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ENERGY EFFICIENCY FINANCE PROGRAMS: BEST PRACTICES TO LEVERAGE PRIVATE GREEN FINANCE

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Abstract

A common struggle across energy efficiency programs is the creation of sustainable private sector markets that reduce the energy demand. The purpose of this study is to outline the best practice for achieving smart public programs that overcome the main energy efficiency challenges and leverage the private finance needed for deployment at scale. Our concluded program is based on an assessment of 10 case studies, interviews, and evaluations of past programs. The results revealed that strong policy frameworks should strengthen investment business cases with the right economic and regulatory drivers. Furthermore, more resources should support technical assistance. Activities such as awareness raising, pipeline generation, and derisking are essential to create sufficient demand and commitment. Besides, upskilling, equipping, and accrediting suppliers and technical advisors are critical to create a sustainable, scalable, and bankable pipeline.

Keywords: energy efficiency, financing energy programs, best practices

JEL Classification: O13, P18, C90

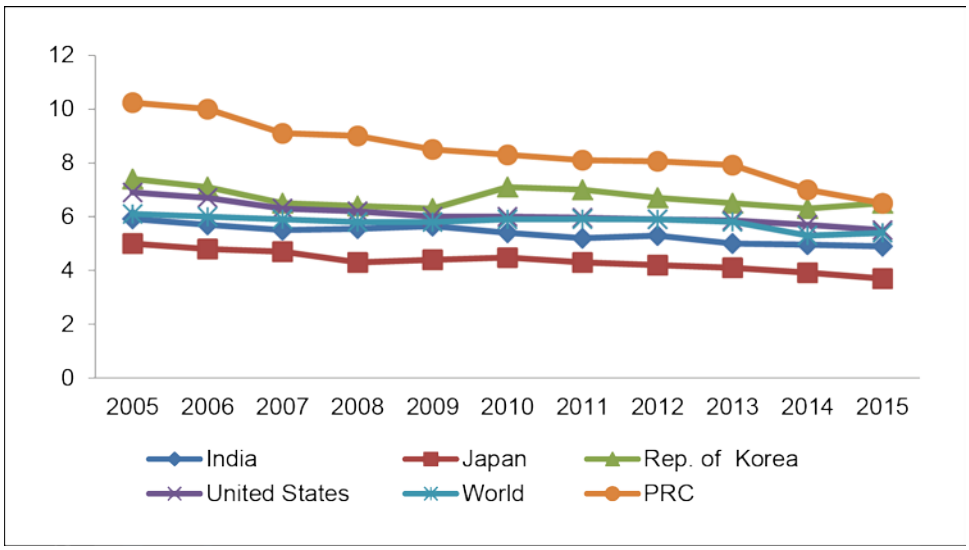
Contents

1. INTRODUCTION

A vast number of studies discuss energy efficiency (particularly Patterson 1996; Greening et al. 2000; Turner and Hanley 2011; Popescu et al. 2012; Tuominen, Forsstrom, and Honkatukia 2013; Markus, Brunauer, and Bienart 2015; Ihara, Gustavsen, and Preter Jelle 2015; Sorrell 2015; Koesler, Swales, and Turner 2016) as a way to achieve more with less energy usage in an economy. They consider energy efficiency, the act of controlling and minimizing energy use, as a major priority of governments around the world.

The importance of energy efficiency in this era is due to the gradual reduction of the planet's natural resources and nations' responsibility to sustain the global economy. Furthermore, energy efficiency has significant effects on various economic aspects. For instance, Smulders and De Nooij (2003) believe that energy conservation and efficiency can stimulate innovation and long-run economic growth, and Bataille and Melton (2017) express that energy efficiency improvements reorient the economic structure from capital-intensive energy supply sectors to relatively labor-intensive manufacturing and services. Taghizadeh-Hesary et al. (2016) find that government mandated energy efficiency targets in developed economies increase the resilience of their economies toward energy price shocks and strengthen the energy security. Moreover, the links between energy efficiency and energy intensity are an important point to consider. Figure 1 illustrates the trends of energy intensity changes in several different countries. It is apparent that all the nations have experienced a reduction in their energy intensity. For instance, Japan has one of the lowest levels of energy intensity (and very high energy efficiency), and, in the People's Republic of China (PRC), it is still high but improving. A reduced magnitude of energy intensity exists for the United States (US), the Republic of Korea, and India and even for the average of all nations in the world (represented by "world" in the figure).

Figure 1: Energy Intensity Trend in Several Nations (2005–2015, MJ/$ 2011 PPP GDP)



Source: Authors' compilation from the World Bank.

Based on the IEA's (2014) *World Energy Investment Outlook*, to unlock the economic and environmental advantages of energy efficiency, a huge increase in finance is necessary, with estimates projecting a need to mobilize over $550 billion a year by the 2030s. To this end, public finance plays a major role. At COP21 (the 21 Conference of the Parties), national governments and multilateral development banks (MDB) announced significant increases in funding for climate mitigation, with some pledging to double the amount that they provide. Even more recently, the G20 members officially affirmed their post-Paris commitment to scaling up green financing.

Generally, public finance has a crucial role to play in the field of energy efficiency (see e.g. Bardhan et al. 2014; Braun and Hazelroth 2015; Gouldson et al. 2015; Hall, Foxon, and Bolton 2016). It is a fact that energy efficiency markets face challenges across the supply chain, from financiers to end-users via technology suppliers and consultants. Whilst the specific barriers to energy efficiency in any given context are likely to be numerous and varied, there are three broad categories, shown in Table 1, into which they fall.

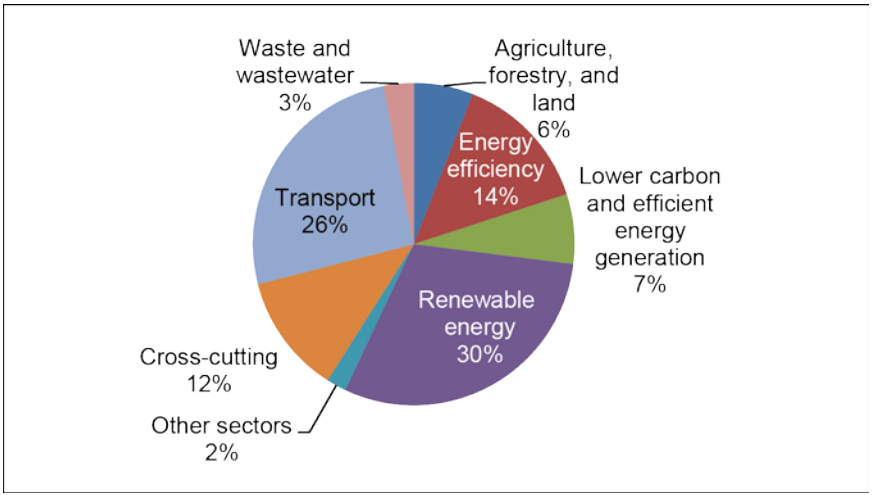
Table 1: Overarching Barriers to Energy Efficiency Deployment

Barrier	Explanation
Awareness and commitment	Lack of knowledge and awareness of energy efficiency, skepticism and misunderstanding of benefits, conflicting priorities, and a lack of motivation across businesses stymie the potential demand. Linked to this is the lack of a convincing business case in contexts with cheap energy and absent regulation.
Technical solutions and expertise	Insufficient technical capacity and a lack of commonality on best practice and standardization of procedures and technologies, including difficulties in project assessment, monitoring, and verification, act as obstacles to the delivery of energy efficiency solutions that are trustworthy and minimize hassle.
Financial resources	Perceived high investment costs, coupled with prohibitive calculations of risk and return, limit the supply of affordable capital and the demand for such investments.

These challenges are a complex combination of technical and financial barriers. Further exacerbated by the presence of market distortions (such as energy subsidies), and without externalities (such as carbon) priced to incentivize energy efficiency, the private sector historically has not invested heavily in energy efficiency relative to other opportunities that exist. Hence, public programs are essential to overcome both the technical and the financial obstacles, stimulate energy efficiency markets to unlock the opportunity, and leverage the far greater sums of private finance needed to scale up to $550 billion per year.

It should be noted that a principle source of public funding for programs is development banks (Oji, Soumonni, and Ojah 2016). They help developing economies – where the greatest opportunities lie – to move toward a sustainable development path. In 2015, multilateral development banks (MDBs) alone committed $2.9 billion to energy efficiency programs. However, this investment represents just 14% of all mitigation investments and is less than half the amount invested in renewable energy (Figure 2). Given the tremendous potential for further investment in energy efficiency, there is scope for this to increase many times over while also improving the deployment of existing investment.

Figure 2: Multilateral Development Bank Mitigation Finance by Sector Type, 2015



Source: Authors' compilation from the *2015 Joint Report on Multilateral Development Banks' Climate Finance* (Asian Development Bank 2015).

There is also an urgent need to reassess and reorient the focus of investment. There has been a common struggle across many programs worldwide to create sustainable private sector markets that are effective in reducing the energy demand and consequently greenhouse gas (GHG) emissions, with very few undisputed examples of success. Too often, programs have only addressed part of the problem, leaving other barriers deeply entrenched. A more comprehensive approach needs to replace the narrow focus on finance, the provision of credit, and enhanced liquidity.

Our study aims to contribute to the energy efficiency finance discussion by drawing from the Carbon Trust's 15 years of experience with energy efficiency in addition to insights from interviews with development banks, commercial investors, program implementers, and non-governmental organizations. The objective is to build a greater common understanding across these organizations about how best to design energy efficiency finance programs to create and support self-sustaining energy efficiency markets.

The remainder of this study is organized as follows. Section 2 sets out a framework for assessing and indeed designing energy efficiency finance programs. The next section represents a number of best practices around the world. Section 4 concludes the paper and offers recommendations.

2. A FRAMEWORK FOR ENERGY EFFICIENCY FINANCE PROGRAMS

In this section, we set out a framework for energy efficiency finance programs. This framework can help in the assessment of individual existing schemes and act as a guide to the necessary elements to include when designing a program.

The first point that we should mention is the question of "what is the target market?" The definition of the target market will shape the parameters of every solution package. Across a number of programs that we examined, there was often insufficient understanding of the market before the design and implementation began. Consequently, the programs failed to exert their expected impact because they were not sufficiently attuned to the market. Hence, a rigorous market analysis is a vital starting point for designing an effective and sustainable solution package. Given that any

program will have limited available resources, it needs to target the market appropriately to achieve the maximum impact. Therefore, a prioritization exercise will decide which target market within a particular country is the most suitable for a program. The most important indicators include energy benefits (as measured by demand reduction and cost savings for energy consumers and the energy system as a whole) and non-energy benefits (such as avoiding GHG emissions, increasing productivity, reducing energy poverty, and other socio-economic benefits).

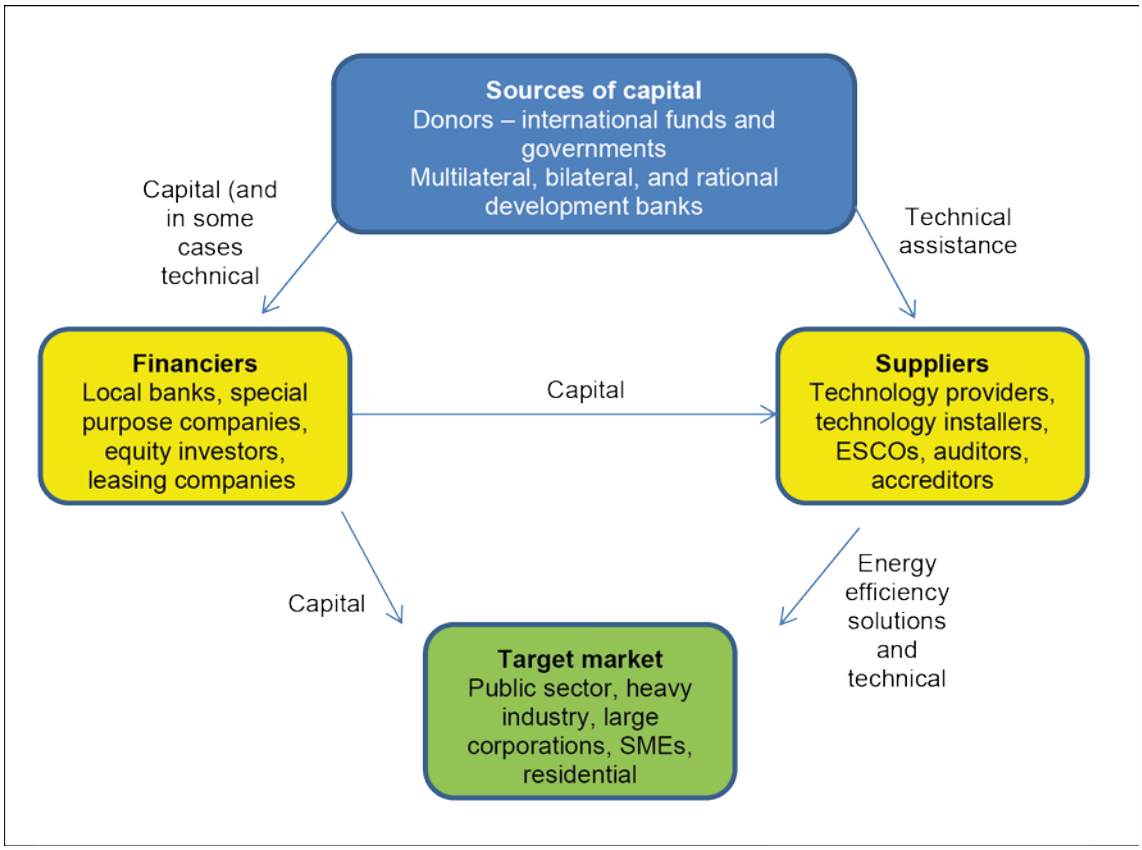
The second important point that we can highlight is the question “are there drivers for action?” It is imperative to understand whether the existing market and policy drivers fundamentally undermine or support the business case for energy efficiency in the target market. If any of these drivers are not favorable to energy efficiency, or not strong enough, they will undermine the goals of a finance program. Though challenging to address, drivers that weaken the case for action should prompt concerted efforts to align the policy with energy conservation where possible, such as removing energy subsidies. It is important to recognize that, if it is not possible to mitigate counterproductive drivers, it may be preferable for a program to focus on narrowly targeting emission reductions for a fixed period, as creating a sustainable market will prove to be problematic.

The third element of the framework is the question “is there a supply chain?” To realize the benefits of energy efficiency in a target market, a flow of information to build the essential knowledge, skills, and behavioral change is necessary. When a program needs capital investment, appropriate flows of technology and funding are essential. Institutions and companies with the expertise and connections to deliver them efficiently and reliably facilitate these flows. Figure 3 sets out a stylized supply chain illustrating the major components that must be in place for an energy efficiency program to succeed. Establishing this supply chain is a precondition for considering how a program can improve the functioning of individual components of the supply chain or flows of information, technology, and funding.

Examining the barriers across the supply chain is the next step in our framework. Before designing an effective program, it is vital to map comprehensively the barriers that key players across the supply chain face. This builds on an analysis of the current situation of the supply chain to understand the factors that are preventing it from operating effectively. The pervasive problem for energy efficiency is the perceived absence of a convincing business case. A lack of pricing of energy and carbon externalities does not help. Furthermore, energy savings do not create sales or cash directly but deliver a return by reducing costs relative to a counterfactual situation. This can be a hard sell, and homeowners, boardroom directors, and potential financiers do not regard energy savings as a transparent and trusted revenue stream.

The immediate objective of a program is to confront the unfamiliar and/or unattractive business case that manifests in barriers that prevent the flow of information, technologies, and capital across the supply chain. These barriers can be very specific to a particular context and apply to individual components of the supply chain as well as the connections between them. In an immature market, the barriers are likely to be numerous and varied, but there are three broad categories into which they fall (Table 1 provides an overview of the barriers).

Figure 3: Indicative Supply Chain for Energy Efficiency Finance Showing Components and Flow



Following the above barriers, the fifth element of our framework is the question "what solutions can address the barriers?" The reality of designing different aspects of programs rarely, if ever, bears a one-to-one relationship with the barriers that are present. In fact, some design features target multiple barriers, and certain barriers can necessitate more than one solution. Across the sample of case studies that we examined, the variety of program features that we identified and scrutinized is presented in Table 2.

We assessed them according to their relative impact on the three challenges that Table 1 outlines, for which darker shading indicates that the design feature is more relevant to that challenge.

Considerations of scale and time play pivotal roles here too. If awareness raising is deployed either too early or too late in relation to the availability of a concessional credit line or a lack of resources hampers its reach, it will neutralize the potential impacts. Programs also require monitoring of their progress and impact and a degree of flexibility in their design to respond to changing conditions. Ultimately, to stimulate sustained private sector investment, a market for projects that adhere to attractive rates of risk and return and are structured in an accessible way for investors is necessary. The objective of a program is to influence perceived risk and/or actual returns positively and to structure the opportunity in such a way that financiers invest in energy efficiency of their own accord. This demands an understanding of the risk–return profile of target investors.

Table 2: The Relevance of Different Solutions to Addressing the Overarching Barriers

Title of Program	Purpose	Method	Barriers		
			Awareness and Commitment	Technical Solutions	Financial Resources
Awareness raising	Build a critical mass of demand by increasing the knowledge and understanding in the target market and among financiers	Advertising, educational events, or direct outreach depending on the level of pre-existing awareness and the feasibility of reaching the target audience	Very relevant	–	–
Project identification and pipeline generation	Develop and prepare a pipeline of bankable projects to establish a sufficient market scale to interest financiers	Training suppliers, facilitating interactions across the supply chain, tracking potential customers, and demonstration projects can all help to create market scale in different ways	Very relevant	Relevant	–
Policy development	Tackle the fundamental drivers that subvert the business case to create a long-term, sustainable market environment	Advising on removing the pricing distortions of energy and carbon, introducing tax breaks, promoting policy roadmaps, and developing energy-efficient codes and standards	Very relevant	Slightly relevant	Relevant
Incentives	Temporarily alter the business case to encourage the demand or supply of finance	Concessional terms of finance, performance subsidies, tax breaks for energy-efficient equipment, and discounted TA	Very relevant	–	Relevant
Project assessment, monitoring, and verification	Develop the local capacity and a track record for ensuring and measuring the profitability of projects to reduce the perceived risks	Training local suppliers of goods and services or installing entities capable of transferring skills or outlasting the program	Relevant	Very relevant	Slightly relevant
Accreditation	Mitigate the perceived risks and consolidate trust in promised energy savings for financiers and end-users alike	Formal, authoritative qualifications based on historical performance for suppliers and equipment	Relevant	Very relevant	Slightly relevant
Standardization	Minimize the extra cost and hassle associated with unfamiliar transactions across the supply chain	Simple and replicable contracts between parties, user-friendly interfaces, and fast decision-making processes	Slightly relevant	Very relevant	Slightly relevant

continued on next page

Table 2 *continued*

			Barriers		
Title of Program	**Purpose**	**Method**	**Awareness and Commitment**	**Technical Solutions**	**Financial Resources**
Support for monetizing energy savings	Grow a market of suppliers that use energy savings within their revenue model, supporting confidence in the promised cash flow	Support for derisking investments in ESCOs to encourage growth in their business model	Slightly relevant	Relevant	Very relevant
On-bill financing	Overcome the lack of upfront capital and lack of trust in energy savings as revenue for property owners	Integrating investment costs with pre-existing bills where energy savings prevent the former from exceeding the latter over the payback period	Relevant	–	Very relevant
Unsecured lending	Alleviate the need for end-users to provide collateral to secure financing for energy efficiency investments	Financiers will lend against the merits and predicted cash flow of a project and not require assets as security	Relevant	–	Very relevant
Leasing	Free end-users from capital constraints associated with high upfront costs	Leasing parties will lend equipment as part of a service, possibly including maintenance or until the end-user pays off the cost and owns it outright	Relevant	–	Very relevant
Insurance	Mitigate the risk of the technology not performing as expected	Premium that the end-user or supplier pays to cover potential losses, reducing the perception of high risk and possibly the cost of capital if financiers concur	Slightly relevant	–	Very relevant
Guarantee	Risk-sharing facility to encourage financiers to expand into new markets that they perceive to be too risky under normal conditions	The program will cover a fixed percentage of the losses that financiers incur if their loans do not perform	Slightly relevant	–	Very relevant
Credit line	Address limited liquidity in financial institutions, increasing their willingness to use funds for energy efficiency	Injection of government, MDB, or other donor funds for on-lending, with specified terms for eligible projects attached	–	–	Very relevant
Aggregation	Increase the supply of capital in the market by reducing the relative transaction costs for investors through scale	Either “pooling” capital prior to identifying projects, or “bundling” pre-identified projects ready for investment	–	–	Very relevant

Local banks are often the primary target investors for energy efficiency due to the fact that they finance the public sector, businesses, and homeowners alike. Banks seek stable returns on low-risk investments. The disaggregated nature of many energy efficiency markets discourages investors: high transaction costs can erode limited returns. A program can attempt to counter this through project assessment, standardization, incentives, or aggregation. However, it must consider how to influence the target market as a whole rather than just isolated projects and investigate whether there is sufficient scale to interest investors.

The last point of our framework concerns "how can change be sustained?" As the first highlighted point of this section, we set out two objectives for measuring the success of an energy efficiency finance program: energy demand reduction and the sustainability of activity in the market when the program expires. While the first is realizable in isolation with targeted programs, too often they involve one-off or short-term fixes. The danger for any seemingly successful program is that, once its support is no longer available, the supply of and demand for finance wither too. There is an urgent need to drive sustained activity. To realize the 2 °C target and the long-term benefits of energy efficiency, quick fixes are inadequate. To achieve lasting change, a program must focus on the energy efficiency problem comprehensively and on the legacy of its solution package. It is vital to recognize that a sustainable legacy must involve the attraction of new entries into the supply chain to grow the private sector market. Simple solutions can best convince new financiers, suppliers, and end-users. Complex ones may appear to be convincing in addressing barriers on paper, but these groups will always seek the path of least resistance. To grow and sustain private sector markets, solutions must either be simple or, if they begin from a complicated starting point, develop over time to approximate the commercial conditions as closely as possible.

The above-mentioned points can manifest themselves in a number of practical lessons for energy efficiency programs aiming to achieve sustainable legacies. The next section describes a number of the most important lessons to emerge from our study.

3. BEST PRACTICES

This section assesses the strengths and weaknesses of ten case studies of energy efficiency programs from around the world, namely Property Assessed Clean Energy in the United States, the Green Deal in the United Kingdom, the Carbon Trust SME Energy Efficiency Programme in the United Kingdom, Commercializing Sustainable Energy Finance in Turkey, China Utility-Based Energy Efficiency in the PRC, the Energy Efficiency Revolving Fund in Thailand, Energy Efficiency Services Limited in India, Sustainable Energy Financing Facilities in 22 Eastern European countries and North Africa, PROESCO in Brazil, and Energy Service Insurance in Mexico (IEG 2010; IFC 2014a). Each program gives an insight into the common challenges and best practices in energy efficiency finance.

3.1 Property Assessed Clean Energy (PACE) in the US

The initial intention of the PACE funding framework was to act as a financing mechanism for solar PV projects to help meet climate goals in San Francisco, California. PACE's design was to provide a means of incentivizing renewable energy projects by tackling one of the biggest barriers to implementation – upfront costs. Energy efficiency exacerbates this barrier in the residential sector, particularly as property owners often move house before investments have paid for themselves. As a result, PACE tries to mitigate this influential disincentive. More broadly, from 2015 onwards, people viewed

PACE as a key mechanism to help policy makers to deliver the US's economy-wide target of a 26–28% reduction in emissions by 2025 from the 2005 levels (Bardhan et al. 2014).

California first introduced the Property Assessed Clean Energy (PACE) financing legislation in 2008. PACE refers to a framework for financing whereby homeowners pay for new technology projects through additional tax assessments placed on their property. These types of loans are available across a range of sectors. By 2010, 31 states had put legislation in place for renewable energy and energy efficiency financing in both the commercial and the residential sector. PACE loans for the residential sector ran into challenges in 2010 due to complaints from mortgage lenders Fannie Mae and Freddie Mac. The Obama Administration, however, revived the scheme in 2015. The case below provides an example in Boulder County, Colorado, which used bonds as a method of financing energy efficiency technologies, a unique approach to a PACE scheme.

In 2009, a Council on Environmental Quality report identified PACE financing programs as a means of expanding residential energy efficiency and the retrofit market. In Boulder County, Colorado, the residential sector was particularly important due to the County's 2008 program, BuildSmart, mandating energy efficiency improvements for homes.

Scholars largely considered the PACE framework to be a success, since the tax assessments combined with senior liens addressed the separate resourcing barriers for both homeowners and third-party investors, namely the lack of capital and the requirement for collateral, respectively. In addition, local municipalities engendered trust through their technical assistance and program outreach to homeowners by linking them with technology suppliers and ensuring that financiers had registered properly.

Despite the successes of this design, however, the sustainability of this model was brought into doubt in 2010 after mortgage lenders Fannie Mae and Freddie Mac complained that the liens had priority over mortgages, thereby causing difficulties in the residential sector. The scheme was revitalized in 2015 following new legislation, but the extent to which the model described above can be sustainable without interfering with other markets (e.g. the mortgage market) could represent a limiting factor.

3.2 Green Deal in the United Kingdom

The Green Deal intended to capture some of the estimated £3 billion per year in energy cost-saving opportunities for UK households and businesses, reduce carbon emissions, and reduce fuel poverty (for homes) by improving the efficiency of the residential and commercial building sectors. The introduction of the Green Deal also brought the UK into compliance with the EU Directive on the Energy Performance of Buildings 2010, requiring member states to draw up financing schemes for private property owners, SMEs, and ESCOs. More broadly, the initiative was part of the work toward meeting the 2008 Climate Change Act's requirement to reduce the UK's emissions by 80% from the 1990 levels by 2050 (Webb et al. 2016).

The Green Deal financing scheme was launched by the UK Department of Energy and Climate Change (DECC) at the end of 2012 to help households and workplaces make energy-saving improvements with loans that they could repay through their energy bills. Despite the addition of a £214 m Home Improvement Fund in 2014 (released in 3 stages), providing homeowners with upfront grants, the Green Deal was scrapped in July 2015 as it was far off course from achieving its target of upgrading 14 million homes,

with only 14,000 homes taking up loans from the Green Deal. The target markets for the Green Deal were the residential and commercial building sectors, which represented 13% and 20% of the UK's CO_2 emissions, respectively. By providing loans for energy efficiency upgrades that borrowers could repay through their energy bills, the expectation was that 14 million properties would participate in the scheme and experience energy bill savings thanks to the equipment by 2020 (Pettifor, Wilson, and Chryssochoidis 2015).

People largely regarded the Green Deal as a failure, as it did not meet the anticipated targets for uptake and then transformed into a grant scheme after the introduction of the Home Improvement Fund in 2014. Property owners were not convinced that the upgrades offered an attractive enough payback period. One of the main flaws of the scheme was its failure to address the lack of technical understanding of the bankability of energy efficiency projects in the financial sector. This resulted in high interest rates on finance of around 7%, reflecting the perception of the high risk of such projects. The high finance cost worsened the payback periods of the loans for property owners. As a result, these loans were largely unsuccessful in supporting investment in energy efficiency. Property owners were unwilling to borrow money for improvements with lengthy payback times. Moreover, the very fact that the Green Deal providers communicated the funding as "loans" when arranging the financing limited the scheme's appeal to property owners, who were unwilling to incur further debt. The scheme therefore failed to address the lack of awareness among property owners of the longer-term benefits of energy efficiency upgrades.

To compound this problem, the technical assistance that property owners received was conservative in its estimation of which energy efficiency technologies would satisfy the Golden Rule, limiting the pipeline of viable projects. The complexity of having to deal with multiple separate parties for both the households and the installer industry also dampened the demand, as did confusion with the Energy Company Obligation scheme, which targeted a similar pool of customers. Finally, the Home Improvement Fund, whilst very popular among homeowners, became unsustainable and ran out of funds in its first six weeks. Furthermore, though connected to the Green Deal scheme, it had very little lasting impact on the uptake of loans from the original scheme or in the marketplace in general, as the Government scrapped both the fund and the scheme in July 2015.

3.3 Carbon Trust SME Energy Efficiency Programme in the United Kingdom

Under the 1997–2010 Labour Government, there was a growing commitment from the UK to set ambitious climate goals, leading to the world's first legally binding GHG target with the 2008 Climate Change Act. Increasing energy efficiency was a key instrument in this commitment, which could also reduce SMEs' operating costs and grow the nascent energy efficiency job market. At this time, business groups viewed the Government's Climate Change Levy negatively, perceiving the Government to be taxing them without providing them with support to move to a lower-carbon, more sustainable basis. As a result, the Government created the Carbon Trust as an independent company with a mission to accelerate the shift to a lower-carbon, more sustainable future. The Carbon Trust was a natural home for implementing the energy efficiency loans scheme that it introduced shortly afterwards.

The Carbon Trust, which the UK Government set up as an independent company in 2001, has managed a $300 million program with the objective of opening up the market for energy efficiency. The Government originally provided the funds and disbursed them via unsecured, 0% interest loans ranging from $4,600 to $600,000. The program has realized savings of over 2MtCO_2 and $560 million on energy bills. Since 2011, it has only been available in Northern Ireland and Wales due to changes in the UK Government's priorities.

The loan scheme targeted any non-domestic businesses but particularly SMEs. The emphasis on SMEs reflects the difficulties that they face in providing the necessary collateral for debt financing in general, which exacerbates their tendency to place a low priority on energy efficiency given their (typically) low energy bills. The types of project financed included building technologies (e.g. air conditioning and heating), industrial process technologies (e.g. compressed air fittings and motors), and on-site renewables (e.g. solar PV and solar thermal). The scheme selected projects on the basis of meeting a minimum CO_2-saving threshold. In total, it reached over 7,000 SMEs across a range of non-domestic business sectors.

The extensive marketing and supplier engagement was influential not just in building awareness but also in connecting potential customers with technology providers. The training and accreditation of suppliers, which gradually built greater trust, enhanced this integration across the supply chain. Strict quality assurance was necessary to ensure that supplier-led projects met quality standards.

Demand was generated through attractive loan conditions and the ease of the application process. The unsecured lending and 0% headline rate circumvented the conventional barriers of SMEs needing to post their limited collateral against the loans and the high cost of capital. The difficulty involved in sustaining the activity beyond the life of the program emerged. The loan terms on offer, as well as the free technical advice, are unsustainable in the long term without ongoing government funding. The scheme has left a legacy in the shape of a recognized accreditation process and standard. There are indications of greater commercial lending to SMEs for energy efficiency, but ideally the scheme would have created a smoother transition to working with banks and suppliers directly in the UK with a clear pipeline of projects extending beyond those that the program supported.

3.4 Commercializing Sustainable Energy Finance Program in Turkey

Economic growth has corresponded to high growth rates in Turkey's energy and electricity usage, raising the country's coal and natural gas imports and thereby driving up the national debt. Turkey's GHG emissions grew from 188 to 422 MtCO_2 between 1990 and 2011. As a result, the Turkish Government made energy efficiency a key priority for a number of years, enacting several new laws and policies. These included a wide-ranging energy efficiency law in 2007 and an energy efficiency strategy in 2012 setting a target of reducing the energy intensity by 20% by 2023 in comparison with the 2008 levels. The move to a cost-based energy pricing mechanism from 2008, which has increased the exposure of customers to the underlying costs of energy, particularly electricity, has particularly assisted the drive toward greater efficiency.

The Commercializing Sustainable Energy Finance Program (CSEF) was a leasing initiative that the IFC set up in 2010 with funding from the Clean Technology Fund (CTF) ($21 m) and the IFC's own balance sheet ($100 m). The aim was to help local financial institutions (including leasing companies) to develop the capacity to assess and finance

energy efficiency projects. Phase II received approval in April 2015 (IFC 2014b). People have considered the scheme to be a success, and in the first four years of its operations, leasing companies invested approximately US$100 million of CSEF funds in over 50 energy efficiency projects. The expectation is that the CSEF will directly mitigate over 200,000t CO_2 per year. The CSEF targeted the commercial, residential, and municipal sectors with a particular emphasis on SMEs and smaller energy efficiency projects. SMEs represent a key sector within the Turkish economy, generating 25% of the country's GDP and 10% of its exports. Additionally, as the largest energy consumer accounting for 33% of the total consumption, the residential sector was a key target market.

The leasing model of the CSEF has helped to catalyze an increase in both the supply of and the demand for energy efficiency equipment, enabling Turkish leasing companies to progress from receiving concessional loans to receiving loans at commercial rates. Indeed, in 2014, the IFC was able to provide Yapi Kredi Leasing with a $96 m loan on fully commercial terms. This was largely thanks to the financial and technical assistance that the leasing companies received. Having addressed the supply-side challenges, the leasing companies, which already had extensive customer networks, were able to assess the technologies and market them to end-users. The customers benefit as SMEs that can access the products through leasing but that perhaps do not have strong enough balance sheets to be able to purchase equipment themselves.

This growth in technical expertise has made leasing companies more confident in seeking finance for energy efficiency equipment. To have a self-sustaining market, the awareness and expertise of Turkish commercial banks, which have traditionally been more reluctant to provide loans with lengthier tenors that are suited to energy efficiency projects, will need to match the confidence that leasing companies generate.

3.5 China Utility-Based Energy Efficiency Finance Program

Building on the success of previous World Bank programs in the Chinese energy efficiency market, the IFC blended its own funds with those of the Global Environmental Facility (GEF). The scheme, launched in 2006, was known as the China Utility-Based Energy Efficiency Program or CHUEE. It comprised two phases and ran from 2006 to 2012, with Phase III commencing in 2013. Banks lent $512 m until June 2009 ($384 m linked to the impact of the scheme) to 98 projects, with 0 defaults, with estimated CO_2 savings of 14 Mt per year over the initial target.

The energy demand in the PRC increased by over 100% in less than a decade, with the country becoming the world's largest CO_2 emitter in 2007. Correspondingly, the Chinese Government has made a strong policy commitment to supporting energy efficiency, particularly in the industrial and building sectors. Increasing energy efficiency became a priority in the 2006 Five-Year Plan, with a target of reducing energy consumption by 20% across the five-year period. The initial target market for the CHUEE scheme was SMEs, which traditionally found it difficult to access finance, particularly for energy efficiency, due to banks perceiving them as having high credit risks and the projects as having high performance risks. However, during the program, large companies from energy-intensive industries, such as steel, chemicals, and cement, dominated the loan applications. Small loans, intended for SMEs with smaller balance sheets, represented less than 10% of the total loans disbursed.

Overall, the program exceeded its CO_2 savings target; however, there were limitations in its design. The sustained change in the energy efficiency market in the PRC that this program drove has been modest. First, large companies from energy-intensive industries dominated the lending under the program, rather than the initial target of SMEs. This was perhaps due to the guarantee mechanism mitigating the perceptions of performance risk, related to energy efficiency technologies, but, with no distinction in the mechanism dependent on company size, the banks favored the lower credit risk of larger companies over SMEs. Second, one of the two banks was responsible for 98% of the loans. This bank had a strategic desire to expand into the market and a viable customer base, mainly large customers in the energy-intensive industries, representing an accessible demand. By contrast, the other bank lacked this connection to the market and was not as prepared to commit internal resources to developing the opportunity. Such a result emphasizes the importance of involving the right participants.

3.6 Energy Efficiency Revolving Fund in Thailand

In 2003, the Thai Government launched the Energy Efficiency Revolving Fund (EERF) as part of its wider Energy Conservation Program to stimulate investment from Thai banks for lending to energy efficiency projects. As of February 2012, 294 energy efficiency projects had been funded, without any defaults on the loans, realizing savings of 0.98 $MtCO_2$/year. In addition, the EERF was able to leverage private sector investment in energy efficiency projects with a 3:1 ratio. However, as of 2015, only 1 of the original 11 participating banks was still actively financing energy efficiency (Streitferdt and Chirarattananon 2015). This program fell under the Government of Thailand's policy target to reduce Thailand's energy intensity by 25% between 2005 and 2025. It also aimed to promote the competitiveness of Thai businesses by reducing their energy costs and their dependence on oil imports from abroad. Though not a specified driver, the program also needed to redress the energy price distortions caused by historic subsidies for diesel and the longstanding Oil Stabilization Fund that Thailand's Government had set up in 1973 to maintain the oil price and reduce the effects of price fluctuation.

The program has been successful in realizing significant energy savings, with over 7 billion THB disbursed to projects that have helped to save 0.98 $MtCO_2$/year. However, there are questions regarding whether the program has been effective in stimulating a self-sufficient market that can work without the incentives of concessional finance and technical assistance. It was initially effective in attracting interest from commercial banks, with the numbers of participants increasing from six to eleven over the course of the program. However, their interest was not sustained; as previously stated, only one bank actively continues to finance energy efficiency projects. The market distortions of the concessional credit and technical assistance prompted the banks' initial interest. The concessional credit line means that the returns on their investments in energy efficiency are more attractive, whilst the technical assistance for assessing projects can help to build capacity and mitigate the high perceived risk.

However, it appears that the local banks have not gained sufficient experience, and therefore confidence, in providing finance for energy efficiency projects. This could suggest that the technical assistance has resulted in a lack of skills transfer.

Part of the problem here could be the reliance on banks to move beyond their core business to assess the technical aspects of the projects. Given the immaturity of the supply chain, people could consider this process to be desirable, but ultimately commercial banks are not geared institutionally to providing such a service. In addition, because the solutions are primarily aimed at increasing the supply of finance, they may

not fully address the demand-side issues. Outside the banks selling the cheap finance and raising awareness themselves, there is no provision for technical training of the supply chain to provide a reliable pipeline. This is evident because, even when the banks have lent money, they have tended to favor larger, energy-intensive companies, because they see these as lower-risk entities. This situation left the original target market of SMEs underserved.

3.7 Energy Efficiency Services Limited in India

The Ministry of Power and Government of India set up Energy Efficiency Services Limited (EESL), a joint venture company of power utilities, to offer street lighting solutions using LED lighting to municipal corporations (MCs) and urban local bodies (ULBs) via an energy-saving performance contract. EESL is billed as a "super ESCO" and is intended both to support activity directly and to stimulate the ESCO market in India more generally (Jituri and Sarin 2015). The program run by EESL aims to replace street lighting across multiple municipalities in India with LED lighting. The Government of India viewed this as particularly worthwhile, as it estimated that it would take only 2 years to replace the country's existing 35 million light bulbs with LEDs and save approximately 9000 million kWh annually from the time of installation. Given the estimate of India's electricity consumption in 2013 of 897 TWh, this 1% reduction is a sizeable opportunity considering the speed of LED installation. The EESL model is also expanding into other technologies and sectors. In 2001, the Government introduced the Energy Conservation Act (ECA) to provide a conducive regulatory and policy framework to catalyze market-based energy efficiency implementation in India. In 2008, the Government followed the ECA with a National Mission on Enhanced Energy Efficiency, which promotes innovative policy and regulatory regimes, financing mechanisms, and business models for achieving energy efficiency in the national economy. The work of India's Bureau of Energy Efficiency (BEE) also supports municipal energy efficiency. The BEE has led projects across 15 states, finding that energy costs account for a significant proportion of their expenditure and identifying energy-efficient streetlights as an area of major saving potential. However, whilst the economic incentive is present, the upfront costs of replacing the existing lights constitute a major barrier for many municipalities that are in a challenging financial position.

The provision of standardized contracts without a minimum saving guarantee for MCs, coupled with repayments as fixed annuities, is expected to encourage MCs to commit to contracts with longer payback times, as they do not face such stringent requirements, which are difficult to prove due to poor data availability. In addition, the capital investments that EESL provides for manufacturers, with the backing of MC or state guarantees of payment, are likely to have a considerable impact on reducing the risk of investment in LED lighting. However, though the scheme is ongoing, there are outstanding questions regarding its sustainability. These arise firstly because manufacturers rely on the capital investment from the EESL to pay for LED lighting and secondly because it is unclear how effectively MCs will retain the technical assistance for installation, operation, and maintenance. To be both effective and sustainable in design, manufacturers will need to see a clear market case for energy efficiency – meaning that they no longer require grant financing. In addition, MCs will need to retain the technical knowledge that they will require for the installation and maintenance of LED lighting once the technical assistance is withdrawn.

3.8 Sustainable Energy Financing Facilities in 22 Eastern European Countries and North Africa

It is important to note that the energy context and challenges are similar across many Eastern European and North African countries. This situation has laid the foundation for the wide-reaching SEFF program. The most important drivers include:

- Technical inefficiencies of old equipment and long-standing underinvestment, which had reduced the international competitiveness of industries;
- For those in Eastern Europe, a political desire to align with the EU directives and regulations as Eastern European countries sought EU membership, despite their carbon intensity ranging from two to four times the EU-15 average;
- A desire to correct the energy pricing and regulatory distortions that did not incentivize energy efficiency investments, thereby highlighting the need for changes in policy.

The objectives of the SEFFs, to boost local investment in cleaner energy solutions, matched these drivers with a particular focus on offsetting the market distortions by incentivizing energy efficiency. Policy discussions, where possible, also worked toward correcting these distortions.

The Sustainable Energy Finance Facilities (SEFFs), which the European Bank for Reconstruction and Development (EBRD) first launched in 2004, aimed to promote efficient energy use in 22 Eastern European and North African countries with relatively high energy intensity across various sectors. Since their introduction, they have saved over 4 $MtCO_2$, channeling over €2.8 billion of the EBRD's own funding via 104 local financiers to over 75,000 end-users (EBRD 2014).

The bank designed the SEFFs to target either a country or a specific region, with Turkey and Bulgaria being the largest beneficiaries in both absolute and relative terms. In terms of specific sectors, while the largest number of projects (93%) were in the residential sector, the industrial sector (including SMEs) has been the main beneficiary in terms of funds (85%), followed by the residential (12%) and municipal (2%) sectors. The SEFFs tended to focus initially on sectors that were easier to reach and had a convincing business case for energy efficiency. Therefore, energy-intensive industries were often the first to receive attention, before markets such as the residential sector. This helped to establish a track record and familiarity within a location.

The scheme considers technical assistance to be invaluable to financiers, helping to reduce the perceived risk of energy efficiency projects and build their awareness and capacity. For every euro invested in technical assistance, the SEFFs leverage €83 in private sector investment. Financiers and end-users do not suffer any deterioration in their returns from energy efficiency projects as a result of this technical assistance because it is grant-funded. However, it is difficult to know whether the transfer of skills to local organizations has been sufficient to ensure self-sustaining private sector markets. Performance-based incentives increase the potential returns for end-users, fueling greater demand. As the SEFFs have matured, there has been a greater emphasis on tying incentives to CO_2 reduction, mimicking the function of a carbon price. The incentives have diminished over time as markets have become established and shifted to new sectors to avoid creating dependence on subsidized returns.

The relatively unusual policy dialogue component addresses the longer-term problems with incentivizing energy efficiency in commercial markets. Importantly, action on the ground complements it – actual projects delivering energy and carbon savings – to reinforce the case with policy makers considering the impact of policy settings.

Overall, while countries can undertake more to establish sustainable markets, the SEFFs' synchronization of financial and technical elements has helped to realize impressive results in diverse contexts and sectors. The simplicity of the program represents a key attraction, especially for financiers, when compared with other EU programs, such as the Structural Funds.

3.9 PROESCO in Brazil

The two main objectives of the PROESCO scheme were to support investments in energy efficiency equipment across Brazil's industrial, public, and commercial sectors and to accelerate the development of its SME-sized ESCO market. These represented significant economic opportunities for boosting competitiveness and growing a new industry. PROESCO's introduction occurred within a policy environment that had clear objectives to promote the growth of an energy efficiency market. Specifically, in 2001, the country introduced the Brazilian Clean and Efficient Energy Program to establish a dialogue between ESCOs and financial institutions.

The Brazilian Development Bank, BNDES, created the PROESCO program as a funding mechanism in 2006, which provided ESCOs with direct concessional loans and guarantees and commercial banks lending to ESCOs with guarantees covering credit risk. The objective was to enable investments in energy efficiency projects. The project witnessed very limited demand for its finance and eventually closed in 2015. This was due to a mix of several factors, such as an overly bureaucratic process when applying for finance, high collateral requirements limiting the capacity of small and medium-sized players to access it, and a general lack of technical assistance to build the pipeline of projects. The target clients of the program were ESCOs, utilities, and end-users interested in funding the purchase of energy efficiency equipment for the commercial, public, and industrial sectors. These sectors accounted for approximately two-thirds of electricity consumption in Brazil in 2006. Although there was no specific threshold, the intention was for PROESCO loans to be above R$1 m, drawing from a credit facility of R$100 m. Additionally, it was anticipated that the equipment being installed would have a payback period of six years. Both the payback duration and the initial funds show this scheme was intended for ESCOs at the larger end of the SME scale.

The solutions that the bank developed for PROESCO largely failed to incentivize the uptake of energy efficiency projects. This was partly due to the fact that, despite guarantees to cover 80% of the project costs, the perceived risk for these projects made commercial banks unwilling to accept even the remaining 20% on their own. For SME-sized ESCOs, this was also problematic due to low awareness as well as low willingness to adopt energy efficiency upgrades that made it challenging for them to secure finance. The collateral requirements of participating in the scheme further limited the demand for finance. In addition, the capping of interest rates at 9.1% for loans channeled through banks, whilst potentially decreasing the risk for ESCOs, also decreased the available returns for the banks, thereby disincentivizing them from building their capability to appraise energy efficiency loan applications. Finally, the process by which ESCOs could obtain loans, or banks could obtain guarantees, was overly bureaucratic, thereby hindering the uptake. Complex processes were particularly unwelcome given the perception of energy efficiency as a low priority due to the historic low cost of energy.

3.10 Energy Saving Insurance (ESI) in Mexico

In Mexico, there is an increasingly positive policy framework for energy efficiency. The policies include subsidies for energy efficiency, efficiency standards for technologies, a national accreditation system for technologies, and standardized contractual arrangements for supply-side energy efficiency

The ESI is a pilot program that commenced in 2015, which the Inter-American Development Bank (IDB) administered and the IDB, the FIRA (Mexico's Development Bank), and the Clean Technology Fund (CTF) funded, with additional support from the Danish Energy Agency. Separate pilots are also underway in Colombia and in preparation in El Salvador. It is the first energy efficiency program to deploy an insurance mechanism mitigating the perceived performance risk in developing countries. A standardized performance contract, validation mechanisms, and processes designed to increase the trust between contracting partners, to reduce the perceived risk, and to ensure that energy savings are realized that can ultimately pay back a loan taken out for an energy-saving project complement the insurance. This provided a derisking solution aimed at aligning market participants' incentives and thereby creating a sustainable environment for increasing private investments in energy efficiency for the local market.

As this program is currently in the pilot phase, with several technology providers having received validation and the first projects undergoing the assessment process, there is insufficient information to judge the effectiveness of its design yet. However, the combination of standardized energy performance contracts, project assessment and verification, and insurance against potential energy-saving shortfalls represents an impressively holistic approach to derisking the market. This could be effective in building trust within the supply chain and, consequently, the establishment of a self-sustaining market.

This multifaceted solution package requires a balancing act to align the benefits that these solutions can provide and the transaction costs that they may represent. In short, these extra processes need to bring down the cost of capital sufficiently for end-users to increase their energy efficiency investments and for financiers to supply finance at adequate rates. The aim is for the market to align with real rather than perceived risks, become more familiar with energy efficiency, and therefore spur competition. The effects of these shifts would be a reduction in transaction costs and the expansion of both the supply of and the demand for finance in the long term.

4. CONCLUSION AND RECOMMENDATION

This study reviewed several programs for financing energy efficiency based on earlier empirical case studies around the world. As a major result, we identified some categories of barriers, namely awareness and commitment, technical solutions and expertise, and financial resources. It is possible to match the most common solutions that have emerged from the case studies and wider energy efficiency programs with these barrier categories. We can suggest the following solutions to each of these barriers from the empirical best practices:

I. Awareness and commitment barrier: some policies, such as advertising, educational events, or direct outreach, depending on the level of pre-existing

awareness and the feasibility of reaching the target audience, can address the lack of knowledge and awareness of the benefits of energy efficiency.

II. Technical solutions and expertise: project assessment, monitoring, and verification are difficult without sector knowledge if there is insufficient capacity, commonality on best practice, and standardization of procedures and technologies. To overcome this barrier, it is possible to train local suppliers of goods and services to access potential opportunities for a given business properly through gaining an understanding of different technologies and building the capacity to conduct or at least understand key reports, such as energy audits. Alternatively, programs can install entities with existing experts that are then capable of either transferring skills to the local supply chain or outlasting the programs.

III. Financial resources: lack of familiarity and trust from end-users and investors in business models that monetize energy savings, such as ESCO (energy service company) service offers, can represent a crucial barrier. This makes it difficult for companies based on these business models to raise capital. To solve this problem, schemes can implement support for derisking investments in ESCOs to encourage growth in their business model.

In the case of awareness and commitment, it is possible to conclude that programs should not focus solely on the supply of finance; they need to stimulate and scale up the demand concurrently. Furthermore, to link the supply and demand, projects must be identified, prepared, and delivered to financiers in a commercially viable way. Moreover, timing and synchronization with the other components of a program are paramount for using awareness-raising and pipeline generation tools effectively. In addition, there should be a mutually reinforcing relationship between policy development and action on the ground. Besides, incentives (such as concessional finance) can temporarily create an attractive business case, but they are more suited to realizing short-term energy demand reduction than sustainably transforming markets. Regarding the barrier of technical solutions and expertise, the main conclusions and lessons from the best practices are the following: (I) trust is the essential glue that binds together any supply chain, performing a crucial derisking function for unfamiliar energy efficiency investments; (II) properly assessing, monitoring, and verifying projects provide the raw data for achieving trust, but these require standardization of procedures, contracts, decisions, and technologies to aid the process of aggregating and scaling credible data; (III) formal accreditation completes the process; (IV) implementing all, or even some, of the above requires skills and investment in the local supply chain; and (V) as a general rule, it is necessary to maintain simplicity wherever possible. In the case of the financial resources barrier, programs should not use financial solutions to address non-financial barriers. Moreover, financial solutions are often limited to addressing one financial problem at a time, and a good understanding of their shortcomings is necessary. In addition, simplicity is a fundamental principle. Furthermore, to nurture a self-sufficient private sector market, any financial program needs to exit the scene with its conditions as close as possible to commercial conditions. Besides, implementing energy efficiency finance demands a close connection between the financial and the technical support to sell energy savings to justify investment.

There are three indispensable recommendations to reorient the focus of programs and thereby drive transformational and sustainable change:

I. Energy efficiency finance schemes will not be enough to change markets. Strong policy frameworks with the right economic and regulatory drivers to incentivize and bring about change need to strengthen business cases. Therefore, influencing such frameworks must be a key objective of future programs.

II. Programs should devote more resources to technical assistance than they have allocated historically. Activities such as awareness raising, pipeline generation, and derisking are essential to create sufficient demand and commitment to act. Careful synchronization of technical and financial elements must also complement adequate attention and resources.

III. Upskilling and equipping suppliers and technical advisors, connecting the financial and technical aspects of energy efficiency, are also critical to creating a sustainable, scalable, and bankable pipeline. Across the supply chain, they have the greatest inherent incentive in their business model to identify, appraise, and deliver viable projects ready for financing.

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