

Energy Efficiency Risk Management

A Report for Financial Intermediaries in Brazil



Background

About 48% of Brazil's energy efficiency potential lies in the industrial sector. To unlock this potential, significant investments are required. An increase in the rate of investment in industrial energy efficiency in Brazil, in turn, requires that several obstacles are overcome, including financial institutions' risk perception towards energy efficiency projects.

To foster the reduction of Brazilian banks' perception of risks associated with energy efficiency projects, and thus to improve such projects' finance-ability, UNIDO and Carbon Trust initiated a project to enhance Brazilian banks' ability to identify, analyze and mitigate risks related to energy efficiency financing. The capacity building activities under this project, including this report, are implemented by adelphi consult GmbH (Germany) and SITAWI Finance for Good (Brazil)

This project is conducted under the Industrial Energy Accelerator (IEA), which is a multi-stakeholder partnership co-convened by UNIDO and the Carbon Trust under the umbrella of the Sustainable Energy for All (SE4All) flagship accelerator platform.

Visit the IEA's homepage for more information: <u>www.industrialenergyaccelerator.org</u>

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SITAWI Finance for Good is a Brazil-based organization working to advance social and environmental outcomes through finance and investing. SITAWI manages philanthropic funds for large donors, develops financial solutions to social enterprises and advises financial institutions and institutional investors on integrating Environment, Social, and Governance (ESG) factors into strategy, risk management and investment analysis.

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1 Introduction

The **Brazilian industrial sector** is characterized by high energy consumption and a **significant energy savings potential** which is yet untapped. The sector represents only a fifth of national GDP but its share in energy consumption is 32.9%. Until 2026, industrial energy demand is expected to grow further, mostly using currently idle capacity. At the same time, Brazil has an overall potential to reduce energy demand by 7% until 2027,¹ with ~8 Mtoe/year that can be saved in industry by 2024².

Unlocking this savings potential, however, requires overcoming several **obstacles that currently limit the development of energy efficiency (EE) projects and the availability of affordable finance** for such projects in Brazil. UNIDO and Carbon Trust, in their diagnostic assessment for the Brazilian market,³ summarize these obstacles as follows:

- (1) Factors that inhibit the supply chain's ability to access finance, including poor creditworthiness of SMEs, a lack of capacity to develop bankable proposals, and a lack of good contractual frameworks;
- (2) Factors that render financial mechanisms unattractive to the supply chain, including the high degree of bureaucracy when trying to access financially attractive publicly-backed loans, a lack of technical capacity among Financial Institution's (FI) staff, and, linked to the last point, high collateral requirements resulting from FI's high risk perception of EE financing.

In view of **FIs' high risk perception**, UNIDO and Carbon Trust highlight the need to act on the side of the EE market to facilitate the development of investment projects and respective financing requests that can be considered as 'low risk' by financiers. Further, they emphasize the need to act within FIs through measures that improve their understanding of EE projects and that increase their capacity to de-risk EE loans.

To tackle the last point, UNIDO and Carbon Trust have initiated a **capacity building initiative for Brazilian FIs** under the umbrella of **UNIDO's Industrial Energy Accelerator**. The main objective of this initiative is to **increase FIs' knowledge of EE value and risk appraisal and to foster their ability to adopt and further develop EE risk mitigation approaches**. To this end, a series of capacity building workshops with Brazilian FIs have been implemented over the course of 2019:

- 29.05.2019, Rio de Janeiro: Energy Efficiency Financing in Brazil: Managing the Risks and Benefits, co-hosted by the Association of Development Banks (ABDE), 30 participants from 12 institutions (mainly regional development banks)
- 23.08.2019, Rio de Janeiro: Energy Efficiency Financing in Brazil: EE Risk Framework, co-hosted by BNDES and ABDE, 13 participants from 6 institutions (mainly regional development banks)
- 25.11.2019, Sao Paulo: EE Financing in Brazil: Managing the Risks and Benefits, co-hosted by FEBRABAN (Brazilian Fed. of Banks), 24 participants from 15 institutions (mainly commercial banks)

All **workshops focused on FIs' technical staff** as main target group (mainly credit risk and product development staff) and aimed to increase participants' understanding of, and hence trust in, EE investments; discuss an EE risk assessment framework that was developed for this purpose; and prioritize EE risk mitigation approaches that are available or needed in Brazil.

The **present report** summarizes the content of the workshops and of the risk assessment framework, and reflects respective feedback obtained from participating FIs.

¹ Brazilian Energy Research Office's (Empresa de Pesquisa Energética or EPE) Ten Year Energy Expansion Plan 2027

² Carbon Trust 2017

³ Industrial Energy Accelerator 2019

2 EE value and risk assessment

2.1 Is EE value and risk assessment worth its cost for FIs?

Assessing the value generation and risks related to an energy efficiency (EE) project can go along with significant transaction costs. Bearing such costs may or may not be justified for Financial Intermediaries (FI), depending on the financing amount and financing approach under consideration. Typically, the value generation from and risks of a specific project are assessed only if investment amounts are substantial, or in the case of non-recourse or project financing. In contrast, financing decisions for EE projects, which usually go along with relatively small investment amounts, tend to be based on the repayment capacity of the borrower only, i.e. without taking the values and risks of the specific project into consideration. For such smaller projects, the relevance of EE values and risks for the repayment of the loan is considered too small relative to the transaction costs of assessing them.

Notwithstanding this logic, the **assessment of an EE project's values and risks can be worth its cost even for smaller investment amounts** under several circumstances. These include cases in which the share of energy costs in a company's turnover is significant; cases in which energy cost savings could be used as collateral; or cases in which the borrower is an ESCO. Further, FIs that are able to identify the environmental impact of financed projects, including energy and CO2 emissions savings, can benefit from growing sources of green finance, and hence in many cases reduce their capital costs.

Significant share of energy costs in the borrower's turnover

Successful energy efficiency investments reduce energy consumption per unit of output and hence **decrease the share of energy costs in a company's turnover**. Besides the resulting positive impact on a company's cash flows, the reduction of energy costs can also imply a lower exposure to volatile energy prices and hence a stabilization of a company's profits. Other benefits that often go along with EE investments, such as decreased maintenance costs, higher productivity, or higher asset values, can further amplify an energy efficiency project's positive impact on a company's financials.

Such value generation from an EE project, i.e. **improved cash flows and lower volatility**, can result in a **lower risk of default** and hence there is an argument that lenders should account for these values in credit risk assessment, eventually implying more attractive financing terms for borrowers.⁴ However, to justify the transaction costs which an FI faces when appraising the impact of an EE project on a borrower's cash flows, the presumed impact of the EE project on the borrower's risk of default must be sufficiently significant. This significance may be given under the following circumstances:⁵

- **High degree of energy cost uncertainty:** In order for energy efficiency to reduce a company's credit risk, its energy costs must be both risky and substantial in relation to its profit.
- **High energy-saving potential of the project:** The higher the energy-savings potential, the greater the risk reduction.
- Low degree of cost pass-through to customers: If companies can pass through the variations in energy costs to their customers by varying their product prices, then energy efficiency projects will not reduce credit default risk. On the other hand, if none of the variations in energy costs can be passed through to customers, EE investment will have a stronger effect.

⁴ Evidence on the risk reducing effect from EE investments is currently still scarce although some attempts have been made. Blyth and Savage (2011), for example, examine the scale of the risk reducing effect for a selection of eight industrial case studies in Asia and Eastern Europe and suggests that the risk reduction could be worth as much as one percentage point (100 basis points) on the cost of debt. ⁵ Blyth and Savage 2011

In **Brazil**, energy cost shares are particularly high for some **extractive and manufacturing industries** (Figure 1), implying that a reduction of energy costs can significantly reduce overall operating costs in these industries. With respect to the volatility of energy prices, the **role of hydropower in Brazil** and its impact on energy tariffs must be taken into account. Energy tariffs charged by utility companies are regulated by ANEEL under a price-cap regime, which varies according to the overall cost for energy generation and the security of the general system. Dry periods result in lower hydroelectric power supply and hence in an increased use of thermal energy, which in turn increases the energy costs to end-users and the carbon footprint of the National Integrated System. In recent years, increased electricity demand and longer dry seasons have compromised the hydroelectric power supply, and thus have caused unpredicted fluctuations in supply and demand, eventually resulting in an increased use of thermal power plants. Energy-intensive industries that improve the energy efficiency of their production processes can decrease their exposure to such fluctuations, and lower the risks of increased operational costs and an increased carbon-footprint of their energy consumption.

Figure 1: Energy cost shares in industrial sub-sectors in Brazil (In %; source: Brazilian Institute of Geography and Statistics 2017)⁶



Using energy cost-savings as collateral

The **inability of EE project developers to present acceptable collateral** to lenders is often highlighted as a key obstacle to EE financing. The lack of acceptable collateral stops EE lending altogether or drives up capital costs to such an extent that the investment is rendered unattractive to project developers. This inability can arise from the fact that EE borrowers are often small and medium sized companies, many of which have a short company history or do not possess enough physical assets to raise funds (e.g. in the case of ESCOs).⁷ Further, collateralizing loans with energy efficiency assets can be difficult because such assets may represent only a share of the investment cost (which are also composed of service costs), often have low second-hand value, or cannot be clearly identified or be appropriated.⁸

Due to these difficulties to provide adequate collateral for EE loans, it is sometimes suggested that **cash flows generated from EE projects could be used as collateral**. This however is rarely accepted by FIs since energy cost savings generated from such projects are perceived as too uncertain. Thus,

⁶ Data for 2017 and 2018 is not available. The sub-sectors are in accordance with the National Classification of Economic Activities (CNAE).

⁷ Business Council for Sustainable Development Brazil 2014

⁸ Carbon Trust 2017

increasing Fl's capacity to assess the value and risks of EE projects could increase their trust in estimated cash flows, and thus increase FIs' willingness to accept such cash flows as collateral.

ESCO business model depends on EE values and risk

The energy efficiency market is home to special business models, in particular **Energy Service Companies** (ESCOs). ESCOs are engineering firms that develop and implement EE projects for their clients, such as industrial companies or municipalities. Often and increasingly so, the term "ESCO" is also connected to the understanding that such companies offer Energy Performance Contracts (EPC) to their clients. Such contracts imply that the ESCO's remuneration is directly linked to the energy cost savings of the project: If the EE project generates less energy savings than expected, the ESCO must reimburse the shortfall in cost savings to the client (Guaranteed Savings Model), or receives a smaller amount of payments from the client (Shared Savings Model).

Access to (affordable) **debt financing is still very limited for ESCOs** in many markets, both because such companies are often small and do not have sufficient collateral, and because their business model and EPC contracts are still unfamiliar to FIs. Improving access to finance for such actors requires that FIs develop trust in ESCO business models and in the related contractual constructs. This in turn requires an improved understanding of EE value and risk appraisal on side of FIs.

In **Brazil**, the ESCO market is fragmented, as indicated by a Carbon Trust research with ABESCO associates (Figure 2). Carbon Trust's research shows that the market is made up mostly of small and medium sized ESCOs, of which more than half have an annual gross revenue of less than BRL 250 thousand (USD 65k). Further, there are **only about 10 'real ESCOs'** which offer off-balance sheet solutions to industrial end-users (mostly focusing on power rather than thermal energy savings), and **less than 40% of ESCOs work with Energy Performance Contracts**. The research also showed that industrial energy efficiency is not yet the focus of Brazilian ESCOs, as less than 40% of ESCOs covered by the questionnaire claimed to have access to EE projects in the industrial sector.



Figure 2: Number of ESCOs by size in Brazil

(Source: Carbon Trust 2017, based on an ABESCO questionnaire with member ESCOs)

Access to growing sources of green finance for FIs

A **portfolio of projects and assets with positive environmental impact** is more than a reputational value driver for FIs. International Financial Institutions (IFI), green or climate funds, and other responsible investors usually have a green mandate written into their investment missions. To implement these missions, such investors search for local FIs through which they can channel investments and financing into green projects and assets. This in turn opens up new funding sources for local FIs, for example through the issuance of a Green Bond or by borrowing from an IFI's green credit line. To access such funding sources local FIs must (1) have (or be able to build) a **green loan portfolio;** and (2) have the **capacity to comply with environmental safeguards**, which usually involves the quantification and measurement of positive impact from the financed projects (e.g. reduction of CO2 emissions, energy savings).

Therefore, FIs capable of identifying EE projects in their portfolio, of attracting additional EE projects, and of quantifying and measuring the energy savings associated to these operations, are in a **strategically advantageous position** to access international financial resources, typically characterized by lower cost of capital.

The increasing awareness of such fundraising opportunities and the recent macroeconomic constraints in **Brazil** shall lead FIs to prioritize efforts for the development of a green/ energy efficiency portfolio and to review their credit appraisal for such projects.

Feedback from workshop participants:

The risk of any type of SME project is mostly associated to the company, not to the project. It is not feasible to reduce the **collateral requirements** by conducting qualitative assessments on EE projects or applying some risk mitigation measures.

Investments in EE may foster funding diversification.

Among the three main types of possible EE financing –equipment purchasing, project finance and corporate finance– projects finance is the type of operation for which the assessment of EE characteristics is most feasible, due to the financing amount vis-àvis **transaction costs**.

Several banks still do not see **ESCOs** as (potential) clients, but understand them to be relevant only as service providers to banks' clients.

BNDES aims to stimulate ESCOs to act as borrowers of EE financing, and hence to foster this market.

2.2 Why are industrial EE projects implemented?

Understanding a **borrower's motivation to implement an industrial EE project** can be important for FIs. Such an understanding helps FIs to determine whether the realization of energy savings is the main objective of a project or whether energy savings are just a "side effect". Depending on the borrower's motivation, the planning process, capital demand, available documentation and data can differ, as well as potential risks relating to the project. In industry, any of the following motivations typically lies behind investment projects that go along with energy savings:

- **Risk management:** In view of fluctuating energy prices and looming carbon taxes, EE investments can constitute an effective strategy to reduce a company's dependency on fossil fuels, thus reducing financial and strategic risk and allowing the company to gain a competitive edge over the market. For large energy consumers, EE investments may also be driven by a desire to reduce reputational risk.⁹
- **Major restructuring:** Long-term strategies, potentially driven by technological developments and changing market demands, can involve major restructuring of production facilities. Such restructuring happens infrequently, often in timeframes of decades, and usually goes along with significant capital costs and cash flow impacts. Often, such investment projects are not clearly labelled or perceived as EE projects since they mainly stem from a desire to achieve improvements in reliability, product quality and output. Thus, documentation on estimated energy savings may be absent and the project host may not prioritize the realization of energy (cost) savings.
- On demand replacement of machinery: Investments that entail EE aspects may also be implemented for tactical/operational reasons. Such investments typically occur on demand, for example because certain equipment reaches the end of its lifetime or new technologies have obvious advantages. Capital cost and impact on overall operational cost is usually marginal compared to overall expenses. Not all of these investments are labelled or perceived as EE projects.
- Energy Performance Contracting: Energy Performance Contracts involve a guarantee on or a contractually defined sharing of energy (cost) savings. Thus, the motivation in such projects is clearly oriented towards the generation of energy savings. Project documentation relating to energy savings is usually available and the investment typically concerns proven EE measures. Risks in such constructs mainly evolve from the particular contractual construct, from the fact that Energy Service Companies are often not sufficiently creditworthy, and from the difficulties that arise when it comes to measuring and verifying realized energy savings.

2.3 How do EE projects generate value?

Energy efficiency means that less energy is used to produce the same or a higher amount of output compared to the status quo. EE projects are measures taken to achieve such **reductions in energy use relative to output**. Such measures can involve new industrial equipment (e.g. exchanging old motors for more efficient motors) as well as changes in procedures or in the operation of equipment.

The most direct value generated by EE projects on the side of the end-user is the reduction of energy consumption, which, in most cases, goes along with a respective **reduction in energy costs**. EE projects, however, often also go along with **additional value creation**, e.g. improved productivity, increased asset value and reduced exposure to energy price volatility.¹⁰ Ideally, all these different values should

⁹ Naumoff and Shipley 2007

¹⁰ The benefits mentioned in this section are only those that accrue to the end-user of the EE project. Benefits to the energy system or society more generally are not discussed, as they do not have an immediate relevance for lenders of EE finance.

be identified and taken into account when appraising energy efficiency investment projects, together with the respective risks that go along with value creation.

Cash flows from energy savings

Energy savings in physical terms (e.g. kWh electricity, liter oil, Nm³ gas) are calculated as the difference between **baseline energy consumption** and **estimated energy consumption after implementation** of the EE project. Baseline energy consumption is the assumed amount of energy that would be consumed by the facility or the (old) equipment if the EE improvement was not implemented. Energy cost savings, and hence the estimated impact on a company's cash flows from reduced energy expenses, are calculated based on assumed energy prices over the EE project's lifetime. A side effect from the reduction in energy cost savings is the reduced exposure to energy price volatility.

Co-benefits of EE investments

Energy efficiency investment projects can bring about a multitude of benefits that are not directly related to energy cost savings. In fact, such **'co-benefits' are often equally (or even more) relevant** in driving a company's decision to implement an EE project. Productivity and operational benefits that go along with EE measures may be as high as 2.5 times the value of energy savings. ¹¹ The inclusion of co-benefits in project assessments can thus bring down payback periods for EE projects substantially. In relation to industrial EE projects, co-benefits can include the following:¹²

- **Competitiveness:** EE improvements decrease energy costs per unit of output and thus, in addition to the generation of cost-savings, can increase a company's competitiveness in the market. Such impacts on competitiveness can also result from an improved corporate image or from overcoming regulatory barriers through EE improvements (see Table 1 for an overview on relevant Brazilian laws or degrees on energy efficiency since 2000).
- **Production:** EE investments can bring down production costs due to process improvements that go along with the project (e.g. shorter process times, use of lower cost factors such as labor and materials). Similarly, process improvements can result in increased product quality and value.

Figure 3: Illustration of possible co-benefits in an industrial EE project (Source: Based on an example provided in IEA, 2014)



- Danish company
- EE project: Reduce energy demand in liquid gas production
- Details: Using a combination of an ozone unit and a sand filter, it was possible to reduce the temperature of cooling water.

Energy savings: 153 000 kWh/yr	USD 12 000/yr		
Co-benefits:	> USD 80 000/yr		
Reduced amount of required process chemicals	USD 50 000/yr		
Reduced need for corrosion inhibitors	USD 12 000/yr		
Reduced corrosion damage	USD 20 000/yr		
 Reduced labour costs, less down time, reduced negative environmental impacts, improved working environment 	(not valued)		

¹¹ International Energy Agency 2014

¹² See e.g. International Energy Agency 2014. This list is by no means exhaustive and it should be noted that the presence of specific cobenefits highly depends on the specific EE measure, the company's sector, as well as other company specific factors.

Box 1: Tightening EE regulation in Brazil

In view of tightening environmental policies internationally, **EE investments can help Brazilian companies to overcome regulatory barriers**. Further, companies can improve their resilience to upcoming or expected environmental changes through early on investment. Table 1 provides an overview on the most relevant energy efficiency related laws or decrees in Brazil since 2020.

Table 1: Relevant EE laws or decrees issued in Brazil since 2000

(Source: Authors)

Year	Most relevant energy efficiency related laws or decrees since 2000
2000	9,991: Determines issues relating to investments in the research and development of energy efficiency on behalf of concessionary, permission, and authorized companies in the electric power sector
2001	10,295: Known as the Law of Energy Efficiency, it establishes minimum efficiency indices for machines and appliances manufactured or marketed in the country, based on relevant technical indicators, which consider the useful life of the equipment.
2002	4,508: Decides on the specific regulations that define the minimum levels of energy efficiency for the three- phase electric motors of squirrel cage induction rotors—produced domestically or abroad, for sale or use in Brazil—of mandatory character.
2015	13,203: Authorizes The National Bank for Economic and Social Development (BNDES) to support resources of differentiated energy efficiency and net metering projects by renewable sources in schools and public hospitals. The law also updates the requirements for the minimum investment in the research and development of energy efficiency from utility companies
2016	13,280: A new update on the requirements for the minimum investment in the research and development of energy efficiency from utility companies

- **Operations and Maintenance:** EE investments go along with modernization of equipment and often with improved energy management in a facility. Both of these factors contribute not only to lower energy costs, but can also result in improved process reliability and thus in reduced equipment downtimes, system failures, process time, or staff required for monitoring and operation. Similarly, installing new and often less maintenance intense EE equipment (such as LED lighting with long lifetimes) can bring down maintenance costs in terms of material and labor.
- Work environment: New EE equipment may also affect factors such as thermal comfort, lighting, acoustics, or ventilation, and may thus improve staff's general work satisfaction and labor output. Process improvements and equipment upgrades that go along with EE improvements can also reduce work-related accidents or other negative impacts on worker health, and thus reduce medical expenses and the risk of liabilities.
- Environment: Reduced energy use in production can go along with a general reduction of emissions (CO2 and others) and thus improve a company's compliance with or resilience to existing or upcoming regulations. Process improvements may also result in solid waste and wastewater reduction, and thus reduce costs of input material as well as disposal costs.

Measuring, quantifying, and monetizing co-benefits can be quite challenging, depending on the cobenefit concerned. This is particularly true in industrial EE projects that are often complex and involve multiple processes. While co-benefits such as reduced maintenance costs can be easy to quantify, the quantification of qualitative factors, such as the value of improved company reputation, is more challenging.¹³ To the extent that co-benefits are quantifiable, they can be **considered in EE loan appraisals by FI staff** and hence can improve the cash flow assessment or the general risk profile of a potential borrower (Figure 3 illustrates the potential relevance of co-benefits).

¹³ International Energy Agency 2014

Profitability assessment for EE projects

As for any investment project, the **economic viability of EE projects** is determined from a comparison of project costs relative to estimated benefits. **Cost factors of EE projects** include pre-operative expenses such as costs for energy audits and feasibility studies; design, engineering, implementation and consultancy fees; equipment and disposal costs; capital cost; operating and maintenance expenses over the life-time of the project; and, if applicable, costs related to measurement and verification of energy savings. **Benefits** are derived from the estimated improvement of cash flows due to energy cost savings and other savings that can go along with EE projects, such as reduced maintenance cost and other co-benefits to the extent that they can be quantified and monetized.

To indicate the **profitability of an EE project**, simple payback (i.e. the number of years it takes to recover the initial investment cost from the project's cash flows) is frequently used. Yet, this measure goes along with some shortcomings: Savings that are produced after the payback time are ignored and hence this indicator does not capture the full value of the project. Further, since cash flows are not examined, the project's rate of return will not be revealed. More insightful indicators are the Internal Rate of Return (IRR) and the Net Present Value (NPV) of the project, both of which are derived from year-to-year cash flow projections over the lifetime of the project.

Except for very simple projects, **sensitivity analysis** should be performed in order to assess the impact of changes in key assumptions on the project's net cash flows. Such an analysis can include scenarios with higher or lower energy prices, shortfalls or over-shooting in energy savings, delays in project implementation and respectively extended downtimes of productive assets, increased operational and maintenance expenses, or increases in project cost estimates.

2.4 What is the process for developing an EE project?

From a project developer's perspective, the **life cycle of an energy efficiency project** can broadly be separated into three phases: Development, implementation, and operation. During each of these phases, a variety of stakeholders can be involved: The end-user which hosts the EE retrofit; contractors and consultants which carry out the work, conduct savings assessments, and advise the end-user; Energy Service Companies that implement an Energy Performance Contract in collaboration with the end-user; and financiers who lend the required investment amount to the end-user or the ESCO.¹⁴

Development phase

An idealized development process for EE project development comprises an assessment of the statusquo in terms of energy consumption, the identification of savings potentials, and a proposal for adequate EE measures. Such a preliminary analysis may be conducted by internal technical staff of the company, an external engineering company, or, in the case of energy performance contracting, by the respective Energy Service Company or an EPC facilitator. The analysis can be based on information from the end-user or on-site inspection of the facility.

In an ideal world, the output of the development process includes:¹⁵

- Technical description and specifications of the proposed EE measures
- Energy and cost savings projections (based on a reference consumption and energy price scenario)
- Estimates of the value of other financial benefits e.g. asset value or increased productivity
- Estimates of the investment cost obtained from budgeting or contractor/supplier quotations

¹⁴ EEFIG 2017

¹⁵ EEFIG 2017

- An Operations and Maintenance (O&M) plan and estimates of O&M cost over the project life-cycle
- An approach to contracting and implementing the project
- In case of performance contracting, a Measurement and Verification (M&V) plan.

Some or all of this information can be contained in an energy audit (Box 2Box 1). Ideally, the lender receives the energy audit and all other relevant information listed above from the borrower (end-user or ESCO) to assess the risk and make a sound financing decision. In reality, available information is often restricted in terms of completeness and reliability.

Implementation phase

Based on the output of the development phase and once financing has been secured, the EE project will be implemented. After full installation of the project, the equipment should be tested and potential deviations from expected performance may be corrected. In cases where the works have been conducted by external contractors (potentially an ESCO), a commissioning certificate / certificate of completion should be issued before formally handing the project over to the end-user.

Figure 4: The EE project life cycle from a lender and borrower perspective

Servicing/Operations **Pre-financing** Lender Origi-Decision to Under-Decision to Admini Draw down Servicing nation writing stration Detailed Concept Detailed Comisinstallation Installation M&V / O&M **Basic design** Borrower design design sioning design Development Implementation Operations

(Source: Adapted from EEFIG 2017)

Box 2: Expected content of energy audits and their use in Brazil

An **energy audit** is a systematic analysis of energy use and energy consumption within a defined scope. It aims to identify and quantify the opportunities for improved energy performance. Depending on the purpose of this assessment, different audit types with different levels of detail are appropriate.

A **walk-through audit** (walk-through inspection of a facility) is sufficient to identify potential savings in order to prioritize further studies. The results of a walk-through audit include an identification of energy saving opportunities, a qualitative analysis of the implementation of energy saving measures, an estimation of potential energy saving, and basic comments on a project's feasibility.

To judge the technical and economic feasibility of recommended measures an **Investment Grade Energy Audit** (IGA) is required. This is a detailed document that estimates all savings and costs for each measure. For industrial processes, IGAs often include a unique set of EE technologies and measures, are based on performance measurements for major energy consuming devices, and take account of the correlation between energy consumption and the level of production. In case of EPC projects, the IGA is usually prepared at the same time as the M&V plan. Costs for an Investment Grade Audit can be quite substantial, depending on the scope of the facility and complexity of processes. Brazilian ESCOs, questioned during a series of interviews, indicated that costs for an IGA oscillate between R\$ 20,000 – R\$ 500,000 (Carbon Trust 2017).

Regarding financial analysis, an IGA should contain the following information (EVO 2009):

- Estimated cash flows over the project life-cycle, broken down into: savings by energy type, other operating cost changes, interest and principal;
- Risks associated with achieving savings and risk mitigation/management costs;
- Project cost breakdown for labour, contractors, materials and equipment, miscellaneous items (e.g. permits, bonds, taxes, insurance), overhead and profit;
- All assumed financial terms including interest rate, current energy prices, any escalation rates, payment terms to lender, investor;
- Estimated Net Present Value of total cash flow benefits and discount rate used.

In **Brazil**, the use of energy audit programs is still rare, mainly due to the **lack of widespread specific standards for industrial EE**. However, some specialists, often associated to ESCOs, are able to conduct energy audits according to international standards. The Brazilian Association of Technical Standards (ABNT) recently leveraged its experience in auditing corporate systems and industrial processes to develop a **methodology to measure and verify the savings achieved by EE programs**. The methodology is based on the following references:

- ISO 50015 Energy management systems Measurement and verification of energy performance of organizations General principles and guidance
- Brazilian Technical Standard (ABNT NBR) for ISO 50.001 Energy Management Systems Requirements and guidelines to the implementation
- Brazilian Technical Standard (ABNT NBR) for ISO 50.006 Energy Management Systems Measurement of energy performance according to energy baseline calculation (LBE in the Portuguese acronym) and Energy Performance Standards (IDE in the Portuguese acronym) – General principles and guidelines

This methodology was developed by the Energy Savings Insurance Program in Brazil, led by the Inter-American Development Bank, in 2016-17. In this context, ABNT offered its services to be the external M&V provider to the projects financed by FIs under the program.

Operation phase

Adequate **Operation and Maintenance** of the EE equipment over its life cycle is key to achieving energy savings and co-benefits. Operations and Maintenance should be conducted in accordance with the O&M plan drawn up during the development phase, and may be implemented by the end-user, an external engineering company, an ESCO involved in the project, or a combination of these.

In cases where the project involves an Energy Performance Contract, **Measurement and Verification** of energy savings is relevant over the length of the EPC and should be conducted in accordance with the M&V plan set-up during the development phase. The primary purpose of M&V is to establish and report project benefits and savings achieved. Proper reporting enables the project developer (possibly an ESCO), end-user and financier to clearly judge performance, decide corrective actions if any, and process appropriate financial payments. Proper measurement and verification of savings is critical to successful EPCs as this ensures adequate attribution of payments between the ESCO and the end-user. Ideally, the M&V process is conducted in line with the International Performance Measurement and Verification Protocol (IPMVP) or a similar generally accepted standard (Box 3). To ensure transparency and independence of the M&V process and respective documentation, a third party such as a specialized consulting firm or an EPC facilitator can be engaged.

M&V costs can be quite substantial, depending on the complexity of the project and the desired degree of accuracy. Thus, for smaller and relatively straightforward projects, lighter M&V procedures, which can include a set of stipulated rather than actually measured values, may be cost-effective.

Box 3: The International Performance Measurement and Verification Protocol (Sources: EVO 2009, EEFIG 2017, Transparense 2013)

The International Performance Measurement and Verification Protocol (IPMVP) provides an overview on best practices for measuring and verifying energy savings. The IPMVP does not prescribe contractual terms for Energy Performance Contracts, but provides some guidance in this respect. The different M&V methodologies described in the IPMVP include the following:

- **Stipulated 'measurement':** Savings estimates are based on stipulated assumptions regarding usage of the EE technology and energy consumption before and after implementation.
- **Measurement in partial or full isolation:** Energy use of equipment is measured in isolation from the energy use of the whole facility. Operating hours may be stipulated or.
- Whole facility measurement: Energy consumption of the entire facility is measured before and after the retrofit.
- **Simulation:** Energy consumption before implementation of the EE measure is simulated by models of the whole building. Energy consumption after is measured from metered data.

These M&V methodologies differ in terms of costs and accuracy and result in different attribution of risks between the end-user and the ESCO. The IPMVP aims to support ESCOs and end-users to select the M&V approach that best matches projects costs and savings magnitude, technology specific requirements, and risk allocation between the end-user and the ESCO.

2.5 Energy Performance Contracts

Energy Performance Contracts involve an Energy Service Company that implements energy efficiency measures in an end-user's facility and a contract that is structured in such a manner that the payments between the ESCO and the end-user are contingent on the savings achieved by the measures. In view of such contract structures, energy performance risks are minimized on the side of end-users and are partly or fully taken on by the ESCO. EPCs may, but must not, involve financing of the EE improvement by the ESCO.

In order to control the performance risk, **ESCOs take responsibility for a broad range of technical services** along the project life cycle, including the initial energy savings assessment, comprehensive engineering design, and installation and commissioning. Depending on the contractual agreement, the ESCO may also conduct on-going maintenance and train the end-user's staff regarding the new equipment and regarding efficient operation modes. An important component of any EPC project is Measurement & Verification of energy savings. The ESCO and the end-user must agree on the M&V method that should be implemented as basis for payments.

The two major types of performance contracting are the Guaranteed Savings Model and the Shared Savings Model. Under the **Guaranteed Savings Model**, the ESCO guarantees a certain level of energy saved to the end-user and covers any shortfall. In this model, upfront investment costs are typically covered by the end-user. Under the **Shared Savings Model**, the ESCO and the end-user share the energy cost savings according to an agreed percentage. In the latter model, typically the ESCO covers upfront investment costs. Box 4 provides an overview on these two EPC model types.

From a Financial Intermediary's point of view, Energy Service Companies that implement an Energy Performance Contract in an end-user's facility can thus play two distinct roles in relation to energy efficiency financing:

- **ESCO as borrower of EE financing:** To finance investment costs that accrue on the side of the ESCO in a Shared Savings Model, the ESCO may obtain a loan from a Financial Intermediary. In such cases, the ESCO faces most of the performance risk and the credit risk of the end-user; and the FI faces the credit risk of the ESCO.
- ESCO as guarantor of a borrower's energy savings: The end-user of an EE investment project may have the improvements implemented by an ESCO under a Guaranteed Savings EPC model. In such cases, it is the end-user who finances the EE investment and who may obtain a respective loan from the Financial Intermediary. The relevant credit risk from a Financial Intermediary's point of view is therefore that of the end-user. In view of the guarantee on energy savings obtained from the ESCO, the performance risk is transferred to the ESCO.

Depending on the type of EPC model implemented and on the entity that acts as borrower, the risks that are relevant from a Financial Intermediary's point of view differ.

Box 4: EPC models with shared or guaranteed savings (Source: Based, among other sources, on Transparense 2013)

In the **Shared Savings Model**, the ESCO receives from the end-user a share of the energy cost savings that are realized in the end-user's facility. The size of this share differs from contract to contract, depending, for example, on the size of the project.

The performance risk in this model is shared between the ESCO and the end-user. The upfront investment amount is typically covered by the ESCO (debt or equity). The ESCO recovers this investment trough the share of energy cost savings that it receives from the end-user. Thus, the ESCO faces the credit risk of the end-user: If the end-user goes out of business, the ESCO will not be able to recover the investment amount.

Variations of the Shared Savings Model are models with variable contract term, including the 'First Out' Model: Once the ESCO has received full payment through its savings share, the contract is terminated. Thus, the risk that full payment cannot be recovered due to lower than expected savings over a fixed contract term is reduced.

In the **Guaranteed Savings Model**, the ESCO guarantees that a certain level of energy savings (in physical units) will be realized in the end-user's facility. In case less than the guaranteed savings are realized, the ESCO pays the shortfall to the end-user. In case more than the guaranteed savings are realized, the end-user may pay an agreed percentage to the ESCO. In both cases, amounts due are calculated based on constant energy prices as contractually agreed.

The performance risk in this model is entirely with the ESCO. The upfront investment amount required for implementation of the EE measure is typically covered by the end-user (debt or equity). Thus, the ESCO does not take on any credit risk from the client or any repayment risk towards an FI. The investment repayment risk resides with the end-user. Thus, for the end-user, an important condition on the EPC is that total costs savings achieved through the contract will be larger than the payments to the ESCO together with transaction costs (e.g. labour, legal, and consulting costs). For the ESCO, the essential condition is that the contract revenues are larger than the total costs incurred. For financial institutions, and important advantage of this EPC model is that it lowers the risk of the end-user, which is the borrower of a loan in this case. If the borrower's energy savings are insufficient to service the debt, the ESCO has to cover the shortfall.



Figure 5: Shared Savings Model (left) and Guaranteed Savings Model (right)

2.6 What are potential risks around EE projects?

Whenever financiers account for the values generated from an energy efficiency project in the evaluation and pricing of a financing request, they must also consider the risk that these values will not be realized. This risk can be broken down into three categories:¹⁶ (1) Estimated cash flows are not realized, (2) cash flows cannot be exploited, and (3) assets (technical EE equipment) have a low value or cannot be exploited. The specific risks within these categories are discussed in more detail over the following sections.¹⁷

Estimated cash flows are not generated

In a certain world, the value of future cash flows of an EE project can be determined from energy savings that will be generated relative to a baseline, the financial value of energy savings in view of future energy costs, and the timeline over which these savings will accrue. In reality however, cash flows are likely to deviate from initial predictions due to risks relating to the correctness and resilience of baseline assumptions; to the implementation, operation, and maintenance of the technology according to the plan; or to energy prices.

Low quality of initial savings assessment

Energy savings estimations involve models, simulations, and assumptions that are prone to error and uncertainty. Obvious misspecifications can arise from insufficient expertise of involved engineers (including a lack of quality in the software tools they use). Uncertainties and inaccuracies in the assumptions and simulations cannot be fully avoided, but can be amplified if hired professional's lack experience or if the project is particularly complex (e.g. involving multiple interacting technologies).

To stress-test profitability assessments with respect to changing assumptions, project documentation should consider different scenarios for key variables, namely energy prices and production amounts. Flaws during implementation of the EE technology, i.e. lower than expected performance, may also be considered in such scenarios.

Box 5: Common shortcomings in Investment Grade Energy Audits (Source: EVO 2009)

The following shortcomings are often found in Investment Grade Energy Audits:

- Improper use of current energy and demand prices
- Incomplete understanding of operating patterns of various elements in the facility
- Incomplete (or excess) allocation of all energies to all energy using components/systems
- Predicted savings unreasonable relative to baseline energy allocated to components
- Incomplete energy-consuming equipment inventory
- Inadequate consideration of the proposed measures' impacts on work environment/process
- Unclear description and identification of the retrofit scheme
- Overestimated savings on combination of all measures
- No consideration of offsetting increased O&M costs
- Incomplete consideration of all feasible proven technologies for efficiency or renewable energy
- No comparison to similar facilities
- Insufficient consideration of the impact people, especially O&M staff, may have on the project

¹⁶ This categorization has been adapted from QualitEE 2018, who distinguish five categories for the development of 'Financial Quality Criteria for EPC financing': 1) Quality of Cash Flow Prediction, 2) Incentive Structure for Cash Flow Generation, 3) Exploitation of Cash Flows, 4) Value and Exploitation of Assets, 5) Non-energy Benefits of Energy Efficiency Service Projects.

¹⁷ The discussion of risks is based on a review of the literature. Highly valuable sources are QualitEE 2018, EEFIG 2017, EVO 2009, and IEA 2010.

Energy consumption baseline not well defined

Energy savings are estimated relative to baseline energy consumption, i.e. energy consumption before installation of the EE equipment. Such estimations of the baseline can be a challenge in itself, for example due to insufficient availability of reliable data on past energy consumption and operation of the machinery / facility for at least one year.

Further, when key variables from which the baseline has been calculated change over time, the initial baseline will not anymore present an adequate comparison for the calculation of realized energy savings. For example, if the intensity at which a production line is used increases after implementation of an EE technology, energy use will increase as well. To properly measure energy savings from an EE project, such changes in use patterns must be accounted for through an adjustment of the baseline, as illustrated in Figure 6.

In relation to Energy Performance Contracts, the clear definition of baseline adjustment factors is highly relevant. The contracting parties, i.e. the ESCO and the end-user, must agree on those factors that may be adjusted at a later stage in order to avoid disputes around actually realized energy savings. Such factors may include energy prices, production amounts, or climate conditions.



Figure 6: Energy baseline adjustment during EE Project implementation *(Source: SEAI 2013)*

Implementation of low quality equipment or poor project design

EE equipment may not perform according to suppliers' specifications or may fail altogether. The likelihood that this occurs can depend on the quality of the EE equipment, which in turn may vary with the reputation of the supplier. If few pieces of equipment form a major part of the project cost, it is recommended to ensure they are from suppliers with a good reputation in the sector. Further, lenders can request proof from borrowers that indicates the use of best available technologies. Such indications may consist in reference to a certain standard in technology or to specific quality labels.

Even high quality equipment may not perform as expected if the overall project is improperly designed or if specific pieces of equipment are incorrectly installed. Inadequate design and incorrect installation may arise from various factors including a lack of expertise of the responsible party or a lack of clearly defined roles and responsibilities in cases where several stakeholders are involved. While professional indemnity insurance may cover the responsible engineer against obvious errors, it will typically not cover losses that arise from lower than estimated energy savings that may arise from poor project design. To reduce the likelihood of such losses, FIs may require technical due diligence of the project through independent engineers, or project development that follows national or international standards.

In general, the more complex and non-standard a project is, the higher is the risk that potential failures in equipment, design, or installation occur. Industrial systems that are commonly applied across different sectors such as those related to motors and pumps, heating and cooling, or lighting, are well proven and thus bear relatively low risks, given of course that the products are of good quality and are used within their specifications. Industrial EE projects that target process changes or major restructuring of production facilities, in contrast, often involve interaction between different technologies as well as changes of output, operation hours, or load, and thus bear higher risks of design failures and production downtimes.

Operational and Maintenance risks

Adequate Operations and Maintenance is often highlighted as the most relevant determinant for the achievement of estimated energy savings. **Operational risk factors** include adjustments in usage as well as inadequate operation of installed equipment. If the end-user adjusts the usage pattern or intensity of the EE equipment over time, less energy may be consumed relative to the initially assumed baseline and hence less energy will be saved (potentially even zero savings in case a production line or facility is closed). Further, realized energy savings can vary with the degree of user capacity. An insufficient degree of user capacity may arise from a lack of familiarity with the new technology, lack of guidance, lack of training, or insufficient incentives for proper use.

Maintenance related risk factors could induce lost savings as well as additional costs. A lack of longterm preventive maintenance can induce a decay in energy savings over time, and the replacement of failed components implies additional costs and can affect operational performance. Thus, for longer credit periods and technologies where maintenance is important, such as compressed air or cogeneration, it is recommended to ensure availability of maintenance plans. Further, foreseeable maintenance should be reflected in the project's budget. For projects with a high share of equipment cost, financial risks of unforeseen maintenance and product failures can be shifted towards the supplier through warranties.

When financing projects that involve an Energy Performance Contract, lenders should pay particular attention to how O&M risk factors will be managed between the end-user and the ESCO, according to the Energy Performance Contract. ESCOs often take responsibility for maintenance of the implemented equipment in order to ensure that the quality of the equipment is maintained over the duration of the EPC contract, and hence that guaranteed or shared savings can be generated. This responsibility can be fixed in the EPC contract through an agreement on on-going commissioning to ensure that errors are detected and fixed. Taking control over operational factors such as operating hours or load is typically not possible for ESCOs, and hence ESCOs should ensure adequate operation by the end-user through contractual terms (e.g. minimum production level to ensure savings can be generated), incentives (e.g. shared savings), and potentially by offering manuals and trainings to the end-user's staff. To make sure that a connection between savings shortfalls and operational factors can be established in case such shortfalls occur, the EPC contract should ensure that operational data is documented, for example in the form of operational logs.

Box 6: Examples of EE project risks in relation to O&M (Source: Woodrof 2016)

Example: Maintenance is critical to achieve long-term savings

"I have seen [Energy Performance] contracts implying that once the initial savings are achieved, the savings will continue for the next 20 years. However, much like a diet to lose weight, savings will continue only if the facility puts some effort into maintaining the equipment. Annual training as well as a budget to replace parts is critical to achieving the long-term savings. If you are installing more sophisticated systems (VSDs, controls, etc.), you will need to spend more on maintenance. You should plan on investing 10-20% of savings toward a budget line item to maintain those savings. Also, a distinction needs to be made between Maintenance and M&V. An ESCO is usually happy to provide M&V, but a prerequisite for the guaranteed savings is that the owner is responsible for maintaining the equipment "properly" – a description that lawyers find vague."

Example: Replacement costs not budgeted in the EPC

"An ESCO proposed to install LED lighting that would last about seven years before relamping. However, when the LEDs do fail, the fixtures will need to be replaced at a cost of about \$350,000. To maintain the energy savings over the 20-year contract, the fixtures will need at least two replacements. The ESCO had zero dollars budgeted for this eventuality, but it claimed all of the energy and maintenance savings."

Risks related to Measurement & Verification

Energy Performance Contracts entail guarantees on the level of energy savings to be achieved. Through Measurement & Verification, the achieved level of savings is specified and hence can serve as **basis for payments between the ESCO and the end-user**. There are various approaches to measurement and verification and they differ regarding costs and accuracy. Depending on the M&V approach decided between the ESCO and the end-user, risks will be allocated to either of them. For example, if the M&V approach entails that performance of equipment or use patterns are stipulated rather than measured (e.g. in order to reduce M&V costs), some risk may be transferred from the ESCO to the end-user. Further if, the M&V approach foresees that assumed baseline energy consumption can be adjusted in line with measurement during the implementation phase, the ESCO will be able to avoid taking the risk of use pattern changes that may dilute measured energy savings.¹⁸

For Financial Institutions, it is difficult to judge whether the decided M&V approach is appropriate, and what are the specific implications in terms of risk allocation between the end-user and the ESCO. However, the FI may be able to **judge the transparency and quality of M&V** to an extent, based on factors that are observable to the FI. This can include the engagement of a specialized independent consultant in the M&V process or the usage of M&V protocols and standards, such as ISO 50015¹⁹ or the International Performance Measurement and Verification Protocol (IPMVP). Further, FIs may require that **M&V reports are linked to loan/investment servicing** as they can provide early warning on lower than expected performance which may affect the viability of repayment.

¹⁸ FEMP 2015

¹⁹ ISO 50015:2014 establishes general principles and guidelines for the process of M&V of energy performance of an organization or its components, see https://www.iso.org/standard/60043.html.

Box 7: Examples of EE Project risks in relation to M&V (Source: Woodrof 2016)

Example: Significant share of savings 'stipulated'

"Stipulated Savings' and 'Avoided Capital Expenditures' are contract terms worth understanding. In a recent contract review, I found that about 50% of the savings were 'stipulated avoided capital expenditures' and would not be measured. While I agree that it may not be worthwhile to measure every single piece of equipment, the facility manager should review all stipulated savings because some assumed savings may never materialize. [...] Also, make sure you understand the escalation rates that ESCOs typically assign to utility, maintenance and labor costs."

Example: M&V costs not properly budgeted

"I recently reviewed a contract in which the ESCO required the owner to pay for M&V as well as preventive maintenance services for the duration of the 20-year contract as a prerequisite for the guaranteed savings. However, the ESCO's financial model only accounted for five years of such services, and what was missing was about \$500,000 in unbudgeted costs to the owner."

Low incentives to generate savings and mitigate risks

In cases where the project is implemented through an Energy Performance Contract, the risk of potential shortfalls in estimated energy savings is fully or partly transferred to the ESCO. Thus, to ensure that O&M risks are minimized, the ESCO typically takes a leading role regarding maintenance and regarding training of end-user staff with respect to proper operations. This leading role of the ESCO is of particular relevance in the Guaranteed Savings Model since the **end-user's incentives to conduct adequate operations and maintenance** are relatively low in view of the ESCO's savings guarantee. In the Shared Savings Model, the end-user has a higher incentive to maximize energy savings in his facility and to maintain machinery in an adequate way. Thus, the ESCO may take a smaller role regarding O&M and rely more on end-user incentives to reduce overall performance risk. In both cases, the Guaranteed and the Shared Savings Model, the creation of a long-term relationship between the ESCO and the end-user is important to reduce O&M risks, and thus to achieve their common goals, i.e. achievement of energy and cost savings and optimizing the overall economy of the project.

Fluctuation in energy prices

Cost savings estimates for EE projects rely on assumed energy prices. As energy prices fluctuate, cost savings will fluctuate as well. That is, even if an EE project performs well and generates the estimated energy savings in physical units, these **savings may still be lower than expected in monetary terms** if energy prices fall below expectations.

In cases where the EE project involves an Energy Performance Contract, fluctuations in energy prices may not only affect the generation of cash flow on the side of the end-user, but may impact the **amount of payments from the ESCO to the end-user or vice versa**. Whether energy price-fluctuations feed-through to payments between the ESCO and the end-user depends on the specific contractual agreement, i.e. whether energy prices are assumed to be constant, change at a fixed inflation rate, or float with market conditions.

Under the **Guaranteed Savings Model**, the end-user typically takes the energy price risk. In this EPC model, energy savings are valued based on constant pre-determined prices. Thus, in cases where energy savings are below the guaranteed amount, payments to cover this shortfall will be made at

constant prices. In cases where market energy prices are above the agreed constant price, the enduser will make a loss.

Under the Shared Savings Model, energy savings may be valued in current prices, implying that the ESCO bears the energy price risk. If energy prices are low, the value of the ESCO's share in energy savings will be low as well, implying that the ESCO may have difficulties to recover its investment amount. For the end-user, decreasing energy prices mean that overall energy costs are reduced at the same time at which the value of the share in energy savings is reduced. Hence, the energy price risk on the end-user side is mitigated to an extent.

Non-compliance with or changes in regulation

Regulatory risks are typically not very prominent in industrial EE investments. Specific regulatory permits may be required, for example if the project location is in protected or urban areas (cogeneration projects may require a permit for fossil fuel combustion if located in urban areas). Changes in feed-in-tariffs can change the economic viability of projects, but only apply to small distributed energy projects that are not the focus of this report. In fact, EE projects rather have a risk reducing effect in relation to regulation, as they enable companies to comply with or increase their resilience to existing or upcoming environmental regulation (see also Section 2.3 on co-benefits from EE investments).

Cash flows cannot be exploited

Contractual partner defaults

In cases where EE projects involve an Energy Performance Contract, the repayment capacity of the borrower depends, to varying degrees, on the **financial stability of the borrower's contractual partner**. Under the Guaranteed Savings Model, where the borrower of an EE loan is typically the end-user of an EE measure, the end-user's repayment capacity can be affected by financial difficulties of the ESCO. A financially troubled ESCO may not be able to stick to contractual agreements such as reimbursement of guaranteed savings in case of savings shortfalls or long-term services such as preventive maintenance. Under the Shared Savings Model, where the borrower of an EE loan is typically the ESCO, the ESCO faces the end-user's credit risk. That is, the ESCO's repayment capacity depends on the end-user's ability to generate energy savings and to share the monetary equivalents with the ESCO. If payments from the end-user are delayed or if the end-user goes out of business or closes the facility, the repayment may be interrupted or stopped altogether.

In both cases, it is important that an **exit strategy** is defined as a safeguard against economic difficulties of contractual parties (ESCO or end-user). Such an exit strategy should consider the possibility of bankruptcy of ESCO or end-user, sale of facilities by the client, legal succession or replacement of the ESCO, and contract termination by the client. In the Shared Savings Model, lenders can reduce the repayment risk of an ESCO via cession, i.e. by securing access to the cash flows that are generated through the end-user. To enable such direct access to the project's cash flows, the Energy Performance Contract needs to allow the ESCO to assign all rights and obligations from the contract to a third party without prior consent of the client.²⁰

Risk concentration at the ESCO

The financial viability of an ESCO goes beyond the income generated from an individual Energy Performance Contract. In view of their business model, ESCOs implement a range of similar EE projects for different clients and the risks relating to each individual contract may be correlated. For example,

²⁰ QualitEE 2018

a low degree of technical expertise at the ESCO can result in high performance risks across all projects which the ESCO implements, and hence may lead to excessive liabilities if the ESCO acts as guarantor of energy savings, or in lower than expected revenue streams if the ESCO's income relies on shared savings from end-users. Further, ESCOs that take on energy price risk may face losses from decreasing energy prices in several projects at the same time.

Legal risks

Energy Performance Contracts serve to allocate risks between end-users and ESCOs. When disputes around these contracts arise, including due to the use of unclear language, energy savings claims may be lost and substantial legal costs may arise. Such disputes can be settled or avoided altogether if Energy Performance Contracts are of high quality and entail a well-accepted risk allocation framework. In markets where standardized procedures, such as established through the IPMVP are not yet prominent and where the market's experience with Energy Performance Contracts is still limited, such legal risks are amplified. Carbon Trust (2017) highlight the current absence of such well-accepted risk allocation frameworks in Brazil: ESCO interviewees highlighted that EPCs leave room for disagreement with their clients, in particular during a project's operational and M&V period, i.e. when ESCOs need to demonstrate the savings achieved against a baseline scenario.

Assets (technical EE equipment) have low value or cannot be exploited

Backing-up loans with EE assets can be difficult because they sometimes only represent a share of the loans (which are also composed of service costs), often have low second-hand value, or cannot be clearly identified or even appropriated.²¹ In cases where technical equipment is collateralized nonetheless, certain conditions need to be fulfilled to enable exploitation of the collateral in case of borrower default²²:

- **Assets can be removed:** Removal of EE equipment can be difficult due to the integration into a building or production facility. To enable collateralization of technical equipment, project documentation should define the value of removable parts.
- Assets can be sold: Being able to sell EE equipment requires that the equipment can be used for different processes and branches. In relation to industrial EE projects, this may be difficult due to a high degree of specialization of the equipment. Further, selling the collateral requires that the borrower secures collateral value over the financing period.
- **Ownership of assets:** In some types of Energy Performance Contracts, ownership of the installed equipment remains with the ESCO. Thus, in cases were the end-user is the borrower of an EE loan, these assets cannot be collateralized. In cases where the ESCO is the borrower, legal difficulties may arise when the ESCO's machinery should be removed from the client's property. Ownership of equipment must thus be clearly defined in the EPC, also covering the possibility of changes in the legal structure of the ESCO or the end-user.

Other risks

Industrial EE projects can be subject to various other risks that go along with construction projects in general, including overruns in construction, equipment, or labor costs, delays in the implementation of the project, failure of contractors to implement the project, or downtimes during construction. Financial risks, including interest rate or exchange rate risks, can also be relevant for EE investment projects. Since these types of risks are not unique to EE projects, they are not examined in this report.

²¹ Carbon Trust 2017

²² Adapted from Leutgöb 2019

2.7 Risk assessment

From a financial institution's point of view, it is often not possible, or at least **very challenging and related to high transaction costs, to evaluate the presence and potential severity of energy efficiency risks** in detail. This is because many of the risks discussed in the previous section are of a highly technical nature and even for trained energy professionals respective risk assessment is non-trivial. Further, risks related to Energy Performance Contracts can be ambiguous given that such contracts are still rather new in many markets and often lack standardization.

To assess the presence and potential severity of risks on the generation and exploitation of cash flows from an energy efficiency project, or on the value of collateralized EE equipment, **FI's may approximate these risks based on factors that are visible to them** (or can be visible with varying degrees of effort). For example, by evaluating the credibility of the source of the savings assessment (e.g. technical expert vs. equipment supplier) FIs can approximate the risk that the energy savings estimation presented by the borrower is too optimistic. Table 2 below summarizes key risks as outlined in the previous section, and reflects indicators through which the presence of these risks can be approximated.

When **evaluating the relevance of such risks for a lender**, the specific financing model (e.g. nonrecourse financing vs. conventional loans) or the relevance of energy savings for the borrower's business must be taken into account. As lined out in Section 2.1, EE values and risks can be particularly relevant in cases where the energy cost share of the borrower is high (and hence energy cost savings could bring down operating costs significantly), or where the borrower's remuneration is directly linked to the energy cost savings that are generated through the EE project (as can be the case in context of Energy Performance Contracts). To take account of the fact that the relevance of risks differs across financing set-ups and depending on the type of borrower/the presence of an Energy Performance Contract, Table 2 distinguishes between different financing scenarios and weighs risks accordingly:

- (1) The end-user of the EE project is the borrower of EE financing and does not benefit from an Energy Performance Guarantee. Further, it is assumed that the FI plans to account for the estimated cash flow of the EE project in credit-risk appraisal, i.e. the FI believes that energy savings and respective performance risks are relevant for the financing decision and terms.
- (2) The end-user of the EE project is the borrower of EE financing and has entered into an Energy Performance Contract with an ESCO (Guaranteed Savings Model). As in scenario (1), it is assumed that the FI plans to account for the estimated cash flow of the EE project in credit-risk appraisal, i.e. the FI believes that energy savings and respective performance risks are relevant for the financing decision and terms. In contrast to scenario (1), and in view of the performance Guarantee from the ESCO, the relevance of performance risks to the borrower and hence to the FI is mitigated. Yet, the presence of the ESCO as a third party also brings additional risks, e.g. in relation to the M&V approach agreed in the EPC or in relation to a potential bankruptcy of the ESCO.
- (3) An ESCO that implements an EE project in an end-user's facility is the borrower of EE financing and has entered into an Energy Performance Contract with the end-user (Shared Savings Model). Here it is important to note that the ESCO finances the project out of the energy cost savings share agreed with the end-user. Hence, the ESCO is subject to performance risks from the project and credit risk from the end-user and these risks may be transferred to the lender.

In the column "relevance" in Table 2, "0" stands for "not relevant", "0.5" for "medium relevance", and "1" for "relevant". The assigned weights aim to provide a rough indication and foster discussion, but should not be understood as definitive.

Table 2: EE risks, risk indicators, and relevance under different financing models

(Source: Authors²³)

	(1) No Energy Performance Contract	Re	Relevance	
Risk	Risk indicator (2) EPC with Guaranteed Savings Model (3) EPC with Shared Savings Model	(1)	(2)	(3)
Quality of cash flow pr	ediction			
Development phase				
	Source of energy savings assessment	1	0.5	1
Low quality of initial	Model for profitability assessment	1	0.5	1
savings assessment	Availability of risk analysis for cash flows	1	0.5	1
Badly defined baseline	Definition of baseline for calculation of energy savings and key factors that impact energy usage (e.g. utilization rates)	1	1	1
Implementation phase	· · · · · · · · · · · · · · · · · · ·			
	Quality of installed equipment	1	0.5	1
	Complexity of measures	1	0.5	1
Implementation	Reliability of technology and supplier	1	0.5	1
of low quality	Parties involved in implementation	1	0.5	1
poor project design	Competence/experience of responsible technical staff		0.5	1
	ESCO: Availability of accreditation of works and services			1
	ESCO: Presence of relevant previous experience	0	0.5	1
Operation phase				
	Foreseen maintenance of the installed EE technology	1	0.5	1
Inadequate O&M	Experience in operating the EE technology			
	Availability of product warranties	1	0.5	1
Savings cannot be verified	EPC: Availability of adequate Measurement & Verification concept	0	1	1
Inadequate risk sharing	EPC: Contractual agreement on how performance risks are shared		1	1
No end-user participation	EPC: Contractual agreement on incentives for the end-user to foster generation of energy savings	0	0.5	1
Exploitation of cash flo	ows			
Financial difficulties	ESCO as borrower: Contractual agreement regarding the lender's access to project cash flow from energy savings	0	0	1
partner	ESCO involved: Contractual agreement regarding an exit strategy in case of bankruptcy of ESCO or end-user	0	1	1
Value and exploitation	of assets (technical EE equipment)			
Low collateral value	Availability, value, accessibility of collateralized EE equipment	1	1	1

²³ Several of the risk indicators contained in the table can also be found in QualitEE's (2018) Financial Quality Criteria, or can be inferred from EVO (2009) or EEFIG (2017). Based on additional research and feedback from Brazilian FIs during the Industrial Energy Accelerator's workshops, additional risk indicatory were added. This list should not be considered as comprehensive but rather as indicative. Depending on an FI's interest in detailed EE risk assessment, such a list of risk assessment questions could further be developed to become more granular.

The risk indicators listed in Table 2 can be understood as cornerstones of a **qualitative EE risk assessment framework** by which banks can approximate the degree of risk around a specific investment project. In course of the Industrial Energy Accelerator's capacity building initiative, such an EE risk assessment framework was suggested to Brazilian banks and was discussed during the Accelerator's workshop series. The suggested framework consists in an Excel based questionnaire with pre-defined answers, where each answer is associated with low, medium, or high risk (see Figure 7). The risk attributed to each provided answer is combined into an overall risk score, which is illustrated as a traffic light system. Besides choosing the answers to each risk assessment question, users of the framework can customize the weights attributed to different questions, and can mark specific question-answer combinations as "red-flag". An example of a relevant red-flag question concerns the availability of an adequate M&V approach whenever an Energy Performance Contract is involved in the project. In case no M&V approach is available, a red flag would be raised and constitute a no-go decision with respect to financing the project.

Bank staff's feedback on the risk assessment framework was mixed. Several workshop participants questioned the feasibility of answering some of the risk assessment questions. They also argued that, in view of transaction costs, detailed evaluations of project characteristics are only possible for medium or large projects. Further, some participants highlighted that a qualitative risk assessment as the one proposed cannot justify changes in collateral requests. Other participants, in contrast, perceived the framework and its guiding questions as an effective approach with several potential use cases in relation to EE finance:

- Provision of guidance to bank staff for the appraisal of EE financing operations, including on documents and information that should be obtained from clients;
- Inform credit analysts' cash flow projections;
- Inform the preparation of clauses and covenants for EE financing;
- Inform assessment procedures and eligibility conditions for collateral funds.

Participants from development banks also highlighted that their social and impact oriented mandate allows them to conduct qualitative assessments even in view of transaction costs.

RISK	WEIGHTS / RELEVANCE OF RISK TO LENDER: 0 - not relevant, 0,5 - medium relevance, 1 -		RED FLAG (enter "1" for YES or	LAG PRESENCE OF RISK					RISK RATING		
SOURCE	no EPC	EPC - Guara nteed	EPC - Shar ed	Cust	"0" for NO)	Indicator	Selection	Description	Risk lev	el	risk level)
Low quality of initial savings assessment	1					What is the source of the energy saving assessment?	Independent energy auditor	Usually these assessments are of good quality; in particular those which are certified or follow standardised methodologies.	low	0	0
Low quality of initial savings assessment	1					What is the underlying model for the profitability assessment?	No saving assessment Not stated End-user Technology provider Independent energy au ESCO	avai This is fine for simple interventions with short payback periods. Projects which are the period should consider different scenarios in a monthly or quarterly resolution.	medium	5	5
Low quality of initial savings assessment	1					Is a risk analysis for cash flows available?	No	It is a good practice to consider variations in the framework conditions and to conduct stress tests on assumptions (e.g. on production quantities and energy prices).	high	10	10

Figure 7: A possible EE risk assessment framework for banks

(Source: Authors)

3 Energy efficiency risk mitigation

The previous chapters presented risks that can go along with energy efficiency (EE) projects and which, depending on the financing construct, may be borne by EE financers. Alongside this previous presentation, possible actions to mitigate such risks were already discussed to an extent. In the present chapter, risk mitigation approaches are discussed in more detail. The focus here is on **risk mitigation solutions that are particularly relevant for industrial EE measures in Brazil**, for example because related initiatives are already active or are currently being discussed. Thus, all risk mitigation measures discussed in this chapter are of **immediate relevance to Brazilian FIs:** These mechanisms can be directly accessed and applied in on-going EE financing schemes, or FIs can contribute to these schemes' development and thus make such risk mitigation measures available in Brazil in relatively short time. The presented content builds on interviews and workshops conducted with Brazilian FIs regarding their EE risk mitigation priorities.

The risk mitigation measures that are discussed in this report are summarized in Table 3. Broadly, these measures can be classified into the following categories²⁴, according to the way in which they affect the presence of EE risks for the financier:

- **Removing the risk source:** Specific risk-bearing elements of a project can be removed or substituted by lenders or borrowers of EE financing to improve the project's overall risk profile. Such risk-bearing elements can consist in project developers with low capacity or a lack of required experience, inadequate technologies or poor quality equipment, or misaligned incentives.
- **Decreasing the risk likelihood:** The probability of risk materialization can be reduced through precautionary measures. Such measures can consist in fostering best practices for Measurement and Verification or in ensuring adequate maintenance of equipment through expert third parties.
- Sharing the risk: It is not always possible to remove the risk source or to change the likelihood of risk materialization. Likewise, relevant risks may remain even after risk elements have been removed or risk likelihoods have been decreased. In either of these cases, risk-sharing mechanisms such as insurance or guarantee funds can help to make an EE investment project bankable.

None of the risk mitigation measures discussed in this report should be understood as a 'silver bullet' to overcome EE financing risks. Rather, in order to manage risks adequately, **risk mitigation measures must be combined and embedded in an FI's overall process** for EE credit risk appraisal, always keeping an eye on transaction costs. Notably, the **interrelation between EE risk mitigation and transaction costs** can go in both directions: On the one hand, risk mitigation can imply an extra effort on lenders' and financers' sides and hence imply an increase in transaction costs (e.g. when additional documents must be provided and assessed). On the other hand, many risk mitigation measures do in fact reduce transaction costs of EE credit appraisal at the same time, as they provide a clear and restricted framework within which a wider group of bank staff can act with confidence (e.g. through lists of eligible EE equipment, accreditation of suppliers, standardization of contracts).

The limited progress achieved so far by the Brazilian market regarding the reduction of EE risk and risk perception calls for a strong effort to foster risk mitigation measures. This must include **awareness** raising regarding the positive impact of EE risk mitigation measures, and fostering a discussion how Brazilian FIs can adopt them. To this end, the present chapter aims to mobilize FI's business development departments and credit and risk teams to combine existing financial products with risk mitigation measures, in order to eventually capture EE opportunities by industrial clients.

²⁴ Naturally, there will be some overlaps, i.e. some risk mitigation measures may fall in several of these categories at the same time.

Table 3: EE risk mitigation measures that can be adopted/developed by Brazilian banks (Source: Authors)

Measure	How Brazilian banks can adopt or develop such measures
Removing the	risk source
Accredi- tation and certification of equipment and suppliers	 Utilize existing definitions of cost-effective eligible EE equipment from IDB's Energy Savings Insurance scheme to develop a comprehensive list of accredited EE equipment, following the example of EBRD's technology catalogue. Develop eligibility criteria for EE credit lines, including criteria on the borrower, the equipment, and energy savings documentation; when doing so, build on the expertise of entities specialized in technical standardization such as INMETRO, PROCEL and ABNT, and on that of BNDES and Brazilian regional banks who regularly work with 'eligibility lists' for special credit lines. Build on existing market experience (e.g. by technology providers) to establish a network of accredited EE service and equipment providers.
ESCOs and EPCs: Quality assurance and standardi- zation	 Enter into partnership with ABESCO (qualiESCO) and ABNT to (further) develop quality criteria and labels for Energy Service Companies and align such criteria with lenders' information needs. Define minimum requirements for Energy Performance Contracts (EPC) and work with ESCOs that have experience with standardized EPCs; existing work of the IDB Energy Savings Insurance scheme (minimum EPC criteria) can be deployed for this purpose.
Reducing the r	isk likelihood
Off balance- sheet financing and SPVs	 Foster schemes that deploy Special Purpose Vehicles (SPVs) to circumvent financing barriers related to ESCOs' and end-users' balance-sheets. Learn with and build on CNI, ABRACE and the World Bank's off balance-sheet initiative 'Sociedade de Eficiencia Energetica', which focusses on the implementation of combustion and heat recovery EE projects in industrial corporates.
Measurement and Verification (M&V)	 Develop manuals on self-measurement for clients and project developers in partnership with SENAI. Deploy and foster integrated solutions (collaborations between large equipment/technology providers and local technical partners) to ensure adequate M&V of achieved energy savings on a large scale. Engage specialized companies or certified professionals in the M&V process and build on the work of third-parties, in particular ABNT, to ensure high quality M&V.
Sharing the ris	k
Insurance coverage	• Learn from and build on IDB's Energy Savings Insurance (ESI) scheme, including on the non-financial measures developed under the ESI scheme, such as the definition of eligible technologies and methodologies to assess EPC providers and projects.
Guarantee mechanisms	 Learn from/build on IDB's previous Energy Efficiency Guarantee Mechanism (EEGM). Foster the development of a National Energy Efficiency Guarantee Fund.

Feedback from workshop participants:

Most risk mitigation mechanisms need to be implemented as a **collective initiative**, i.e. fostered and funded by third parties such as multilateral organizations. This includes lists of eligible technologies, an online tool to aggregate EE service providers, or certification provided by the Brazilian National Standards Organization (ABNT).

It is clear that transaction costs could be reduced by the adoption of a **standardized list of technologies**. However, there is lack of references to build on.

An off-balance sheet model or "**super-ESCO**" (to be established by some equipment and services providers) could aggregate several EE projects and have direct access to credit lines provided by banks.

Banks are not really aware on the use of **technical assistance** as a risk mitigation measure. SEBRAE/SENAI could be key partners to provide technical assistance to clients, since banks do not have specialized staff to be in charge of that. Banks would like to see articles and case studies with evidence on how technical assistance can contribute to de-risking operations.

For clients with a good credit score, adequate M&V plans or the involvement of certified professionals may lead to **reduced collateral requirements**. For high-risk clients it is unlikely that banks will provide more flexible collateral requirements, even for good EE projects. BNDES has a product for SMEs with EE measures as eligible items. For the purpose of EE risk mitigation, BNDES asks for specific project characteristics and documentation, including energy audits and M&V in line with international standards (IPMVP).

4.1 Accreditation and certification

A focus on accredited equipment/technology and/or certified manufacturers/suppliers/service providers can contribute to the reduction of EE financing risks. More specifically, technical performance risks as well as other risks that may realize in relation to an EE measure (e.g. work process interruptions) can be reduced through such a focus, thus implying a positive impact on the expected financial performance of the energy end-user. In cases where this end-user is also the borrower of EE financing, respective credit risk borne by the FI can be reduced accordingly. Further, if only high quality equipment from respectable suppliers is financed, reputational risks on the side of FIs that engage in EE financing can be reduced. Such reputational risk may materialize if FIs finance non-performing low quality technologies under a green loan scheme.

In terms of **internal FI processes**, accreditation and certification schemes can involve overviews on manufacturers, suppliers or service providers that have been pre-approved for financing, or white lists of eligible EE equipment, as discussed in the following:

Overviews on pre-approved manufacturers, suppliers or service providers can entail minimum requirements on legal compliance, technical capacity, or experience in the market. Such overviews can provide an indication on the entity's likely success in developing or implementing an EE project from a financial and technical perspective. Similarly, if possible within the FI's general policies, FIs may decide to work with an exclusive network of accredited manufacturers, suppliers, or service providers, potentially based on long-term financing agreements. Such long-term relationships may be accompanied by on-going training to ensure the entities are well informed about the FIs' respective financing terms and criteria.

Setting up white lists of eligible equipment requires a good understanding of the underlying technologies, e.g. regarding cost-effectiveness, performance, or market demand in different industrial sectors and availability of the technology in the country. Since FIs typically do not have such knowledge in-house, they need to collaborate with external technical experts to establish such lists, or draw on lists that have been set up by third parties. White lists of eligible technologies typically contain EE project types and technologies that are "standard" in the sense that they are tested and proven, are implemented frequently, and are cross-sector, i.e. they are implemented in industries or buildings of various sectors and types. Such lists of standard technologies can further be narrowed down to best in class technologies, i.e. specific products within a category of EE technologies that perform better than average.

The mentioned lists and overviews can have the **additional benefit of reducing transaction costs** on the side of FIs: They provide a clear indication to FI staff regarding the types of equipment or projects that can be financed, and hence the effort related to appraising individual projects from a technical perspective can be reduced, which is particularly relevant for smaller investment projects.

A **European example for EE related accreditation schemes** is the European Bank for Reconstruction and Development's (EBRD) Technology Catalogue (Box 8). The catalogue is an online technology selector in which high-performing EE products within groups of standard EE measures are listed. EBRD experts according to minimum performance criteria have verified the performance of all technologies listed in the catalogue. Local FIs that draw on EBRD funding for EE financing can use the Technology Catalogue as guidance on eligible technologies. Thus, risks as well as transaction costs on the side of local FIs can be decreased: The identification of (eligible) EE projects follows a clear approach and the risk of financing underperforming technologies or projects is minimized through the performance criteria applied by the Technology Catalogue.

Box 8: The EBRD's Technology Catalogue

(Source: EBRD Technology Catalogue)

The **European Bank for Reconstruction and Development (EBRD)** has developed an online Technology Catalogue to foster EE investments and financing through EBRD funded credit lines. The Catalogue serves as **technology-selector for various EE measures**: Windows, doors, insulation, boilers, heat pumps, cogeneration, photovoltaics, batteries, cooling, motors and pumps, process technologies, transport, domestic appliances, and lighting.

The technology catalogue combines several **key-characteristics**:

- Online shopping-style platform
- List of best-in-class EE technologies from around the world
- Performance and availability of technologies is verified by a network of experts
- Listed technologies are eligible for EBRD's Green Economy Financing Facility via local FIs

The main objective of the Technology Catalogue is to help vendors of green technologies to connect with businesses and homeowners. Yet, the platform also fosters the establishment of **streamlined processes for EE loan appraisal** and thus the reduction of transaction processing times, particularly for small-scale investments commonly implemented by SMEs.

The Technology Catalogue builds trust in listed technologies and thus fosters investing in and financing of related EE projects. The **verification process** works as follows:

- 1. Vendors apply for having their technologies registered in the Catalogue.
- Experts hired by EBRD verify the performance and availability of these technologies. Minimum Performance Criteria require that listed technologies induce an energy performance improvement of at least 20% beyond baseline technologies in a given country. Thus, the Catalogue only promotes the higher performing segment of technologies on local markets.
- 3. Performance requirements for technologies and vendors are reviewed on a regular basis and adjusted to reflect market developments,

	Europe to allocations	n Rank ne finatymu	PRODUCT CATALOGUE EBRD		Hello, log in Vendor account Q
ATEGORY		TECHNOLOGY (Browse products that are assessed	CATALOGUE I as eligible by EBRD, per country. Read	more	
Windows & Doors		Quick search: Country	✓ Technology	✓ Manufacturer	🖌 🔍 Search
nsulation	~				
Boilers	÷				
Heat pumps	-		-		
Power & Cogeneration	~			CED	50
Cooling	~	<u>[[i]</u>		CODE	
Notors & Pumps	÷			ALC: NOT	
rocess Technologies	~			MOTOPS & PLIMPS	11- 23
ransport	~			Moroks & POMPS	A AL
Oomestic Appliances	~	Res a		1	- AAF
ighting	~	1			

Figure 8: User-interface of EBRD's Technology Catalogue

In **Brazil**, currently no catalogue such as that of the EBRD is available. However, Brazilian FIs can benefit from some existing resources, previous experiences, and enablers in the national context, and can build on these to further develop accreditation schemes for EE financing:

• The IDB Energy Savings Insurance (ESI) Program provides valuable experience regarding the predefinition of eligible technologies for specific EE financing mechanism: Regional development banks involved in the ESI program's pilot phase identified (with support from external consultants) technologies with high potential demand, high cost-effectiveness (according to the main energy-intensive industrial processes in the region) and required financial amount compatible with the typical credit lines available (see Box 9). This experience is relevant since it is a typical step that could be followed also for the accreditation of manufactures and suppliers. In the EBRD example, the identification of cost-effective technologies with a relevant potential for the European context was decisive to the development of the Catalogue. In Brazil, a similar assessment is required. In the case of banks with a geographical focus (e.g. some mid-sized commercial banks and regional development banks); this assessment may concentrate on the most relevant industrial segments in each state or region.

Box 9: Eligible technologies under IDB's Energy Savings Insurance scheme

The Energy Savings Insurance (ESI) Program is an initiative led by IDB to foster EE financing by providing an insurance scheme as a risk-sharing tool. It selected seven technologies to be eligible for credit lines provided by the participating FIs. These technologies were selected according to the cost-effectiveness for the industry and the business opportunity for banks:

- Boilers and steam generators
- Co-generation systems
- Compressed air systems
- Diamond multi-wire saws
- Highly efficient motors
- Solar heaters
- Refrigeration systems

Further information on IDB's ESI scheme is available in Section 4.5.

 ABNT is one of the best-positioned agents to support FIs in the assessment of projects and providers. Besides its experience in establishing standards for industrial equipment and processes, ABNT also provides on-demand certification services to assess whether industrial projects comply with best practices and achieve expected results. In 2017, ABNT developed a methodology to accredit providers under the above-mentioned IDB Energy Savings Insurance (ESI) Program. Table 4 presents the eligibility criteria that were defined by ABNT in this context.

Table 4: ABNT's accreditation criteria for IDB's ESI scheme

(Source: ABNT)

1) Provider's documents

- Company's legal registration, annual income tax, proof of address
- Registry certification of the technician in charge
- Technical term of responsibility of management and those involved in the projects
- Provider's legal representative documents: proof of address and personal documents

2) Provider's financial capacity documents

- Amount of provider's own resources to finance projects
- Cash flow capacity to meet immediate net collateral
- Minimum number of years with profits

3) Documents on technical experience and infrastructure

- List of last 10 projects developed, information on company's history
- List of ongoing projects and contract values
- Personnel involved in projects and at least two documental evidences by professional
- Technical term of responsibility of professionals involved in the projects
- Main office, transportation, tools and measurement teams
- Grievance mechanism
- Products certification complying with official Brazilian and/or international regulation

4) Equipment's technical capacity documents:

- Technical specification of used components and equipment
- User Guide, containing instructions of equipment use
- Product certification, in case of compulsory certifications, issued by Certifying Bodies
- Other necessary evidence to demonstrate compliance with regulations on the equipment
- Label of the Brazilian Labeling Program (PBE), issued by INMETRO
- Label stating A-Classification for energy efficiency

- INMETRO and PROCEL are additional specialized entities that could act as partners for the development of accreditation schemes in Brazil, in particular regarding EE equipment. PROCEL has an important role of standardization and evaluation of equipment performance, providing a label that is widely accepted by market players. Similarly, INMETRO, the National Institute of Metrology Standardization and Industrial Quality, already provides product-labelling schemes. Such work could be replicated and extended to EE equipment relevant in the Brazilian industry.
- **BNDES and Brazilian regional development banks** regularly develop and communicate lists of eligible financing items in relation to different credit lines. Besides defining specific machinery or types of interventions, these banks also set some minimum eligibility criteria, such as the minimum percentage of domestically produced components in products that are financed under credit lines for equipment purchasing. A similar rationale and the associated eligibility assessment process can be extended to the accreditation of EE technologies, manufactures and equipment providers.
- Another example in the Brazilian market is the partnership between FIs and large equipment providers that perform integrated solutions. One of these large providers, Schneider Electric, has a network of local partners that are specialized in providing services to a range of industries. Due to size and large client portfolios, large providers have the capacity and interest to provide large-scale technical assistance to local providers. The local partners, called 'integrators', are responsible for the development and execution of projects, which in turn are composed of the large manufacturers' technologies. Besides providing technical assistance to integrators, large manufacturers require that minimum performance standards are kept, and hence that integrators have the capacity to reduce performance risks to the final client. Figure 9 illustrates this scheme.

Brazilian FIs could build upon these solutions such that they can incorporate measures to existing financial products. Since equipment, technologies and providers are previously vetted, transaction costs for the FI will be reduced. Moreover, the performance risks associated with the project commissioning and equipment performance will be better managed.



Figure 9: Partnerships between large technology providers and local EE integrators *(Source: Authors)*

4.2 Energy Performance Contracts

Energy Performance Contracts (EPC) and the associated guarantees on energy savings, as offered by **Energy Service Companies (ESCOs)**, constitute a risk mitigation mechanism from the end-users' point of view, and hence from the point of view of the institution that lends to such end-users. At the same time, EPCs and ESCOs can have specific shortcomings and risks attached to them, as lined out in the previous chapter on EE risks. Such risks can be mitigated to an extent through measures such as **careful selection of the ESCO**, e.g. according to quality guidelines; use of **standardized Energy Performance Contracts**; or specific **financing constructs** that shift FIs attention away from the creditworthiness of the ESCO and to the end-user instead. These risks mitigation approaches are detailed in the following.

Quality assurance for ESCOs and Energy Performance Contracts

Mistrust in the quality of energy services can be a key obstacle to end-user demand and financing of EPCs.²⁵ Schemes that aim to certify the quality of energy services can reduce this mistrust. Such schemes can involve **codes of conduct** that ESCOs voluntarily adhere to, or consist in **certification**, **accreditation**, **labelling and qualification schemes for ESCOs**.²⁶ Box 10Box 10 illustrates respective outcomes of the European "Transparense" initiative, which was set-up to increase the transparency and trustworthiness of European EPC markets.²⁷ Building on such examples as well as the existing experience in Brazil could foster the level of trust in the Brazilian EPC and ESCO market.

Another measure to assure quality and increase trust in the end-user–ESCO–financier nexus is the involvement of an **EPC project facilitator**. Entities such as energy consultancy companies can be involved throughout the project development life cycle and thus ensure a high degree of quality and understanding between all involved parties. EPC facilitators can be involved in the financial as well as in the technical development of a project, can provide trainings to end-user or ESCO staff, help with the selection of a suitable ESCO or EPC model, and may be involved in EPC contract design. Although EPC facilitators' main responsibility relates to the intermediation between end-user and ESCOs, their involvement can mitigate risks from a financier's perspective as well.

²⁵ For the European market, a study from 2013 revealed that 44% of ESCOs see such mistrust as one of the major barriers (Garnier 2013, Transparense 2015).

²⁶ Transparense 2015

²⁷ A comprehensive review of different quality assurance schemes across Europe is also provided in QualitEE 2018, a report that has been developed as part of the European project "QualitEE" that aims to develop quality certification frameworks for EE services.

Box 10: European example of a quality assurance initiative for ESCOs and EPCs

The **Transparense project** (www.transparense.eu) is a European initiative that was active from 2013 to 2015. The goal of the Transparense project was to **help increase the transparency and trustworthiness of Energy Performance Contracting markets throughout Europe**. Among the project outcomes are the "European Code of Conduct for Energy Performance Contracting" and the definition of quality criteria for EPC providers (see Table 5 below).

The **European Code of Conduct for Energy Performance Contracting** was developed in 2014 (Transparense 2014). It entails a set of values and principles that are considered fundamental for the successful, professional and transparent implementation of EPC projects in Europe. It constitutes a **voluntary commitment for EPC providers** and is not legally binding.

The EPC Code of Conduct consists of the following nine guiding principles:

- 1. The EPC provider delivers economically efficient savings
- 2. The EPC provider takes over the performance risks
- 3. Savings are guaranteed by the EPC provider and determined by M&V
- 4. The EPC provider supports long-term use of energy management
- 5. The relationship between the EPC provider and the Client is long-term, fair and transparent
- 6. All steps in the process of the EPC project are conducted lawfully and with integrity
- 7. The EPC provider supports the Client in financing of EPC project
- 8. The EPC provider ensures qualified staff for EPC project implementation
- 9. The EPC provider focuses on high quality and care in all phases of project implementation

Table 5: Quality criteria for energy services and providers in the Transparense Project(Source: Transparense 2015)

Quality criteria for providers:	Quality criteria for energy services
 Educated and experienced staff References Duration of market presence Portfolio of services Coverage of the portfolio of services Market appearance Other quality assurance instruments 	 Adequacy analysis Service level for the implementation of technical measures Savings guarantee Verification of services Conservation of value and maintenance Communication between provider and client Adherence of user comfort User information and motivation Transparency and completeness of contractual stipulations

In **Brazil**, the Association of ESCOs (ABESCO) and the Association of Technical Standards (ABNT) are well positioned to be partners in the development of criteria or labels for the most capable ESCOs. In 2011, ABESCO developed the **qualiESCO label** in partnership with the German Agency for International Cooperation. This initiative resulted in 24 qualified ESCOs. The certification under this label follows the process summarized in Figure 10, which involves three groups of evaluation criteria: (1) The ESCO's project records, including information on energy audits and project management; (2) technical capacity of project staff; and (3) reports on projects' results.

In 2019, ABESCO is building a new phase to attract more ESCOs to apply. The association designed an online platform for applications' submission (https://qualiesco.abesco.com.br). The joint efforts with Financial Institutions interested in financing EPCs and ESCOs may lead to further useful results.





Standardized Energy Performance Contracts

Standardized contractual arrangements enable FIs to reduce transaction costs and manage risks. Since most FIs do not have specialized staff to assess the risks related to individual Energy Performance Contracts in detail, the standardized design of such contracts is all the more important. Key elements of EPC contracts, which must naturally be considered in any standardized approach, are the following:

- Definition of responsibilities of contractual parties (end-user and ESCO)
- Description of third-parties (if relevant) and respectively definition of their responsibilities
- Methods and assumptions underlying the Measurement & Verification approach, and hence the approach towards the determination of realized energy savings on which payment streams between end-user and ESCO are based
- Arbitration process to deal with any disputes between end-user and ESCO

In **Brazil**, further developments are required to foster the usage, and in this context the standardization, of Energy Performance Contracts. Currently, only a small number of ESCOs actually work with EPCs when they provide energy efficiency services. Most of the time, their services do not include a savings guarantee (hence no EPC contract).

IDB has proposed a standardized EPC within the Energy Savings Insurance Program in Brazil. Besides typical terms and clauses applicable to agreements between two parties under the national law, the contracts have specific contents on the dynamics of the EE project. This content is summarized in Table 6. It provides a minimum framework on which other Brazilian banks, ESCOs, and clients could build to improve their EPCs.

Table 6: Content of an Energy Performance Contract under IDB's ESI scheme

(Source: Authors, based on IDB information)

Торіс	Content
Main definitions	Definitions of terms
	Description of parties and their roles (ESCO and end-user)
Time period	Starting and ending date of the contract:
	• The contract shall be applicable when the following conditions are met: (i) credit approval;
	(ii) Certification of the project and EPC provider; (iii) Approval of associated financial
	schemes (e.g. insurance)
	The contract shall be applicable until all obligations are performed by the parties
Project phases and	Description of the duties of each part regarding their commitment to achieve better
requirements	performance. It includes requirements on each project phase:
	Diagnostic Phase
	Implementation Phase
	 Monitoring and Verification (M&V) phase
	It also includes requirements on preventive and corrective maintenance.
Energy Savings	Detailed description of requirements regarding the definition of energy consumption baseline
Measurement	and estimated energy performance
Payment	Description of payment amount and method
	Applicable penalties in case of delays
Waste management	Dispose of project waste in a responsible manner, in compliance with environmental law
Technical guarantee	Coverage term and procedures to be followed in case of equipment failure
Changes and deviations	Define ESCO's duties in case of changing operational conditions
	Energy user's duties in case of changes (e.g. those that result in relevant decrease of
	production)
Mediation and arbitration	Description for procedures to be followed in case of controversies between the parties
Additional compliance	Definition of parties' responsibilities regarding labor, fiscal and environmental law
requirements	

To advance the EPC market further, Brazilian FIs should work in the following directions:

- Build **business cases with those ESCOs** that already have a track record in the implementation of Energy Performance Contracts;
- Define **minimum requirements for ESCOs and EPCs and reflect these in standardized contracts**, taking into account the key contents highlighted above.

Specific financing constructs

The majority of Brazilian ESCOs are small companies with limited capacity to obtain financing for projects, mainly due to the limited amount of real assets they can offer as collateral, but also because the ESCO / EPC concept is rather new in Brazil and most ESCOs have a short history of implementing EPCs. To overcome the obstacle of ESCO's limited creditworthiness, the specific construct of Energy Performance Contracts can be deployed to shift some or all of the credit risk to the end-user of the EE measure, and hence to an entity that (potentially) satisfies FIs' lending criteria.

One way to achieve the attribution of credit risk to the end-user is simply by financing this entity directly. In relation to EPCs, this would usually be done through the **Guaranteed Savings Model**, where the end-user invests in energy efficiency and obtains respective financing from the FI, and the ESCO is only a third party which is contracted for the development, implementation, and operation of the measure, and which guarantees the savings towards the end-user. In this case, the ESCO's creditworthiness is only indirectly relevant to the FI, namely as it determines the reliability of the savings guarantee provided towards the end-user (i.e. the borrower).

Another way to reduce lending risk – even if the ESCO itself is the borrower — involves **cession of receivables**. ESCO's that implement an EE project under a **Shared Savings EPC model** (i.e. a model in which the ESCO and not the end-user is the investor and borrower) can sell their claims towards the end-user (i.e. the future energy cost savings share which they have a right to receive) to a Financial Institution or agree that the FI will obtain these rights in case the ESCO defaults. In the former case, this cession of receivables will substitute the credit financing (pure forfeiting); in the latter case, the cession serves as additional security to support the credit financing. To avoid that the FI takes on the performance risk of the EE measure, the amounts to be paid by the end-user must be fixed.²⁸

4.3 Off balance-sheet financing and Special Purpose Vehicles

Taking a conventional approach to EE financing (i.e. providing a loan to an ESCO or an energy end-user) can be problematic in view of **restrictions on a borrower's balance sheet.** On the one hand, borrowers such as ESCOs or energy end-users that take a loan to finance an EE project increase their debt level, and thus may face an increased cost of capital or be confronted with internal leverage limitations. Put differently, EE investments are subject to internal competition for capital, and often are assigned low priority when compared to more return-oriented investments. FIs, on the other hand, face restrictions to provide financing to borrowers with low credit-worthiness, such as ESCOs or end-users with weak balance sheets.

Off-balance sheet financing is thus regularly mentioned as one way to overcome EE financing barriers: Financial solutions that enable ESCOs and end-users to obtain EE financing without putting additional pressure on their company's balance sheet can increase the attractiveness of EE investments as the competition with other investment plans is alleviated. Further, solutions that disentangle an EE project's risk and return structure from the potentially weak balance sheet of the EE investor (ESCO or end-user) can improve the attractiveness of EE financing on FIs' side.

Special Purpose Vehicles (SPVs) are one way to organize off balance-sheet financing solutions. SPVs are stand-alone legal entities with an independent balance sheet that are established to satisfy a narrowly defined purpose over a (typically) restricted period. Notably, SPVs are 'bankruptcy-remote entities', i.e. their obligations are restricted to those directly related to the SPV's purpose, and hence the SPV is not affected in case of insolvency of the parent company (e.g. an ESCO or end-user which established the SPV). Thus, the credit risk associated to the SPV is isolated from the credit risk of the parent company, and hence financial terms offered to the SPV can be more attractive than those that may be offered to the parent company.

ESCOs or EE end-users can establish SPVs for the implementation of an EE project without carrying the associated assets and liabilities on their own balance sheet. The SPV develops, operates and owns the EE project, and arranges required capital (debt provided to the SPV; or equity, e.g. provided by the parent). The SPV parent, in turn, pays a fee to the SPV for the services provided in relation to the EE project. Through this structure, and ESCO or EE end-user (e.g. an industrial company) can **transform capital expenditure (CAPEX) for EE into operational expenditure (OPEX) for EE**, and hence avoid competition with other investment plans. It should be noted that SPVs are complex structures with specific costs attached to their management, and hence have limited relevance for single companies that implement an individual EE project of rather small scale.

In **Brazil** (as in many other countries), FIs often highlight the low creditworthiness of entities such as ESCOs or SME end-users as a major barrier to the provision of (affordable) financing for EE investments. In fact, the specific risk/return structure of the EE project itself rarely plays a role vis-à-vis the superior

²⁸ See e.g. Grazer Energieagentur 2008

importance of company risk. In view of this, and in view of the required scale to make an SPV attractive for FIs, one or several SPVs that aggregate funding to service several EE projects could present a relevant solution in Brazil. Groups of industrial companies or ESCOs could enter into an arrangement for the implementation of an SPV, which would follow these parent companies' common goal of reducing their energy intensity (or their clients' energy intensity in the case of ESCOs). Such a partnership in the creation of an SPV could be particularly interesting for larger industrial companies with a high energy cost share, such as those active in the extractive industry. Figure 11 illustrates the basic possible set-up of such an SPV.





Currently, as described in more detail in Carbon Trust (2017), there is one consolidated SPV initiative under way in Brazil, the **Sociedade de Eficiencia Energetica** or SEE: The National Confederation of Industry (CNI), the Association of Large Energy Consumers (ABRACE), and the World Bank collaborated with the objective of establishing an SPV for the implementation of energy efficiency projects. Under this 'Off Balance Sheet Initiative', these institutions conducted assessments on the economic feasibility of such an SPV and found that there would be sufficient demand from potential SPV parent companies, in particular regarding the implementation of combustion and heat recovery projects. The general set-up of this SPV would be such that member industrial corporates would contribute to the SPV's balance sheet through assets and annual fees. The SPV would then obtain additional financing for the purpose of implementing energy efficiency measures in the members' facilities, potentially drawing on dedicated EE credit lines or green bonds. At the date of this report, the development of the Sociedade de Eficiencia Energetica was in its final steps: A relevant project pipeline has been identified and discussed with industrial clients, administrative details yet had to be clarified.

4.4 Measurement & Verification of energy savings

Gaining insights into the realized benefits from an energy efficiency project requires that energy savings are regularly measured and verified after implementation of the project. These insights are particularly relevant in context of **Energy Performance Contracts, where the payments between the ESCO and the end-user are dependent on realized savings**. Agreeing on a Measurement and Verification (M&V) plan however can go along with substantial transaction costs and uncertainties on the side of ESCOs and end-users, and hence hamper the implementation as well a quality of Energy Performance Contracts. Thus, it is recommended that FIs foster the application of standardized M&V procedures and thus contribute to the reduction of actual and perceived risks and the establishment of trust on all sides (ESCO, end-user, FI).

The International Performance Measurement and Verification Protocol (IPMVP) provides an overview on best practice for measuring and verifying energy savings (see Box 3 in the previous chapter). The IPMVP does not prescribe contractual terms for Energy Performance Contracts, but provides some guidance in this respect. It aims to support ESCOs and end-users to select the M&V approach that best matches a project's costs and savings magnitude, technology specific requirements, and risk allocation between the end-user and the ESCO. The Efficiency Valuation Organization (EVO) provides IPMVP/M&V certification to qualified energy professionals. Candidates who have the required educational background and work experience can participate in a training and obtain the title "Certified Measurement and Verification Professional (CPMVP)" after passing the CMVP exam.

In the **Brazilian national context**, FIs can collaborate with various enablers to foster the implementation of high quality M&V practices in projects that they finance:

- Develop M&V manuals for borrowers and/or project developers and have them implemented in collaboration with entities such as SENAI: In collaboration with technical experts, FIs can develop manuals to support borrowers on their individual M&V approach. Such manuals can entail advice on cost-efficient ways to self-measure realized energy savings, but may also detail the specific approach required by the FI to offer financing. It should be noted, however, that SMEs will often lack the required capacity to thoroughly follow such manuals. Thus, it is recommended that technically oriented third-parties which already work with such SME industrial customer segments are involved (e.g. SENAI, the Serviço Nacional de Aprendizagem Industrial) in order to support SMEs in the implementation of adequate M&V approaches.
- Foster adequate M&V through integrated solutions with large equipment provides/ manufacturers such as Schneider Electric: In Section 4.1, we highlighted the potential benefits from collaborations between FIs and large equipment providers / manufacturers that offer integrated solutions, such as Schneider Electric. Such integrated solutions, in which local partners of large equipment providers/manufacturers offer services to a range of industries, can entail M&V practices. Since the responsibilities of these local partners include project commissioning, and since they are centrally trained by the provider/manufacturer, such local partners are in a good place to also perform adequate Measurement and Verification of achieved energy savings.
- Engage specialized companies and/or certified professionals in M&V: Besides installing EE projects, some ESCOs are capable to offer M&V services (Table 7 provides an overview of ABESCO members with certified M&V professionals). FIs can require clients to purchase such services from qualified ESCOs, and can request that M&V is implemented according to international standards. Further, M&V services can be provided by independent consultants and professionals associated to energy services providers other than ESCOs.

Among the firms that provide energy services, there are two main groups: Those focused on the implementation of solar PV systems and those that provide EE services. Some companies provide both services. In Brazil, as of June 2019, there were 213 certified CMVP/ IPMVP certified energy professionals, with some of them in training to be certified in the next months. These 213 professionals were distributed across nearly 150 companies, of which 27 are associated to ABESCO, the Brazilian Association of ESCOs (see Figure 12 for their geographical distribution).²⁹ ABESCO's website³⁰ also facilitates information gathering on the services provided by its members.

Table 7: ABESCO members with certified M&V professionals

(Source: Authors, based on information from ABESCO and the Association of Energy Engineers)

List of ABESCO members with CMVP professionals (as of June 2019)		
3E Engenharia em Eficiência Energética Ltda.	Eletron Energia	
5EC Engenharia Ltda	Energias Assessoria em Sistemas de Energia Ltda.	
Ação Engenharia	Engie Brasil Serviços de Energia	
ACE Energia Ltda.	GreenYellow	
Acxxus Engenharia de Medição Ltda	Indústria e Comércio Fox de Reciclagem e Proteção	
AGES	ao Clima	
АМВІО	INSTALWATT	
Anima Projetos	KMR Energia e Meio Ambiente	
BGF Consultoria em Engenharia Ltda.	Megaenergia	
CPFL Eficiência Energética S.A.	Perfil Energia Consultoria em Energia Elétrica Ltda.	
CPFL Paulista	Publikimagem Projetos e Marketing Ltda	
CPFL Piratininga	Sage	
EDP	Vitalux – Ecoativa	
Efficientia	WEG	

Figure 12: Geographical distribution of IPMVP professionals in Brazil

(Source: Authors, based on information from the Association of Energy Engineers)



 ²⁹ The full list of certified professionals is available in a database provided by EVO and the Association of Energy Engineers: <u>http://portal.aeecenter.org/custom/cpdirectory/index.cfm</u>
 ³⁰ <u>http://www.abesco.com.br/pt/associados/</u>

Build on the work of third-parties, in particular ABNT: ABNT can directly be contracted (e.g. by FIs or by an FI's clients) to perform M&V and thus to ensure that the quality of EE projects is maintained during project operation, that realized energy savings are reported in line with predefined assumptions, and that such savings are verified according to good practices. Further, ABNT's existing standards, including with respect to M&V, can be leveraged for individual use by FIs: As part of IDB's ESI Program (Section 0) and drawing on ABNT's experience for industrial projects, ABNT recently developed a methodology for energy related measurement, verification, and respective certification of projects and EPC providers. The methodology is based on ISO 50015 (ISO standard on Energy Management Systems) and two Brazilian norms which were developed by ABNT: ABNT NBR 50001 (requirements on the use of energy management systems) and ABNT NBR 50006 (principles and guidance for measuring energy performance by adopting energy baselines and energy performance indicators). ABNT's methodology encompasses several stages of the project cycle, from project design to operation. The steps outlined in Table 8 aim in particular to ensure that an adequate energy baseline is defined, reliable assumptions for the estimation of energy savings are built (e.g. on operating patterns for the EE equipment), and generally to control and ensure a high quality of the overall project. Further, a mediation process to resolve potential disputes between end-user and technology or service provider is foreseen in ABNT's approach.

Table 8: ABNT's M&V methodology under IDB's ESI scheme

1. Project Validation
1.1 Project description: Objectives and equipment
1.2 Current operation conditions: Details on limitations and equipment
1.3 Proposed operation conditions: Details on limitations and equipment
1.4. Measurement Plan Description: Method and steps to measure energy savings
1.5. Details on the investment budget: Financial resources needed for the project
1.6. Energy Performance indicator: Energy consumption baseline, estimated energy performance
1.7 Details on solid waste: Generated waste, waste management plan
1.8. Project schedule: Schedule for installation, commissioning and operation
2. Project Installation checklist
1.1. Verify the correct equipment installation and commissioning:
 Is the installed equipment the same as defined in the project?
Analysis of Installed equipment technical certifications
• Do associated devices attend to the requirements stated in the project calculations?
• Does the installation comply with applicable regulation (norms, instructions, legislation)?
1.2. Verify the installation and calibration of the monitoring system:
Calibration, calibration program and calibration reports criteria forecast
Data collection and analysis process
Results reports according to the methodology
1.3. Verify information about waste disposal:
• Check the compliance with environmental authorities' permits regarding waste collection,
transportation and disposal
3. Mediation of controversies (when applicable)
After verification, the technology provider will develop periodic reports on the use of energy and

After verification, the technology provider will develop periodic reports on the use of energy and achieved energy savings. In absence of a consensus between the technology and service provider and the end-user (the borrower) regarding the Results Report, ABNT will act as a judge

4.5 Insurance coverage for energy efficiency projects

One way to tackle the lack of confidence in energy savings from EE projects is performance insurance. Currently, energy savings insurance is still a niche product with limited availability in many markets, including in Brazil.³¹ However, **interest in such insurance products and respective offers are increasing**. International examples include the 'EE Insurance' offered by HSB/Munich Re in several European countries and in the US, or the insurance product 'EE Protect' offered by the German company b2b Protect in collaboration with (re-)insurers (Table 9). In Brazil, the only EE insurance initiative currently available is the one of AXA and the IDB ESI program, as described below.

Most EE insurance products focus **on insuring savings guarantees offered by Energy Service Companies**. That is, the ESCO holds the insurance policy and the insurer pays the ESCO in case the generated energy (cost) savings fall below the insured amount. In some cases, the payments from the insurer are made to the end-user (the ESCO's client) or an investor rather than to the ESCO itself. Such insurance products are generally connected to the following benefits: ³²

- Improved confidence on end-user's and investor's side and thus a higher likelihood for a positive investment decision
- Improved financing terms may be available to the ESCO or the end-user after shifting the technical performance risks from the ESCO (which may have a low creditworthiness) to a (renowned) insurer
- Improved balance sheet of the ESCO since the risk on a given balance sheet is shifted to the insurer and hence making provisions on the balance sheet can be avoided

EE insurance offers are not limited to specific EE projects or technologies, but can range from simple measures with short payback periods, such as energy efficient lighting, to more complex projects and projects with longer payback periods, such as cogeneration of heat and power and building insulation. Naturally, the premium will depend on the complexity and reliability of the technology, and on the insured party's previous experience with such technologies. Insuring the energy savings from a specific ESCO or EPC project typically involves a review of the Energy Performance Contract through the insurer, including an analysis of the plausibility of guaranteed energy savings. Shortfalls in energy cost savings due to user behavior or energy price fluctuations are generally not covered.

Table 9: International examples of energy savings insurance products

(Source: Authors, based on mentioned links)

Energy Efficiency Insurance HSB Engineering Insurance / MunichRE, UK / Germany www.munichre.com	 UK, Europe, and internationally Energy savings insurance provided to: Investors in energy conservation measures, ESCOs, and those financing energy savings projects Coverage: EE material damage/breakdown, revenue loss from EPCs due to equipment damage, shortfall in energy savings relative to insured amount Policy term: Up to five years
Energy Efficiency Protect b2b Protect GmbH / Hannover RE, Germany www.klimaprotect.de	 Insured party: ESCO that offers savings guarantees Project specific insurance: Case-by-case evaluation of EE project; suitable for projects with different measures and savings volumes > 1mio EUR Framework insurance coverage: Applied to a number of similar (often rather small) projects that are implemented by a single ESCO Savings shortfalls paid directly to end-user / investor, not to ESCO

³¹ However, in absence of dedicated EE insurance product, any ESCO or project developer could contract a standard surety coverage. ³² See e.g. Tatjen 2016, HSB / MunichRE.

As mentioned above, there is no established EE insurance product available in **Brazil** currently. However, in 2016, IDB initiated the **Energy Savings Insurance (ESI) Program in Brazil**. The program was previously established in other countries, e.g. Colombia and Mexico, with the same objectives: Foster EE financing by providing an insurance scheme that covers end-users in the event that estimated energy savings are not realized, given that involved service providers (typically ESCOs) cannot compensate for the savings shortfall under (standardized) Energy Performance Contracts. In view of this overall objective, the ESI scheme aims to guarantee low-risk investments towards end-users (the borrowers) and builds upon existing insurance instruments. Participants in the ESI scheme include a large multinational insurance company (AXA) and four regional development banks. As of June 2019, the scheme was in a pilot phase and there was one EE project under assessment.

The ESI scheme works as follows (see also Figure 13):

- Basic setting: An Energy Service Contract provider (typically an ESCO) implements an EE measure in an end-user's facility, receives respective payments for these services from the end-user, and guarantees energy savings towards the end-user. The end-user enters into a financing contract with an FI, and pays the EPC provider from the borrowed amount.
- On top of this basic setting, the EPC provider obtains surety coverage from the insurance company (AXA). Thus, the ESI insurance policy will be activated and will compensate the end-user in case the first-loss guarantee from the standard EPC contract cannot be deployed to compensate the end-user for a shortfall in guaranteed energy savings.
- By backing up the Energy Performance Contract through the insurance scheme, the degree of trust in the EPC, and hence between the end-user and the EPC provider/ESCO, is increased. This fosters end-users' willingness to implement energy savings projects in collaboration with EPC providers. Further, since the EPC provider's potential inability to adhere to the guarantee is insured, the loan repayment probability of the end-user is increased. Ideally, this will positively affect commercial banks' willingness to lend to end-users under the ESI scheme.
- It should be noted that, under this scheme, it is unlikely that the EPC provider will pro-actively
 trigger the activation of the insurance. Rather, the EPC provider will do its best to compensate endusers for savings shortfalls or other damages related to the EE measure. This is because the EPC
 providers' guaranty is likely much higher than the claims; drawing on the insurance would imply a
 loss in credibility and jeopardize future insurability.
- Thus, the end-user benefits from a robust risk mitigation instrument: Energy savings are guaranteed independently of the reserve for the first loss guarantee and the maximum amount covered by the insurance, because, in case of a claim, the economic and reputational damage to the provider would be bigger than the total cost of the energy efficiency project.

In addition to the set-up described above, the ESI scheme involves several financial and non-financial components to reduce risk perception and actual risks, and hence minimize insurance costs: One such component is the use of standardized Energy Performance Contracts to mitigate risks around such contracts and reduce transaction costs. Another component is a list of eligible technical equipment, which was developed based on an initial market assessment regarding key EE technologies across sectors. Further, as presented in Section 4.4, ABNT established a certification procedure for EPC providers and projects under the ESI scheme in order to ensure that adequate M&V procedures are in place. All these financial and non-financial components help to build trust between EPC providers and end-users, as well as between end-users, financial institutions and insurance companies.

Figure 13: IDB's Energy Savings Insurance scheme³³ (Source: Adapted from IDB)



Although the ESI scheme is still in a pilot phase, a number **of lessons learned** can already be deducted from it, for the benefit of future initiatives that aim to foster EE investing and financing:

- Financial solutions should be connected to non-financial measures to reduce transaction costs, including the pre-definition of eligible technologies and methodologies to assess EPC providers and projects;
- Non-financial measures enable affordable financial measures: The non-financial components of the ESI scheme reduce risk perception and actual risk and thus keep insurance costs low;
- It is important to mitigate the credit risk for concessional and flexible credit lines: Development banks usually have more flexible financial conditions and can assess how to use their existing credit lines to finance EE projects under the ESI Program;
- Communication efforts are needed: The lack of awareness and technical capacity on the demand side (end-users) is a barrier, even if affordable financial mechanisms are available.

IDB's ESI scheme provides a current business case and illustrates opportunities to insurers and lenders. Large banks that are active both in credit and insurance markets can draw on the IDB program's experience to identify opportunities for cross-selling lending and insurance products (within the regulatory requirements). Further, development banks and insurers will have the possibility to build on the experiences made by peers that are participating in the ESI program. On the demand side, ESCOs or other project developers can see it as one way to contract standard surety coverage for their projects.

 $^{^{\}rm 33}$ TSP means 'technology solution provider', firm is the end-user.

4.6 Guarantee mechanisms for energy efficiency financing

Loan guarantee mechanisms reduce the risk of energy efficiency loans that are issued by local banks, and thus foster the development and deployment of energy efficiency credit lines. Such guarantees are increasingly offered by national governments and by International Financing Institutions. Examples include the IDB/UNDP Energy Efficiency Guarantee Mechanism in Brazil (EEGM, not active currently), the PF4EE instrument offered by the European Investment Bank and the European Commission to commercial banks in the EU, or the World Bank's Partial Risk Sharing Facility for Energy Efficiency in India. Details on these programs are contained in Table 10 below. The EEGM mechanism is also discussed in more detail on the next page, in particular with a view to lessons learned from this mechanism. Details on the set-up of the European PF4EE instrument and the functionality of its risk sharing mechanism are provided in Box 11.

Energy Efficiency Guarantee Mechanism (EEGM) IDB & UNDP	 Funding: USD 25 million available for guarantees and structuring the scheme, formed jointly by the IDB and Global Environment Facility Scope: Local (both commercial and regional development) banks in Brazil Timeline: 2012 - 2014 Target: Energy efficiency projects for commercial and industrial sectors, developed by ESCOs under performance contracts (tickets from USD 150,000 to 800,000) Additional info: IDB provided a letter of guarantee (up to seven years to expire) to share the risks with local banks. See more details in the next section.
Private Finance for Energy Efficiency (PF4EE) European Investment Bank and European Commission https://pf4ee.eib.org	 Funding: EUR 80 million for the credit risk protection, EUR 480 million EIB loan to be on-lent by local Financial Institution Scope: Partner banks across the European Union Timeline: 2014 – present Target: Energy efficiency investments in existing buildings, in industry, in public lighting and in district heating and cooling, renewables for self-consumption, cogeneration of heat and power Additional info: All PF4EE partner banks obtain technical assistance through a network of energy consultants, the 'Expert Support Facility
Partial Risk Sharing Facility for Energy Efficiency (PRSF) Small Industries Development Bank of India, Global Environment Facility, Clean Technology Fund https://prsf.sidbi.in	 Funding: USD 43 million in total, of which USD 37 million are for the risk sharing facility, and USD 6 million finance a capacity building component Scope: India, partial credit guarantee managed by SIDBI and provided to sub-financiers Timeline: 2015 - 2022 Target: Enterprises, municipalities and ESCOs investing in a wide range of energy efficiency projects Additional info: Entails technical assistance and capacity building

Table 10: International examples of guarantee mechanisms for EE financing

(Source: Authors)

Box 11: The European Investment Bank's PF4EE Instrument (Source: Authors)

Private Finance for Energy Efficiency (PF4EE) (<u>www.pf4ee.eib.org</u>) is a joint initiative between the European Investment Bank and the European Commission. The instrument aims to improve access to energy efficiency financing and to make energy efficiency lending a more sustainable activity within European financial institutions.

PF4EE operates through private sector partner banks that use the instrument to offer preferential energy efficiency financing in their national markets. Each PF4EE partner bank benefits from the instrument's three key components:

- **Risk Sharing Facility:** The risk sharing facility mitigates partner banks' credit risk when financing energy efficiency projects. The risk protection covers 80% of losses from individual loans, up to a maximum agreed amount (see Figure 14 below).
- **EIB Loan:** The EIB provides long-term financing to national partner banks to be on-lent for financing of energy efficiency investments.
- **Expert Support Facility:** The Expert Support Facility provides consultancy services to improve partner banks' understanding of the energy efficiency market, to support them in the development of loan pipelines, and to ease the appraisal of PF4EE financing requests.

The PF4EE instrument was launched in 2014 as a joint initiative between the European Investment Bank and the European Commission. The instrument is managed by the EIB and funded by the European Commission's Program for the Environment and Climate Action (LIFE Program) under the Directorate General for Climate Action.

Through the LIFE Program, the European Commission has committed EUR 80 million to fund the instrument's credit risk protection and expert support services. The EIB leverages this amount, making a minimum of EUR 480 million available in long-term financing.





Loan guarantee mechanisms can be useful in cases where a borrower's ability to provide sufficient collateral presents an obstacle to obtaining affordable financing, as can be the case in relation to SMEs and EE investments. The ability to draw on public guarantees on the side of FIs can substitute their collateral requirements to an extent, and hence support financing in priority sectors, such as EE.

In **Brazil**, there is currently no guarantee scheme for EE financing available. Nevertheless, Brazilian EE market agents (including financers) **frequently identify guarantee schemes as a potential solution to unlock EE financing** since large collateral requirements present a main barrier to potential borrowers of EE financing (particularly for small and medium-sized ESCOs and end-users).

The Energy Efficiency Guarantee Mechanism, developed in 2013 by IDB and the United Nations Development Program (UNDP) with support from the Global Environment Facility, tackled exactly this barrier: The mechanism aimed to stimulate banks to account for the cash flows from shared savings contracts as collateral for loans to ESCOs. It was also an attempt to foster ESCO contracting by end-users, since it provided an additional fundraising option to them. Under the EEGM scheme, ESCOs could access credit lines provided by local banks to finance their EE projects to end-users under an EPC. In order to share the risk with the bank (and reduce its risk perception), IDB provided a letter of guarantee which states its commitment to repay the loan to the bank lender in case of default. ESCOs paid for the guarantee and signed a reimbursement agreement with the IDB in order to induce the client to sign the EPC. Figure 15 illustrates this scheme.

The guarantee provided by the IDB reduced the total real assets required by banks as collaterals from their clients. As a result, local banks in Brazil generally saw it as an opportunity and welcomed the EEGM. However, the scheme faced problems regarding the legal enforcement of IDB's letter of guarantee: Some banks understood that the letter of guarantee could not be easily liquidated in case of ESCO's default. Since banks with a great potential to take advantage from this scheme did not engage, the major part of the USD 25 million that were available for the guarantee was not disbursed, although IDB provided its AAA-rated balance sheet to act as guarantor.

One commercial Brazilian bank (Banco Indusval & Partners) agreed to participate in an EEGM operation and financed some projects performed by a local ESCO (APS Soluções). APS received a letter of guarantee for 80 percent of the total amount disbursed by the bank, but did not need to claim the guarantee. The operation was successful and contributed to the expansion of the ESCO that thereafter was acquired by a large energy utility.





The possibility of **creating a National Energy Efficiency Guarantee Fund in Brazil** is currently under discussion by the Financial Innovation Lab (an initiative led by the Brazilian Securities and Exchange Commission), the Association of Development Banks in Brazil, and IDB. This new fund would be similar to the existing national Investment Guarantee Fund, but would exclusively focus on EE projects. The Guarantee Fund under discussion would be managed by BNDES, who would utilize it to leverage financing through commercial FIs and regional development banks. Thus, the National Energy Efficiency Guarantee Fund would involve three main entities: The borrower, the commercial or regional development bank, and the fund. The interaction between these three entities would be as follows: The borrower (ESCO or end-user) that submits a loan request for an EE project to a commercial or regional development bank can access a guarantee fund. This fund provides a guarantee to the lender, which therefore can charge reduced interest rates and/or require softened real asset collateral requirements. In order to access the fund, the borrower pays a charge. This payment made by the borrower feeds into the fund, and hence can be used to cover potential default cases and contribute to the fund's expansion.

4 Making progress

The previous chapter presented a range of enablers and resources that support the mitigation of EE financing risks and the reduction of FIs' risk perception in Brazil. Some of these risk mitigation solutions can directly be considered and applied by Brazilian FIs, for example the establishment of partnerships with entities that are specialized in standards for (EE) technology or the adoption of the qualiESCO label. Further solutions yet need to be initiated and / or developed. This includes the Energy Efficiency Guarantee Fund currently under discussion at the Financial Innovation Lab, the definition of lists on cost-effective standard EE equipment, or the discussed SPV for energy efficiency projects. Such solutions are not yet available, but must also not be invented from scratch. International examples such as those presented in this report, can be utilized as a basis and be adjusted for the Brazilian context. Brazilian FIs in collaboration with related initiatives and agents from the industrial EE market should take an active role in shaping such solutions, and thus foster their applicability in the Brazilian EE financing context.

Notwithstanding the risk reducing character of the solutions presented in this report, many of them will not immediately result in more flexible collateral requirements or in improved financing terms for EE funding, since credit risk appraisals depend on a complex set of variables defined by FIs' risk policies. However, if combined with internal capacity building at FIs, the presented risk mitigation solutions have the potential to smooth specific steps in the credit appraisal process, and hence decrease transaction costs of and increase FIs' comfort in energy efficiency financing. Reduced transaction costs and increase the amount of dedicated energy efficiency funding offered by the financial markets, and may eventually result in carefully considering the financial risks and benefits of energy efficiency in credit risk appraisal.

Building up FIs' capacity for EE financing includes the need to increase awareness for EE risks and mitigation approaches, but goes much further. Lending for EE investments differs from other credit procedures in several aspects, in particular with respect to the need to identify the EE character of an investment project and to account for the 'special EE characteristics' (such as estimated energy saved) in loan appraisal. Building capacities for EE financing thus requires the implementation of adequate processes and the development of internal knowledge in various FI departments. Thus, in Appendix 1, we provide a brief discussion on useful elements to foster the identification and appraisal of EE projects through FIs.

Next steps:

After the Accelerator's workshops, several **bank participants** highlighted that they may evaluate whether and how the proposed **EE risk assessment framework** could be translated into risk matrices for consideration in credit risk appraisals for EE projects, or which of the proposed risk assessment questions could be included in existing qualitative EE appraisal methodologies. Further, some participants mentioned they would like to evaluate the possibility of **flexible collateral requirements** in more detail. In terms or **risk mitigation measures**, participants were particularly interested in standardized lists of eligible EE equipment and measures such as insurance for projects with bigger investment amounts.

A potential use of the **EE risk assessment framework** in relation to the upcoming **Guarantee Fund FGenergia** was discussed. This Fund is currently under development by BNDES in partnership with the Financial Innovation Lab. It is designed to benefit mainly projects in small and medium-sized enterprises. Several questions included in the risk assessment framework could be relevant for eligibility assessments of the Fund, and hence BNDES and other entities involved in the design of the Fund may draw on the framework or aspects of it for the definition of guidelines on the assessment of projects under the Collateral Fund.

Appendix 1: Processes for EE credit appraisal

The **identification of EE projects** often constitutes a challenge to FIs, and hence presents an obstacle to EE financing: Bank staff without previous experience in EE lending often has difficulties to detect EE aspects in clients' financing request. Thus, projects such as industrial modernization or building refurbishment, which often go along with significant energy savings, are processed according to standard credit procedures, implying that the value creation from energy savings as well as respective risks remain under the FI's radar. Further, the inability to identify EE projects implies a missed opportunity in terms of building a portfolio of green loans for re-financing through green bonds, tapping on financing possibilities from IFIs, or improving the FI's green image.

To enable identification of energy efficiency projects, the following measures can be implemented:

- **Training of sales staff:** Bank staff with end-user contact should be trained to detect EE aspects in financing requests. This can entail example cases to increase staffs' awareness on projects that regularly go along with energy savings, e.g. industrial modernization projects conducted by companies with a high energy cost share or refurbishment of particularly old buildings.
- Questionnaires for clients: Sales staffs' ability to identify EE projects can be further fostered by
 integrating targeted questions in standard client questionnaires. For example, clients may be
 asked whether their project goes along with energy savings and whether respective
 documentation of estimated savings is available. If answers indicate that the project may be an EE
 project, internal procedures for EE project appraisal should be triggered.

Another process-related challenge concerns the **appraisal of EE projects**, and relates to lacking FI capacities of technical terms and documents, special contract structures, or special types of clients such as ESCOs. To support appraisal procedures for EE projects, the following elements can be useful:

- Define standards for energy savings documentation: Requesting some sort of ex-ante documentation of estimated energy savings from end-users serves three purposes: (1) such documentation proves that the project is indeed an EE project; (2) it quantifies estimated energy savings which may be required when drawing on special funds for EE for example as offered by IFIs; and (3) when valuing energy cost savings in credit risk appraisal, a reliable source for this valuation must be available. FIs should define criteria on the documentation they request when appraising EE projects and should establish procedures to assess such documentation. The latter may involve building internal capacities (e.g. trainings on energy audits) or the involvement of external technical experts. As the availability of energy savings documentation is often a major obstacle to EE financing, FIs should take into account the status of savings documentation in their country (e.g. availability of energy audits from certified experts) as well as the purpose for which the documents are required (e.g. eligibility for EE funds vs. credit risk appraisal). The box on the next page illustrates how an online tool facilitates the documentation of energy savings in EIB's PF4EE credit line.
- Establish internal technical expert divisions: The ability to draw on in-house technical expertise can be a key success factor for EE financing. Staff with a background in EE will be able to assess the risks that go along with specific projects (e.g. in terms of assessing the quality of energy savings documentation or of a suggested M&V approach), and will bring valuable expertise for EE loan pipeline development. The latter can include approaching stakeholders in the energy efficiency market or identifying sectors with a high energy (cost) savings potential.
- Involve external technical assistance: FIs do often not have the possibility to build up internal expert teams for EE. In absence of internal expert staff, the involvement of external technical assistance can fill such gaps to an extent. Such external experts can be involved to review the technical documentation of EE financing requests and thus support the FI in the assessment of performance risks and in the identification of risk mitigation measures. External technical assistance can also be useful to bridge the gap that often exists between the financial and technical sides of EE investing. This may consist in supporting the FI in developing pipeline development strategies that are targeted to the needs of EE end-users and ESCOs.

Box 12: Documentation of energy savings under EIB's PF4EE instrument (Source: Authors)

The European Investment Bank's Private Finance for Energy Efficiency (PF4EE) instrument combines an EIB loan, a risk sharing mechanism, and technical assistance for PF4EE partner banks across the EU (see also Box 11). To finance projects under PF4EE, FIs must request documentation of estimated energy savings from clients. For bigger projects (capex > 500.000 EUR), this must generally involve an energy audit that has been conducted in line with European standards. For smaller projects, the EIB, in collaboration with technical experts, has set up simplified procedures that involve energy savings estimations through an online tool called EEQuest.

The **EEQuest tool** has the following characteristics:

- Provision of energy, energy cost, and CO2 savings estimates for about 20 typical EE measures, such as motor replacement, cogeneration, insulation, or efficient lighting
- Downloadable PDF summary that can be used when applying for PF4EE financing
- Available free-of-charge and without registration, no user data is saved in the tool

The tool can be used in the 28 countries of the European Union and is available on <u>eequest.eib.org</u>. Customized versions for PF4EE partner banks, which have the additional functionality of checking the eligibility for PF4EE financing, can be accessed on <u>pf4ee-webcheck.eib.org</u>.

Through this online tool, **end-users** can get an idea of the savings potential of typical EE measures and (if they use the PF4EE customized version) they can pre-check their eligibility for PF4EE financing and use the PDF download from the tool to apply. **Bank staff** can use the tool to asses PF4EE loan applications in a standardized manner and for marketing purposes. Figure 16 illustrates the intended use-process for the online tool.

Figure 16: Foreseen process for use of the PF4EE online tool in EE financing





Abbreviations

ABDE	Associação Brasileira de Desenvolvimento (Brazilian Association of Development)
ABNT	Associação Brasileira de Normas Técnicas (Brazilian Association of Technical Standards)
ABRACE	Associação Brasileira de Grandes Consumidores Industriais de Energia (Association of Big Industrial Energy Consumers)
BNDES	Banco Nacional de Desenvolvimento Econômico e Social (National Bank for Economic and Social Development)
CMVP	Certified Measurement and Verification Professional
CNAE	Classificação Nacional de Atividades Econômicas (National Classification of Economic Activities)
CNI	Confederação Nacional da Indústria (National Confederation of Industry)
EBRD	European Bank for Reconstruction and Development
EE	Energy Efficiency
EEFIG	European Energy Efficiency Financial Institutions Group
EEGM	Energy Efficiency Guarantee Mechanism
EPC	Energy Performance Contracts
ESCO	Energy Service Company
ESI	Energy Savings Insurance
EVO	Efficiency Valuation Organization
FEBRABAN	Federação Brasileira de Bancos (Brazilian Federation of Banks)
FI	Financial Institution
IDB	Inter-American Development Bank
IEA	Industrial Energy Accelerator
IFI	International Financial Institution
IGA	Investment Grade Energy Audit
IPMVP	International Performance Measurement and Verification Protocol
IRR	Internal Rate of Return
M&V	Measurement and Verification
NPV	Net Present Value
0&M	Operations and Maintenance
PF4EE	Private Finance for Energy Efficiency
SE4All	Sustainable Energy for All
SENAI	Serviço Nacional de Aprendizagem Industrial (National Service for Industrial Training)
SME	Small and Medium-sized Enterprise
SPV	Special Purpose Vehicles
UDNP	United Nations Development Program

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