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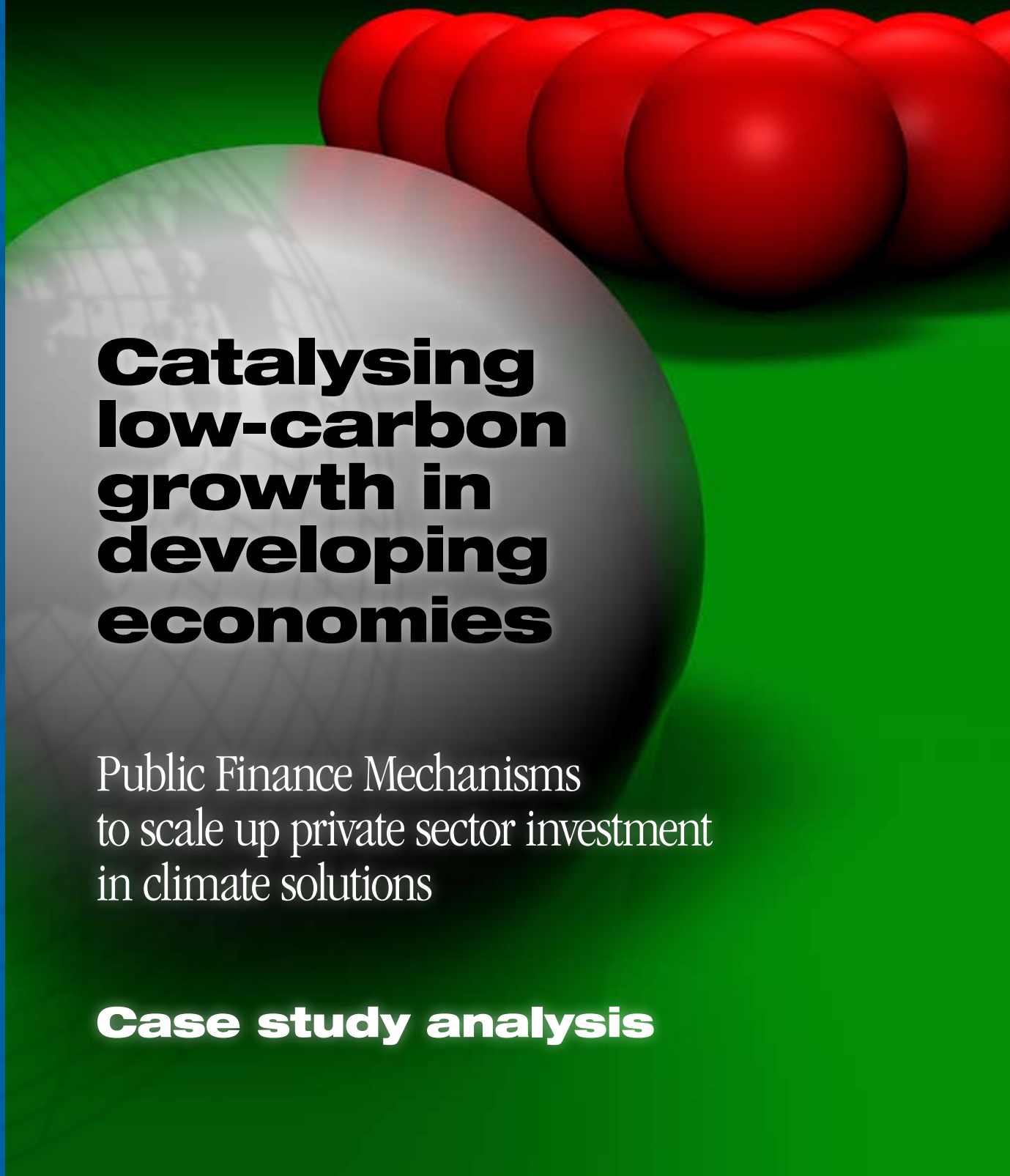

Catalysing low-carbon growth in developing economies

Public Finance Mechanisms to scale up private sector investment in climate solutions

Case study analysis

SEFI

UNEP Finance Initiative
Innovative financing for sustainability

IIGCC
Institutional Investors Group on Climate Change

DFID
Department for International Development

ClimateWise

The Prince of Wales's PS Group

PRI
Principles for Responsible Investment

Investor Network on CLIMATE RISK

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UNEP and Partners
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Contents

1 Introduction **4**

2 Key findings from individual case studies **5**

2.1 Low-carbon and infrastructure funds 5

2.2 Baku-Tbilisi-Ceyhan pipeline 7

2.3 Solar Thermal Electricity Generation in India, Egypt, Morocco and Mexico 7

2.4 Energy efficiency in Central and Eastern Europe 8

2.5 Domestic solar homes in the developing world 8

3 Emerging insights **10**

3.1 Key constraints to private sector engagement 10

3.2 The effectiveness of PFMs 11

3.3 Factors influencing success 12

3.4 Summary table 13

Annex: Individual case study details **14**

A.1 Low-carbon and infrastructure funds 14

A.2 Baku-Tbilisi-Ceyhan pipeline 17

A.3 Solar Thermal Electricity Generation in India, Egypt, Morocco and Mexico 19

A.4 Energy efficiency in Central and Eastern Europe 22

A.5 Domestic solar homes in the developing world 26

Appendix 1: List of abbreviations 31

Appendix 2: Interviewees 32

1 Introduction

This report presents a case study analysis on the use of Public Finance Mechanisms to scale up private sector investment in climate solutions. This analysis supports key recommendations presented in a companion report.[1]

Each of the five case studies illustrates aspects of Public Finance Mechanism (PFM) design. They include developed and developing world experience, more and less mature technologies, large infrastructure as well as small-scale projects. The five case studies are as follows.

The **funds** case study examines the use of PFMs at the fund level. The potential for institutional investors to allocate capital to funds concentrating on low-carbon projects provides one of the greatest opportunities for directing private sector capital to low-carbon investment in the developing world. This case study explores the constraints that are currently preventing this from happening and the ways in which these obstacles could be overcome.

The **Baku-Tbilisi-Ceyhan oil pipeline** (BTC) case study reviews a multi-country energy transport project. It shows how multiple PFMs, across several public institutions, can be successfully deployed in a coordinated approach. It provides insights into the way PFMs can support large-scale projects across several different national jurisdictions.

The **solar thermal electricity generation** (STEG) case study explores an early stage technology with considerable technical risk. The PFMs were intended to facilitate the uptake of the technology globally.

The **energy efficiency** case study examines support provided by the European Bank for Reconstruction and Development (EBRD) to energy efficiency projects in Central and Eastern Europe, where a suite of complementary PFMs were used to channel investment.

The **solar homes systems** case study examines small-scale photovoltaic units. PFMs were introduced in an attempt to stimulate a mass market for the technology in the developing world.

These five case studies draw upon material that is largely publicly available, as well as 30 interviews with individuals (listed in Appendix 2) with either firsthand experience of the case studies or other experience of PFMs.

This report is divided into two main sections. First, the key findings from each of the individual case studies are summarised. Second, there is an overview of the key themes that emerge from the collective experience of the case studies. An explanation of how these insights influenced the key recommendations in the main report[2] is provided.

More details on each case study, including the reasons underlying the choice of case studies, are available in the Annex.

1 UNEP and Partners (2009), *Catalysing low-carbon growth in developing economies: Public Finance Mechanisms to scale up private sector investment in climate solutions*, October.
2 Ditto.

2 Key findings from individual case studies

2.1 Low-carbon and infrastructure funds

2.1.1 Constraints

Although there are many opportunities for low-carbon (and similar) investments by funds in the developing world, three key categories of constraints prevent these opportunities from being realised. The three categories are: specific problems of low-carbon "deal flow", general problems associated with international investments (of any sort) in the developing world, and cultural constraints or lack of awareness among institutional investors of the opportunities available. These are summarised in the figure below.

Figure 1

Various constraints limit the growth of low-carbon funds investing in the developing world; many are common to all developing world funds

Barriers	Regulatory risk Planning risk Administrative barriers/corruption Project/construction risk	Forex risk Country risk	Culture Lack of awareness Unfamiliarity
Players	Project developers	Fund managers	Institutional investors Funds

Source: UNEP and Partners / Vivid Economics

Scaling up the number of funds focusing on low-carbon investments will require an increase in commercially attractive projects with an appropriate risk-adjusted return. Without increased "deal flow", low volumes lead to low liquidity and hence fewer exit opportunities for investors. A barrier to exit becomes a barrier to entry. In addition, the fund managers lack currently sufficient transaction volumes to build expertise and "track record".

Country, regulatory and currency risks also reduce investor interest in developing world low-carbon funds. Where PFM solutions are available, e.g. country risk guarantees, they tend to be at the project level rather than the fund level. This can be unattractive to institutional investors, who would prefer to be confident that PFMs will be available for the fund's projects, prior to committing capital to specific funds. In many cases, fund managers resort to tapping finance from local investors, even though this limits the pool of capital available, in order to overcome these risks.

A third constraint is that cultural barriers within fund and institutional investor organisations prevent serious engagement with the opportunities provided by low carbon, developing world investments. We do not pursue this issue further in this report except to note that such problems could be (partly) overcome by the publicity surrounding the creation of a package of risk support measures.

2.1.2 Issues identified in devising solutions to these problems

The problem of low transaction volumes needs to be tackled at macro level: fund and / or policy. Although PFMs supporting individual projects can help, Development Finance Institutions (DFIs)[3] are unlikely to have the resources to be able to offer a sufficient volume of project-level PFMs. The key recommendations report[4] proposes public support e.g. for the establishment of dedicated low-carbon project development companies, supplemented with technical assistance grants. Development companies could interact positively with low carbon funds, providing part of the solution to the lack of deal flow. Parallel to this, effective and credible low-carbon policies, including, for instance, feed-in tariffs and Advanced Market Commitments[5] (AMCs), could be another important component of overall success.

In terms of country, policy and currency risk, a distinction can be drawn between PFMs that result in the public sector sharing or absorbing specific risks and PFMs where the public sector shares in all risks.

The recent report led by Lord Nicholas Stern suggests that identifying and parcelling out specific risks to the public sector is preferable to an approach where all risks are shared by the public sector.[6] This is likely to increase economic efficiency and reduce overall costs. To this effect, multilateral DFIs could write country and policy risk insurance, as suggested in the key recommendations.

Alternatively, the public sector could share in all risks through equity participation. The International Finance Corporation (IFC), the Asian Development Bank and, to a lesser extent, the EBRD all use this approach. This may not be economically efficient in theory because DFIs would share in commercial and operating risks, which may better reside with the private sector, which can control these risks more effectively. However, equity participation has the important practical advantages of being simple, easy to implement and appealing to private capital.

For instance, the public sector might share in all risks through a subordinated equity stake. Subordinated equity receives dividends only after higher-ranking equity has been paid. This increases the number of projects in which a fund has invested that can face difficulties before private sector investors fail to receive a return considered acceptable. This may be particularly attractive when the risks are complex and interacting, so that specific risks cannot be underwritten. DFIs may feel that these structures are too generous to the private investor and may worry that fund managers will exercise less caution in controlling risk. Concerns with competition laws have also been identified, but it is possible that these can be addressed by ensuring vigorous competition for the available PFMs.

Options in which the public sector is allocated some risks or shares in all risks are not mutually exclusive. It is possible that some funds could both have a (subordinated) capital tranche from public sector institutions and also receive access to PFMs that transfer specific risks to the public sector. This possibility is reflected in the key recommendations.

The manner of implementation is important. The interviewees for this case study stressed that it is not simply a question of getting the public sector to provide the correct policy or PFMs,

3 Multilateral and bilateral finance institutions created for the purpose of development.
4 UNEP and Partners (2009), *Catalysing low-carbon growth in developing economies: Public Finance Mechanisms to scale up private sector investment in climate solutions*, October.
5 Advance Market Commitments are government commitments to procure, and therefore provide a viable market for, new technologies in advance of their development.
6 London School of Economics (2009), *Meeting the climate challenge: Using public money to leverage private investment in developing countries*, September. The summary for policy makers states: *'The private sector will invest to the extent that it expects a competitive risk-adjusted return. The role of the public sector, therefore, should be limited to reducing risks associated with market failures, policy credibility and equity considerations .... To go beyond this would be inefficient, stretching financing capacity of governments and causing deadweight loss. Governments would also risk crowding out market players otherwise ready to take on market related risk.*'

but that the implementation and *culture* of public sector institutions are crucially important. With reliance on policies that create demand, low-carbon funds benefit from close cooperation between public sector institutions and the private sector. If DFIs behave in a bureaucratic or inflexible manner, cooperation may not be effective.

2.2 Baku-Tbilisi-Ceyhan pipeline

The Baku-Tbilisi-Ceyhan (BTC) pipeline is used to export oil from Azerbaijan. It is a complex project involving eleven oil companies (led by BP, the project sponsor) and fifteen commercial banks. Two international financial institutions (IFC and EBRD), eight export credit agencies (ECAs) and various government authorities are also involved. The total investment cost was $3.8 billion. The pipeline became operational in 2005 after a three-year construction period.

PFMs were used to address inter-country and within-country political risks. Specifically, Georgia and Azerbaijan were newly independent states with little experience of international debt markets, and Turkey was in the midst of a financial crisis. Environmental risks related to routing and spillage were also a concern.

International Financial Institutions (IFIs) provided debt, and export credit agencies wrote guarantees. The IFC and EBRD provided 7% of the finance (9% of the debt). Oil companies and commercial lenders provided the rest. The commercial debt was underpinned by risk insurance and public guarantees from export credit agencies.

The IFIs brought intangible benefits. They enhanced the enforceability of host government agreements and helped ensure a transit deal for Georgia, reducing the risk of future disputes and interruptions.

Without the provision of PFMs, it is unlikely that the project would have been successful. The presence of two private-sector oriented DFIs facilitated the syndication and is believed to have increased the tenors (term of repayment) of commercial loans from 3 to 10 years, significantly improving the project's feasibility. The overall PFM package resulted in a DFI/non-DFI debt leverage ratio of 1:10.

2.3 Solar Thermal Electricity Generation in India, Egypt, Morocco and Mexico

The Global Environment Facility (GEF) embarked on a support programme for Solar Thermal Electricity Generation (STEG) in the 1990s through its Operational Programme 7. This programme supports the commercialisation of environmentally beneficial technologies by bringing down their cost. It commits to paying the difference between the cost of STEG and conventional technology, hoping to encourage take-up and decrease costs in the longer term. By 1999, the GEF was involved in four STEG projects with a forecast $195 million in grants (representing 13% of total investment costs) in India, Egypt, Morocco and Mexico.

The technology was new. STEG uses concentrated solar thermal energy to generate steam, either alone or in combination with fossil fuel generation. The configuration was commercially untested.[7]

The experience has been less successful than hoped due to a combination of problems. The transactions were delayed, there were difficulties with information sharing, and insufficient attention was placed on baseline risks (e.g. credible energy sector regulation). An effective response to these problems would only have been possible with close and effective collaboration between the GEF and the private sector. Two of the four projects have been cancelled.

7 In all four cases examined, the configuration was an Integrated Solar Combined Cycle (ISCC) System. This configuration integrates the steam output from a solar field into the steam turbine of a combined cycle gas turbine (CCGT).

The GEF envisaged privately-operated projects, but in the end they were operated publicly. The projects proceeded without private power producers, and only government co-financing was secured (from KfW, the Japan Bank for International Cooperation (JBIC) and the African Development Bank).

Progress was impeded by cultural differences. Consistent with the findings from the funds case study, there were differences in approach between the prospective public and private sector participants that may or may not have been soluble with greater dialogue. The private sector viewed the GEF very warily due to differences in language and speed of implementation.

There have been longer term benefits. The GEF pilots have raised awareness of the technology but may not have reduced technology costs.

2.4 Energy efficiency in Central and Eastern Europe

The EBRD Sustainable Energy Financing Facilities provide credit lines, supplemented by grant support, to energy efficiency and renewable energy projects in Central and Eastern Europe. The credit lines are made available to local banks for on-lending, at the banks' risk, to finance energy efficiency and renewable investments in the industrial, SME, residential and municipal sectors. In addition, consultants provide free energy efficiency advice, assistance with the preparation of loan applications and assistance to loan officers in local banks. Capital grants, often co-funded by partners, can contribute between 7.5% and 20% of the capital cost. These grants are disbursed when the project is accredited as delivering the improvements identified.

Since its introduction in 2004, the scheme has been scaled-up. In total, framework credit lines in excess of €850 million have been agreed, with 11 schemes operational across 9 countries. Up to the end of 2008, the EBRD reported that €362 million had been disbursed across 25 banks supporting more than 24,500 sub-loans.

The various PFMs collectively tackle the barriers that prevent (near) profitable energy efficiency projects from being undertaken. The credit lines allow longer tenors (repayment terms) than those typically possible in business lending. Grant support reduces capital costs and helps remove other barriers such as a lack of technical expertise preventing identification of projects, banks' potential misperceptions of risk in energy efficiency projects, and high initial capital costs.

Intangible support from DFIs has been important. The EBRD maintains a dialogue with policy makers with the intention of keeping the broader regulatory environment conducive to investment.

Private capital leverage ratios under the scheme have ranged from 0.1x-1.5x. This is a measure of how much additional private capital has been invested given the EBRD commitments in credit lines and grants/subsidies. It is also possible to assess how much investment in energy efficiency has been undertaken given the amount of grant/subsidy support.[8] The leverage associated with this grant support is much higher: typically 6x to 70x. Industrial energy efficiency projects appear to offer more cost-effective CO_2 savings than programmes focused on SMEs and/or residential investments.

2.5 Domestic solar homes in the developing world

PFMs for solar homes systems (SHS) aim to kick-start a self-sustaining market in small-scale solar photovoltaic (PV) units. These offer access to electricity in rural areas without power. The World Bank Group has attempted SHS support in over 20 countries, of which two, Sri Lanka and Bangladesh, are examined in detail here. Sri Lanka has received approximately $30 million in

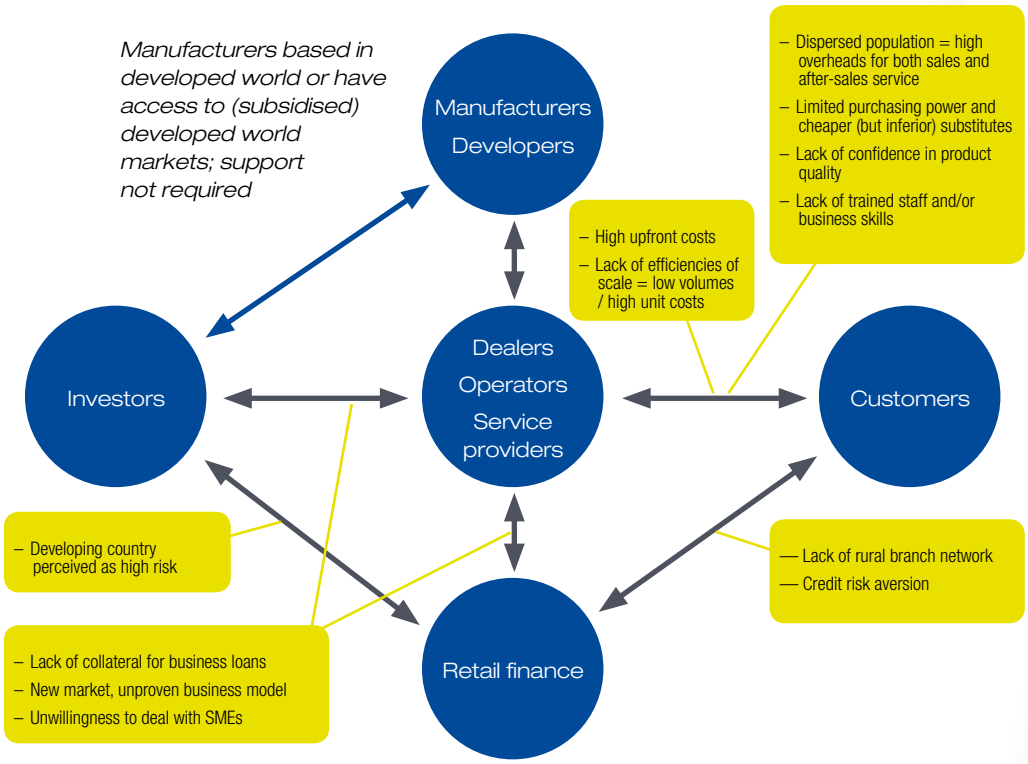
8 This calculation is important in the context that commercial banks on-lending the EBRD credit lines are free to set their own (commercial) terms.

assistance for SHS under two World Bank/GEF programmes since 1997, while Bangladesh has received approximately $23 million from both the World Bank/GEF and the IFC since 1998.

A self-sustaining SHS market requires numerous commercial relationships to function. These include relationships between manufacturers and dealers, dealers and customers, and customers and their creditors. The network of relationships between the different stakeholders and potential risks to each are shown in the figure below.

Figure 2

The web of relationships and risks in the market for solar homes systems



Source: UNEP and Partners / Vivid Economics

PFMs have been applied to most of these relationships. Typical components include: concessional loans to local financial institutions to ease flow of consumer credit; installation grants to reduce the price to consumers; technical assistance, for example to develop quality standards; and concessional loans to dealers to supplement their working capital. In the case of Bangladesh, World Bank PFMs included concessional loans to refinance consumer micro-credit, technical assistance and installation grants, while IFC/GEF provided a one-off loan to Grameen Shakti. In Sri Lanka, the focus was on loans to financial institutions for on-lending and installation grants. By further contrast, in northwest China, sales grants were combined with development of technical standards to improve confidence in product quality.

SHS sales grew exponentially in Sri Lanka and Bangladesh, but this may not have been the result of PFMs. Tens of thousands of units are now sold each year, compared to hundreds in the mid-nineties. This may be partly attributable to circumstances specific to the countries themselves and the time at which the programmes were implemented. The spread of PV in Bangladesh has been assisted by high population density and pre-existing expert micro-finance institutions, while the Sri Lankan programme was set up when there was considerable global optimism over the commercial potential of solar PV in developing countries. SHS in Bangladesh is still limited to social entrepreneurs, whereas there has been more commercial involvement in Sri Lanka.

SHS throughout the developing world retains a requirement for 'patient capital' that is willing to accept low risk-adjusted returns, or even the possibility of no return.

3 Emerging insights

This section draws out the key collective insights from the case study analysis. Eleven insights are grouped into three categories:

- the key constraints that PFMs need to overcome;
- the effectiveness of PFMs; and
- factors that influence the success of PFMs.

In each case, the evidence backing up the insight is provided, as well as a brief explanation of how this influenced the proposals set out in the key recommendations report.[9]

3.1 Key constraints to private sector engagement

Insight 1 Institutional investors seek scale. PFMs can enable scale by aggregating small projects

Institutional investors make capital allocation decisions at a scale far greater than the size of a typical low-carbon project. This is also the scale required to achieve global emission reduction targets. PFM support for institutional investors needs to be applied at this scale.

This scale can be achieved in two ways:

- First, numerous low-carbon funds into which institutional investors deploy capital can be developed. Both the recent World Economic Forum (WEF)[10] and Stern reports[11] consider models for low-carbon funds.
- Second, institutional investors can, via collaboration, encourage listed (multi-national) firms in which they hold stakes to undertake large-scale projects that they might finance directly.

This insight lies behind our proposal for a package of PFMs that would be easily available to institutional investors. One component of this package – early stage project management companies and associated technical assistance grants – is explicitly focused on promoting deal flow.

Insight 2 PFMs will often need to be packaged together

Since there may be several obstacles to overcome, several PFMs may be needed in response. The funds case study demonstrates the need to address both the *demand* for finance (commercially viable projects) and factors affecting *supply* of finance by tackling country risk and currency risk.

The need for a multi-pronged PFM response is found in several of the other case studies. The interventions in solar homes systems cover purchase cost reduction, credit availability, a qualified dealer network and working capital provision. The energy efficiency programme focused on both reducing capital costs and removing constraints within companies and local financial institutions. Meanwhile, the STEG industry was held back by insufficient host country regulation, low scale and technology risk.

Low investment and inadequate returns are often due to a number of factors that need tackling in tandem. A holistic and patient package of support may be required to enable projects to reach commercial viability.

This leads us to propose a package of PFMs and not a 'silver bullet' solution.

9 UNEP and Partners (2009), *Catalysing low-carbon growth in developing economies: Public Finance Mechanisms to scale up private sector investment in climate solutions*, October.
10 World Economic Forum (2009), *Task force on low-carbon prosperity*, September.
11 London School of Economics (2009), *Meeting the climate challenge: Using public money to leverage private investment in developing countries*, September.

Insight 3 **Many obstacles to low-carbon investment are generic**

While improving the competitiveness of low-carbon technologies compared to conventional ones via carbon pricing or other policies is important, many of the barriers to low-carbon investment are generic. In the fund case study, a lack of easily executable projects, country risk and currency risk are obstacles that also feature outside the low-carbon space. Likewise, in the STEG example, specific technology risks were compounded by more general problems of policy uncertainty, for example on power purchase arrangements, land access, adequacy of transmission infrastructure, and absence of regional power sharing agreements.

This is why the recommended PFMs, although only intended to be available for low-carbon investment, focus mainly on generic constraints preventing investment in developing countries. Only insurance cover for low-carbon policy risks reflects a response to specific challenges posed by low-carbon investment.

3.2 The effectiveness of PFMs

Insight 4 **PFMs can work!**

Well designed PFMs can leverage private sector investment. In the BTC example, all stakeholders agreed the support provided by the EBRD, IFC and export credit agencies was critical to the viability of the transaction. The combination of EBRD/IFC financing and export credit ratings resulted in a debt leverage ratio of 11:1. The energy efficiency case studies in Central and Eastern Europe also demonstrate how PFMs can help leverage private sector capital. While the experience with solar homes systems has not been an unequivocal success, there has nonetheless been a substantial roll-out of these systems in both Sri Lanka and Bangladesh.

Insight 5 **Success breeds success**

When PFMs work well, they may generate further rounds of investment without public support. Follow-on foreign direct investment is said to have started flowing in the aftermath of the BTC project and banks are now marketing directly to SOCAR (State Oil Company of Azerbaijan with 25% shareholding in BTC). Also, interviewees pointed to energy efficiency projects in Eastern Europe which they claim are now being undertaken without PFM support.

The PFMs within the proposed package could require institutional investors (or their intermediaries) to make a payment towards the support provided. This would provide an incentive to only use the PFM when it was necessary.

Insight 6 **There are intangible benefits to PFMs**

The benefits to the private sector from PFMs are not solely financial. In the BTC example, much of the benefit from DFI involvement was the comfort that came from their influence in the relevant countries, as well as their environmental, social and corporate governance standards. The EBRD's experience of running its energy efficiency programmes has also shown that it plays an important role in maintaining a dialogue with policy makers to ensure that the broader environment remains conducive towards investment.

This suggests that some elements of the package of support may be best supplied by multilateral actors, particularly country and policy risk insurance, where their political influence could reduce exposure.

Insight 7 **PFMs will not leverage institutional investor capital in all cases**

Technologies and investments with no or limited immediate commercial market prospects may be unsuitable for institutional investors. The solar homes case study showed that private sector

engagement was often limited to investors who did not require a market rate of return. In cases such as this, institutional investors are unlikely to be willing to provide capital.

This partly explains why the proposed package of PFMs is targeted at complementing the financing activities of institutional investors, largely by providing risk cover, rather than by providing direct financing. Thus public resources might be used in a direct financing role where institutional investors are unlikely to provide capital.

3.3 Factors influencing success

Insight 8 **PFMs need to be tailored to specific circumstances (both geography and technology) to be successful**

There is no universally best PFM. The requirements and incentives of the private sector will differ from geography to geography and industry to industry and also over time. The STEG example demonstrates that grants may help overcome cost disadvantages if a technology is not least cost, but they are an expensive (and possibly ineffective) way to address broader policy and business environment issues. The EBRD energy efficiency credit lines have been successful in part because they have adjusted to different circumstances in each country. In the solar homes case, demand for solar homes systems was boosted through micro-finance initiatives in countries where the micro-finance institutions were strong (Bangladesh) and by reducing up-front costs where such institutions were weak but savings rates were higher (China).

This implies that crude comparisons of leverage rates between different PFMs over dissimilar geographies and technologies are unlikely to be helpful. The appropriate question is rather, 'in this context, what PFM design will leverage the maximum additional private capital'? Involvement in the design stage of intended target parties of the PFM can help answer this question.

This is an important reason for proposing a menu of PFMs. It will allow institutional investors and their intermediaries to select the PFMs that best suit their specific circumstances.

Insight 9 **Mutual understanding between private and public sectors is necessary**

The creation of an appropriate PFM does not guarantee success: it has to be implemented effectively too. This includes collaboration between public and private parties. The STEG case study shows how the absence of common interests and approaches can undermine the effectiveness of PFMs. By way of contrast, there was much greater mutual understanding between the relevant DFIs and the private sector in the case of BTC.

This justifies the proposal for a regular forum explicitly focused on the issue of PFMs. In addition, the proposal to introduce competition between DFIs may encourage the public institutions to collaborate more with the private sector.

Insight 10 **Local involvement and support aid success**

Outcomes are improved where local stakeholders are fully engaged in defining the objectives of the investment and, often, its execution. In the STEG example, differences between the host countries (focusing on poverty alleviation) and DFIs (focusing on technology deployment) engendered brittle local support. In contrast, part of the success of the energy efficiency case can be attributed to the engagement of local financial institutions.

The proposals envisage host countries playing a role in defining access to PFMs, in determining spending priorities for grants, and in the proposed forum for dialogue on PFMs.

Insight 11 **Involvement of large firms with strong balance sheets and project management expertise is associated with success**

The BTC and EBRD energy efficiency credit lines are two of the more successful case studies. Common to them both is their implementation by large, well-capitalised companies: BP in the first case and leading local banks in the second case. By contrast, part of the problems associated with the STEG development was the perception that there was insufficient interaction between the World Bank and the existing STEG industry.

PFMs could be made available to firms undertaking (large) projects. Furthermore, since many large firms are part-owned by institutional investors, these investors could encourage the development of such projects. The finance for these projects could be provided either directly by institutional investors (in the case of projects that are large enough) or via low-carbon funds.

3.4 Summary table

Table 1 summarises the insights, the case studies from which they were drawn, and how they have influenced the key recommendations.

Table 1 **The findings from the case studies informed the recommendations**

Insights	Case studies	Influence on recommendations
Key private sector engagement constraints		
Institutional investors require investment opportunities at scale, but smaller scale projects should not be ignored	Funds	PFMs must be available to institutional investors. Project management companies and associated on-the-ground technical assistance is explicitly focused on promoting deal-flow
Problems are multi-faceted and require a coordinated portfolio of responses	Funds, STEG, solar homes, energy efficiency	A package of PFMs is preferred over a single mechanism
Many barriers to low-carbon investment in the developing world are not carbon-specific	Funds, STEG, solar homes	Cover for generic developing country investment risks is important enough to be included in the package of PFMs
The effectiveness of PFMs		
PFMs can work!	BTC, energy efficiency, solar homes	Essential pre-condition for proposing any form of PFM support
Success breeds success	BTC, energy efficiency	Institutional investors or their intermediaries could contribute towards PFM support to incentivise use only when necessary
There are soft/intangible benefits to PFMs	BTC, energy efficiency	Some of the package support is best provided by multilaterals
PFMs will not lever institutional investor capital in every case	Solar homes	Ensure that PFMs for institutional investors complement the private sector investor role to release public sector resources
Factors influencing success or failure		
PFMs need to be tailored to specific circumstances	Energy efficiency, solar homes, STEG	Essential to have a balanced package of PFMs
Implementation of the PFM is crucial	STEG, BTC	Forum bringing together providers and users of PFMs
Local involvement and support is a pre-requisite for success	STEG, energy efficiency	Involve host countries in outcome of competition for access to PFMs, in technical assistance grant priorities and within forum
Company involvement is linked to success	BTC, energy efficiency, STEG	Package of PFMs made available to firms as well as funds

Source: UNEP and Partners / Vivid Economics

Annex: Individual case study details

A1 Low-carbon and infrastructure funds

A1.1 Purpose of the case study

The aim of this case study is to examine the potential use of PFMs at the fund level, to look at funds that have already financed climate change mitigation projects (or projects with similar characteristics), with and without PFM support, and to draw out the lessons and themes from this experience.

On many occasions, investors make their investment decisions at the fund level. According to a recent statement by the Institutional Investors Group on Climate Change (IIGCC)[12]: *'most institutional investors such as pension fund managers invest in funds rather than individual projects. They need certainty that potential losses will be mitigated* ***at the fund level****, and that sufficient numbers of attractive deals will be available* ***to the fund****.'* [emphasis added]

Interviews with fund managers revealed:

— factors that discourage institutional investor participation in funds investing in climate change solutions, climate change mitigation and generally in the developing world;

— possible PFMs and other means of overcoming obstacles.

A1.2 Deal flow and developing country risk are key constraints

A consistent theme expressed by fund managers was that the scarcity of funds focusing on low-carbon investments is, to a significant extent, caused by a lack of attractive projects in which funds could profitably deploy capital.

— The limited interest in the asset class reduces liquidity and limits exit opportunities, making it less attractive to invest in a project in the first place, i.e. 'a barrier to exit is a barrier to entry'.

— The internal investment of time and money required by fund managers to gain the necessary expertise could only be recouped over a small number of transactions, reducing the incentive to make the investment. Moreover, not only are there a small number of projects, but they tend to be reasonably small scale, ie. $100 million or less.

This insight justifies the study's focus on PFMs at both the project and the fund level: successful use of PFMs at the project level could increase deal-flow and alleviate one of the major constraints on fund managers being able to offer attractive investment propositions for end-investors.

In addition, many of the constraints on end-investor interest in (developing world) low-carbon funds are generic to the developing world, namely:

— political risk where, in turn, a distinction can be made between, on the one hand, regime risk and the threat of insurrection, and more 'subtle' risks such as unanticipated changes in renewables policy or regulation; and

— currency risk which, for instance, as a result of mark-to-market accounting practices, undermine stable and predictable returns.

A1.3 There are a number of alternatives to project-based PFMs to improve deal-flow

As observed above, part of the way to improve deal-flow is likely to be achieved through project-level PFMs. However, the discussions also revealed a number of other alternatives.

12 IIGCC (2009), *Non-carbon market financing mechanisms for climate change mitigation and adaptation in developing countries*, May.

Improve the execution of market infrastructure and public sector institutions

A large proportion of the low-carbon sector only exists in response to carbon policy and so, relative to other sectors, the role played by public sector institutions can be disproportionately important.

Private sector investors commonly expressed concern that the execution of public support could be improved. Administrative delays obtaining Multilateral Investment Guarantee Agency support (see Section 2.1 of the key recommendations[13]) and approval of Clean Development Mechanism projects from the CDM Executive Board were cited as examples. More broadly, numerous discussions touched on differences in culture between development finance institutions (DFIs) and the private sector, with some DFIs considered to have overly bureaucratic and unresponsive procedures, sometimes unwilling to adapt standardised procedures to specific circumstances. These issues are also discussed in the STEG case study.

One response may be to improve the resources available to such bodies so that they attract and retain expertise. Another option is to introduce competition for sovereign funds between DFIs. Those institutions that successfully engage the private sector and leverage large amounts of private capital (profitably) would see their level of donor funding increase over time at the expense of those that were less successful.

Consider policies as well as, or instead of, projects

Many low-carbon projects are relatively small scale. Even the best resourced DFIs are unlikely to be able to offer much management time to individually-transacted PFMs such as grants or loans. Some discussants suggested that DFI support could be channelled to sector-wide policies, improving the viability of all projects in the sector: for example co-financing a feed-in tariff.

Project development companies

A further inducement to deal-flow is the deployment of project development companies. This is discussed in Section 2.4 of the key recommendations.

A1.4 Most other fund risks are not carbon-specific

The second set of obstacles consists of risks common to many projects, not just low-carbon projects. These include country and currency risk. There are two ways to share some of these risks with the public sector:

— transfer specific risks; and/or
— transfer a proportion of all risks.

The former approach should lead to risks being placed on those parties best able to control the risk, and hence lower overall costs. The latter is simpler and could be attractive if neither party is best placed to shoulder the risk or if different risks are inter-related and cannot be separated.

Parcelling out specific risks

For some country-specific risks, political risk insurance is available from the private sector, but cover is incomplete and pricey. For this reason, there are already a large number of PFMs that provide political risk guarantees (see the BTC pipeline case study). One option mentioned by interviewees would be to make similar insurance instruments more easily available at the fund level, i.e. to provide a country 'wrap-up' for all projects within the fund. As well as an insurance product of this sort being instrumental in leveraging private capital into low-carbon funds, the insurance itself could be leveraged through the use of PFMs. This would be particularly attractive in cases where the public sector considers private sector insurance providers to be currently mispricing risk.

13 UNEP and Partners (2009), *Catalysing low-carbon growth in developing economies: Public Finance Mechanisms to scale up private sector investment in climate solutions*, October.

Alternatively, a high-risk country could enter into a contract to transfer risk with a country where the political risk is much lower. This approach has already been used at the project level, for example, in the arrangements for the toll road between Pretoria (South Africa) and Mbutu (Mozambique). This works best where the fund is domiciled in a low risk country neighbouring a higher risk country in which the investments are being made: in this case the low risk country would have the strongest incentive, and be in the best position, to influence the political risk associated with its neighbour.

Some currency risk can be hedged in the foreign exchange markets. However, instruments may not be available for some developing country currencies.

Sharing in all fund risks

In another model, the public sector takes a (subordinated) equity stake in a fund. This reduces the magnitude of all risks borne by institutional investors.

An innovative example of this approach was proposed in relation to a proposed fund for investing in developing world renewables set out in Box A1.

Box A1 The potential role of subordinated public equity in a fund

- Proposed €100m fund for mid-size renewable (wind, solar, hydro, biomass) projects (<€10m, 5-50MW) in developing countries.
- Fund manager identified niche between large projects that are often funded on an individual basis with donor support and smaller projects that are too dispersed and with returns that are too low to engage institutional investors.
- Public sector planned to invest around 20-30% 'subordinated tranche' with remaining investment from institutional investors.
- Private investors would receive all net cashflows generated by the fund up to a return of around 6% above the risk free rate.
- Public sector would receive the next tranche of net cashflows until a nominal return of 2% above the risk free rate had been achieved.
- The remaining cashflows would then be shared between public and the private sector on a pro rata basis.

The proposal stalled upon legal advice that preferential treatment of end-investors could contravene competition laws. More generally, public sector subordinated equity tranches might also reduce incentives on fund managers to control risk.

A1.5 Summary of case study key findings

1. Funds are constrained by a lack of projects with attractive returns. The supply of finance from funds follows demand for them.
2. Public institutions' processes could be better tuned to private sector investors' needs.
3. Many of the risks of greatest concern to institutional investors are not unique to low-carbon investments; experience from other sectors is pertinent.
4. Such risks can be specifically parcelled up and allocated to the public sector, or absorbed by the public sector in a more generic risk support package, depending on what is considered appropriate in the circumstances.

A2 Baku-Tbilisi-Ceyhan pipeline

A2.1 Purpose of the case study

The Baku-Tbilisi-Ceyhan oil pipeline (BTC) is a case study from outside the low-carbon sector, but it provides insights that are relevant to large scale low-carbon investment in the case of mature technologies.

BTC was a highly complex project finance transaction. It was financed through project-specific debt and equity rather than through the balance sheet of any of the participating oil companies and involved a large number of stakeholders: oil companies (including BP, the project sponsor), commercial financiers, international financial institutions (IFIs), export credit agencies (ECAs) and government authorities.

BTC is an example of a multi-country energy transport project, bringing Azerbaijan's hydrocarbon reserves to market via Georgia and Turkey. There are parallels to, and lessons for, plans for a high voltage transmission line for solar power from North Africa to Spain.

By using PFMs, the project overcame country risk, financing gaps and reputational risk in a concerted approach involving several public institutions (two IFIs, eight ECAs).

A2.2 Description

Background and objectives: The 1,000-mile-long Baku-Tbilisi-Ceyhan pipeline establishes an export route for Azerbaijan's oil reserves. It is part of a larger effort that includes a parallel gas pipeline and the development of the Azeri-Chirag-Gunashli (ACG) oil field.

Ownership: The pipeline was developed by a dedicated company (BTC Co.) formed by the affiliates of eleven national and international oil companies, led by BP as the majority shareholder and operator of the company.

Cost: $3.8 billion.

Financing structure: The project was structured as a project finance deal (i.e. off the sponsors' company balance sheet, with loans repaid entirely from project cash flow), with strong sponsor guarantees during the construction phase. BP and its partners provided 30% of the finance as equity, with the remaining 70% provided by a combination of commercial lenders, international financial institutions (IFC, EBRD) and eight export credit agencies from seven countries, which also provided risk coverage. The large number of parties was a function of the size and complexity of the deal together with perceived high political risk. Loans are due to be repaid by 2013–15 with all investment costs to be recouped by 2026.

A2.3 Numerous risks associated with the pipeline called for a PFM

Political risks: Three states, Azerbaijan, Georgia and Turkey, collaborated on the project. Georgia and Azerbaijan were newly independent at the time of financing and construction and had little experience of international debt markets. Turkey was in the midst of a financial crisis.

Inter-country risks: More parties in general create more risk: the same pipeline within one country would have presented lower risk. Georgia, as a pure transit country, was of greatest concern since its interests were least aligned with the pipeline's objectives. In contrast, the principal benefits of BTC accrued to Azerbaijan through increased revenues and capacity to deliver oil to international markets. Similarly, Turkey had much to gain from selling the oil.

Price and volume risks: Since the sponsors also owned the ACG oil field in Azerbaijan, there were few volume risks. The transit tariff was structured to increase with lower throughput, keeping revenues relatively constant and giving sponsors an incentive to pump. However, a minimum operational flow is necessary. Oil price stress tests suggest that the project remains viable at oil prices as low as $14 a barrel.

Environmental risks: There were multiple environmental risks related to routing and the risk of spillage.

Reputational risks: Any adverse impact on human rights or the environment would damage the reputation of both sponsors and lenders.

A2.4 In addition to debt financing, the PFM provided significant intangible benefits

There were several benefits from public sector involvement in this project.

Increased debt financing through long term financing and syndication facilitation: The IFIs provided much needed long-term financing, both directly through their A loans and indirectly by mobilizing commercial bank funding through their B loans.[14] Without the IFIs the maximum tenor provided by commercial lenders might have been about 3 years. With the 12 year guaranteed debt provided by the IFC, EBRD and ECAs, commercial tenors increased to 10 years.

Political risk mitigation: The two IFIs (i.e. IFC and EBRD) possess considerable regional know-how and influence as major investors in Azerbaijan, Georgia and Turkey. For example, transit fee conditionality pushed through by IFIs ensured that Georgia got a fair deal, preventing disputes and potential interruptions later. The presence of IFIs enhanced the enforceability of host government agreements and international agreements.

Reputational risk control: The environmental and social standards of the IFIs gave comfort to banks and sponsors. In particular, the IFC's linkage and community development programmes were developed to complement the sponsors' programmes.

Structuring expertise: The ECAs looked to the IFC and the EBRD to help structure the transaction.

Transparency: The IFIs ensured that the project was run transparently.

A2.5 Leverage

IFI financing was a small percentage of overall debt financing. IFIs, in conjunction with risk insurance and public guarantees, enabled 10x debt leverage (Table A1).

Table A1 The direct financial contribution from IFIs was limited

Financing type	Source	Amount (% of total debt)
International Financial Institution (IFI) loans	IFC EBRD TOTAL	$125 million (4.6%) $125 million (4.6%) $250 million (9%)
Commercial loans	15 commercial banks; risk insurance/public guarantees from 8 export credit agencies	$1.5 billion (56.4%)
Senior sponsor loans	BP, Statoil, Total, ConocoPhillips	$923 million (34.3%)
PROJECT DEBT	All	$2.7 billion
of which NON-IFI DEBT	All	$2.5 billion (91%)
PROJECT EQUITY (11 shareholders; BP: 30.1% majority holding)	All	$1.1 billion
PROJECT FINANCING	TOTAL	$3.8 billion

Source: UNEP and Partners / Vivid Economics – based on discussions with EBRD

14 In an arrangement using both A and B loans, the IFI lends directly to the borrower (the A loan) but also sells a proportion of the loan to commercial lenders (B loans). Those purchasing the B loans share in the preferred creditor status of the IFI.

A2.6 Implications for scale up

Despite its country risk, BTC is widely considered a success and won the 2004 'Deal of the Year' award of the Infrastructure Journal. Following its opening, Azerbaijan recorded economic growth in excess of 20% p.a. for several years, while Georgia and Turkey benefited from transit fees. Local engagement was achieved through community, social and environmental programmes. BTC promoted economic and political links within the region and with the West.

Large-scale project finance, particularly in a cross-border context, is a lengthy and complex process involving numerous parties. The financing structure depends on balancing the need to share risk and secure longer tenors against the complexity of managing numerous parties. Cross-border pipeline sponsors have essentially two project financing options. If political risk mitigation is important, IFIs' and/or ECAs' participation will be needed with the associated costs and delays. Alternatively, if avoiding "carrying" financially weaker partners is important, capital market financing could be sought but may either not be available or would come with a cost (e.g. short tenors).

The need for a PFM contribution can be temporary and yield wider benefits. Follow-on foreign direct investment is said to have started flowing as a result of realizing the BTC project and banks are now marketing directly to SOCAR (the State Oil Company of Azerbaijan with 25% shareholding in BTC). Alternative investors to IFIs would need to be assessed against three key attributes that IFIs brought to the BTC table: ability to extend tenors, significant regional know-how and rigorous environmental, social and corporate governance standards. These are hard to replicate and, together with an assessment of the international debt market, are crucial to bear in mind when considering whether a purely private financing deal would have been possible.

A2.7 Summary of case study key findings

1. Even where there is significant country risk, PFMs can support large, complex transactions.
2. In complex transactions it is crucial that the PFM partners (in this case IFC, EBRD, ECAs) and the private sector develop mutual understanding and trust.
3. Multi-country projects with political risk are well-suited to PFMs. A fair allocation of project benefits (e.g. transit tariffs) reduces the risk of disputes and costly service interruptions later.
4. PFMs should be designed to account for the different incentives of different participants, for example producers versus transit countries, and should recognise that these incentives may vary over time.

A3 Solar Thermal Electricity Generation in India, Egypt, Morocco and Mexico

A3.1 Purpose of the case study

This case study explores the role of PFMs in the support of solar thermal electricity generation (STEG). STEG is viewed as a promising renewable generation technology at relatively large scale (although the historical pilots discussed in the case study were relatively small).

The focus of the study is the Global Environment Facility (GEF) experience of STEG in the 1990s. The GEF made STEG a priority in the mid-1990s, aiming to accelerate uptake globally and drive down costs. Although STEG is functionally proven, there are considerable technology risks, limited access to technical expertise and high generation costs.

It is a case study where not everything has gone according to plan. There were administrative, technical and financing complications that caused delays, and two projects were cancelled. However, two GEF-supported STEG projects are now under construction, and the first is expected to become operational in 2010.

A3.2 Projects

The GEF has a unique mandate to support climate change mitigation in developing countries, including, under one programme (Operational Programme 7), by supporting the commercialisation of environmentally beneficial technologies that are not yet least cost.

Solar thermal electricity generation power plants were identified as a priority technology under OP7 in the mid 1990s. In the belief that STEG would have great potential, the GEF began grant financing. Most projects were expected to be operated by an independent power producer (IPP) and implemented by the World Bank.

The GEF planned to subsidise the incremental cost of STEG plants over and above conventional fossil fuel plants. By 2000, the IPP approach had failed and was replaced by a purely public approach, with a national utility as the owner financed by government, donor and GEF grants or loans.

By 1999, four projects with a forecast $195 million in grants had entered the GEF/OP7 portfolio in India, Egypt, Morocco and Mexico (Table A2).

Table A2 **All countries experienced problems, while in India and Mexico construction did not start**

Project description	Financial source (financing mode)	Amount (% of total)	Notes
Mathania, INDIA 140MW ISCC o/w 35 MW solar 1994-2004 Cancelled	Rajasthan Govt (loan, equity, grant) KfW (composite loan, mainly CCGT) GEF (grant, mainly for solar portion) TOTAL Nil disbursements	$43m (21%) $113m (55%) $49m (24%) $205m	Project not implemented due to design, location, inability to secure gas supply and unwillingness of national government to commit subsidies to project. No bids for initial RFP, bidding process revised to attract interest.
Kuraymat, EGYPT 151 MW ISCC o/w 20MW solar 1998-current Construction: 2008-2010 Commissioned by 05/10	NREA – Govt of Egypt (loan) JBIC (loan for CCGT portion) GEF (grant for solar portion) TOTAL GEF grant fully disbursed	$126m (38%) $151m (46%) $50m (15%) $328m	Implementation began in 2008, after 10 years. Delays due to splitting of packages funded by GEF and JBIC led to scope change and redesign of RFP. Potential integration, performance problems due to separate contractors for separate EPC and O&M contracts for each portion (solar and CCGT).
Ain Beni Mathar, MOROCCO 472MW ISCC o/w 20MW solar 1999-current Construction: 2008-2010 Commissioned by 05/10	ONE – Govt of Morocco (equity) AfDB (loan to ONE) GEF (grant) TOTAL GEF grant fully disbursed	$135m (24%) $390m (69%) $43m (7%) $568m	Market uncertainties, technology and lack of long term power purchase agreement led to lengthy bidding process. AfDB co-financing relatively smooth. Interest in scale-up activity as completion imminent.
El Fresnal, MEXICO 271MW ISCC o/w 29MW solar 1999-2008 Cancelled	CFE – Govt of Mexico GEF (grant) TOTAL Nil disbursements	$299m (86%) $49m (14%) $349m	Project not implemented due to limitations enforced by CFE (the public utility company). Poor industry response to published bidding. Several delays and inconsistencies between WB and country's procurement policies.

Source: World Bank; GEF; UNEP and Partners / Vivid Economics
Note: 'o/w' stands for 'of which'; ISCC (integrated solar combined cycle); RFP (request for proposals); EPC (engineer, procure, construct); O&M (operate and maintain)

A3.3 Delays and cancellations

Each country experienced significant delays in the initial design and bidding phase, often with ten years' lag to start of construction (right hand column, Table A2). In two cases, the projects were cancelled. There were a number of generic reasons for this. The technology itself was relatively untested commercially. In particular, the ISCC plants were the first of their kind; there were few suppliers and little consulting expertise globally, let alone in each country. This reflected the general status of the solar thermal industry which was still at an embryonic stage.

The World Bank had overestimated the suitability of independent power production given the level of baseline risks faced in the host countries. Deals were unblocked after moving to a less ambitious but more suitable (for the local context) public sector structure.

Furthermore, objectives of developing country parties (poverty alleviation) and those of developed world parties (alleviating environmental concerns) resulted in misalignment of expectations and brittle local support. In Mexico and India, there was controversy over the suitability of the chosen site. In Egypt, the government viewed the STEG plant as an opportunity to improve local manufacturing capabilities and provide employment opportunities, yet co-financing by the Japan Bank for International Cooperation (with their corresponding demand for a separate contract for the CCGT portion reflecting limited domestic interest in solar technology) created further implementation delays and risks. In contrast, African Development Bank (AfDB) co-financing of the STEG plant in Morocco was relatively smooth and aligned with the AfDB's objectives.

There were also differences in culture between GEF and the private sector. The private sector viewed GEF very warily due to differences in "language" and speed of implementation. In response to similar problems, IFC created intermediaries (funds, programmes – effectively executing agencies) that were responsible for delivery of particular programmes at arm's length from the IFC. The GEF was concerned that such a solution implied a lack of oversight.

A3.4 Extent of leverage is open to interpretation

Co-financing was drawn purely from public sources: other multilateral or national DFIs and client country governments. The pure public strategy was unsuccessful in India and Mexico, yet had strong client country backing in Egypt and Morocco.

Table A3 Ultimately, no private investment was leveraged

Project	Leverage scenarios	Leverage
Kuraymat, EGYPT	1.GEF grant leverages JBIC and NREA debt 2.GEF and JBIC leverage NREA debt 3.No leverage since no private investment	6x 0.6x 0x
Ain Beni Mathar, MOROCCO	1.GEF grant leverages ONE equity and AfDB debt 2.GEF grant and AfDB debt leverages ONE equity 3.No leverage since no private investment	12x 0.3x 0x

Source: World Bank; GEF; team analysis

A3.5 Recent developments

Industry: STEG activity has intensified in the last three years. 1.2GW is under construction, and another 13.9 GW is due to be added by 2014. There are several new entrants, including niche companies leading in various STEG technologies. GEF's projects, together with another ISCC plant in Algeria, have been closely followed by other countries and public-private partnership interest is growing in Tunisia, Jordan and Morocco. Nonetheless, the industry remains small and focuses on one-off customers. There are no end-to-end R&D, large-scale manufacturing, operations and maintenance programmes. The result is very high cost, underexploited economies of scale and limited investment in R&D.

Developed regions: Increased activity in STEG is centred on Spain (with 22 projects, 1 GW online by 2010) and the US (5.6 GW announced).

Developing regions: The Middle East and North Africa are suitable for solar power generation, having minimal cloud cover, high insolation and unused flat land close to road networks and transmission grids. In addition, energy consumption is growing quickly, and there may be future opportunities to trade renewable electricity in the Mediterranean Basin. However, country risks such as uncertain power purchase arrangements, land access, access to transmission infrastructure, and absence of regional power sharing agreements remain.

Financing: Large-scale deployment outside the US and Spain is unlikely to occur without additional concessional financing.

A3.6 Summary of case study key findings

1. Country context needs to be taken into account in project design and, in some contexts, advanced public-private deal structures may be too ambitious.
2. Investment grants may have a role to play but are an expensive and ineffective way to address broader policy and business environment issues.
3. Conflicting objectives and donor procurement rules can delay projects.
4. Novel technologies are particularly risky.

A4 Energy efficiency in Central and Eastern Europe

A4.1 Purpose of the case study

The aim of this case study is to examine a classic PFM designed to encourage energy efficiency projects in Central and Eastern Europe. The EBRD Sustainable Energy Financing Facilities provide a series of credit lines to banks for on-lending to energy efficiency projects in Central and Eastern Europe supplemented by targeted grant support.

Energy efficiency projects are often identified as a clear area where public sector intervention can help correct market failures. Several barriers to their efficient financing and implementation have been identified. For instance, from the company perspective, there is often a lack of focus on the opportunities provided by such projects due to limited in-house management expertise and a tendency to focus only on the core business. This, in turn, leads to barriers within the commercial financial institutions that might lend, including uncertainties about market demand and a lack of technical expertise for project appraisal.

A4.2 Description

The EBRD Sustainable Energy Financing Facilities scheme provides a series of PFMs (Figure A1):

— Credit lines are made available to local banks for on-lending, at the banks' risk, to (part-) finance energy efficiency and renewable investments in the industrial, SME, residential and municipal sectors.

— Technical assistance packages from consultants provide free energy efficiency advice, help prospective borrowers prepare loan applications, and assist loan officers in local banks in evaluating energy efficiency investments.

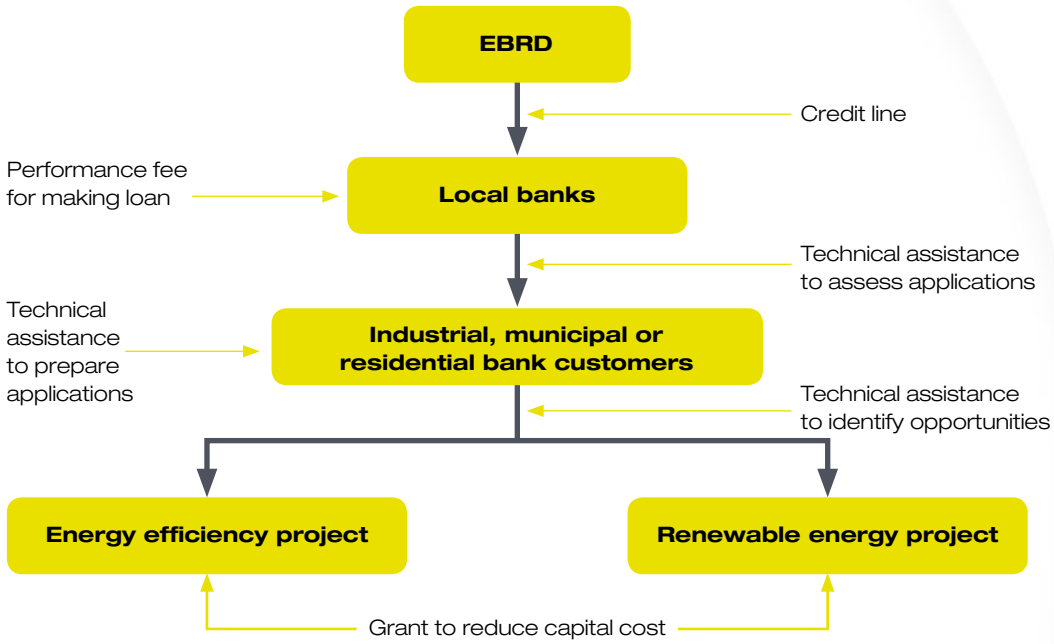
— In many instances, performance fees of 1-2% of the eligible loan value are paid to the bank upon agreement of the on-loan.

— Capital grants covering between 7.5% and 20% of the capital cost of specific projects are disbursed when the project is accredited as delivering the improvements identified.

The credit line scheme is part of a wider initiative within the EBRD to support energy efficiency in Central and Eastern Europe. The grant funding for grants is often provided by partner organisations.

Figure A1

PFMs are provided along the financing chain



Source: UNEP and Partners / Vivid Economics

A4.3 The scheme has been expanded in recent years

Framework credit lines in excess of €850 million have been agreed, with 11 existing schemes operational across 9 countries /regions (Table A4). A further two schemes are expected to start in 2009 with framework credit lines amounting to €120 million.

Up to the end of 2008, the EBRD reported that €362 million had been disbursed across 25 banks and that this, in turn, had supported more than 24,500 sub-loans. The bulk of the credit line support has been devoted to industrial energy efficiency and renewable energy projects.

To date, Bulgaria has seen the largest amount of credit line support, reflecting the fact that one of the initial impetuses for the scheme was to reduce the requirement for electricity supply from the Kozloduy Nuclear Power Plant.

Table A4 **Initial successes have led to geographic and sectoral expansion**

Country	Year commenced	Framework credit line agreed, €m	Amounts disbursed, €m	Sectors
Bulgaria	2004	155	85	Industry – energy efficiency and renewables
Bulgaria	2005	50	40	Residential
Ukraine	2006	150	66	Industry – energy efficiency and renewables
Georgia	2007	25	unknown	Industry/residential – energy efficiency and renewables
Slovak Republic	2007	60	38	Industry/residential – energy efficiency and renewables
Romania	2008	80	unknown	Industrial energy efficiency
Bulgaria	2008	20	unknown	Industrial energy efficiency
Kazahkstan	2008	53	1st loan agreements imminent	Industry – energy efficiency and renewables
Hungary	2009	25	too early	Municipal energy efficiency
Western Balkans	2009	60	too early	Industry/public buildings – energy efficiency and renewables
Russia	2009	200	Too early	Industry – energy efficiency
Ukraine	*2009*	*100*	*n/a*	*SMEs – energy efficiency and renewables*
Moldova	*2009*	*20*	*n/a*	*SMEs – energy efficiency and renewables*

Source: EBRD and scheme websites. Note: schemes in italics have yet to begin

A4.4 The public sector's roles

The intention of the PFM is to raise awareness of, and create a market for, energy efficient investments and to help overcome barriers that prevent (near) profitable energy efficiency projects from being undertaken. The credit line facility, although provided on commercial rates to participating banks, helps to overcome the problem that the required tenors can often be longer than those typically provided for business lending.

The grant focused on different types of barriers:

— the lack of technical expertise, preventing the identification of projects and the subsequent application for, and assessment of, loans to finance these projects, is tackled through the technical assistance packages.

— banks' uncertainty over market demand and potential misperceptions of risk of energy efficiency projects are addressed by the performance fees.

— the capital cost is addressed through the grant payable at the project's completion.

Consistent with this, a notable feature of the different schemes is that, although most grant support has been directed towards reducing capital costs, the weight attached to different forms of grant support has varied according to the relative prevalence of different barriers:

— In the Slovak scheme, where the total credit line facility is €50 million, €2.5 million of grant support (17% of total grants) has been provided for technical assistance; grants to cover the capital cost have amounted to €10 million (68%); and performance fees to banks accounted for €2.5 million (17%).

— In the Bulgarian residential scheme, where the framework credit line facility is also for €50 million, technical assistance has accounted for €1.4 million (10% of grant support), with grants and performance fees amounting to €13.2 million (the remaining 90%).

— In the Ukrainian industrial scheme with a framework credit line of €150 million, the only grant support, of €2 million, is for technical assistance.

Experience of running the programmes has also identified an important role for the EBRD in maintaining a policy dialogue with policy makers to ensure that the broader environment remains conducive towards investment, for example, providing a supportive regulatory framework for renewables.

A4.5 Leveraging private capital

Table A5 shows the outcomes achieved in a selection of five of the schemes to the first quarter of 2009. From this (restricted) sample, a number of observations can be made.

PFMs can work; the subsidies have been associated with projects many times the value of the subsidy being undertaken (in the selection in the table a minimum of 6 times more). Measured in terms of private capital leveraged by total public support, the leverage rates are lower.

If the circumstances are right then small amounts of public money in the form of technical assistance can be very effective at leveraging private capital. Situations where more extensive public support is required, as would be expected, have lower leverage rates.

Industrial energy efficiency projects appear to offer CO_2 savings at lower levels of subsidy than programmes focused on SMEs and/or residential investments.

The sub-loans provided under the scheme are reported to be performing better than the rest of the banks' loan books. This is attributed to the strong 'project finance-like' discipline imposed by the monitoring role of the EBRD and its agents, as well as a scheme design which ensured that subsidy was only disbursed when the project had been delivered.

Table A5 Subsidies have been associated with projects many times their value

Sectors	Subsidy from EBRD and partners, €m, (A)	EBRD loans €m (B)	Private capital €m (C)	Private capital leveraged by EBRD funds (C/(A+B))	Investment undertaken per € of subsidy ((B+C)/A)	Subsidy per tonne of annual CO_2e saving
energy efficiency for SMEs, renewables	13.8	82.1	70.4	0.7x	11.1x	25
energy efficiency for SMEs, renewables	8.1	36.1	10.8	0.2x	5.8x	38
residential and SME energy efficiency, renewables	6.7	38.0	10.3	0.2x	7.2x	235
industrial energy efficiency	1.7	9.0	0.9	0.1x	5.8x	4.9
industrial energy efficiency	2.0 – technical assistance only	55.5	85.5	1.5x	70.5x	4.4

Source: EBRD. Please note these figures are provisional

A4.6 Implications for scale up

The experience of the scheme provides a number of lessons when thinking about scaling-up schemes such as these and/or other PFM schemes.

Local banks and other financial institutions with an extensive branch network can provide an important distribution channel and 'on the ground' knowledge for ensuring that PFM support has a greater reach than would be possible if the PFM was only available through individual transactions.

'Smart subsidies' (e.g. subsidies only provided once as the scheme has been verified as delivering the identified improvements) can be used to overcome concerns traditionally associated with providing subsidies. While this has been successful, it has required the development of reasonably costly monitoring and verification arrangements which, initially, led to a reluctance on the part of local financial institutions to participate in the schemes. Consequently, if 'smart subsidies' are to become extensively used, the cost implications would need to be acknowledged, and there would need to be a priority on ensuring that the institutional arrangements were sufficiently well-resourced to ensure that they did not constrain the flow of projects.

On occasion, there has been a challenge in ensuring a sufficient pipeline of projects given the low priority to energy efficiency investments. In the context of these schemes, this was overcome by the EBRD advertising their benefits. Such promotional work could, in certain situations, be supplemented by a specialised agency akin to the UK Carbon Trust.

A4.7 Summary of case study key findings

1. The range of support mechanisms can and should be tailored to the specific features of the sector and country.
2. Grant support can be made contingent on outputs, but the monitoring arrangements required to achieve this may be expensive.
3. In the right circumstances, technical assistance packages can offer very high leverage rates.
4. The distribution networks of local financial institutions can be an effective means of DFI support penetrating an economy.

A5 Domestic solar homes in the developing world

A5.1 Purpose of the case study

This case study examines a mass market technology in the developing world. The aim of the PFMs is to stimulate a market in small-scale off-grid solar photovoltaic units (solar homes systems, or SHS) to advance rural electrification in developing countries. Many developing countries have large dispersed rural populations who may benefit from off-grid electricity supply.

The World Bank Group has attempted SHS support in over 20 countries including Sri Lanka and Bangladesh. There are many other examples, although with varying levels of success and publicly-available information.

A5.2 Interlocking market barriers necessitate a range of PFMs

A domestic PV market features numerous bilateral commercial relationships between a large number of market players. Many of these bilateral relationships are initially weak or non-existent, creating interlocking barriers to market development that discourage private sector interest. There may, therefore, be a need for a programme of PFMs to tackle these (and other) barriers concurrently.

Figure A2 sets out some of the barriers to SHS market development that may exist between each set of actors before the application of PFMs. Typical components of programmes to address these barriers often include:

— concessional loans to local banks and micro-finance institutions to ease flow of consumer credit;

— dollar-denominated installation grants to compensate for high over-heads, provide direct incentives to suppliers and reduce foreign exchange risks associated with imported components;

— technical assistance, for example to train staff or develop quality standards;

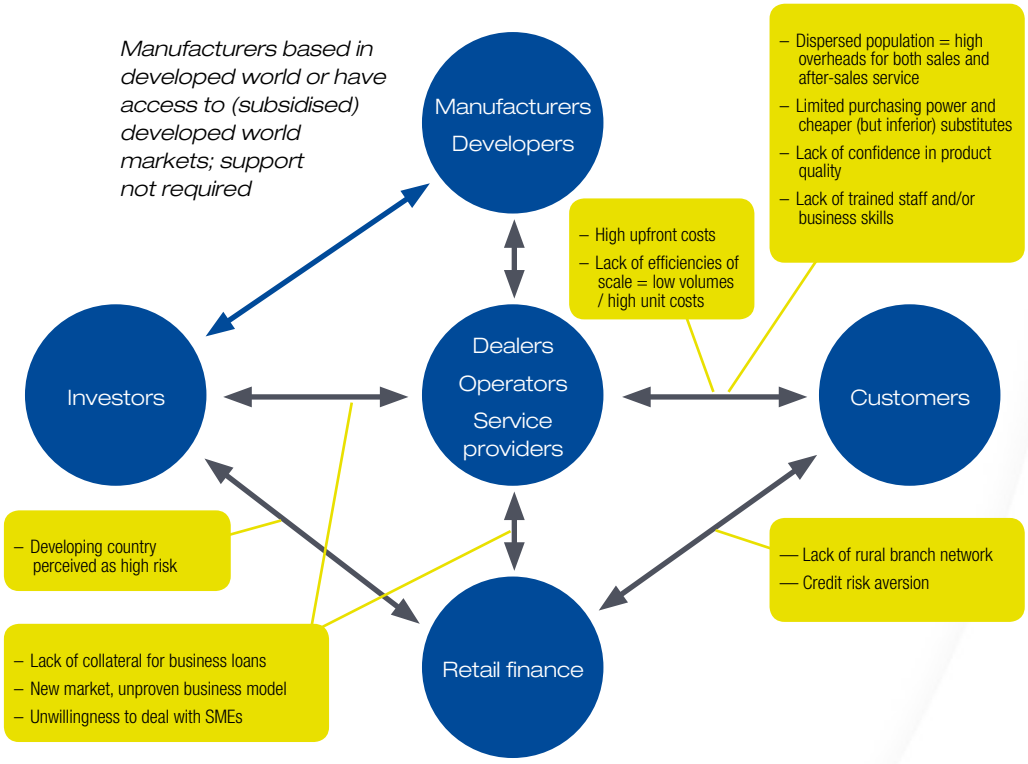
— concessional loans to dealers; and

— provision of guarantees on their behalf, to supplement working capital.

The borrowing requirements of both dealers and customers may differ, just as the preferences and willingness-to-pay for the units among customers may vary. A diversity of both financial and product offers must be available.

Figure A2

PFMs to support solar homes systems may need to overcome multiple market barriers



Source: UNEP and Partners / Vivid Economics

A5.3 The Sri Lankan scheme

Sri Lanka received assistance under the World Bank/GEF Energy Services Delivery (ESD, concluded in 2002) and its successor, the Renewable Energy for Rural Economic Development projects (RERED).

Under ESD, a credit programme was channelled through the Ministry of Finance/Development Finance Corporation of Ceylon (DFCC) for on-lending towards a variety of energy technologies including solar home systems. Participating credit institutions (commercial banks, development banks, micro-finance institutions, etc.) borrowed money from DFCC on concessional terms to lend to sub-borrowers (developers, dealers, customers) at market rates and terms. The total refinance provided by ESD as a whole (all technology components) over five years was roughly $19 million, while GEF funded installation grants (about $100 per unit) and business planning.

The GEF commitment was around $1.5 million.

RERED took over and scaled-up the programme in 2002. World Bank and GEF financed $18.8 million and $3.9 million respectively. Grants were reduced and phased out for SHS systems larger than 40 Wp (peak Watts) in 2004.

A5.4 The Bangladeshi schemes

Bangladesh received assistance under both the World Bank/GEF Rural Electrification and Renewable Energy Development Project (REREDP, ongoing) and the IFC/GEF SME Programme. The proposed World Bank and GEF finance for the solar components were $16.4 million and $5.3 million respectively. Support has been supplemented by KfW and GTZ.

Rural Electrification and Renewable Energy Development Project

Under REREDP, funds are disbursed by the Infrastructure Development Company Limited (IDCOL), a non-bank financial institution set up by the Bangladeshi government. The programme applies a dealer finance model where 16 'partner organisations' both install and offer credit to customers. Components of support include:

— Installation grants of $90-140 offered to partner organisations, gradually phased out.

— Concessional loans without the need for collateral to partner organizations for refinancing of consumer credit (with householders paying higher or commercial interest rates).

— Technical assistance on staff training, marketing and logistics.

IFC/GEF SME Programme

A one-off $750,000 loan was given to the social enterprise SHS dealer Grameen Shakti in 1998. Grameen Shakti was already operating on a dealer-finance model. The loan allowed purchase of inventory which freed capital to offer consumer credit over extended terms, allowing Grameen Shakti to grow its sales.

A5.5 Scheme expansion

The Sri Lankan and Bangladeshi off-grid solar industries are both now operating at a significantly greater scale than they were before the support programmes were implemented.

Sri Lanka

125,000 units (5.5 MWp) were installed over 11 years. The Sri Lankan solar industry was selling around 2,000 units per month in 2004 compared to 20-30 per month prior to the ESD programme. At the end of the ESD programme there were four major SHS companies, compared with 2–3 fledgling companies at the start, although one of these (Shell Solar) has since left the market. By the end of 2007, there were 14 firms selling SHS.

Access to capital for entrepreneurs was a key barrier to market development. There was minimal private investment in solar PV before 1997 and only struggling pilot and/or non-commercial ventures. There was no consumer credit available for SHS, and there were no technical standards. The influence of the PFMs has, in all likelihood, been highly additional.

Bangladesh

Grameen Shakti installed 600 units in 1996–98, before the loan. It now installs tens of thousands of units per year and has set itself a target of 1 million units by 2015. The ability to extend longer term credit to customers was important in gaining new business.

REREDP was attributed with the installation of more than 100,000 solar homes systems (7.4 MWp) by the end of financial year 2006/7, exceeding its initial target of 50,000. However, given the pre-existence of one of the major partner organizations, Grameen Shakti, the additionality of the programme is less clear cut. As Grameen Shakti was already installing 4,000 SHS per year when the programme started, and has experienced rapid growth since, it is not clear what proportion of the installations is truly additional.

A5.6 Financing and leverage

Sri Lanka

The total cost of the solar component of the ESD programme was $9.2 million, and the RERED programme forecast is $28.3 million.

Participating credit institutions and entrepreneurs contributed 11% and 24% of disbursements respectively for the ESD programme as a whole (figures are not available for the solar component), implying a leverage rate of around 1:0.53. The contribution of participating credit institutions was less than half that expected.

Sri Lankan SHS dealers were operating with a 15–25% gross profit margin in 2004, while profit margins were thought negligible prior to ESD.

Bangladesh

The project attracted further *donor* support, but it is not clear whether the private sector has contributed significant finance – partner organizations are generally NGOs or social enterprises.

A5.7 Implications for scale up

The Sri Lankan and Bangladeshi examples show that a mass-market technology can develop rapidly.

Growth in Bangladesh has benefited from high population density, a high proportion of people without access to grid electricity and the pre-existence of a partner organisation with experience of micro-finance (Grameen Shakti is an offshoot of Grameen Bank, founded in 1976).

The Sri Lankan ESD programme was initiated at a time when there was considerable optimism over the commercial potential of solar PV. Sales took off noticeably with the entry of Shell Solar, but Shell Solar later withdrew from the market.

Potential customers sometimes may find PV too expensive, especially where the domestic appliances they use are inefficient, whereas smaller, cheaper units could be used to power more efficient appliances. Energy efficiency standards for domestic appliances, or PFMs designed to encourage efficient products, might complement SHS PFMs.

In Kenya and Papua New Guinea, existing social and employment networks are used to disseminate the technology and reduce risk of customer non-payment. A World Bank scheme in China has seen consumers start with the smallest, cheapest units and gradually work their way up to larger units. As savings rates in China are high, grants to reduce upfront costs rather than support for credit were chosen.

SHS throughout the developing world retains a requirement for capital that is willing to accept low risk-adjusted returns, or even the possibility of no return. With tens of thousands of units sold a year, the scale and returns are unlikely to attract larger-scale investors for the foreseeable future.

A5.8 Summary of case study key findings

1. Multiple, simultaneous interventions may be necessary in order to stimulate a mass market for a technology.
2. When large capital outlays cannot be borne by either customers or dealers, availability of loan finance is key.
3. Scale can be achieved from relatively small public loans. However, typically, domestic solar power offers only low returns.
4. There is no generic PFM model because country-specific circumstances are important. Dealer finance works in Bangladesh thanks to the experience of Grameen, but dealers were reluctant to lend in Sri Lanka.
5. A diversity of financial and product offers, accommodating different needs and income levels, may be more effective in stimulating take-up among households.
6. Grants in appropriate currencies may reduce exchange rate risk.
7. Bureaucratic procedures can be especially costly for SMEs.
8. Social networks can be effective in accelerating the take-up of new technologies.

Appendix 1: List of abbreviations

AfDB	African Development Bank
ACG	Azeri-Chirag-Gunashi (oil field in Azerbaijan)
BTC	Baku-Tbilisi-Ceyhan
CCGT	combined cycle gas turbine
CDM	Clean Development Mechanism
CFE	Comisión Federal de Electricidad (Mexico)
$CO_2(e)$	carbon dioxide (equivalent)
DFI	development finance institution
EBRD	European Bank for Reconstruction and Development
ECA	export credit agency
ESD	Energy Services Delivery project (Sri Lanka)
EU	European Union
FI	financial institution
GDP	gross domestic product
GEF	Global Environment Facility
GTZ	German based international cooperation enterprise for sustainable development
IFC	International Finance Corporation
IFI	international financial institution
IIGCC	Institutional Investors Group on Climate Change
IPP	independent power producer
ISCC	integrated solar combined cycle
JBIC	Japan Bank for International Co-operation
KfW	German government-owned development bank
MDB	multilateral development bank
MIGA	Multilateral Investment Guarantee Agency
MWp	megawatt peak (1,000,000 watts)
NAMA	nationally appropriate mitigation action
NREA	New and Renewable Energy Authority (Egypt)
ONE	Office National de l'Electricité (Morocco)
OP7	Operational Programme 7 of the Global Environment Facility
PFM	public finance mechanism
PV	photovoltaic
R&D	research and development
RERED	Renewable Energy for Rural Economic Development (Sri Lanka)
REREDP	Rural Electrification and Renewable Energy Development Project (Bangladesh)
SHS	solar homes system
SME	small or medium enterprise
STEG	solar thermal electricity generation
$tCO_2(e)$	tonne of carbon dioxide (equivalent)
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WEF	World Economic Forum

Appendix 2: Interviewees

We have benefitted enormously from discussions/interviews with a wide range of stakeholders in the purposes of research for this report. We would particularly like to acknowledge the contributions of the following individuals.

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Elisabetta Falcetti, EBRD

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Chandra Govindarajalu, World Bank

Michael Green, EBRD

Kirsty Hamilton, Chatham House

Harish Hande, Selco

Richard Hosier, World Bank

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Abyd Karmali, Merrill Lynch

James Maguire, Marsh

Terry McCallion, EBRD

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Damian Miller, Orb Energy

Richard Parry, Infraco

Anton Rohmer, Macquarie

Jens Rosebrock, Dresdner Kleinwort

Inderjeet Singh, PWC

Chris Stephens, GLOBE

Ian Temperton, Climate Change Capital

Christine Wallich, Independent Evaluation Group

Dominic Waughrey, World Economic Forum

Ulrik Dan Weuder, ATP

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www.unep.org/energy/finance

DTI/1227/PA

SEFI

UNEP Finance Initiative
Innovative financing for sustainability

IIGCC
Institutional Investors Group on Climate Change

DFID Department for International Development

The Prince of Wales's
P8 Group

ClimateWise
REDUCING THE RISK FOR TOMORROW

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Principles
for Responsible
Investment

Investor Network on
CLIMATE RISK