ireema POLICY PAPER

Supporting Iran in implementation of an integrated energy efficiency market

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Draft

Energy Efficiency Funds: Insights from international experience

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About IREEMA

Iran belongs to the top ten greenhouse gases emitting countries in the world and the Iranian economy is the most energy intensive of all oil and gas producing nations. Domestic energy tariffs are set by administrative decree far below export market prices. Over the last decade, the energy productivity in Iran declined further. Iranian policy makers are aware of the need to the increase energy efficiency of the economy.

With the adoption of the Article 12 of the "Law on elimination of barriers to competitiveness and improving the country's financial system" the legal basis was created for specific economic incentives for energy efficiency investments. Because the implementation mechanism is still to be developed, investment projects have not yet been implemented on a large scale.

The IREEMA project shall support Iran's Vice-Presidency for Science and Technology to implement an integrated energy efficiency market in practice.

The project therefore aims at developing together with the responsible Iranian stakeholders an efficient implementation mechanism and to lower transaction costs for potential investors. In addition, the project aims at testing this approach in practice by developing the huge energy efficiency potential in the country in two main areas: the gas sector with special focus on the South Pars Special Economic Energy Zone (PSEEZ) in Assaluyeh and the sustainable energy supply in selected rural pilot areas. In case of necessity, adjustments of the implementation mechanism will be suggested accordingly to ensure proper functioning. The implementation mechanism shall become the corner stone of the integrated market for energy efficiency in Iran. Such a functioning mechanism could foster the implementation of Iran's INDC and even raise the ambitions of policy makers.

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درباره IREEMA

ایران در لیست ۱۰ کشور دارای بیشترین انتشار دی اکسیدکربن به جو قرار دارد و در میان تولیدکنندگان نفت و گاز، شدت انرژی اقتصاد ایران از همه بیشتر است. با اینحال، تعرفه های داخلی حامل های انرژی توسط دولت و به صورت یارانه ای معین می گردد. تعرفه های حاملهای انرژی در ایران بسیار پایین تر از قیمت صادراتی آنهاست. از این رو، در طی دهه گذشته، بهره وری انرژی در ایران به شدت افت کرده و دولت به اهمیت بهینه سازی مصرف انرژی پی برده است.

با تصویب ماده ۱۲ قانون «رفع موانع تولید رقابت پذیر و ارتقاء نظام مالی کشور» بستر قانونی مشوق‌های مالی برای سرمایه گذاری در امر بهینه سازی انرژي فراهم گشته ولی ازآنجا که ساز و کارهای اجرایی این مشوق ها هنوز پیاده سازی نشده اند، تاکنون سرمایه گذاری خاصی در این زمینه صورت نگرفته است.

پروژه ی IREEMA، معاونت علمی و فنآوری ریاست جمهوری ایران را در راستای ایجاد و توسعه ساز و کار بازار متمرکز بهینه سازی انرژي حمایت میکند.

لذا هدف این پروژه و ذینفعان مسوول، این است که در نهایت، ساز و کاری موثر و دارای کمترین هزینه جانبی، برای سرمایه گذاران بالقوه فراهم گردد. بعلاوه این پروژه در نظر دارد که رویکرد به دست آمده را به صورت عملی مورد آزمون قرار دهد؛ بدین صورت که پتانسیل بزرگ بالقوه بهینه سازی انرژی را در دو عرصه مهم اجرایی نماید: یک، در بخش گاز با تمرکز بر منطقه ویژه اقتصادی انرژي عسلویه؛ و دو، در بخش تامین پایدار انرژی در مناطق پایلوت روستایی منتخب. بر این اساس و در صورت نیاز، ساز و کار ایجاد شده با پروژه های واقعی سنجیده شده و در جهت رسیدن به بهترین شیوه و عملکرد، تغییرات لازم ایجاد می گردد. اجرای این مکانیسم، بنیان بازار متمرکز بهینه سازی انرژی را شکل خواهد داد و چنین ساز و کار موثری می تواند به ایران در اجرای اهداف INDC توافقنامه پاریس و به سیاست گذاران در رسیدن به اهداف بلند پروازانه بهره‌وری انرژي کمک رساند.

Executive Summary

Low domestic energy prices are the main reason for the high and continuously increasing energy-intensity of the Iranian economy. Because energy consumers do not face the real costs of energy, they consume more energy as they otherwise would and refrain from investing in energy efficiency projects, as such projects are not able to cover the investment costs from the corresponding energy savings in monetary terms. In order to promote energy efficiency measures, the Iranian government has implemented policies such as Article 12 and the Market for Energy Efficiency and Environment (M3E), aiming at assigning a higher monetary value to energy savings. While Article 12 makes the provision to export saved quantities of energy targets the M3E domestic opportunities for tariff arbitrage among different consumer groups. But the export channel under article 12 is not in operation yet, and for the M3E first findings indicate that tariff differences are too small, so that many of the energy efficiency projects remain economically non-feasible. To overcome the latter are additional incentives necessary. Among several options considered is the creation of a supportive energy efficiency fund.

The paper presents a selection of illustrative international cases to assess various options to support energy efficiency projects via public energy efficiency funds. Four case studies provide an overview:

- *China*'s Fund supports energy efficiency projects via a risk-sharing facility for financial institutions addressing the risk aversion of the banking sector.
- In *Turkey*, the Energy Efficiency Fund circumvents a major investment obstacle for small businesses, i.e. the high up-front costs of energy efficiency investments, by developing a leasing market for energy efficiency technologies.
- *Mexico*'s Fund focuses on issuing guarantees and insurance payments in the event of non-performance of energy efficient technologies.
- In *Germany*, existing funds are channelled cost-effectively into industries that face very long investment-cycles. The fund aims at incentivizing industrial companies to opt for the more efficient technology.

Energy Efficiency Funds differ substantially with respect to target groups, eligibility, instruments, objectives and sources, but they all have one common objective: Reducing so-called "investment inefficiencies" that hinder otherwise privately profitable investments from actually being made. Thus, in Iran, the rationale for an Energy Efficiency Fund would have to be different: Instead of facilitating a largely functioning market, the Fund would have to add substantial value to private energy savings in order to make them profitable in the first place. Thus, a fund could effectively complement the Market for Energy Efficiency and Environment (M3E) by reducing the major obstacle to its functioning. Regardless, important learnings and policy recommendations can be drawn from the case studies:

- *Understand potential downsides:* Energy Efficiency Funds bear possible risks such as promoting the wrong technology. Therefore, it should always be the main objective to develop a sustainable energy efficiency market in the long run – even in the absence of additional funding. An Iranian Fund should therefore focus on making the M3E work.
- *Design based on thorough market analysis:* As different stakeholders face different investment decisions and obstacles regarding energy efficiency investments, a careful analysis is a precondition for setting up a functioning Energy Efficiency Fund. The design follows the analysis. For example, small-scale farmers could benefit from an earmarked fund with a defined list of eligible projects as

they may lack the information on the existence and/or benefits of measures. A technology-open fund could be more appropriate for the industrial sector with more complex technology needs.

- *Establish a verified project selection through standardization and verification:* An Iranian Energy Fund should highlight the benefits of energy efficiency investments for a verified number of projects. These could be scaled-up through standardization and verification procedures and could help to pool small-scale investments in order to make them economically viable in sum.
- *Achieve sustainability through capacity development:* Finally, it is essential for Iran to recognize the important role of non-financial instruments in order to build confidence, provide technical expertise and raise awareness.

Contents

List of Abbreviations

BMWi	Federal Ministry of Economics and Energy
CFSEE	Competitive Funding Scheme for Energy Efficiency
CHUEE	China Utility-Based Energy Efficiency Program
CIF	Climate Investment Fund
CO_2	Carbon Dioxide
CSEF	Commercialising Sustainable Energy Finance Program
CTF	Clean Technology Fund
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
ESCO	Energy Service Company
ESI	Energy Saving Insurance
FIRA	Trust Fund for Rural Development
IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
IFC	International Finance Cooperation
IFC	International Finance Cooperation
INDC	Intended Nationally Determined Contributions
IREEMA	Iranian Energy Efficiency Market
KfW	German Development Bank
M3E	Market for Energy Efficiency and Environment
PSEEZ	South Pars Special Economic Energy Zone
R&D	Research and Development
SME	Small- and Medium-Sized Enterprise
TA	Technical Assistance
TurSEFF	Turkey Sustainable Energy Financing Facility
USD	United-States Dollars

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1 Introduction

Distorted Energy Prices in Iran and Challenges to improve Energy Efficiency

Iran is the eighth largest producer of CO_2 emissions in the world (JRC 2017). Energy production accounts for the majority of its greenhouse gas emissions (Farajzadeh und Nematollahi 2018). The major drivers of the rising energy intensity are artificially low energy prices in combination with government subsidies. As a result, the most important market signal – the price – does not reflect the opportunity value of energy when used for alternative purposes. This leads to higher than necessary domestic consumption of energy. Low energy prices impede energy efficiency projects, because owners cannot recover the associated investment costs through energy savings. Barkhordar et al. (2018, 8-9) analysed the relationship between energy prices and the economic viability of energy efficiency projects in Iran and showed that an increase in energy prices substantially raises the economic benefit of improving energy efficiency.

Implemented Policies to Support Energy Efficiency Measures and Shortfalls

In the absence of a functioning market environment policy makers decided to provide financial incentives for the implementation of energy efficiency projects in Iran. A first attempt was made in 2014 when a program of improving productivity was formulated and embedded in the fiscal budget under article "G". Article "G" proposed that a credit of 100 billion USD to be allocated in order to improve productivity in the energy sector. Refinancing was assumed to be made via increased productivity in the energy sector, where the private sector would invest on energy efficiency improvement and the payback would be guaranteed by NIOC based on the performance of individual projects. However, improving boiler houses was the only project where the pay back was based on the performance of the individual project.

In 2015 Article "G" of fiscal budget was reformulated as article 12 of new law on "Elimination of Barriers to Competitive Production and Improving Financial System" which was approved by the parliament and it was issued in April 2015. Article 12 allows to receive cash flows from investments in energy efficiency projects through selling energy savings *externally* at export prices, i.e. the largest opportunity value of Iranian fossil energy. Several problems have been impeding the successful implementation of Article 12 and the economically attractive redemption of energy savings at export prices so far. Currently the biggest barrier are the sanctions of the USA imposed on Iran that make it difficult for the country to generate export earnings.

In addition to article 12, Iran started developing the Market for Energy Efficiency and Environment (M3E)– an domestic instrument for energy efficiency measures based on price differentials within the Iranian energy tariff system. The concept of M3E is to utilize the potentials of price differentials through trading saved energy among different domestic consumer groups. This could assign a higher value to energy without increasing energy tariffs by allowing to save energy at a lower energy tariff level and selling the saving to consumers with higher assigned tariffs. Hence, the main driver for a functioning M3E depends on large tariff differences for different groups of energy consumers. First findings indicate that obtainable margins across different tariff categories are (too) small in absolute and real values, which shrinks to zero the economic feasibility of most energy efficiency projects.

The Rationale for Improving the Economic Viability of Energy Efficiency Projects

Since increasing prices for energy is considered in Iran as a politically not feasible option, this paper examines how an Energy Efficiency Fund could create additional incentives by subsidizing energy

efficiency projects and thereby assigning a higher value to energy savings. We derive first policy options from the analysis of international examples of Energy Efficiency Funds. However, it must be kept in mind that in all cases discussed in this paper energy prices reflect – at least rudimentarily – the cost of production and foregone opportunity of alternative use. The Energy Efficiency Funds mainly aim at reducing impediments to energy efficiency caused by "investment inefficiencies" that hinder private actors to invest in actually profitable investments. An Iranian supportive Energy Efficiency Fund needs to address such impediments as well, but at the same time it also needs to tackle the impediments provided from low energy prices.

According to Taylor et al. (2008, 49) a substantial number of energy efficiency investment projects with high financial rates of return of up to 20 percent are not being implemented worldwide due to investment inefficiencies. This may not be the case in Iran as energy prices are just too low to produce similarly high returns as elsewhere, but it is essential to understand the rationales behind setting up Energy Efficiency Funds in other countries.

Potential reasons for investment inefficiencies are manifold (Schleich 2007, 88):

- **Risk:** There can be a higher financial or technical risk associated with energy efficiency investments resulting in longer payback periods or higher interest rates than conventional "dirty" investments. Kapoor et al. (2011, 54) explain this by the fact that green technologies often are in an early phase of development increasing at least the perceived risk of investing in them. Smaller businesses tend to invest in efficiency enhancements only if payback periods are shorter than three years.
- **Uncertainty about the political environment:** The lack of a consistent and stable policy framework undermines investor confidence. In Iran, this is associated for example with doubts about the political adherence to the mechanisms of Article 12 and the M3E as well as the uncertainty of future national energy prices.
- **Imperfect information:** A lack of knowledge on energy efficiency potential and the corresponding energy savings could be a reason for an insufficient implementation of measures. Especially for newer technologies, longer time series on the performance of energy efficiency measures impede the accurate assessment of investments. In addition, a lack of knowledge and awareness of managers, and a lack of in-house energy efficiency experts contribute to imperfect information.
- **Access to capital:** A lack of sufficient funding for investments is especially the case for small businesses that have a general problem with acquiring necessary resources for capital investments. In addition, long pay-back periods discourage banks providing respective capital at affordable conditions.
- **Split incentives:** The actor that invests in an energy efficiency measure does not benefit from this investment through energy savings as other actors are the main beneficiaries. This makes it unattractive to invest in the measure although it would be economically viable. For example, tenants with a fixed total rent would not benefit from energy savings through behavioural changes and therefore do not have an incentive to do so.

Although these problems may arise for different types of investments, specific characteristics make them especially relevant for investments in energy efficiency:

- **Different times for realizing costs and benefits:** Unlike investments in new assets with high yields, investments in energy efficiency aim to improve productivity through cost savings. Specialised companies often conduct calculations for these cost savings. Combined with high upfront costs, non-specialised investors and financial institutions may be reluctant to support them. Kapoor et al.

(2011, 21) add that the different timing of costs and benefits makes the known hyperbolic discounting of private actors even more pronounced during the investment decision, where behavioural idiosyncrasies result in not treating one unit of currency of savings as equivalent to a unit of currency earned.

- **Small and scattered projects:** Even when facing relatively high project returns, individual managers consider the overall financial importance of small projects not sufficiently important, whether in companies or financial institutions. If one cannot aggregate or pool such small projects in order to reduce transaction costs, they remain unfunded and unimplemented.
- **Technical requirements for implementation are complex and varied leading to high information costs:** There are different technical solutions for hundreds of types of energy applications in different industries. Some technical solutions are quite general and highly reproducible for different consumers, others are complex and only applicable to a specific problem, e.g. for a specific industrial process. It highly depends on the complexity and reproducibility of the technical solution whether technicians or companies can specialise in delivering technological solutions and investment packages for different industries and sectors. If there are no specialised companies, information costs for evaluating the return on energy efficiency projects are very high, and unevenly distributed between the seller of a technology and the potential buyer.

Purpose of this Paper

This paper will provide first answers to the following questions:

- What is the experience of other countries with Energy Efficiency Funds?
- Which different designs of Energy Efficiency Funds do other countries adopt?
- What are the lessons learned?
- Which policy recommendations are of relevance for Iran for setting up an Energy Efficiency Fund?

2 Selected international cases of Energy Efficiency Funds

We have carefully selected four different case studies to illustrate different approaches to the institutional set-up of Energy Efficiency Funds, namely in China, Turkey, Germany and Mexico (see Figure 1).

Figure 1: Geographical Coverage of the Case Studies

Source: own illustration

2.1 China Utility-Based Energy Efficiency Program (CHUEE)

Volume	• USD 783.3 million of loans issued for 178 projects • USD 61 million co-financing from IFC
Period	2006-2012
Region	China
Target group/ sector	• Financial Institutions • Equipment Suppliers and Service Providers • End-Users (i.e. industrial, commercial, small and medium-sized enterprises, municipal/institutional, or multi-family residential sector customers)
Projects	Energy Efficiency Projects approved by technical experts from the advisory services
Instruments	Financial Instruments: • Risk-sharing facility / guarantees provided to commercial banks Non-Financial Instruments: • TA especially for financial institutions • Information campaigns
Main objectives	• Overcome financial barriers for investments in energy efficiency • Address risk aversion of the banking sector • Awareness raising to the benefits and feasibility of energy efficiency projects

Background and Objectives

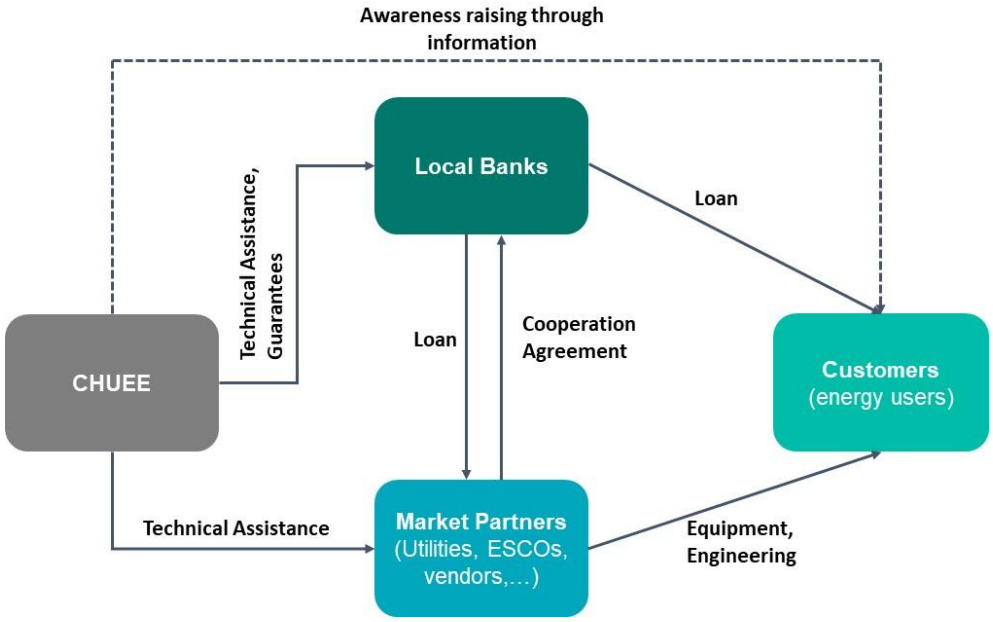
The China Utility-Based Energy Efficiency (CHUEE) Program focusses primarily on building a sustainable energy finance market in China. Local banks typically decide on the credit risk by considering only fixed assets as security. Banks prefer larger loans and tend to be very risk-averse. As a result, especially smaller companies do not have enough access to finance for their energy projects. Further impediments to efficiency projects were a lack of awareness among end-users regarding the benefits of such investments and a limited experience by suppliers of energy efficiency products.

Instruments and Institutional Setup

In order to create a commercially sustainable delivery mechanism for developing, implementing and financing energy efficiency projects, CHUEE provided loan guarantees for energy efficiency projects and technical assistance to local banks. A risk-sharing facility bears part of the losses arising on energy efficiency loans, lowering the risk of investments for local banks. An advisory service offered technical assistance to local banks in order to develop a portfolio of local energy efficiency projects.

Furthermore, CHUEE collaborated with private sector energy utilities to act as lead marketing partners, facilitators and aggregators for energy efficiency projects. They also received loans and agreed to support local banks with their expertise. They also offered equipment and engineering services to customers. The dissemination of information, case studies, and research raised the awareness of companies and end-users. Figure 2 illustrates the institutional set-up.

Figure 2: Institutional Setup of the CHUEE Program



Source: own illustration

Results

By the end of the program, the technical experts of the CHUEE program recommended 105 energy efficiency projects, of which 50 by were financed. CHUEE disbursed 178 loans to energy efficiency projects at a value of USD 783.3 million. The total value of investments was USD 1.77 billion.

Lessons Learned

Providing the financial institutions with technical assistance (TA) was a central element in sustaining the effort of CHUEE. The risk-sharing facility alone did not convince the local banks to hand out loans to pioneering projects. Instead, TA via the advisory service was key to initiate and expand loans for energy efficiency projects. Nevertheless, it was difficult to convince local banks to establish their own network of technical support and thereby become an assistance provider to end-users. Furthermore, CHUEE could not reach small businesses, because with no distinction in the mechanism dependent on company size, the banks favoured the lower credit risk of larger companies over SMEs.

During the program, it became very clear that ESCOs are crucial partners to address finance barriers particularly for SMEs. In order to produce a higher output, programs should focus on developing a diversified end-user base by using channel partners or multipliers such as ESCOs that share similar objectives. The established network of 384 energy services companies (ESCOs), equipment suppliers, and industrial associations is supposed to strengthen the capacities to develop, implement, and finance energy efficiency projects on an on-going basis.

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2.2 Turkey‘s Commercialising Sustainable Energy Finance Program (CSEF)

Volume	• USD 121 million co-financing from CIF and IFC • Investments of USD 100 million in over 50 energy efficiency projects by leasing companies
Period	2010-2015, Phase II started 2015
Region	Turkey
Target group/ sector	• Leasing companies • Commercial, residential, and municipal SME sector
Projects	• Energy Efficiency Projects with a minimum of a 15% efficiency gain • No specific technology • Examples: Energy efficient production lines, EE motors, heat systems upgrades, EE compressors, peak-controls, EE measures in buildings etc.
Instruments	Financial Instruments: • Soft loans to leasing companies Non-Financial Instruments: • Technical assistance to leasing companies
Main objectives	• Develop a sustaining leasing market for energy efficiency technology • Scale-up energy efficiency deployment in Turkey’s SME sector by specifically addressing the barriers to their access to finance

Background and Objectives

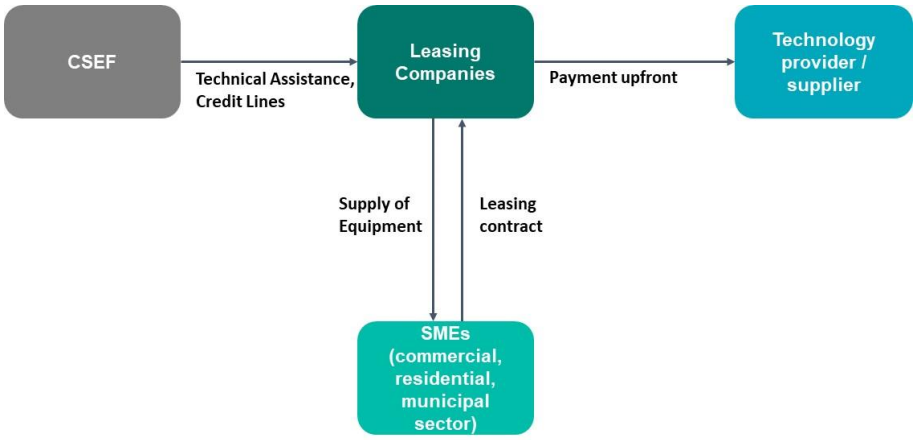
Since 2007, Turkey has put a focus on promoting energy efficiency. Although many programs already were in place, SMEs still were lacking access to finance for energy efficiency. A lack of assets, an insufficient track record and a short balance sheet brought financiers to assess loans to SMEs as too risky. In addition, bank loans were often too short-term to meet the payback periods of energy efficiency investments. The lacking awareness of energy efficiency projects' benefits in both – leasing companies and SMEs – further impeded the development for the supply of energy efficiency products.

Instruments and Institutional Setup

CSEF targeted SMEs with a leasing approach in order to enable them to utilise energy efficient equipment without needing to make a high capital investment. The leasing approach directly addresses all impediments to energy efficiency projects caused by a lack of collateral, uncertainty of operating costs, and high upfront costs.

In order to implement the leasing approach, CSEF offered credit lines and training to leasing companies. Leasing companies used the loans to buy energy-efficient equipment from technology providers and leased it to the end-user, i.e. SMEs in the commercial, residential or municipal sector. Additionally, technical assistance helped to increase the leasing companies' understanding and ability to invest in energy efficiency – especially in order to assess the quality of energy-efficient equipment offered by the technology providers.

Figure 3: Institutional Setup of the CSEF Program



Source: own illustration

Results

Through the investments in the leasing companies FinansLeasing, IsLeasing, and Yapi Kredi Leasing, CSEF reached 50 end-users. The end-users achieved an operational cost reduction through energy savings. Leasing companies managed to increase their energy efficiency portfolio significantly. Furthermore, Turkish leasing companies are now able to receive loans for their refinancing at commercial rates. The CSEF is expected to mitigate over 200,000 tons of CO_2 per year.

Lessons Learned

The innovative approach to address leasing companies was very successful – especially with regard to developing a sustainable energy efficiency leasing market. The combination of an innovative financing model and a comprehensive capacity building helped the leasing companies to move to a market that finances on purely commercial terms. The success of the programme shows that leasing is an attractive option for SMEs as it does not burden the balance sheets of smaller companies and de-risks investments. However, it is important to note that Turkey already had a very developed leasing market.

Understanding the specific obstacles faced by SMEs made it possible to put together an effective solution package. This underlines the value of a thorough market assessment before developing a fund. Furthermore, as leasing companies already had a good relationship to their SME customers, they jointly sorted out relevant energy efficiency options, assessed them with the help of the offered training and bought the necessary equipment from the technology providers. Leasing companies thus served as a market facilitator and as an information provider by quality- checking the equipment.

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2.3 Mexico's Energy Saving Insurance (ESI)

Volume	• USD 2.5 million grants in Mexico • USD 25 million of investment in 190 energy efficiency projects in the agro-industry sector through 2020
Period	Since 2015
Region	Mexico, expanded to Colombia, El Salvador, Nicaragua, Brazil and Peru
Target group/ sector	• SMEs in the agricultural sector
Projects	• Energy Efficiency Projects via list of energy efficient technologies
Instruments	Financial Instruments: • Energy savings insurance • Guarantees mitigate the credit risks of the SMEs • Loans to SMEs Non-Financial Instruments: • Standardized performance contract • Quality validation of energy service providers and their projects • Pilot projects • Information campaigns
Main objectives	• Build trust in energy efficiency investments by counteracting the risk of the technology not producing the savings as expected • Enhance technical capacity to evaluate energy efficiency investments • Support access to external capital

Background and Objectives

A persistent lack of trust in energy efficiency measures is one of the main obstacles for energy efficiency finance in Mexico. Local banks refrain from funding especially SMEs, because they do not have the technical capacity to assess the potential pay back of energy efficiency investments. As a result, especially the SME sector typically lacks funding. At the same time, technology providers want to sell their technology, but do not guarantee the energy savings supposed to finance the investment.

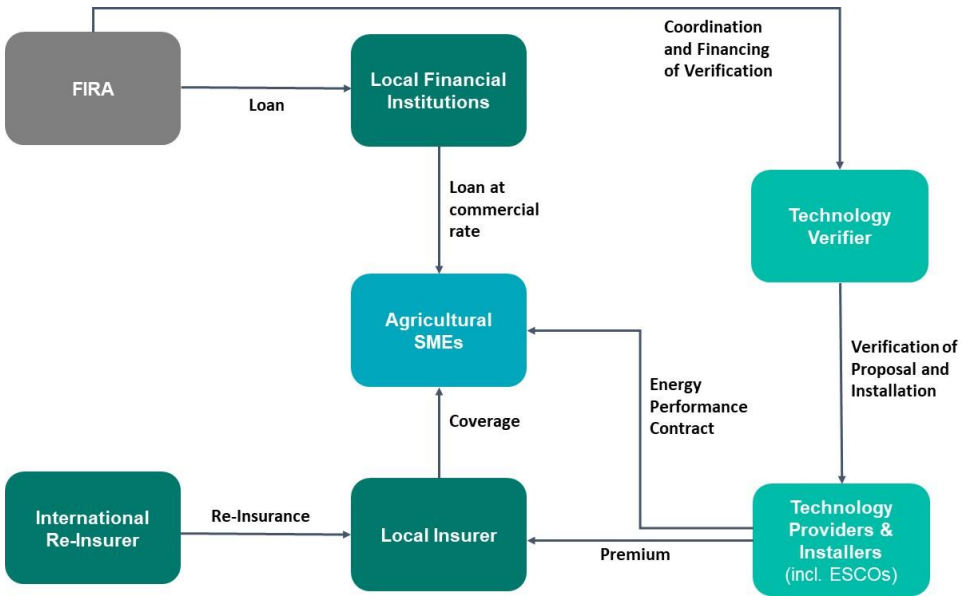
The Energy Saving Insurance (ESI) aims at building trust in energy efficiency investments by insuring against the risk of the technology not producing the savings as expected. This is supposed to unlock access to finance as the insurance covers the perceived risks. Furthermore, banks are stimulated to offer loans even for projects with longer payback periods, safe in the knowledge that their investment will be reimbursed. In the long-term, the insurance mechanism helps to reduce perceptions of risk as stakeholders become more and more familiar with energy efficiency products.

Instruments and Institutional Setup

The ESI was established in 2015 and has a very sophisticated structure (see Figure 4). The Mexican Development Bank FIRA provided local financial institutions with capital in order to support long-term loans for SMEs in the absence of collateral. In this way, FIRA guarantees to mitigate the credit risks of agricultural SMEs – the target group of ESI. Agricultural SMEs themselves receive loans at commercial rates. These loans typically covered 75% of the upfront project costs.

SMEs and technology suppliers agree on standardised energy performance contracts for each eligible technology type. Within the framework of these contracts, the customers, i.e. the agricultural SMEs, pay only 75% of the costs for the equipment until the promised savings are realised. Only then can the supplier redeem the last 25%. An energy savings insurance covers the remaining risk in case of underperformance. The coverage is provided by local insurance companies that re-insure internationally with international re-insurers such as Swiss Re. The technology supplier finances their premium in order to back their contractual guarantees to their SME clients on the performance of their energy efficiency products. The local insurance company will re-insure internationally to offer lower premiums to technology suppliers.

Figure 4: Institutional Setup of the CSEF Program



Source: own illustration

Before local financial institutions issue a loan, a third party determines whether the estimated energy savings of a technology seem plausible. FIRA coordinates this verification process with the technology verifier – the National Association of Normalization and Certification for the Electric Sector (ANCE) – and provides the respective financial means. Furthermore, ANCE validates the whole project's design, its projected energy savings, and its monitoring scheme. Later on, it also checks the proper installation.

Results

The ESI approach has attracted much international attention because it is a holistic approach to tackling barriers to energy efficiency: the combination of standardised energy performance contracts, project evaluation and verification, and insurance against potential energy savings losses directly address the three main barriers to energy efficiency in the Mexican SME agricultural sector. The solution also aims at aligning the incentives of market participants and thus creating a sustainable environment for increasing private investment in energy efficiency at the local market. Furthermore, ESI represents a potentially important way to attract institutional investors as a new source of capital for energy efficiency markets. The advantage of the insurance mechanism is that it could help create a secure cash flow with the necessary performance guarantee so that energy efficiency investments can be sold to institutional investors. However, as the programme is still comparatively new, it is too early to assess the impacts and sustainability of the ESI.

Lessons Learned

There are concerns that the programme will generate new transaction costs. Standardisation, verification procedures, and certificates for specific technologies are key to reducing them. In addition, the multi-stage approach may be too complex and therefore dissuasive for end-users or financiers. Local coordinators such as FIRA may help to understand and address the concerns of actors along the local supply chain.

A special feature of the ESI programme in Mexico is the close focus on a specific target market: It focuses only on SMEs in the agricultural sector and concentrates on a list of eligible energy-efficient technologies. By narrowing down the target group and eligible technologies, the probability of loan defaults is reduced, while the chances of building a project pipeline are increased.

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2.4 Competitive Funding Scheme for Energy Efficiency (CFSEE) in Germany

Volume	• EUR 7 million per approx. bi-yearly competition rounds •
Period	Sine 2019
Region	Germany
Target group/ sector	• Private and municipal companies • Freelancers
Projects	• Holistic optimisation of production processes • All measures/technologies that increase energy efficiency and reduce greenhouse gas emissions
Instruments	Financial Instruments: • Partial financing as a non-repayable grant
Main objectives	• Increase energy efficiency through investments by industry • Use available funds as efficiently as possible • Reduce primary energy consumption and CO_2 emissions, strengthen the competitiveness of companies and support the dissemination of high-efficiency technologies

Background and Objectives

The German Government aims at reducing greenhouse gas emissions by 55 percent by 2030 compared with 1990. Improving energy efficiency in the industry and business sector is crucial for achieving these targets. As energy efficiency in this sector depends largely on investment in new technologies, the Federal Ministry of Economics and Energy (BMWi) initiated a funding programme: the "Energy Efficiency Competition". Within this an open Fund, a competitive procedure ensures a cost-efficient implementation of energy efficiency projects that are open to actors, sectors and technologies. The CFSEE is one instrument within the wider EE-Funds of Germany, which also provides funding for EE consultancy, training and a wide range of other measures to overcome EE market barriers.

Instruments and Institutional Setup

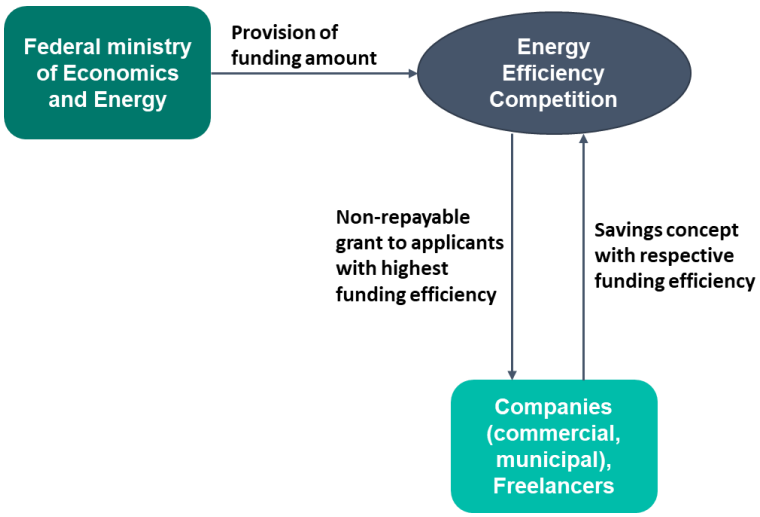
Funding is provided in the form of share financing (part of the cost of the measure is funded) in the form of a non-repayable grant. Eligible costs are the additional investment costs that arise by choosing a high-efficiency technology instead of a conventional one.

There are several competition rounds with deadlines each year. BMWi provides CFSEE with a fixed amount of grants for each competition round (e.g. EUR 7 million for the last round in 2019). Companies from industry, trade, commerce and services apply for investment measures for the energetic optimisation of industrial and commercial plants and processes, including process conversions to efficient technologies, measures to increase electricity or heat efficiency, measures for waste heat utilisation or measures for the provision of process heat from renewable energies. In essence, CFSEE is an open fund, as all measures and technologies that increase energy efficiency and reduce greenhouse gas emissions can be proposed.

For each project, applicants point out the eligible costs, the estimated saved final energy and the annual CO_2 savings as of the certified energy saving concept as well as the individual funding rate. The costs of the investment may be supported up to 50 percent of the eligible costs with a maximum funding amount of USD 5.5 million per project. Within this maximum limit, each applicant then decides which funding rate he wishes to apply for from a competition-strategic point of view.

The central criterion for the funding decision is the so-called funding efficiency, i.e. the funding applied for compared to the tonnes of CO_2 saved. From the funding rate and the energy-saving concept the funding efficiency can be calculated (euros per saved ton of GHG-emissions). All projects are ranked according to this "funding efficiency". The project with the highest funding efficiency receives its grant first, then the project in second place, etc. until the entire funding pot has been used. The nominated Project Managing Agency organises the competition rounds, professionally proofs and assesses the project documents and selects to projects being funded. Up to 50% of the overall sum of the grant will be provided in tranches during project implementation. The remaining 50% will be after implementation of the project.

Figure 5: Institutional Setup of Program



Source: own illustration

Results

As the project did not start until the beginning of 2019, no results can be obtained yet. The "Energy Efficiency Competition" is expected to stimulate savings of around 0.7 million tonnes of CO_2 or three terawatt hours (TWh) of final energy by 2023 respectively.

Lessons Learned

It is the objective of the CFSEE to reduce the primary energy consumption by using subsidies as efficiently as possible. Initiating competition between companies due to the limited available funds provides incentives for the cost-efficient implementation of energy efficiency measures. At the same time, all companies face the same funding probability and conditions. Using the economic principle of competition therefore optimizes the investment efficiency of the available funds by construction. This is why policy makers worldwide very well received the programme so far.

Not only policymakers, but also the industry itself supports the programme especially due to its openness regarding approach and technology. This supports the holistic optimisation of production processes. Furthermore, the open fund leaves it to the industry which technology and investment is the most promising. Not BMWi decides on the amount of funding but the competition between the projects. On the other hand, it is uncertain for applicants whether the funding efficiency of one's project is high enough to receive funding eventually. While this may avoid deadweight effects as intended by the ministry, it could also lead to some energy efficiency projects not being carried out for fear of not receiving any funding at all.

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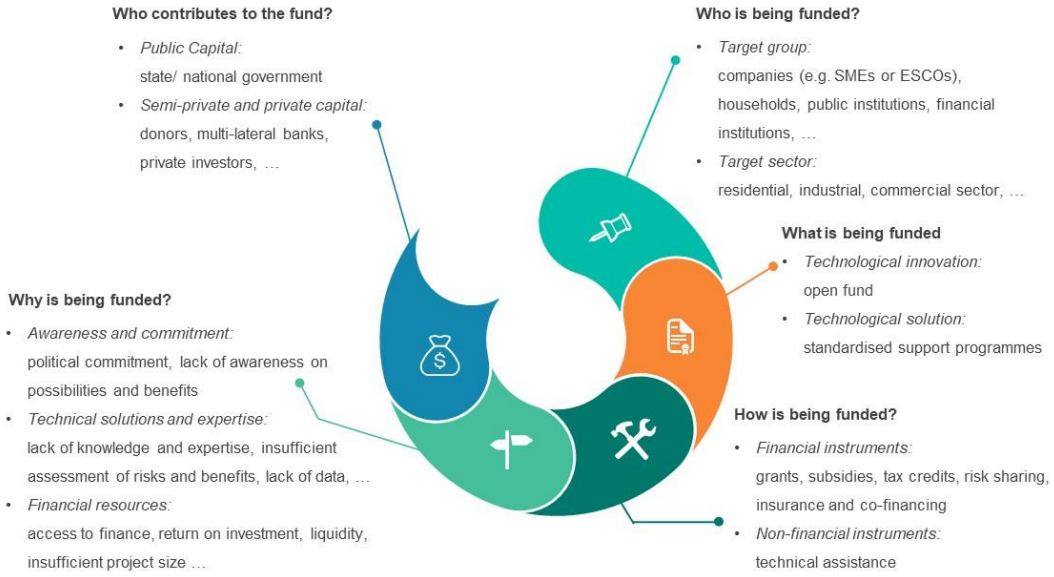
3 Designs of Energy Efficiency Funds

As the international cases illustrate different approaches of Energy Efficiency Funds with respect to target groups, targeted projects and sectors, financing instruments, objectives and financial sources (see Figure 6), the following section presents the most important features and possible reasons for choosing a specific form for the Fund.

Figure 6: Different Features of Energy Efficiency Funds



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3.1 Target group: Who Is Being Funded?

Target group: Funds may focus on one or more specific target groups to which the financial instruments are specifically tailored. Three main sectors can be differentiated – the corporate, household and public sector. Within these three groups, there are all forms of differentiations. For example, the European Energy Efficiency Fund identifies regions, city councils, universities, public hospitals and other public entities as its target group – all being part of the public sector. Furthermore, also local financial institutions can be a target group of an Energy Efficiency Fund. CSEF in Turkey intends to help local financial institutions in developing the capacity of assessing and financing energy efficiency projects.

Target market: Funds may focus on specific sectors, such as the building sector, the transport sector, the heavy industry, or the food processing industry. The combination of target group and target market defines the main beneficiary of the Fund. The ESI, for example, focuses on SMEs from the agricultural sector. Lastly, a specific geographical region can also narrow down the target group even more, i.e. a country or urban versus rural areas within the country.

3.2 Eligibility: What Is Being Funded?

The major objective in all funds is to support energy efficiency projects. The selection of projects has an influence on the structure of the fund, as there are different approaches to define the portfolio of funded measures: In an **open fund**, there are no eligibility criteria in the narrower sense, but individual measures that serve the objectives of the fund, i.e. the reduction of energy consumption, are supported upon application. The Competitive Funding Scheme for Energy Efficiency in Germany is an example for this. In an **earmarked fund** on the other side of the spectrum, a defined portfolio of measures, i.e. a list of eligible products, technologies or measures, could be eligible for funding. The focus can be for example building renovations, renewable heat, and energy-efficient production. The funding decision is based on previously defined criteria and the amount of funding is normally fixed.

The decision which scheme to choose depends on the following considerations:

- **Technological lifecycle:** Energy efficiency measures make use of technologies at different stages of the technological life cycle. Standardized schemes are not suited for early technological stage investments as innovations cannot be defined ex ante. On the other hand, the demonstration and deployment of existing technologies may be best implemented via a standardized scheme showing the benefits and costs of a well-defined set of measures.
- **Information level of government and target group:** The information levels of policy makers setting up the fund as well as the information level of the target group may also be a reason to opt for a more standardized scheme. If the benefits of proposed measures by the state are well-known, but households or companies do not have the time or the access to this information, then an earmarked programme with a specific set of fundable measures is probably best suited. At the other end of the spectrum, the state may not know which processes or measures are best suited for a specific sector or company. Thus, an open fund would be a better fit.
- **Applicability and complexity of the technology:** The decision between a standardized and an open set up also depends on the question whether an existing technology is being rolled out for a large number of actors or whether a specific technology is needed that is not scalable. Pre-defining schemes for large industries do not account for the complexity of energy efficiency measures in this context, whereas technologies or products applicable to a large number of households or companies may best be operationalised in an earmarked scheme.

To give one example, the German "energy-efficient renovation" commissioned by the State Development Bank (KfW) offers promotional loans for households in order to provide low-interest financing for energy saving measures in residential buildings. A list of eligible measures (e.g. thermal insulation of walls) is provided. This example ticks all the mentioned pros for a standardized scheme: The technology proposed is very mature, the measures are applicable to a large number of households and the target group lacks the information on the existence and/or benefits of the proposed measures. Standardized schemes can reduce this lack of information and the associated information costs by highlighting effective, and economically viable measures.

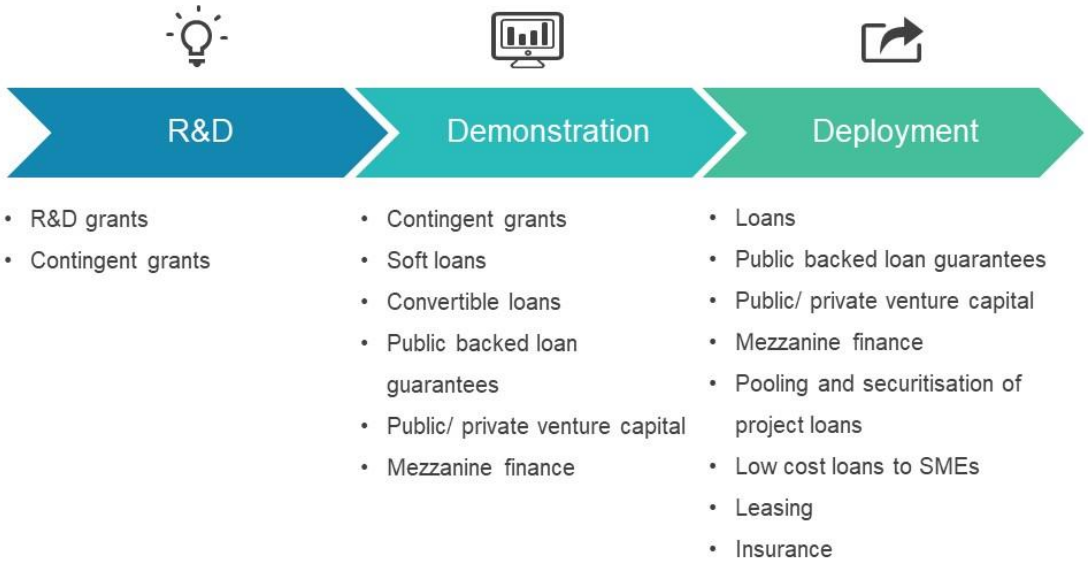
3.3 Instruments: How Is Being Funded?

Financial Instruments

There are multiple instruments available for financially supporting energy efficiency investments. Public financial support can be provided in many forms such as grants, subsidies, tax credits, risk

sharing, insurance, leasing, and co-financing. Kapoor et al. (2011) point out that the choice for an instrument mainly depends on the **technological maturity** of the funded energy efficiency measures as well as the targets of the funding (see Figure 7). The development of new technologies, i.e. R&D, face the strongest problems in attracting capital due to the spill over effects associated with it. Research and new inventions do not only benefit the researching company, but also have positive effects on other companies – especially if other companies can quickly imitate it. This can make it unattractive for companies to invest in R&D but rather wait for another competitor to launch a new product. Thus, public contingent grants are the best financial instruments to incentivize investments. The demonstration and deployment of technologies is associated with the typical problems described before. The high initial costs, and the relatively high perceived risks result in insufficient investments in these measures. Whereas the demonstration of energy efficiency measures may be supported by contingent grants, and publicly backed loans or guarantees, the deployment of technologies can function even with less capital expenditures by the state, but rather the pooling and securitisation of project loans as they are often less capital-intensive and face less spill-overs. The latter can encourage financial institutions, banks, and investors to pool and share the financing of several small projects. Guarantees in the demonstration phase address particularly the risk perception of investors and financing institutes. A relatively new instrument is leasing.

Figure 7: Forms of Financial Support along the Development Cycle



Source: own illustration based on (Kapoor 2011, 116)

Furthermore, the choice of the financial instrument depends on the **institutional environment** and the status of the financial system. If there is a banking system that functions less well, then grants have a greater reach than credit offers. Therefore, in many developing countries, public or semi-public credit institutions as well as multilateral development banks play a crucial role in the design of the respective financing instrument due to a lack of a well-developed commercial banking system.

Non-Financial Instruments

Besides the classical financial support mechanism, non-financial instruments play an important part in making Energy Efficiency Funds successful. The most important one is the provision of **technical assistance (TA)** in combination with financial instruments. The TA can be targeted at the recipients itself or at the financiers.

Another way to address a lack of technological expertise are pilot projects. Setting up pilot projects demonstrates how energy efficiency projects work and how successful they can be. This helps to further remove some of the uncertainty associated with new and untested technologies. Therefore, especially open fund schemes promote pilot projects. Standardized measures within the framework of an earmarked fund have a comparable effect to pilot projects: they evaluate the feasibility of a measure in principle and thereby reduce risks and valuation problems.

Furthermore, other non-financial measures and constructs help to promote energy efficiency. The idea is to create positive incentives that go beyond a financial contribution - such as social recognition or control. For example, in Germany so-called Energy Efficiency Networks serve as peer-to-peer platforms that enable energy efficiency improvements and investments by exchanging experiences and undertaking steps to improve energy efficiency together. The social control within the group helps to incentivize the participating companies to actually implement the measures identified.

3.4 Objectives: Why Is Being Funded?

Another central question for an Energy Efficiency Funds that aims at supporting energy efficiency is: Which barriers does the fund want to address – awareness and commitment, technical solutions and expertise barriers or the lack of financial resources (Retallack 2018, 17-18)?

Awareness and commitment raising can be a response to the lack of knowledge and awareness of the benefits of energy efficiency as the international examples have shown. Positive side-effects include the awareness raising of the benefits of these measures. Furthermore, an Energy Efficiency Fund can signal a political commitment to the matter at hand. Reducing uncertainties about the political environment and commitment to promote energy efficiency can improve the investor's confidence.

Technical solutions and expertise is another central rationale for setting up an Energy Efficiency Fund. As pointed out, project evaluation, monitoring and verification is difficult without specific knowledge. This may hamper investments as the benefits and risks of energy efficiency projects may not be assessed correctly – especially when capacities are inadequate, best practices are hard to find and processes and technologies are not standardized. Funds can address these barriers by identifying, verifying, and demonstrating technical solutions. Thereby they help to introduce them to a larger market. Standardisation and accreditation can further support this causeway.

Most importantly the lack of **financial resources** can be addressed by an Energy Efficiency Fund. The lack of financial resources can either be due to an insufficient access to finance, a low return on finance, or a lack of liquidity – each resulting in a different set-up or preferable instrument choice. Furthermore, the lack of familiarity of end users and investors in business models that monetise energy savings can be critical. Funding the initiation of such business models can not only lead to the implementation of an energy efficiency project, but result in positive spill-overs such as the adaptation of new business models in the energy efficiency market and an improved market design.

3.5 Sources: Who Contributes to the Fund?

Last but not least, funds differ according to the source of funding. Either the capital stems from the government and is transferred as direct payment from the state budget, or the fund is set-up to raise additional private or semi-private funds. The majority of semi-private investments in developing countries are provided by donors and development agencies such as the World Bank. The Green for Growth Fund (GGF), for example, set up by the European Investment Bank (EIB) and KfW is designed

to attract commercial capital from both multilateral and private institutional investors in order to invest in energy efficiency. Attracting private investors is only a feasible option if the returns from energy efficiency investments are considerable though.

4 Conclusions

4.1 Understand Potential Pitfalls of EE-Fund

Energy efficiency funds focus on providing financial incentives to promote investments in energy efficiency by overcoming market failure. They offer direct payments or tax breaks, and access to capital measures, i.e. grants and soft loans for specific investments in energy efficiency. Financial support via a fund may have potential downsides such as:

- **Incentives for the wrong technology:** Subsidising a specific technology or product always bears the risk to bet on the wrong horse, i.e. the wrong technology. Market-based instruments, on the other hand, leave the choice of technology to market forces by choosing the most efficient technology given the observed costs of reducing energy or emissions. Choosing the right target market and the right pool of eligible projects and technologies thus requires a profound knowledge and expertise by the implementer.
- **Free rider problems, windfall profits, and inefficiencies:** Subsidizing firms or companies always bears the risk of free-riders, who got a subsidy, but would have invested also in the absence of the financial support. The associated windfall profits can reduce the cost-effectiveness of an Energy Efficiency Fund substantially. Therefore, competition for funding and implementation of professional selection procedures are important to avoid windfall profits.

Understanding these pitfalls is essential in designing an Energy Efficiency Fund in the best possible way. Furthermore, it should be noted that Energy Efficiency Funds may help kicking-off a market for EE and introducing new EE technologies but will not be sufficient to sustainably change market structures.

Lessons for Iran:

- Choose an earmarked fund if a specific technology is widely accepted among experts and international experience exists. Otherwise, a technology-open fund is more appropriate.
- Build the Energy Efficiency Fund in a way that it promotes the development of a sustainable and self-sufficient market for energy efficiency in the long-run.
- Incorporate (and enforce) existing market mechanisms and programmes in order to achieve this goal.

4.2 Base the Design on a Careful Market Analysis

As pointed out above, the general rationale for Energy Efficiency Funds worldwide is to reduce impediments by “investment inefficiencies”, i.e. although a measure pays off from an overall economic point of view, it is not worthwhile for the responsible individual. The specific reasons for the “investment inefficiencies” can differ substantially though. The international case studies have shown that the identified country- or context-specific barriers to energy efficiency investments shape the design of the Energy Efficiency Fund to a large extent.

- The main objective of China’s CHUEE program was to address the risk aversion of the banking sector. It therefore focussed on a risk-sharing facility for financial institutions.

- In Turkey, soft loans were given out to leasing companies in order to develop a sustaining leasing market for energy efficiency technology. This was based on the analysis that SMEs cannot afford the high up-front costs of energy efficiency investments.
- The ESI in Mexico put an emphasis on building trust in energy efficiency investments by guaranteeing payments in the event of their non-performance.
- In Germany, existing funds are channelled cost-effectively into the industry that faces long amortisation times (minimum 4 years) for EE investment. The fund aims at incentivizing industrial companies to opt for the more energy efficient technology if investments are being made. Furthermore, it is a technology open fund and windfall profits are reduced by only supporting additional costs to highly efficient technologies.

Although the basic ideas are comparable, the case studies address different goals and different parts of the supply chain. A precise analysis of the local energy efficiency market and the existing value chains should therefore always precede the planning and design of an energy efficiency fund.

In addition to the analysis of the local market for energy efficiency, the institutional environment must be assessed carefully. One of the biggest causes of operational failures in energy efficiency financing projects is the mismatch between the solutions attempted and the local institutional environments. The institutional environment includes the regulations and resources set by the government. These can have an enormous impact on the success of energy efficiency measures. Furthermore, drivers or policies that weaken the case for Energy Efficiency Funds should be tackled where possible, such as removing energy subsidies. Another important factor is the status of the financial system. If the banking system functions less well, then grants have a greater reach than credit offers. The careful diagnostic on existing in-country conditions should form the basis for project design and interventions. After understanding the environment for a Fund, the institutional arrangements for can be planned accordingly.

Lessons for Iran:

- A precise analysis of the energy efficiency market in Iran throughout the whole value chain to identify bottlenecks and systematic barriers is an important precondition when designing an Energy Efficiency Fund.
- Removing (or reducing) energy subsidies in the long-run would be beneficial to energy efficiency as subsidised energy prices weaken the development of a sustainable market for energy efficiency.

4.3 Select the Target Group by Understanding the Investment Decisions of Key Stakeholders

The selection of a target group has a significant impact on the design of the Energy Efficiency Fund. One possibility is to identify the sub-sector with the highest EE potential – for example buildings. Another opportunity is to look on sectors with high needs for modernisation – for example central heating or cooling. A financial incentive could also be used to ensure that a usual modernisation investment takes into consideration technologies with highest levels of energy efficiency. In that case incremental costs could be financed by a fund. Therefore, selecting a sub-sector should take into account the following questions: Which sectors must be given priority on the way to lower energy intensity? Which investment inefficiencies prevail and who can best be reached within the known institutional environment?

In order to understand how financing schemes for energy efficiency investments can actually change the behaviour of investors, it is necessary to put oneself in the position of the central stakeholders. For SMEs for example, the high up-front cost of capital, short maturities and high collateral loan requirements remain the main obstacles to access long-term finance. At the household level, high investment costs, uncertain or unknown returns on energy savings and long pay-back periods are major barriers to investment. Moreover, in the case of split incentives, as it is the case for example in apartment buildings, the returns on the investments do not benefit the investor. The analysis should not only encompass the target group, but all actors involved in the supply chain – from technology providers to financial institutions. From their point of financial institutions for example, energy efficiency projects often represent only a small part of the business and financing them is mostly uncommon. In addition, transaction costs for small and/ or non-replicable projects are often very high.

Last but not least, it must also be examined when and by what means an investment can be triggered at all. Analyses conducted on KfW's Energetic Buildings Renovation Programme have shown that the programme cannot trigger an investment per se, but that in the case of renovation it can lead households to choose the more energy-efficient technology. Accordingly, not only the barriers to investment, but also the conditions for the investment decision are central to the analysis of the initial situation.

Lessons for Iran:

- Base the analysis on a thorough understanding of the key players' investment decisions, such as SMEs, households, large industries, municipalities, financial institutions, etc.
- Focus subsidies on actors that have to invest in technologies or products anyways. Then a small subsidy could help them to opt for the more energy-efficient technology.

4.4 Establish a Verified Project Selection through Standardization and Verification

Barriers to energy efficiency investments are not only of financial nature. One major failure of energy efficiency finance is the lack of developing imitable energy efficiency projects. Therefore, establishing a project pipeline is of high importance. As learned from the Mexican case study, concentrating on a limited number of eligible technologies can be a success factor for Energy Efficiency Funds. Narrowing down technologies that are efficient helps to build a verified project pipeline and thereby build confidence.

Proper evaluation, monitoring and verification of projects provides the data for confidence building. This requires standardization of procedures, contracts, decisions and technologies to support the process of aggregating and scaling credible data. Standardization and verification procedures thus are key instruments in scaling the developed project selection. Furthermore, they help to reduce transaction costs associated with new procedures set up by the fund. Especially for relatively small size projects that were too unattractive for local banks could become interesting if the project assessment is relatively easy and involves low transaction costs.

Lessons for Iran:

- Recognize Energy Efficiency Funds' function for marketing, project development, and technical design.
- Build up a verified project selection that displays the benefits of energy efficiency investments and thereby reduce transaction costs.
- Scale up the project pipeline through standardization and verification procedures where possible.

4.5 Achieve Sustainability through Capacity Development

One of the main lessons learned from CHUEE is that providing TA is crucial in sustaining the effort of an Energy Efficiency Fund. Especially in countries where existing local capacities in the energy efficiency industry are weak, the development of this capacity is a prerequisite for Energy Efficiency Projects. Policy interventions should therefore not only focus on the supply of financial resources, but also establish capacities for confidence building, commitment and awareness raising.

As pointed out, Energy Efficiency Funds will not change markets sustainably. Therefore, policy makers should focus on the important aspects of building a sustainable market for energy efficiency. One important way to achieve this overall objective is to institutionalise sustainable market institutions that facilitate market mechanisms and substantially reduce investment inefficiencies. Programmes that recognise this are especially successful in triggering sustainable market mechanisms. In Turkey, for example, developing a sustainable energy efficiency leasing market by using leasing companies as market facilitator is crucial for the high scalability of the Fund. A similar conclusion can be drawn for the CHUEE Program. Providing a one-stop-shop by establishing a network of equipment and service suppliers as well as financial institutions for energy efficiency projects is an important factor for CHUEE's success. Programs should thus use channel partners or multipliers such as ESCOs that share similar objectives in order to create a sustainable and scalable energy efficiency market. These market facilitators could further pool standardized energy efficiency projects and thereby facilitate their implementation.

Lessons for Iran:

- Recognize the role of non-financial instruments in order to achieve confidence building, commitment and awareness raising.
- Identify market facilitators or channel partners that can promote an energy efficiency market in the long-run and help to pool energy efficiency projects.

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