched to appropriate off-balance sheet finance;
- For investors, benefit stems from lowered upfront due diligence costs and access viable pipeline that matches their specific criteria.

To enable quick access to project finance, eQuad streamlines the pre-due diligence process for clean energy projects, covering third-party financial analysis, project performance insurance, project certification, and due diligence. The platform includes a document management system and sends vetted project portfolios to investors within Joule's finance network.³¹

Today, through eQuad, Joule acts as market enabler in Europe, spurring the development of the clean energy sector, with a particular focus on SME-sized projects. However, Joule's ultimate aim is to ensure that all viable projects reach finance and completion. A current example in Joule's pipeline includes an innovative retrofit project for a housing association in the UK, which uses PV, storage, and building control systems. The project will be rolled out in increments, starting with 200 homes for low-income households, but is expected to scale to over 5000 homes. Its successful completion will result in profound environmental and social benefits: it will enable a cleaner and more efficient electricity system with the possibility of entering a demand response program, and will lower utility payments and improve comfort for low-income families.

³¹ JouleAssets (2017):

Key Messages

- » **“One-Stop-Shops”** facilitate the comprehensive and complex energy contracting process between ESCOs, building owners and financial institutions by offering diverse services such as **project management** (marketing, tender preparation & evaluation, contract/legal advise), **project aggregation/bundling**, **financial advise** (financing, subsidies), **certification of ESCOs or energy services**, and **energy auditing**.
- » Such intermediary organisations can **also support financial institutions to identify, access, and aggregate scattered energy renovation projects**.
- » “One-Stop-Shops” can **be established e.g. by local energy agencies or super ESCOs**, given their network to different actors and technical competence in the field. A “One-Stop-Shop” can also be established using the model of public-private partnerships or partnerships between key stakeholders such as energy agencies, associations, banks, etc.
- » The **development of standardised toolkits**, e.g. for energy data analysis, technical and economic assessment of building pools, is important for an efficient operation of these “One-Stop-Shops”.
- » **Average facilitation costs are about 3% (1%-14%)** of investment costs. These costs are usually outweighed by higher quality and lower prices of energy services.³²
- » The experience of several facilitators in Europe has shown that **subsidies were useful for the set-up and initial operation phase** of an intermediary organisation.
- » The “One-Stop-Shops” can **work with intermediaries such as house associations to create building pools** with sufficient size that matches the interest of financial institutions.

Reducing technical risks of energy retrofitting projects: insurance mechanisms

Uncertainties about the performance of energy saving measures in terms of energy and cost savings and lack of trust in MSME ESCOs represent major barriers for energy efficiency investment and lending. If the anticipated energy cost savings will not be achieved due to miscalculated savings or poorly installed or defect measures, there will be a default on the loan for financial institutions. An insurance mechanism, which reimburses the beneficiaries/ project owners when the expected level of energy savings is not reached, can be an effective measure to address these barriers. Insurance mechanisms of

energy efficiency projects are built upon insurance companies' specialisation in risk management and, sometimes, engineering expertise of validating expected energy savings. Technical risks are therefore insured, allowing financial institutions to focus on credit risks.³³ Insuring technical risks will also lead to an increased creditworthiness of the project. In the long run, the high data requirements for insurance products will create evidence of building energy efficiency investment and projected energy savings. This in turn will enhance trust in the energy efficiency market.

³² Bleyl et al. (2013)

³³ EEFIG. (2017)

EEP

Energy Efficiency Protect



In Germany, Hannover Re SE and KlimaProtect (brand of b2b Protect GmbH) developed the insurance solution Energy Efficiency Protect (EEP). With the help of EEP an energy efficiency service provider can insure the energy efficiency warranty given to its customers. If the energy savings guaranteed are not achieved, the customers will receive a compensation payment. The insurer covers this guarantee risk. The confidence of end-users and banks in energy efficiency projects can therefore be effectively increased through the insurance solution EEP.

Each EEP insurance is based on an analysis of the energy savings potential of the project, which includes an intensive assessment of the provider and his energy efficiency projects. During this examination, technical components as well as implementation and calculation methods of already successfully implemented projects of the energy service provider are verified. In the process of this analysis the energy service provider, KlimaProtect, the insurer, the reinsurer, and external experts work closely together. The analysis provides a precise picture to what extent and to what conditions an energy efficiency project can be insured.

EEP targets energy service providers in Europe that provide a savings guarantee to their customers including (performance) contractors, planning offices and further innovators. Examples of insurable technical measures include building insulation, building control, LED installations, energy management systems, and compressed air generation.³⁴

The premium is calculated individually for each measure, considering different aspects such as experience with technology, comparable projects in the past, etc.

Benefits of EEP to energy service providers and customers are as follows:

- EEP builds confidence of customers and thus enhance their willingness to invest in energy renovations;
- EEP increases investment security;
- Value of guarantee: The customers are ensured that a renowned insurer, in case of loss, will be able to pay in the future if the energy savings will not be achieved;
- By insuring the guarantee, the ESCO no longer needs to make any provisions;
- The ESCO can differentiate from its competitors;

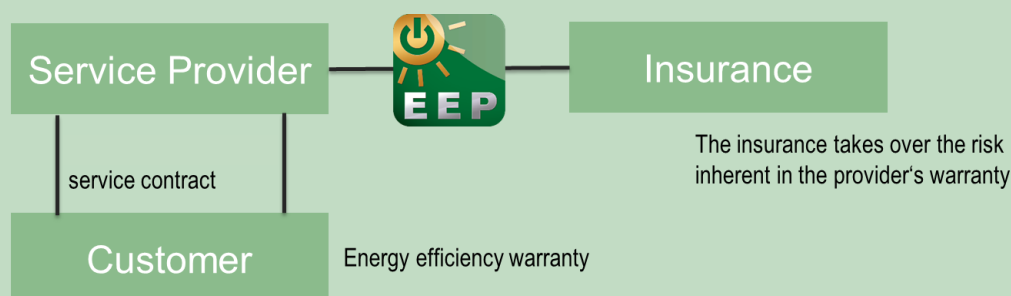


Figure 3: Schematic diagram of Energy Efficiency Protect, adapted from Klimaprotect (n.d.)

³⁴ Klimaprotect (n.a.)

Key Messages

- » Given their specialisation in risk management and sometimes engineering expertise, insurance companies can help to **reduce technical risks of energy retrofitting projects** through specialised insurance products, and thus improve risk profiles of potential projects.³⁵
- » **Insurance in combination with a standardised underwriting process** could significantly enhance the confidence of building owners and the financial institutions in ESCOs and their projects.
- » Local insurance companies may not be eager to provide insurance to SMEs. To address this barrier, the insurance program can **focus on a selected number of established technologies** that allow for easy assessment, monitoring and verification of savings.
- » **Engaging experienced reinsurers to work with local insurance companies** can further enhance their trust in energy saving projects and their capacity for the provision of an energy saving insurance.³⁶
- » The premium of insurance may be a barrier for ESCO SMEs to pursue the insurance. At the early stage, **financial incentives for certification and premium payment** can be helpful.³⁷

³⁵ G20 EEFTG (2017)

³⁶ Micale & Deason (2014).

³⁷ Micale & Deason (2014).

4. Unlocking green financing for sustainable buildings: recommendations for China

In the last decades, the Chinese government has developed various policies to promote sustainable buildings and to recognize and support ESCOs in energy and green building renovation projects. However, there is still a huge financing gap. Meanwhile, China has become a leader in green financing in recent years, which can play an essential role in scaling up sustainable buildings in the future. To seize the opportunities, China still must overcome a series of remaining barriers faced by diverse actors, including the financial and building sector, ESCOs and building owners, by establishing a supportive regulatory framework condition and targeted policy instruments.

Green Credits

Green credits are the core of the green financing system in China. The Chinese government has developed a comprehensive national policy package for green financing consisting of guidelines, a statistical system, and an evaluation system. By June 2017, the provision of green credits of 21 Chinese major banks and financial institutions reached 1.07 trillion €, in comparison to 679 billion € in 2013.³⁸ Green building development and building energy efficiency are both key targets for green financing in China.

However, similar as in other countries, Chinese commercial banks generally perceive building energy renovation projects initiated by ESCO SMEs to be risky, because ESCO SMEs heavily rely on loans, often have limited collateral and weak balance sheets, and lack financial track records. On the one hand, this **calls for policies that provide incentives for commercial banks to grant credits to ESCO SMEs for sustainable projects**. For example, differentiated risk supervision and monetary policies for green loans

could be established³⁹ or green loans from the loan-to-deposit ratio indicators in banking risk management could be excluded.⁴⁰ On the other hand, **effective enforcement mechanisms** need to be established to ensure that expected energy savings are achieved and green building standards are fulfilled. Furthermore, **purchasing future receivables of energy savings** from ESCOs and recognising these receivables as collateral, which is a common approach in most developed EPC markets, can help to secure refinancing for ESCOs with limited collateral and clear their balance sheets. To scale up this practice, the **government needs to develop clear guidelines and procedures for calculating and valuing future receivables from energy savings**. In addition, **schemes that ensure the quality of ESCOs and EPC projects** need to be further strengthened, for example, by supporting the establishment of a pre-qualification scheme for ESCOs, and publicly disclosing their performance to enhance banks' trust in ESCOs and confidence in future receivables.⁴¹

³⁸ Chinese Government Network (2018)

³⁹ Zadek & Yao (2017).

⁴⁰ Chenghui et al. (2015)

⁴¹ EF: Research on Green Finance Implementation System of Energy Saving Reconstruction of Public Buildings in Key Cities

Green securities

Green securities can play an important role in financing building energy renovation and green building projects. Sales of future receivables from sustainable projects in the capital market make the monetary value of these projects tangible for banks and can stimulate financing for sustainable projects. Green securities can also address the maturity mismatch challenge of financing sustainable building projects.

China's green bond market has witnessed a rapid development in the last years. While bonds related to sustainable buildings account for 34% in the issuance of green bonds globally, its share in China is only about 10%. Given the huge investment needs in sustainable buildings in China, the potential of green bonds in this field is largely untapped.

To grant access to the green bond market, sustainable building projects of smaller-size need to be aggregated. **Well-established aggregation instruments in the traditional bond markets, such as asset-backed securities (ABS) and mortgage-backed securities (MBS), have enabled sustainable building projects** to tap into finance from the capital market in Europe and worldwide.

In China, it can be expected that the green bond market for sustainable buildings will continue to grow. For example, in 2016, Modern Land, a Beijing-based real estate company, issued the first Mainland China's green bond raising 310 million€. At the beginning of 2017, Chongqing Longhu real estate company issued green bonds for developing low carbon buildings amounting to about 525 million €. ⁴² In the same year, Harvest Capital Management and CECEP Group issued the first

green commercial mortgage-backed securities (CMBS) with buildings receiving the LEED Gold certificate and China Green Building Label (GBL) two-star certificate.⁴³ In addition, the Chinese government released a policy for supporting securitization in the real estate sector. The public sector can play an important role in further tapping the potential of green securities for sustainable buildings in China. For example, **standardisation of green loan contracts** could be facilitated, the **establishment of financial warehousing of green loans** supported, **tax incentives for both investors and issuers** and credit enhancement provided⁴⁴, **pilots for green securities for different types of buildings** established, and **guidelines for green securities of building energy renovation projects** developed. It is evident that large real estate companies are the major players in green securitisation of sustainable building projects for new buildings. So far, there have been hardly green securities of building energy renovation projects. SME ESCOs, the major players in China for the implementation of building energy renovation projects, mostly have limited capital and low credits, which makes it impossible for them to issue green securities. Banks have also not been active in issuing green bonds for sustainable building projects. The exploration of **innovative mechanisms for securitisation of energy renovation projects such as studies or pilots of RMBS, ABS, or special purpose vehicles**, which will enable an indirect participation of ESCOs, needs thus be supported by the government. European and global experiences with such mechanisms may be beneficial in the exploration phase and should thus be taken into account.

⁴² Climate Bonds Initiative. (2017)

⁴³ Climate Bonds Initiative. (2018)

⁴⁴ Dai, Kidney, & Sonerud, (2016)

Supportive mechanisms for financial institutions to finance

sustainable buildings

The development of green credits and the green securities market for financing sustainable buildings requires a collaboration of multiple stakeholders to identify actions and develop effective toolkits.

Standardising the underwriting process of financing energy refurbishment projects is essential to reduce transaction costs for financial institutions and can support the aggregation of projects for subsequent refinancing/securitization. In Europe, **public research and development funding** (Horizon 2020) supported the development of the Investor Confidence Project (ICP) that has started in the US to standardize the development, documentation, and measurement of energy efficiency projects. The Chinese government may also provide support for the development of a similar project.

Certification schemes for ESCOs can help to enhance financial institutions' and clients' confidence in ESCOs. In China, the national energy conservation association, EMCA, has rolled out a pilot ESCO certification system since 2015. ESCOs can get one of three certification levels based on their qualification: 5A, 4A, and 3A (from high to low).⁴⁵ However, the financial capital and number of staff of ESCOs as key criteria for such a certification might discourage well-performing SMEs. For example, in order to get a 5A certification, the company shall at least have a registered capital of 6.5 million € or a total capital of 13 million € and 100 staff members. Thus, **specific certification schemes tailored to SME ESCOs need to be explored.**

Data platforms that help recognising the economic value and other benefits of actual sustainable building projects implemented are needed to increase the confidence of financial institutions. Although the Chinese national government has issued various policies to promote energy efficiency and green buildings, in

some areas, the local market of energy retrofitting and green building development is not yet mature. As a result, banks have a low motivation to set up separate loans or explore tailored financing products for sustainable buildings. Information platforms, such as DEEP (developed in Europe), sharing detailed technical and financial information as well as analysis of sustainable building projects, can help banks and investors to recognise actual benefits of these projects. Equally important is **monitoring and evaluation of sustainable building operation**. The transparency potentially enhances the confidence and interest of financial institutions and other investors in financing building energy renovations and green buildings. In various Chinese cities, monitoring platforms for public and commercial buildings are being piloted and implemented. The lessons from these pilots shall be further scaled up and communicated to financial institutions.

Facilitators between ESCOs, banks and building owners: Intermediary organisations (facilitators/"One-Stop-Shops") could facilitate the comprehensive and complex energy contracting process between ESCOs, building owners and financial institutions by offering a range of services. Their activities could range from quality assurance, verification and certification of ESCOs (or their services) and financial advice for ESCOs and their clients, to the aggregation of projects in order to reduce transaction costs and diversify the risks for financiers and ESCOs. Financial institutions can particularly be supported in identifying qualified project pipelines and aggregating scattered energy renovation projects to reach a sufficient size for financing. The latter facilitates green securitisation. In China, for example, **associations in the field of sustainable buildings or the state-owned /-backed technical centre of energy efficient and green buildings** possess both technical competence in identifying qualified sustainable building projects and government support that enhances the confidence of financial institutions.

⁴⁵ Sun (2016)

These organisations are well positioned to provide facilitator services in China. The set-up and initial operation phase of such ESCO market facilitators can be subsidised. In fact, there are already initiatives in China, for example, Qingdao City considers creating a platform which provides services to ESCO SMEs. This platform pools small energy efficiency projects into qualified project pipelines, which match needs of banks and other funds. It will also provide loan guarantees to SMEs in order to help them secure loans from the bank.

Insurance mechanisms can fulfil credit enhancement. In China, most developers only pursue labels of green buildings design rather than of green building operation, because it is difficult to access actual performance data. Besides, monitoring of the actual performance of energy consumption after energy renovation is generally lacking. Performance uncertainties represent a major barrier for energy efficiency investment and lending. Insurance mechanisms focused on technical risks such as Energy Efficiency Protect (EEP) in Europe, which

reimburse the beneficiaries/project owners when the guaranteed energy savings are not reached, can increase the creditworthiness of sustainable building projects and help to improve credit enhancement. The Chinese insurance sector is still at an early stage in terms of green insurance solutions. **Capacity building**, e.g. by engaging experienced reinsurers to work with local insurance companies, could therefore help to accelerate the development of sustainable insurance products for the building sector. Besides, similar as banks, insurance companies may lack trust in SME ESCOs. **Insurance companies could first experiment with the insurance of a selected number of established and reliable building energy saving technologies** that allow for easy assessment, monitoring and verification. In addition, in order to encourage the take-up of insurance solutions at this stage, **financial incentives can be provided to SME ESCOs** to partly cover the insurance premium.

5. References

- Agster, R., Eisinger, F., Cochun, A. (2016): Enabling SME access to finance for sustainable consumption and production in Asia. An overview of finance trends and barriers in China. Adelphi, February 2016.
- Amann, S., Leutgöb, K. (2015): Quality Certification for EPC services: Case studies from AT and CZ.
- Asian Development Bank (ADB) (2013): People's Republic of China: Energy Efficiency Multi-Project Financing Program. Technical Assistance Report. <https://www.adb.org/sites/default/files/project-document/79111/47918-012-prc-tar.pdf>
- Berlin Energy Agency (BEA). (no date): Berlin Energy Saving Partnerships, City of Berlin – Germany. Federal state of Berlin, Senate Department for Urban Development and the Environment. http://cityinvest.eu/sites/default/files/library-documents/Model%20_Berlin%20Energy%20Saving%20Partnerships_final.pdf
- Bertalot, L. (2017): Integrating Energy Efficiency in Mortgages. In: EASME (2017): Energy efficiency in buildings: how to accelerate investments?
- Bertoldi, P., Rezessy, S. (2005): Energy Service Companies in Europe, Status Report 2005, European Commission DG, Joint Research Centre.
- Bleil et al. (2013): ESCO market development: a role for facilitators to play. ECEEE summer study proceedings, Belambra Les Criques, France.
- Buildings Performance Institute Europe (BPIE) (2015): Renovation in Practice. Best Practice Examples of Voluntary and Mandatory Initiatives across Europe. <http://bpie.eu/publication/renovation-in-practice/>
- CBRC & NDRC (2015): Notice of the China Banking Regulatory Commission (CBRC) and the National Development and Reform Commission (NDRC) on Issuing the Energy Efficiency Credit Guidelines. <http://www.iipnetwork.org/CBRC-NDRC-EEGuide.pdf2>
- Center for Clean Air Policy (CCAP) (n.a): Berlin Energy Saving Partnership for Energy Efficiency in Buildings. http://ccap.org/assets/CCAP-Booklet_Germany_Berlin.pdf
- Chenghui, Z., Zadek, S., Ning, C., Halle, M. (2015): Greening China's Financial System – Synthesis Report.
- China Energy Efficiency Association (2017): Study on the impacts of PPP on building energy efficiency: <http://www.efchina.org/Attachments/Report/report-lccp-20170623/PPP模式对建筑节能领域促进作用研究.pdf>
- China Industrial Bank (2013): Industrial Bank Boosts Energy Conservation and Emission Reduction by SMEs. http://www.cib.com.cn/en/About_IB/whatxs_new/20130626_1.html
- China Industrial Bank (2015): With 8 Years' Exploration, Industrial Bank Grows into a Professional Service Supplier in Energy Efficiency Credit. http://www.cib.com.cn/en/About_IB/whatxs_new/20150129_1.html
- Chinese Government Network (2018): 我国绿色信贷规模稳步增长 信贷质量整体良好. http://www.gov.cn/guowuyuan/2018-02/21/content_5267818.htm
- CityInvest (n.a): A guide for the launch of a One Stop Shop on energy retrofitting Based on RenoWatt's experience in Liège. <http://cityinvest.eu/sites/default/files/library-documents/RenoWatt%20Toolkit%20disclaimer%2004.01.17.pdf>
- CityInvest (n.a.): Sunshine-Latvia. <http://cityinvest.eu/content/sunshine>
- Climate Bonds Initiative (2017): China Green Bond Market Newsletter. Issue 3. https://www.climatebonds.net/files/files/CBI-Newsletter03-China-Final--06_05_17.pdf
- Climate Bonds Initiative (2018): China Green Bond Market Newsletter Q1 2018. (<https://www.climatebonds.net/files/files/China%202018%20Q1%20Newsletter-EN%281%29.pdf>)
- Crossley, D., Xuan, W. (2013): ESCOs as a Delivery Mechanism for Grid Company DSM in China: Lessons from International Experience, RAP policy brief China.

Dai, W., Kidney, S., Sonerud, B. (2016): Roadmap for China: Green securitisation, tax incentives and credit enhancements to scale green bonds. Climate Bonds Initiative, IISD International Institute for Sustainable Development.

Ecofys (2018): LABEEF in Latvia, Fact sheet for the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), <https://www.euki.de/euki-publications/factsheet-latvian-energy-efficiency-facility-labeef-englisch/>

Ellis, J. (2010): Energy Service Companies (ESCOs) in Developing Countries. Published by the International Institute for Sustainable Development.

Energy Efficiency Financial Institutions Group (EEFIG) (2015). Energy Efficiency – the first fuel for the EU Economy How to drive new finance for energy efficiency investments.

Energy Efficiency Financial Institutions Group (EEFIG) (2017): The EEFIG Underwriting Toolkit. URL: <https://valueandrisk.eefig.eu/introduction>

Energy Efficiency Financial Institutions Group (EEFIG) (2017): The Project Life Cycle

Energy Efficiency Protect (EEP) (n.d): Klimaprotect. <https://www.klimaprotect.de/en/>

Eurocontract (2007): Comparison and Evaluation of Financing Options for Energy Performance Contracting Projects, Final Manual Nr. 2, Version_071112.

Eurocontract (n.d.): Certification, qualification schemes and networks for ESCOs. WP 4 manual Nr. 2, Version 070830.

Evans, M., Yu, S., Roshchanka, V., Halverson, M., Shen, B., Price, L., Liu, M., Meng, L., Miao, P., Dai, F. (2015): Unleashing energy efficiency retrofits through energy performance contracts in China and the United States. Pacific Northwest National Laboratory and Lawrence Berkeley National Laboratory. http://www.globalchange.umd.edu/data/epc/EPC_Market_Opportunity_Paper_final0429.pdf

G20 Energy Efficiency Finance Task Group (2017): G20 Energy Efficiency Investment Toolkit (2017)

GIZ (2013): Assessing Framework Conditions for Energy Service Companies in Developing and Emerging Countries. Guideline, 51.

Institute for Industrial Productivity (IIP) (2012): China Energy Efficiency Financing Landscape Report. <http://www.iipnetwork.org/IIP-ChinaFinancingLandscape.pdf>

International Finance Corporation (IFC) (n.a.): China Utility-Based Energy Efficiency Finance Program (CHUEE). http://www.ifc.org/wps/wcm/connect/RegProjects_Ext_Content/IFC_External_Corporate_Site/Home_CHUEE/

Investor Confidence Project (ICP) (2017). Unlocking Capital for Energy Efficiency Projects. URL: <http://europe.eepperformance.org>

JouleAssets (2017): About eQuad. <https://www.eu.jouleassets.com/about-equad/>

JRC (2014): ESCO market report 2013.

KfW (2017): KfW presents itself. Structure and mission of KfW. https://www.kfw.de/PDF/Download-Center/Konzernthemen/KfW-im-%C3%9Cberblick/GP_2014_deutsch_112014_final-2.pdf

Kidney, S.; Giuliani, D., Sonerud, B. (2017) Stimulating private market development in green securitisation in Europe: the public sector agenda. Policy Paper. Climate Bonds Initiative

Klimaprotect (n.a.): Energy Efficiency Protect EEP

Micale, V., Deason, J. (2014): Energy Savings Insurance-Phase 2 Analysis Summary. The Global Innovation Lab for Climate Finance

Milne, C., Assets, J. (2017): Deliverable D1.1 - Report on the establishment of the core stakeholder group, V1.0 Final Version. SEAF (Horizon 2020).

Mo, K. (2016): Financing Energy Efficiency Buildings in Chinese Cities. Paulson Institute

Pacific Northwest National Laboratory, Ernest Orlando Lawrence Berkeley National Laboratory (2015): Unleashing Energy Efficiency Retrofits through energy performance contracts in China and the United States. White Paper. http://www.globalchange.umd.edu/data/epc/EPC_Market_Opportunity_Paper_final0429.pdf

Rezessy, S., Bertoldi, P. (2010): Financing Energy Efficiency: Forging the link between financing and project implementation. Joint Research Centre of the European Commission.

Schlein, B., Szum, C., Zhou, N., Ge, J., He., H. (2017): Lessons from Europe, North America, and Asia: Financing Models that are Facilitating Building Energy Efficiency at Scale. ECEEE 2017. Presqu'île Giens, Hyeres, France,

Slim, R., Peyraud, C. (2016): Renovate America – Green Bonds – Hero Funding Trust 2016-2. Framework Overview and second opinion by Sustainalytics.

Stancioff, N., Rochas, C. (2017): Energy Performance Contracting for Multifamily Residential Buildings in Latvia. LABEEF. https://ec.europa.eu/energy/sites/ener/files/documents/035_5d_sunshine_labeef_seif_brussels_19-01-17.pdf

Stancioff, N. (2017). Latvian Baltic Energy Efficiency (LABEEF) – presentation. https://ec.europa.eu/energy/sites/ener/files/documents/016_2a_nicholas_stancioff_seif_paris_11-12-17.pdf

Suerkemper, F., Venjakob, M., Thomas, S. (2014): Energy Service Companies (ESCOs), Task 5 report, Thai-German Programme on Energy Efficiency Development Plan (TGP-EEDP).

Sun, M., Gilcrease, W. (2016): Cracking the Energy Efficiency Market in China. A Look at the Tantalizing Opportunities and the Challenges of EE Financing. China US Energy Efficiency Alliance. URL: <http://chinauseealliance.org/wp-content/uploads/2016/12/Financing-Report-1.pdf>

Sustainable Energy Authority of Ireland (n.a.): A Guide to Energy Performance Contracts and Guarantees. URL: http://www.seai.ie/Your_Business/Public_Sector/Energy_Performance_Contacts_and_Guarantees.pdf

Sustainalytics (2018). Framework Overview and Second-Party Opinion. Obvion Green STORM 2018. Available at: <https://www.climatebonds.net/files/files/Sustainalytics%20Second%20Party%20Opinion%20Rabobank%20STORM%202018.pdf>

Switch-Asia Policy Brief (2016): Enhancing Capital Flows for Energy Efficiency Investments in China's Building Sector. URL: http://www.switch-asia.eu/fileadmin/user_upload/RPSC/event/6Sep16-Six-Chinese-Bank/Policy_brief_on_the_EE_Investments_in_China_Draft_for_Review.pdf

Taylor, Robert P. (2012): Next steps for financing energy efficiency in China. Energy Pathways LLC. URL: <http://www.iipnetwork.org/RPTaylor-NextStepsEEFinancingChina.pdf>

The Lab -The Global Innovation Lab for Climate Finance (2015): Energy Savings Insurance: Pilot Progress, Lessons Learned, and Replication Plan. Valerio Micale, Martin Stadelmann, and Leonardo Boni. April 2015. URL: <http://climatefinancelab.org/wp-content/uploads/2014/08/Energy-Savings-Insurance-Lab-Phase-3-Analysis-Summary.pdf>

World Bank (2017): China Energy Service Company (ESCO) market study. Washington, D.C.: World Bank Group. URL: <http://documents.worldbank.org/curated/en/642051493025883088/China-Energy-Service-Company-ESCO-market-study>

World Bank Group (2010): Assessing the impact of IFC's China utility-based energy efficiency program. Energy Efficiency Finance. IEG Study Series. URL: <https://openknowledge.worldbank.org/bitstream/handle/10986/2480/555490PUB0Ener1EPI1992912801PUBLIC1.pdf?sequence=1&isAllowed=y>

Yan, M., Yu, X. (2015): Energy Efficiency: Benefits for Environment and Society.

Zadek, S., Yao, W. (2017). Establishing China's Green Financial System: Progress Report. UNEP Inquiry International Institute of Green Finance



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