



Evaluating **Clean Energy** Public Finance Mechanisms

November 2011

Prepared by



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Evaluating Clean Energy Public Finance Mechanisms

A report for the UNEP SEF Alliance

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Prepared by



IRBARIS

strategy | sustainability | value

Climate Bonds INITIATIVE

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EXECUTIVE SUMMARY

This report presents an evaluation methodology to highlight leading practice in the design and delivery of clean energy PFMs.

In recent years, the clean energy industry has experienced unprecedented growth and development, driven in large part by supportive government policies and regulations. Governments and public finance agencies have also often intervened through Public Finance Mechanisms (PFMs)¹ to address funding gaps or specific barriers that stand in the way of successful growth of the clean energy industry.

As a result, investment flows in clean energy have grown substantially since 2008, overcoming the global economic and financial crisis with the aid of substantial public funding stimulus. However, current economic conditions and increased pressure on sovereign balance sheets leave the clean energy sector facing complex challenges in maintaining investment flows, achieving price parity and reaching scale.

Under these situations, targeted PFMs, along with policy and regulatory certainty, are particularly important to maintain growth and realise economic potential. While the role of PFMs has been well documented, there is a clear need to provide the tools to objectively evaluate PFMs in order to understand their effectiveness and added value as well as improve their implementation.

This report showcases a methodology to evaluate the performance of different PFMs and their suitability for replication in other applications, policy contexts, geographies across the *clean energy continuum*. This continuum represents stages of development – R&D innovation, demonstration, targeted deployment, untargeted diffusion, and market independence – to support the growth of an industry.

Context is the necessary starting point for any PFM evaluation. Each PFM operates in unique policy frameworks; it has a designated purpose or stated goal and needs to address barriers specifically related to the industry stage of development.

The PFM is then characterised and assessed using qualitative and quantitative indicators organised under specific criteria:

- Design – includes indications of barrier identification, national policy and market complementarity, private sector linkages and a programme lifecycle strategy.
- Implementation – includes indications of coordinate with other sources of support, effective administration and management, and cost effective operations and use of public funds.
- Market Impact – includes indications of barriers addressed, private finance leverage, and industry development.

¹ In this report, PFMs are defined as financial commitments made by the public sector that alter the risk-reward balance of private sector investments by reducing or removing barriers to investment (adapted from Mostert (2010)). While policy instruments that set the overall economic framework conditions for investment in clean energy such as feed-in tariffs, carbon taxes and renewable portfolio standards are not regarded as PFMs, their presence has a significant effect on the success of a given PFM. They are therefore taken into account when evaluating the context in which successful PFMs operate

Eight case studies were evaluated against the methodology and leading practices are identified. The case studies are widely recognised as ‘successful’ PFMs and represent a balance between different types of PFMs from across the clean energy continuum, from developed and developing countries, and from UNEP SEF Alliance members and non-members.

Conclusions

The study identified a number of themes describing best practice in the design and implementation of PFMs.

- 1) Two key dimensions that set the country context for applying the most efficient PFM and use of public funds need to be considered. These include **the clean energy policy and regulatory framework** and **the investment climate** (e.g., capacity of local banks and extent to which international finance can be accessed). These dimensions are used to describe where each case has been deployed to maximum effect.
- 2) The case studies highlight a number of key factors to ensure effective implementation and design of PFMs:
 - The design of a PFM benefits from a **comprehensive analysis of barriers** to be mitigated or reduced to inform specific programme activities.
 - This barrier assessment should **consider the capabilities** of implementing agencies, local banks, and programme beneficiaries to ensure the PFM is fit for purpose. In some cases, programmes have demonstrated the benefit of adapting the design of the PFM when underlying assumptions change.
 - In many cases, there are benefits of **building extensive networks** with large corporations, SMEs, and investors to ensure the PFM is well received and leveraged effectively.
 - It is important that a conditions-based limit is placed on the programme to adequately communicate **expectations of success and to prepare the private sector for eventual withdrawal of public support**.
 - The implementation of PFMs requires addressing a **trade-off between keeping operating costs low while also maximising the ability of the PFM to add value**. Therefore, direct comparisons of the cost-effectiveness of PFMs using indicators such as % of budget used for operating costs, for example, can be misleading.
- 3) The case studies illustrate some of the key considerations when understanding the impacts of a PFM:
 - PFMs can play a role in **stimulating whole industries provided there is joined-up support through the clean energy continuum**. Successful support for a technology at one stage in its development does not necessarily mean it is well placed to continue to thrive. Disconnects along the clean energy continuum can result in any benefits from PFM intervention negated by other barriers remaining in place. An assessment of PFM impact must describe linkages to other support mechanisms.
 - The **most commonly used metric to describe PFM impact is the leverage factor** – the amount of private finance raised through the use of public funds. It is useful in

indicating the level of connectedness of the PFM to the wider market. When the leverage factor is reported, it must be accompanied by a detailed description of underlying context (e.g., market attractiveness of technology, strength of local banks) and method used to calculate leverage.

- The impacts of a PFM are often greater than direct outcomes. Indeed, for many PFMs, there is evidence to suggest their absence would mean clean energy companies would develop much more slowly or never progress at all. Metrics used to describe impact should therefore include **indirect economic effects of growth in the clean energy sector** such as job creation, value added etc.

Priorities for action

Based on the methodology development and analysis of case studies, key priorities for action by public finance agencies have been identified:

1. **Get the context right.** Not only does policy alignment and the capacity of the financial sector need to be taken into account, but also the relevant stage of the industry and the need for its transition along the clean energy continuum.
2. **Integrate the removal or reduction of identified barriers into every level of PFM actions.** This includes a top-down overview of assessing market needs and reviewing programme impact, to bottom-up evaluations of individual project applications and project impact. This is required to provide a comprehensive evaluation and confidence that public finance is still required.
3. **Integrate data requirements to communicate the direct and indirect benefits of public finance intervention** from the level of each individual project to the programme level.
4. **Demonstrate private sector appetite** for public finance intervention through industry platforms and consortium development.
5. **Communicate clear conditions-based indicators of success** that can signal eventual removal of public funds.
6. **Stress the indirect benefits of PFMs** such as job creation, net economic benefit and health costs reduction, as well as the more usually used leverage factors.
7. Construct a continuum of PFMs to **support the transition of clean energy industries** through the clean energy continuum.

1 INTRODUCTION

Expanding the deployment of many clean energy technologies is dependent on a strong industry sector, private sector investors and a public sector creating the conditions for growth.

Yet, even when the right conditions are created, investors can be dissuaded from participating in clean energy development by actual or perceived risk in this emerging sector. Governments therefore often use Public Finance Mechanisms (PFMs) to address funding gaps or specific barriers that stand in the way of successful sector growth.

The role and use of public finance mechanisms (PFMs) to catalyze large-scale investment in clean energy is well documented.² While many of these studies recognise the importance of value-for-money in promoting PFMs, they were undertaken in the context of steady economic growth where the case for the use of public funds to support clean energy was relatively well received.

With recent increased pressure on public-sector spending, there is a clear need to demonstrate the impact and value for money of clean energy PFMs.

To provide an objective analysis of PFMs, standardised evaluation criteria are therefore required to help existing clean energy public finance agencies to demonstrate their effectiveness, improve their existing programmes and to support the establishment of new PFMs drawing from the lessons learned from others.

This report presents an evaluation methodology to assess the effectiveness of the design and delivery of clean energy PFMs

The purpose of this evaluation methodology is to provide a standard set of criteria to assess the effectiveness of, and key success factors for, different PFMs at each stage of the clean energy continuum, using a combination of qualitative and quantitative analysis.

For the purpose of this analysis and consistent with previous reports from the UNEP SEF Alliance, PFMs are defined as ***financial commitments made by the public sector that alter the risk-reward balance of private sector investments by reducing or removing barriers to investment.***³ The clean energy industry includes both renewable energy and energy efficiency sectors.

The report is structured as follows:

² Please refer to previous reports on PFMs from the UNEP SEF Alliance amongst others including Mostert, W. (2010); UNEP & Partners (2009); UNEP SEFI (2008); and WEF (2010).

³ Adapted from Mostert (2010). While policy instruments that set the overall economic framework conditions for investment in clean energy such as feed-in tariffs, carbon taxes and renewable portfolio standards are not regarded as PFMs, their presence has a significant effect on the success of a given PFM. They are therefore taken into account when evaluating the context in which successful PFMs operate.

- Chapter 2 provides an overview of current trends in clean energy development and investment flows.
- Chapter 3 discusses the role of PFMs in the context of industry development through the clean energy industry continuum.
- Chapter 4 presents the methodology to review and evaluate the effectiveness of PFMs based around a standard set of criteria (described through a set of qualitative and quantitative indicators).
- Chapter 5 provides a case study analysis of recognised PFMs from both UNEP SEF Alliance members and other organisations to test the evaluation methodology and illustrate lessons learnt. The case studies represent a balanced selection across each stage of the clean energy industry continuum, different clean energy technologies and developed and developing countries.
- Chapter 6 concludes with a discussion of opportunities for cross-fertilisation and recommendations for the replication of clean energy PFMs.

2 CURRENT STATUS AND TRENDS OF CLEAN ENERGY INDUSTRY AND INVESTMENT FLOWS

In recent years, the clean energy sector has experienced unprecedented growth and development, driven in large part by supportive government policies and regulations.

Global renewable energy (RE) technology installations have grown at annual rates of between 15% and 50% from 2005 to 2010. Renewable energy power plants accounted for approximately half of new power capacity additions in 2010.⁴ Clean energy technologies in heating, transport and energy efficiency (EE) have also experienced similar growth rates.

Growth in investment and activity in the sector has been actively encouraged; Governments around the world have been active in attempting to foster clean energy development to achieve three key objectives:

- **Energy security:** Clean energy industries deliver on energy security by either reducing the energy required to provide the same level of service (through energy efficiency), displacing imported energy (electricity or fuel – solids, liquids, gas) with energy from renewable sources within the country or region, diversifying the energy portfolio, and reducing dependence on increasingly scarce and price volatile fossil fuels.
- **Climate change and carbon risk:** By displacing fossil fuel use throughout the economy, the clean energy sector reduces greenhouse gas emissions and carbon liabilities.
- **Economic prosperity:** If structured appropriately, the growth of the clean energy sector can lead to significant job creation both for domestic deployment and export. The sector can also support wider economic prosperity through contributing to gross domestic product (GDP), tax revenues, and reducing trade imbalances on energy imports.

Countries respond to these drivers in a variety of different policy and regulatory signals to stimulate investment:

- 51 countries have announced national renewable energy targets, often out to 2020;
- 87 national, state or provincial level jurisdictions have enacted policy mechanisms to achieve targets such as subsidised Feed-in Tariff (FiT) regimes for certain renewable energy sources;
- 63 jurisdictions have established renewable portfolio standards or quotas for energy providers.⁵

⁴ REN21 (2011)

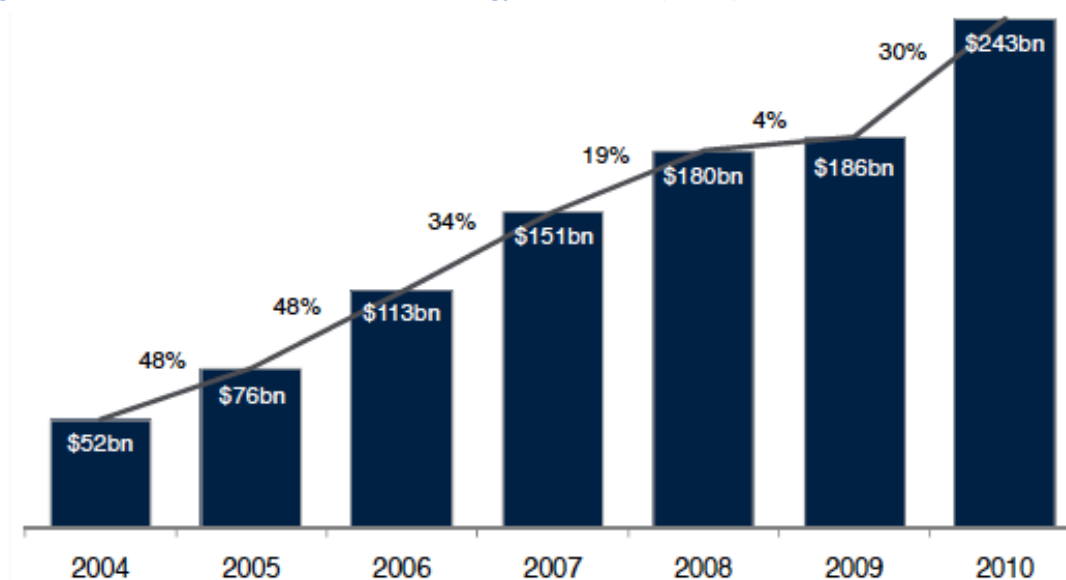
⁵ Ibid

Investment flows in clean energy have grown substantially, hurdling the global economic and financial crisis since 2008 with the aid of substantial public funding stimulus.

Prior to 2008 and the impact of the financial and economic crisis, the sector experienced a rapid growth in annual global investment from \$52bn in 2004 to \$180bn in 2008. Investment continued to grow in 2009 (following the financial crisis) albeit by only 4%.

In 2010, investment leapt to \$243bn (Figure 1). Much of this leap may be due to increased investment in clean energy from public sources through fiscal stimulus funding. Previous UNEP SEF Alliance reports described a total of \$190bn in government stimulus funding for clean energy with \$21bn in credit from multilateral state-sponsored institutions.⁶ By the end of 2010, half of the available stimuli had been spent with the remainder allocated for 2011 – 2013 expenditure.⁷

Figure 1: Global total new investment in clean energy, 2004 to 2010 (US\$bn)



Figures include investment in renewable energy, biofuels, energy efficiency, smart grid and other energy technologies, carbon capture and storage and infrastructure investments targeted purely at integrating clean energy. Investment in solar hot water, combined heat and power, renewable heat and nuclear are excluded, as are the proceeds of mergers and acquisitions (which does not contribute to new investment). Source: Bloomberg New Energy Finance from WEF (2011)

This was seen as an excellent opportunity to use fiscal stimulus funds to develop a promising sector that is aligned to the long-term costs associated with energy security and climate change. For example, global government RD&D expenditure on renewable energy grew 121% year-on-year from 2009 to 2010 while corporate RD&D fell by 12%.⁸

At the same time, the level of support for the clean energy sector is still dwarfed by conventional energy – the IEA reported subsidies of \$312bn in 2009 for fossil fuels compared to \$57bn for renewables.⁹

⁶ UNEP SEF Alliance (2010)

⁷ WEF (2011)

⁸ UNEP & BNEF (2011)

⁹ IEA (2010)

Yet current economic conditions and increased pressure on sovereign balance sheets leave the clean energy sector facing complex challenges in maintaining investment flows, achieving price parity and reaching scale.

In particular, investment in the clean energy sector is now projected to decrease again after 2012 due to uncertainty in the Eurozone, deficits in the US, and softening of economies elsewhere.

As a result of public budget cuts in many countries, the level of support experienced through fiscal stimulus is unlikely to continue. There are also other factors that will hinder the prospects for promising clean energy markets over the coming years:

- Recent years have experienced volatile energy prices. While the global economic slow-down might reduce the growth in demand for oil, for instance, tightening supplies over a longer timeframe could still spur yet more oil price volatility. This will have significant impact on investment conditions for clean energy.
- Despite the role of clean energy within a resource constrained global economy, there is a short-term reaction taken by some to argue for reduction in public sector investment in clean energy while economic conditions are not favourable. In 2011, there has been increasing criticism by media, politicians and others on the levels of investment into clean technology for example through the review of solar PV feed-in tariffs (FiTs) in the UK and Australia and the provision of loan guarantees to solar PV manufacturers in the US.
- Finance prior to the crisis in 2008 was predicated on comparatively high confidence in risk profiles. When this changed, the implications for cost and tenor of debt were severe, leading to a highly risk averse rebound. Debt finance for renewable energy has been particularly affected in this rebound as it involves still maturing technologies. However, even though upfront fees and margins have increased, interest rates are at record lows. Other effects include reduced maturities, conservative gearing levels and tighter covenants. Since the financial crisis, gearing has returned – but for a smaller number of higher quality borrowers. The availability of capital for small and medium enterprises is still limited.
- While instruments that establish the overall framework to support clean energy remain in place (e.g., quotas, FiTs, tax incentives), there will always remain aspects of the system as a whole that do not operate effectively. The same financing, technology or regulatory barriers that existed over the past decade limiting progress in clean energy (and for which PFMs were designed) still exist today.

Nevertheless, in the current economic climate, there is a strong business case for investment in particular areas of clean technology:

- Many of the drivers for clean energy investment that existed prior to 2008 still apply today such as requirements to respond to climate change, need for investment in grid (and other) infrastructure, drive to meet development goals (e.g., rural electrification) and concerns regarding energy security.

- Energy efficiency (EE) can reduce costs. In Ireland, for instance, it is reported that €2.25 billion could be saved in the economy in 2020 through avoided energy costs.¹⁰
- Manufacturing and deployment of clean energy technologies in domestic markets creates jobs when many other sectors are undergoing restructuring or lack competitiveness. The US solar industry experienced a jobs growth rate of 6.8% in 2010/2011 compared to 0.7% for the general economy.¹¹
- While some clean energy industries are commercially competitive, others have barely started their journey and risk becoming stalled.

Policy and regulatory certainty, along with targeted public finance support are required to maintain growth and realise economic potential

A major challenge facing the clean energy industry is that the value of energy security, lower emissions, and domestic economic development are poorly factored into energy market pricing – if at all. Current processes of incorporating these drivers into market pricing, e.g., through carbon prices, tend to be incomplete, weak, geographically variable and volatile over time.

The costs of many clean energy technologies have reduced substantially over recent years. Residential solar PV has already reached parity with electricity prices for end-users (grid parity) in Italy and Turkey, and will penetrate most industrialised markets by 2015, while carbon costs are making onshore wind competitive with coal on a \$/MWh basis.¹² However, on the whole, most clean energy technologies are still not competitive with fossil fuels on an unsubsidised basis.

The public sector plays a key role in driving the costs down and alleviating immediate investor concerns regarding underlying risks and market stability. There have been many examples of where a well designed and implemented public finance mechanism addresses these risks and the industry is able to develop with much reduced barriers.

¹⁰ DCENR (2010) , in consultation with Sustainable Energy authority of Ireland (2011)

¹¹ Renewable Energy World (2011)

¹² BNEF (2011)

3 THE ROLE OF PFMS AND THE CLEAN ENERGY CONTINUUM

The clean energy continuum provides the context of clean energy industry development

PFMs are specifically designed to target different constraints along the clean energy development process and need to be evaluated in this regard. We have adapted technology innovation chains and project development chains from previous UNEP SEFI and UNEP SEF Alliance literature to chart a *clean energy continuum* in order to reflect the role of different PFMs in supporting development at the industry-wide level. The **clean energy continuum** can be summarised as five stages as illustrated in Figure 2. Further details on each of the PFMs listed is provided in Table 1.

An industry is more than technology. It is a continuous system that begins at resource discovery and quantification of either energy sources or energy conservation; through to research and innovation processes to develop technologies that can harness these resources; through to demonstration and commercialisation processes; and on to the critical phase of driving up scale and driving down costs until the industry is providing competitive energy and energy services to the consumer.

In order for an industry to be successful, the right mechanism is needed for each stage of its development. Building an embryonic clean energy industry into a major economic force requires commitment, stability and an evolving process of support throughout its development and might collectively be considered as the clean energy continuum.

While policy instruments that set the overall economic framework conditions for investment in clean energy such as feed-in tariffs, carbon taxes, and renewable portfolio standards are not regarded as PFMs, their presence has a significant effect on the success of a given PFM. They must, therefore, be taken into account when evaluating the context in which successful PFMs operate.

Figure 2: The clean energy continuum

| Stage of Development | R&D Innovation | Demonstration | Targeted Deployment | Untargeted Diffusion | Market Independence |
|--|--|--|---|---|--|
| Objective | Encourage innovation and entrepreneurship | Prove concept at scale | Support diversity of scalable technologies | Support resource efficiency and competitiveness | Stable and securing ongoing growth |
| Policy/Tax Mechanisms | <ul style="list-style-type: none"> National targets National research agendas Fiscal incentives | <ul style="list-style-type: none"> Regulatory and legal framework for specific developments/projects Investment tax incentives | <ul style="list-style-type: none"> Feed-in Tariffs Portfolio standards Grid development Targets for specific industries/resources | <ul style="list-style-type: none"> Technology neutral renewable energy targets Carbon taxes Carbon trading BAT requirements | <ul style="list-style-type: none"> With or without: <ul style="list-style-type: none"> Carbon taxes Carbon trading |
| Examples of Public Finance Mechanisms | R&D Grants | Project Grants | Guarantees and insurance products | | |
| | | | Soft Loans | | |
| | Incubators | | Mezzanine Finance | | |
| | | | Credit Lines | | |
| | Public/Private VC Funds | | Public/Private PE Funds | | |
| | | Technical assistance | | | |

Source: Adapted from UNEP SEFI (2008); UNEP & Partners (2009); and UNEP SEF Alliance (2010)

The **Research & Development Innovation** Stage is where innovative ways to harness renewable resources or to use energy more efficiently are devised, developed and tested. While they are classified together, the activities included within this step are notably different; research into new technologies involves developing a concept or basic principles; development involves formulating an application and preparing lab-based prototypes, etc. Innovation in this context includes product development processes, identifying routes to market and developing underlying capabilities. In the clean energy sector, significant government funding is required due to the relative immaturity of industry and uncertainty as to the economic payoff. They carry significant technology risks and barriers to commercial application such as entrepreneurial skills and intellectual property management.

Example clean energy technologies in this stage of development include organic/dye sensitised solar PV; algae biofuels; or components in advanced batteries.¹³

The **Demonstration** Stage is where promising solutions are trialled in the real world, usually at small scale to prove the concept. Start-ups moving from the laboratory to commercialisation need to demonstrate the full-scale performance of their technology. While technology risk is lower than at the R&D stage, it is still too high for commercial finance institutions. On the other hand venture capitalists and angel investors are not inclined to provide finance for major capital investments as these cannot realistically provide the high returns demanded by such investors.

Example clean energy technologies in this stage of development include floating offshore wind, marine energy, smart appliance control and enhanced geothermal.

The **Targeted Deployment** Stage provides a shift of focus from technology to industries and markets. Many countries know the resources that are locally predominant and can therefore identify and develop the industries that are most likely to prosper. However, since

¹³ Example technologies for each stage derived and adapted from UNEP SEF Alliance (2010). Note: We acknowledge certain mature technologies may continue with R&D activities to improve such as in component design and materials use; while similarly there may be instances of certain technologies which still require significant R&D yet also have demonstration or deployment activities in certain areas such as in smart grids/smart meters, or biofuels.

different industries will be at different stages of development, with different economies of scale they will require different prices for their products and energy service commodities in order to be able to deploy projects. Therefore development policies differentiated by industry are appropriate, such as portfolio standards, which set aside ring-fenced market share for identified industries, or Feed-in Tariffs, which pay different prices for energy for different sources. Without such 'targeted' support, there is a risk of more mature or lower cost clean energy industries dominating the supply of public finance resources.

Example clean energy technologies in this stage of development include electric vehicles, offshore wind, heat pumps and solar PV.

The **Untargeted Diffusion** Stage describes the phase in which those industries that are reaching commercial maturity and large scale deployment and which may be in a position to compete with conventional energy sources or with other clean energy sources while still grow as industries.

Example clean energy technologies in this stage of development include onshore wind and traditional geothermal.

The **Market Independence** Stage encompasses industries that are so competitive, mature and of sufficient scale that they can compete in the open energy market either modified by a carbon price or, in some cases, without a carbon price.

Example clean energy technologies in this stage of development includes solar hot water and large-scale hydro in some markets.

Public Finance Mechanisms (PFMs) address barriers to investment

As discussed earlier, PFMs are financial commitments made by the public sector that alter the risk-reward balance of private sector investments by reducing or removing barriers to investment and or market development across the the clean energy continuum. They level the playing field for clean energy industries which might otherwise find barriers to market entry too great to surmount.

Examples of PFMs that operate across the clean energy continuum are listed in Table 1.¹⁴

¹⁴ Adapted from UNEP SEFI (2008) and WEF (2010)

Table 1: Description of different types of PFMs

| Stage of development | Example of PFM type | Description |
|--|---|---|
| R&D Innovation | Research grants | Grants provided to innovators and researchers for early-stage technologies |
| R&D Innovation/ Demonstration | Incubators | Advisory and technical support services provided to selected start-ups to reach milestones in technology and market development |
| R&D Innovation/ Demonstration | Public/private venture capital (VC) funds | Equity investments in start-up technology companies through either state-run funds or investment in privately run funds |
| Demonstration | Project grants | Grants provided to demonstrate technologies at differing stages of development |
| Demonstration/ Targeted deployment | Technical assistance | Facilities and funds aimed at building the capacities of market actors |
| Targeted deployment/ Untargeted diffusion | Public/private private equity (PE) funds | Equity investments in clean energy companies and/or clean energy projects. |
| Targeted deployment/ Untargeted diffusion | Guarantees | A risk management tool shares in the credit risk of loans or equity investments which commercial financial institutions (CFIs) or investors make. |
| Targeted deployment | Soft loans | Provision of debt capital at concessional interest rates |
| Targeted deployment | Public/private mezzanine funds | Provision of subordinated debt capital to overcome debt-equity finance gaps |
| Targeted deployment/ Untargeted diffusion | Senior debt credit lines | Credit line to CFIs for senior debt lending to projects/companies. |

PFMs are often designed to reduce financial barriers, such as access to capital, lack of capacities in commercial financial institutions, high perceived risks to the sector, etc. Those barriers that may be directly addressed by PFMs or indirectly mitigated are highlighted in Table 2.

Table 2: Examples of barriers addressed directly or indirectly by PFMs

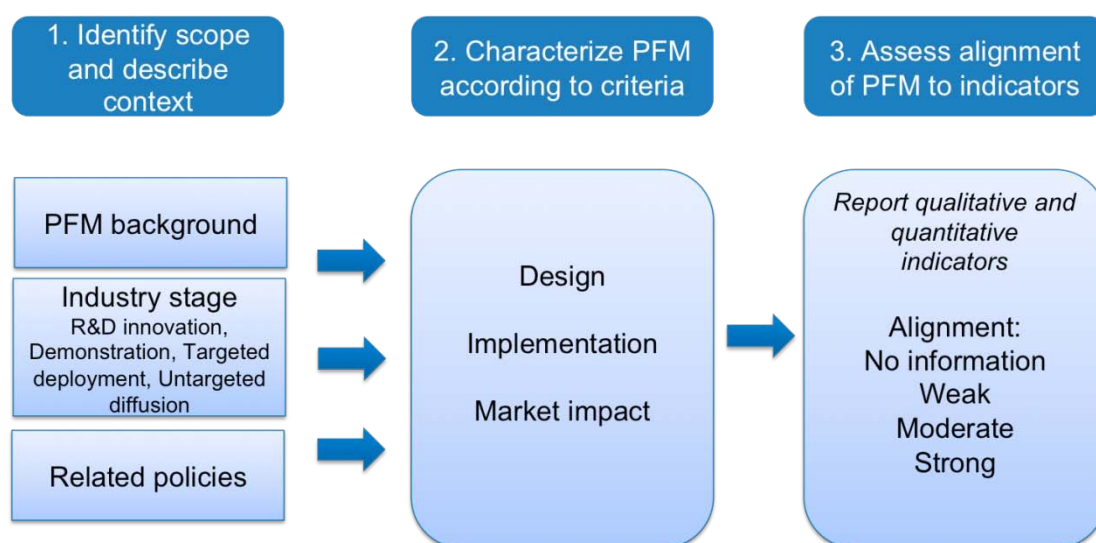
| Barriers | R&D Innovation | Demonstration | Deployment/Diffusion |
|-------------------------------------|---|--|--|
| Directly addressed by PFMs | <ul style="list-style-type: none"> • Lack of R&D facilities • Lack of skills/competencies of entrepreneurs/innovators • Lack of access to capital through CFIs/VC | <ul style="list-style-type: none"> • Lack of test facilities and access to technology demonstration • High costs of capital • Poor understanding in CFIs • Lack of availability of insurance | <ul style="list-style-type: none"> • High costs of debt/equity capital • Lack of capacity or awareness in CFIs • Prohibitive insurance costs |
| Indirectly mitigated by PFMs | <ul style="list-style-type: none"> • Delays due to permitting e.g. patents • Poor science-industry links • High technology performance risks and learning curve assumptions | <ul style="list-style-type: none"> • Delays to site permitting and grid connectivity permits • Public acceptance risks • Delays in achieving grid connectivity • Lack of standardisation of technology • Construction risks • Technology performance risks | <ul style="list-style-type: none"> • Slow, complex planning and permitting process • Public acceptance risks • Lack of enabling infrastructure for large-scale deployment • Offtake price volatility • Skills shortages and competency • Construction risks • Technology performance risks • Limited O&M capacities and access to technology over time |
| Outside scope of PFM impact | <ul style="list-style-type: none"> • Resource limitations • Lack of clean energy policy framework; national research agenda • Reduction of tax incentives • Environmental impacts | <ul style="list-style-type: none"> • Lack of supportive policy framework and instruments | <ul style="list-style-type: none"> • Supply chain security • Lack of supportive policy framework and instruments • Reduction of production tax credits |

4 A METHODOLOGY TO EVALUATE PUBLIC FINANCE MECHANISMS

Methodology overview

This project has developed a methodology to assess PFMs based on three key steps as presented in Figure 3.

Figure 3: Overview of methodology for assessing PFMs



This methodology is designed to evaluate the performance of different PFMs and their suitability for replication in other applications, policy contexts, placement in the clean energy continuum, and geographies.

Step 1: Identify scope and describe context

As PFMs are designed to meet specific requirements and reflect the national circumstances within which they operate, the starting point of the methodology is to establish the scope and context of the evaluation.

The scope of the evaluation should be defined in terms of the stated aims of the PFM including:

- The technologies expected to be influenced by the PFM. This includes their positioning along the clean energy continuum and the key barriers to their deployment.
- The requirement to address specific barriers.
- The planned/actual time frame for the implementation of the PFM.

The context should consider:

- The policy framework which may influence the relative impact of the PFM and the extent to which this supports/hinders the PFM.
- An overview of the key commercial, public sector and other organisations active in the deployment of the target technology (including dynamics between key players).
- Details of underlying national resources and enabling infrastructure.
- Other PFMs operating alongside the targeted PFM that may address other barriers or other stages in the continuum.

Step 2: Characterize PFM according to criteria

The methodology has developed and defined a common set of criteria and indicators to characterise and assess the performance of the PFM in design, implementation and market impact. These criteria are laid out in Table 3 below.

Most of the criteria are the same for all PFMs, but two criteria which will vary between different PFMs – the criteria “identification of barriers” and “barriers addressed” – include indicators specific to challenges faced at different stages of the clean energy continuum as listed in Table 2. For example, improving skills and competencies of innovators is a direct challenge for industries at the R&D stage while improving capacity and understanding of perceived risks in financial institutions is a challenge during the deployment and diffusion stages.

While many of the criteria are necessarily qualitative, the quantitative indicators can also be used to describe the performance of a given PFM; as such the methodology does not include quantitative metrics for the Design stage. The choice of metric will depend on the underlying intent of the PFM. For example, the outcome of a PFM can be measured in terms of tonnes of carbon saved; GWh generated, etc., depending on the stated goal of the implementing agency or policy priorities. The methodology provides some flexibility by listing the metrics commonly used.

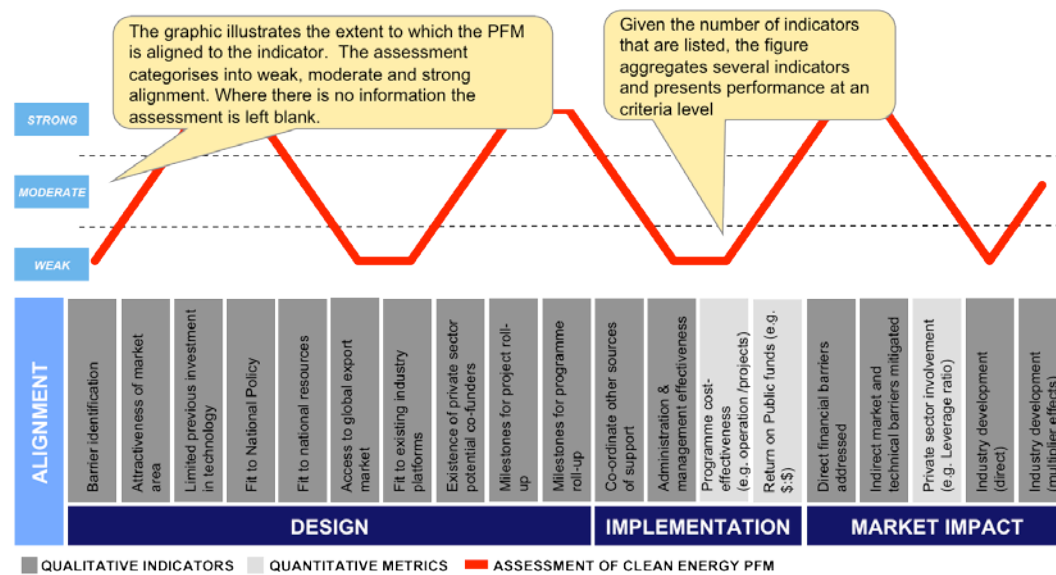
Table 3: PFM evaluation criteria and indicators

| DESIGN | | |
|---|---|--|
| Criteria | Qualitative indicators | |
| Appropriate for industry stage of development | Identification of barriers to be targeted Attractiveness of investment area for market opportunity Limited investment/deployment in clean energy area prior to programme | |
| National policy complementarity | Fit to national policy goals and policy framework – e.g., targets, FiT. | |
| National market complementarity | Potential to exploit national resources e.g. 2020/2050 roadmaps Potential to access global market and export potential | |
| Private sector linkages | Existence of identified industry platforms/programme clients Existence of matched co-funding requirements, leverage targets | |
| Programme lifecycle strategy | Existence of milestones that lead to project level roll-up – e.g., success/failure indicators Existence of indicators that lead to programme roll-up – e.g., number of projects or companies supported, investment outlay, and also ensure smooth transition across the clean energy continuum | |
| IMPLEMENTATION | | |
| Criteria | Qualitative indicators | Quantitative metrics |
| Coordinate with other sources of support | Grants, use of facilities, public-private industry platforms, tax incentives, capacity building programmes | Public-public leverage |
| Administrative and Management effectiveness | Processes for MRV and adaptability, Dedicated staff per project/grantee, Response time, Due diligence capacity for finance modelling | - |
| Cost effectiveness | Existence of independent value for money assessments | % proportion on projects/overheads Return on public funds in: \$/\$ (money returned) \$/GWh generated; \$/GW installed; \$/tCO ₂ abated; \$/KWh saved / avoided |
| MARKET IMPACT | | |
| Criteria | Qualitative indicators | Quantitative metrics |
| Barriers addressed | Direct financial barriers addressed Indirect market barriers mitigated | Additionality of public funding (% cost of capital reduction, % increase of IRR) |
| Private finance leverage | Targets for leverage achieved | Leverage ratio directly by PFM |
| Industry development | Direct benefits: deployment, companies supported, job creation, innovation, Multiplier/spillover effects: Post-PFM industry-wide deployment, investment growth, patents, exports, jobs, global value added (GVA), NPV of economic benefit. | Direct benefits: units of deployment, number of projects, projected energy generated or saved, CO ₂ savings; number of companies supported, number of jobs created/retained, number of patents, year on year growth of each resource/industry, number of industries, national added value % Multiplier/spillover effects; Post-PFM industry-wide deployment, investment growth, patents, exports, jobs, global value added (GVA), NPV of economic benefit. |

Step 3: Assess alignment of PFM to indicators

The third step involves assessing the PFM by comparing against each criteria with due regard to the context within which it operates. This process is not intended as a scoring exercise allowing direct comparison of PFMs (though in a few circumstances quantitative metrics can be considered side by side). Instead it is used to identify some of the key attributes of PFMs and opportunities for sharing experiences, insights and lessons learned. The output is illustrated in Figure 4 below.

Figure 4: Illustration of evaluation output



5 CASE STUDY ANALYSIS

Case study selection

This section presents case studies evaluated against the methodology described in Section 4. The case studies represent a balance between different types of PFM from across the clean energy continuum, examples from both developed and developing country UNEP SEF Alliance members and from countries outside the UNEP SEF Alliance.

Table 4: List of case studies examined for this project

| Country | R&D Innovation | Demonstration | Deployment | Diffusion |
|----------|-------------------------------|---|--------------------------------------|--------------------------------------|
| UK* | Carbon Trust Incubator Scheme | | | |
| Canada* | | SDTC SD Tech Funds | | |
| Ireland* | | SEAI Ocean Energy Grants and Prototype Fund | | |
| Chile* | | | CORFO Credit line | |
| Germany | | | KfW renewable energy loan facilities | |
| France | | | | FIDEME public private mezzanine fund |
| China | | | | IFC CHUEE partial loan guarantee |
| Brazil | CIETEC Incubator | | | |

*UNEP SEF Alliance members

The evaluation of case studies was conducted through a combination of desktop research and interviews with programme managers. While quantitative data (e.g., leverage ratios; companies supported, etc.) is provided, comparative ranking is likely to be misleading due to the different contexts surrounding each PFM. Furthermore, some of the data for certain PFMs was not available, limiting the scope of the evaluation in several case studies. Therefore, not all of the evaluation indicators are reflected in each case study.

As many case studies overlap through different stages of the clean energy continuum, they are grouped into two sections – R&D Innovation/Demonstration, and Targeted Deployment/Untargeted Diffusion. More information on each of the programmes and the implementing agencies are available through the websites provided within each case study.

R&D Innovation / Demonstration Stage

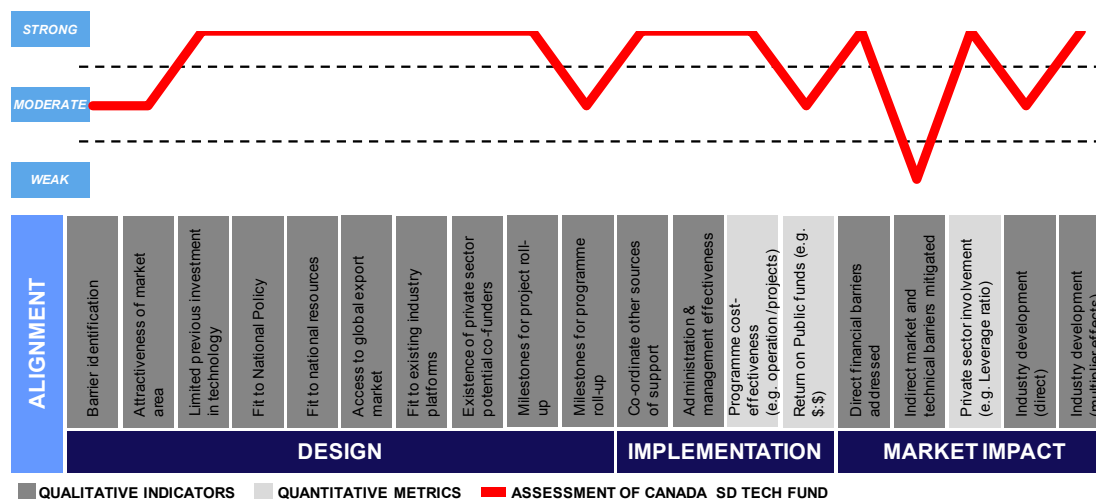
The following section presents four PFM case studies focusing on research, development and innovation of clean energy technologies, and/or providing funds for demonstrating concepts. The PFMs include technical assistance, project grants and incubator programmes:

- Sustainable Development Technology Canada (SDTC) – SD Tech Fund: Grants and technical assistance for project development and demonstration
- Sustainable Energy Authority Ireland (SEAI) – Ocean Energy Development Unit: Grants, test facilities and technical assistance for project development and demonstration
- Carbon Trust (UK) – Incubator/Entrepreneurs Fast Track Scheme: Technical assistance and research grants for R&D Innovation
- CIETEC (Brazil) – Incubator programme: Technical assistance for R&D Innovation.

Sustainable Development Technology Canada (SDTC) SD Tech Fund¹⁵

| Overview | | |
|--|------------------------|---|
| Name of PFM: SD Tech Fund | | Target phase(s) of development: Demonstration |
| Start: 2001 | Finish: Ongoing | Evaluation period: 2001-2010 |
| PFM Description: The SD Tech Fund provides a non-repayable grant of no more than 50% of project costs to demonstrate climate change, clean air, clean water and clean soil technologies. Across the portfolio, public funds must be no more than 33% of the total value. The Fund targets proven technologies in lab-based environments that may not have resources to fund further development and demonstration. Development support and capacity building are also provided through the programme. | | |
| Country context: The Canadian government has adopted an emission reduction target of 17% below 2006 levels by 2020. There is also a patchwork of policies supporting the research, development, adoption and implementation of clean technologies in Canada operating at a National and Provincial level. However, there continues to be a lack of technology-specific interventions to promote widespread adoption and co-investment. This makes it difficult for federal level programmes such as SDTC to support specific technologies or cleantech subsectors. | | |
| Key performance metrics | | |
| Direct Investment: \$478m | | Operation costs as % dispersed funds: 11.8% |
| No. of projects: 195 | | Operation costs as % of portfolio worth: 3.4% |
| Direct leverage ratio ¹⁶ : 1:2.43 | | Return on public funds ¹⁷ : |
| Follow-on leverage ratio: 1:10 | | \$27 - \$62 public funds per tCO ₂ /yr saved |

Figure 5: Alignment of SD Tech Fund to evaluation indicators



¹⁵ Evaluation based on SDTC (2011a), SDTC (2011b), SDTC (2010), SDTC (2006), Robinson Research & TNS Canadian Facts (2009), and a semi-structured interview and questionnaire with programme managers

¹⁶ Direct leverage is private sector funds invested alongside public funds. Follow-on indicates private investment post public. Leverage is calculated by the proportion of public funds to private investment.

¹⁷ Return on public funds indicates cost effectiveness of the public funds in terms of results. It can include the financial return from use of public funds; the \$ of public funds per GW installed or GWh of energy generated or saved; or the \$ public funds per carbon savings

Key findings

The SD Tech Fund aligns strongly with many of the indicators in the evaluation. Key findings include:

- Despite operating in a challenging policy environment for market adoption and technology deployment, funding agreements with the Canadian Government, can inform **policy priorities**. This is especially applicable to incentives for research and innovation.
- The Fund was **clearly designed to target financing gaps** at specific points along the clean energy continuum – between lab-based innovation and demonstration, as well as between demonstration and equity funding.
- Applications are evaluated against suitable deployment **potential and opportunity in the domestic and global market**. If no market is perceived for a given technology, or no gap in the market exists, then it is unlikely the project will receive funding. In terms of export potential, SDTC documentation reveals that while technologies must be developed in Canada, US market drivers (i.e., policy and regulatory environment) are factored into priorities set by the Fund.
- The implementing agency maintains **well-coordinated linkages with the private sector**. A 'Go-to-market' consortium is developed for each project including end-users, industry stakeholders, financiers, academia, not-for-profits, and the government. The consortia, coordinated through follow-on funding programmes, ease the transition post-project to fully commercial financing; this multiplies the leverage achieved by the public funds.
- There are **safeguards to maximise value for public money** in project financing. Four to six project and company-specific milestones are monitored whereby financing is released on the achievement of each milestone. In typical demonstration projects, no revenues are expected. If this occurs, however, through a sale, or commercial use of the assets etc., then the applicant is obliged to return the similar proportion of the grant provided by the Fund to SDTC until such time as the total grant is reached.

The 10-year operation of the fund has allowed it to make a significant impact on the market. \$478 million of funds allocated to 195 projects by year-end 2010 had leveraged \$1.2 billion – a split of 29%/71% of project costs throughout the portfolio. In addition, the leveraged amount represented a proportion of private (84%) and public funds from other sources (16%) indicating the value perceived by private sector investors in projects. Furthermore, companies that have exited the portfolio with additional technical assistance provided by SDTC have attracted follow-on funding, increasing the leverage impact of the Funds original grant to 1:10. This impact has been achieved while operating costs for the 10-year implementation of the fund have been kept to 11.8% of dispersed funds and 3.4% of the portfolio value. CO₂ savings calculated at the end of 2009 from 183 projects estimated savings range from 7 to 17MtCO₂/yr by 2015.

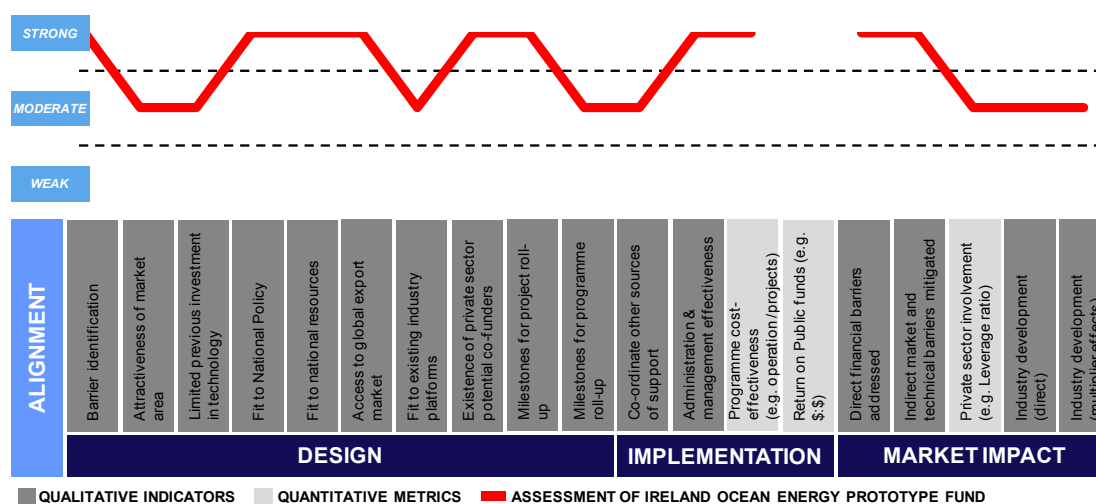
With such a large fund operating across a long timeframe, a concern may be that the continued presence of available public capital could crowd out private investment. However, a programme evaluation undertaken in 2009 did not support such a conclusion due to general market conditions and the focus of the fund in the market. Seed and venture capital funding remained steady in Canada throughout the life of the programme with any increases marked by extended leverage by the SD Tech Fund. However, the evaluation does criticise the lack of a timely review of the need for fund recapitalisation in order to better guide the market as to the availability of capital. This points to weak alignment with indicators that the financing

intervention would no longer be required (programme level roll-up) and how funded projects have reduced barriers in the market.

Sustainable Energy Authority Ireland: Ocean Energy Development Unit¹⁸

| Overview | | |
|--|------------------------|---|
| Name of PFM: Ocean Energy Development Unit | | Target phase(s) of development: Demonstration |
| Start: 2008 | Finish: Ongoing | Evaluation period: 2008-2010 |
| PFM Description: The unit is aimed at supporting Ireland's ocean energy development programme. Grants are provided to ocean energy technology companies for developing demonstration projects. Development of test sites are funded. Research centres are supported and strategic studies and reports on industry development are funded. It should be noted that five wave energy companies were supported through the RD&D programme and a 1/4-scale test site was established prior to the establishment of the Ocean Energy Development Unit in 2008. These activities are included in this analysis | | |
| Country context: Ireland has been allocated challenging targets for renewable energy generation as part of the EU's 2020 targets. This has led in recent years to signification onshore wind development. Policy and regulatory developments have included targets for renewable generation, electric car market penetration and energy efficiency. However, the Government has recognised the potential to become a market leader in the development of tidal and wave energy technologies. The PFM therefore operates in the context of a well-defined multi-annual industry development strategy which includes ocean specific power generation targets by 2020 and a generous feed-in tariff of €220/MWh for installations approved before 2015. | | |
| Key performance metrics | | |
| Direct investment: €8.4m | | Leverage ratio: 1:1.4 |
| No. of projects: 44 | | Operation costs as % of budget: 4.4% |

Figure 6: Alignment of the SEAI Ocean Energy Development Unit to evaluation indicators



¹⁸ Evaluation based on SEAI (2011a), SEAI (2010a), SEAI (2010b), SEAI (2010c), SEAI (2009a); SEAI (2009b), SEAI & Marine Institute (2005), SQW Energy (2010), and a semi-structured interview and questionnaire with programme managers

Key findings

The SEAI's ocean energy programme has a balance of moderate to strong alignment with the evaluation indicators. Key findings include:

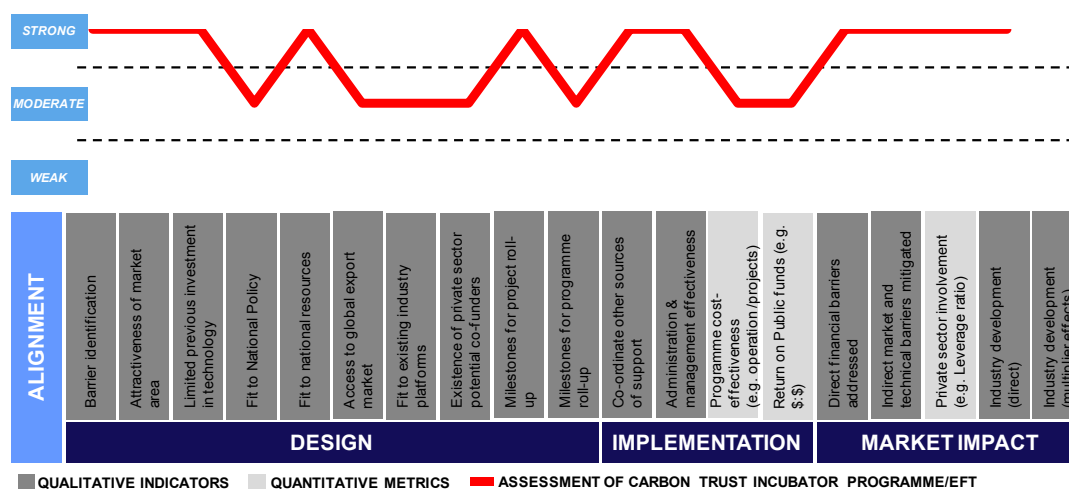
- Developing a **dedicated technology-specific industry development strategy** prior to the design of the PFM can result in a positive policy, regulatory, and investment environment; this can enhance the impact of the PFM. Prior to the programme, an ocean energy strategy identified funding needs for developing an industry out to 2016 in three stages. Although no specific finance barriers were identified, technology specific barriers related to tidal and wave energy were identified that the programme should aim to overcome. The strategy provided a reference point including expectations for job creation and economic wealth potential to encourage government and private sector support for policy development and investment in the area.
- **Comprehensive evaluation criteria** improve the efficiency of private sector application of public funds. The ability to overcome technical and market barriers is included in the evaluation criteria for grants in the programme. In addition, additionality of public investment is considered in accordance with EU State Aid rules.
- **Calendar year budget allocations have both negative and positive impacts on industry development.** In the SEAI RD&D grant programme, funding is allocated on an annual basis so projects must be completed in the same calendar year. Companies are allocated unique milestones of success for the contingency of continued support. While this structure allows for efficient response times for project applications (2-3 weeks depending on project size); it may also result in unnecessary uncertainty as to the provision of follow-on funding support in multi-year projects. With the establishment of the Ocean Energy Development Unit (OEDU) in 2008, allowance was provided to provide funding commitments over two years.
- The PFM responds to key financial and technical barriers to industry development through the provision, for example, not only of grants for prototype demonstrations, but also test facilities and market assessment and potential studies. It therefore **combines the benefits of a technology-specific approach to innovation with an industry development perspective to future deployment.**

In 2010, funding of €4.3m was announced for ten companies developing ocean energy technologies to bring total grant commitments under the OEDU to €7.1m. Prior to 2008, SEAI had provided approximately €1.3m in grants to ocean energy companies under its renewable energy RD&D programme. The OEDU has had significant success in overcoming demonstration barriers through the provision of a ¼ scale test facility and funding to develop a full-scale test facility by 2013. It is considered that significant interest and investment in the sector has been generated due to the PFM within the wider industry strategy with approximately 250 jobs created, 15-20 domestic-based companies working on technologies, and incoming foreign investment leveraged.

Carbon Trust Incubator/Entrepreneur Fast Track Scheme¹⁹

| Overview | | |
|--|------------------------|---|
| Name of PFM: Carbon Trust Incubator/Entrepreneur Fast Track Scheme | | Target phase(s) of development: R&D Innovation |
| Start: 2001 | Finish: Ongoing | Evaluation period: 2001-2010 |
| PFM Description: The Entrepreneurs Fast Track (EFT) Scheme replaced the Incubator and Applied Research technology grant programmes in 2010. The Incubator programme provided free business incubation and mentoring services to the value of £70k, as well as networking and introductions to VC, BA and other funders; the Applied Research grant programme provided up to £500k in grants. The EFT combines these two schemes. This analysis incorporates the Incubator programme and year one of the EFT. | | |
| Country context: The programme began in response to a policy environment where the UK had signed up to emission reduction targets by 2012 through the Kyoto Protocol. The programme aims to promote open innovation in clean tech and it is not intended to align specifically to specific policies. However, it is noted that the adoption of legally binding targets out to 2050 by the UK as well as various policy mechanisms have fostered greater interest for innovators in clean energy. | | |
| Key performance metrics: | | |
| Direct investment: £10m approx. | | Operation costs as % of budget: 10% |
| No. of companies: 300 | | Return on public funds: |
| Leverage ratio: 1:13 | | 20p of public funds per tCO ₂ saved up to 2050 |

Figure 7: Alignment of Carbon Trust Incubator/EFT scheme to evaluation indicators



¹⁹ Evaluation based on Carbon Trust (2011) and a semi-structured interview with programme managers

Key findings:

The Carbon Trust Incubator/Entrepreneurs Fast Track Scheme aligns well with the evaluation indicators. The key findings include:

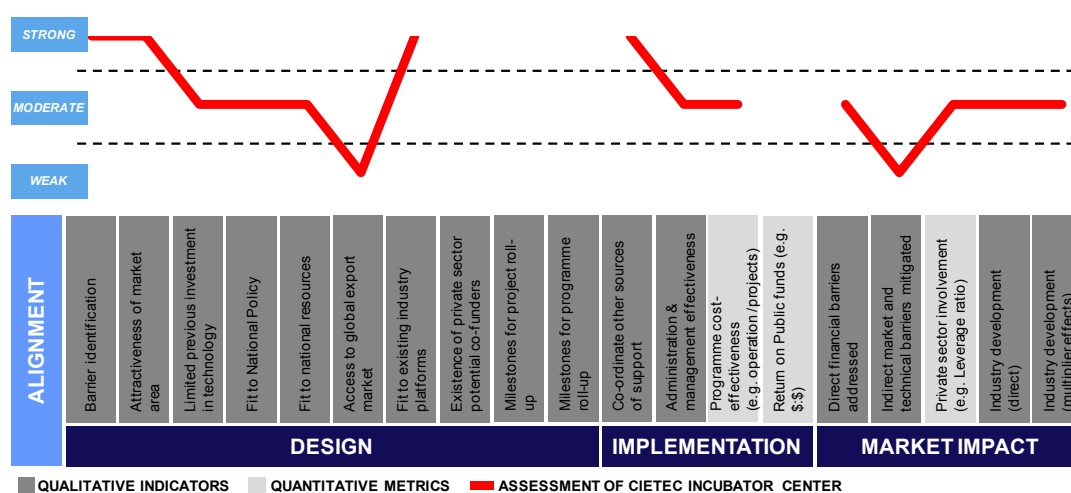
- The programme adopts a **practical approach to supporting early stage R&D** and innovation. Barrier identification is an important part of assessing the effectiveness of a PFM. The Carbon Trust implements other programmes aimed at filling identified technological or finance gaps in the UK clean energy sector. The incubator programme however, focuses on open innovation and challenges at the company-level rather than directed support driven primarily by national policy. It allows the discovery of new innovations to be supported rather than proscribing specific solutions allied to market needs. The strengths and weaknesses of each company is analysed including the identification of barriers to the commercialisation of the technology, access to finance and market readiness. This provides a focus for the work programme and milestones for success.
- **Overheads are minimised through a streamlined application process.** There are few in-house staff available to manage and administrate the programme. The programme receives approximately 1,000 expressions of interest of support per annum. Rather than invite prospective entrepreneurs to submit lengthy application forms, the programme conducts two rounds of telephone interviews with potential applicants to deduce their readiness to receive support and identify likely candidates. As a result, 150 promising applications are received out of the 1000 initial enquiries. **Free advice and consultancy services can leverage as much private investment as more direct financial contributions.** Incubators provide an essential service in maximising effective impact of new technologies further along the clean energy continuum. An incubator programme, through its focus on early-stage innovators, can improve business models, intellectual property protection, and commercialisation opportunities that will have an inherent added value when technologies begin to be demonstrated at scale or deployed commercially. By producing investment-ready companies, incubators play an important role in **minimising the need for public finance intervention in later stages.**

The 9-year operation of the incubator programme and 1-year operation of the new EFT scheme has supported a total of 300 companies. Sixty-seven percent of companies have achieved commercial outcomes – a term to describe activities such as securing follow-on funding or intellectual property rights. Over £130m of private sector finance has been leveraged at ratio of 1:13, either while companies were undergoing support or within one year after a company has exited the incubators. It is also estimated that the programme activities will result in 48MtCO₂ to be reduced up to 2050, which provides a return on the public funds of £0.2 per tCO₂ reduced.

In considering the Carbon Trust incubator programme and its alignment with indicators, it is important to place it in the context of other activities undertaken by the Carbon Trust which may have a more direct role in developing a clean energy industry, for example through technology accelerators or providing finance through the provision of interest-free energy efficiency loans.

| Overview | | |
|---|------------------------|--|
| Name of PFM: Incubation Center for Innovation, Entrepreneurship and Technology (CIETEC) | | Target phase(s) of development: R&D Innovation |
| Start: 1998 | Finish: Ongoing | Evaluation period: 1998-2010 |
| PFM Description: CIETEC in Brazil is a private non-profit organisation established jointly by five public institutions in 1998. Its aim is to support SMEs fostering technological innovation with a public purpose. Services include support for the establishment of partnerships with educational, tech and research institutions, consulting for financial resources from fostering agencies and private investors, guidance for business planning, marketing, commercialisation and intellectual property management. Of the 140 companies currently supported, 24 are in the environment and clean energy sector including micro-enterprises on solar, fuel cell and energy infrastructure. | | |
| Country context: The Brazilian Government has expressed its commitment to clean energy by adopting a target of 16% of electricity from renewables excluding large hydro by 2020. This is an increase from 6% in 2009 with large hydro contributing 83% of electricity generation. Brazil is also the 2 nd largest biofuels producer in the world after US. There is a vast network of incubators centers, technology parks and universities in Brazil that draw on public funding to support micro-enterprises in innovation and R&D. This is in response to a traditional absence of a private sector venture capital market in Brazil. | | |
| Key performance metrics: | | |
| Total turnover over 12 years of incubator: R\$ 261m | | Operations costs as % of public funds secured in 2010: 10% |
| No. of companies supported: 350 | | Return on public funds: Estimated R\$ 52m in tax revenue |

Figure 8: Alignment of CIETEC Incubator Center to evaluation indicators



Key findings

Although not exclusively dedicated to the clean energy sector, the CIETEC Incubation Center in Brazil provides useful lessons in the promotion of R&D and innovation start-ups in

²⁰ Evaluation based on CIETEC (2011) and interview with programme manager

developing countries where no strong tradition of venture capital investment exist. These include:

- **Broad-based coalitions to create a culture of entrepreneurship and innovation are** critical in countries such as Brazil. CIETEC was an initiative of university and industry organisation seeking to provide a platform for technology-based start-ups. Rather than a top-down initiative driven by government policy, Brazil's incubation network is a bottom-up response to the need for facilitating government agencies, public research institutions and industry organisations supporting particular sub-sectors or themes.
- **Grant programmes for micro and small enterprises (MSEs) can support a wide-ranging, diverse and dedicated incubation network.** CIETEC is a novel example of PFM which has managed to continue operations after direct public finance has ceased. For the initial eight years of operation, CIETEC received funding from Sebrae – an industry organisation supporting MSEs. Once this funding source ceased, CIETEC was able to charge a small fee to participants after achieving a critical mass of several hundred start-ups in the incubator programme. Government agencies also support incubation centres around the country through dedicated grant programmes which accounts for 20% – 25% of CIETEC income.

Since 1998, over 100 companies have graduated from CIETEC's incubation programme out of over 350 admissions. Ninety-five percent of graduated start-ups remain in operation. Start-ups have generated over R\$261m of turnover over the 12 years of CIETEC support. Two hundred projects have successfully access public funding programmes to the total of R\$94.2m through the support provided by the incubation centre. In 2010, the centre supported the creation of 890 jobs, securing public funds of R\$9.8m for participant start-ups against operation costs of approximately R\$1m.

Targeted Deployment/ Untargeted Diffusion

The following section provides four case studies supporting the targeted deployment and untargeted diffusion of clean energy technologies with different PFMs. These include loan guarantees, technical assistance, credit lines, mezzanine funds, and loan facilities:

- International Finance Corporation (IFC) – China Utility-based Energy Efficiency Program (CHUEE): A partial loan guarantee for local banks and technical assistance for project deployment and diffusion
- Chilean Economic Development Agency (CORFO) – Non-conventional renewable energy (NCRE) CORFO Loans Scheme: A credit line to local commercial banks for soft loans for project deployment and diffusion
- FIDEME (France) – Investment Fund for Renewable Energy: A privately run, publicly financed mezzanine fund for subordinated debt for project deployment and diffusion
- KfW (Germany) – Renewable Energy Loan Facilities: Soft loans for project deployment and diffusion

The IFC China Utility-based Energy Efficiency Program (CHUEE)²¹

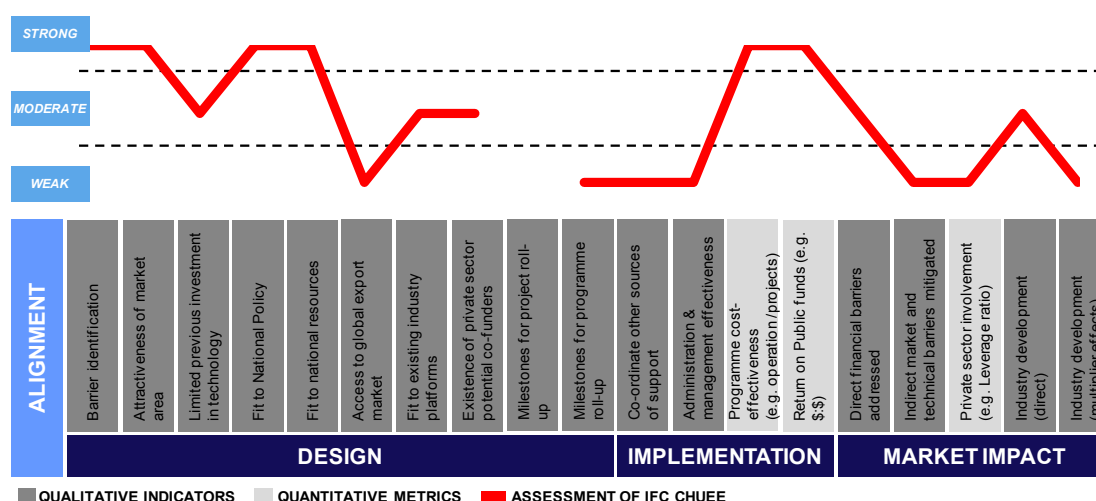
| Overview | | |
|---|--|---|
| Name of PFM: China Utility-based Energy Efficiency Program (CHUEE) | | Target phase(s) of development: Targeted Deployment |
| Start: 2007 | Finish: Ongoing | Evaluation period: 2007-2009 |
| PFM Description: CHUEE is a loan guarantee or risk-sharing facility for local banks for energy efficiency loans that are also provided with technical assistance. The programme was originally intended for utilities, but evolved to include equipment vendors and energy service companies and other customers of the local bank. Since launch in 2006, IFC has entered into four risk-sharing facilities with three domestic banks. This evaluation covers the first two facilities and is based on a World Bank evaluation report conducted in 2009. ²² The coverage of the IFC guarantee on project loans varied through each facility. ²³ Technical assistance was also provided through IFC which consisted of market studies and training on project finance and technology-based lending for local banks. Typically, 20% equity was required in projects from borrowers. | | |
| Country context: Prior to the programme design, there was a lack of an effective policy mechanism on energy conservation in China. The Energy Conservation Law of 1998 had few incentives or enforcement mechanisms. In 2006, the 11th 5-Year Plan adopted a 20% energy intensity target which resulted in numerous incentives and regulations being enforced including: <ul style="list-style-type: none"> - Targets for local governments and large industrial companies - Guidelines for banks to link loan criteria to applicant's energy performance - Subsidies for key energy conservation technology deployment However, these new policies left the poor tax and price signals for energy conservation unchanged. The PFM also operated in the context of a severe lack of project finance capacity in local banks, particularly in relation to energy efficiency projects. | | |
| Key performance metrics (2007-2009 only) | | |
| Loans issued: RMB 3.5bn (\$512m) | Operation costs as % of budget: 1.47% | |
| No. of projects: 98 | Return on public funds: 38% internal rate of return | |
| tCO ₂ /yr savings: 14Mt | Return on public funds: Annual energy cost savings \$38.4m on a 9% discount factor | |
| Leverage ratio (to guarantees issued): 1:0.6 | | |

²¹ Evaluation based on IEG (2010), IFC (2008), and www.ifc.org/chuee

²² Please refer to www.ifc.org/chuee and IEG (2010) for a comprehensive overview of the CHUEE programme and more up to date information on impacts.

²³ The first facility loan guarantee consisted of a dedicated fund allocated by the Global Environment Fund (GEF) guaranteeing 75% on the first 10% loss of the principal amount; and the International Finance Corporation (IFC) 40% of the remainder of the loan. The second phase reduced this loss sharing to half of the first 5%.

Figure 9: Alignment of IFC CHUEE to evaluation indicators



Key findings

The alignment of the CHUEE programme to the evaluation indicators varies. Key findings include:

- An **effective identification of financial barriers** is important to focus the programme design. The programme sought to address a lack of awareness and experience among local banks in financing energy efficiency projects. In particular it was responding to the risk aversion to project finance among local banks due to a tradition of lending in relation to fixed assets as collateral rather than project cashflows (e.g., inhibiting access to finance for ESCOs).
- **Alignment with national policies is essential in less developed financial sectors.** The programme coincided with a significant national policy push for energy efficiency, including a national target broken down to local governments and large companies. Given the lack of project finance capabilities and awareness of energy efficiency in the finance sector, the programme may not have achieved similar success without such concerted policy action soon after the policy was developed.
- **A guarantee programme must be flexible to tailor to the needs of local banks.** The programme had a dedicated in-country management unit who were able to adapt the programme model at the outset to reflect needs of partner banks and client base. The programme was modified from a focus on providing capital to utility customer base such as SMEs, to increasing capital to industry and large companies for energy efficiency.²⁴
- **Articulating exit clauses for technical assistance programmes** is integral to achieving sustainable impacts. Having indicators for programme roll-up and transitioning to other priorities means local partners are compelled to enhance internal capacities while support is available. The guarantee limit was reached ahead of schedule. While the CHUEE programme reliance on one bank in the early stage of programme allowed a project pipeline

²⁴ Two local banks and a gas utility were identified to be part of the programme. The initial model was for banks to provide capital to improve efficiency of the gas-utility customer base consisting of SMEs such as hotels, shopping centres and restaurants. However, when one local bank pulled out at the outset, the remaining bank's client base did not fit with the utility's and they consider transaction costs to be too high.

to be quickly built up, it also prolonged the banks' dependency on IFC expertise in loan approvals.

- **Assessment of indirect benefits of PFMs needs to be designed from the outset.**

Participating banks adopted new lending practices with lower collateral requirements and dedicated staff units were established and the awareness of profitable EE lending was raised among banks. However the extent of the benefits are difficult to measure.

A cost-benefit analysis conducted in 2010 revealed a 38% return on programme costs and \$38.4m in cost savings per year based on a 9% discount factor. RMB 3.5 billion (\$512m) of loans were provided to 98 projects on the back of RMB 2.1bn (\$312m) of guarantees issued. The programme goal of reaching 13 MtCO₂ per year in emission reductions was surpassed five years ahead of schedule. Operating costs were an average of 1.5% of guarantees issued.

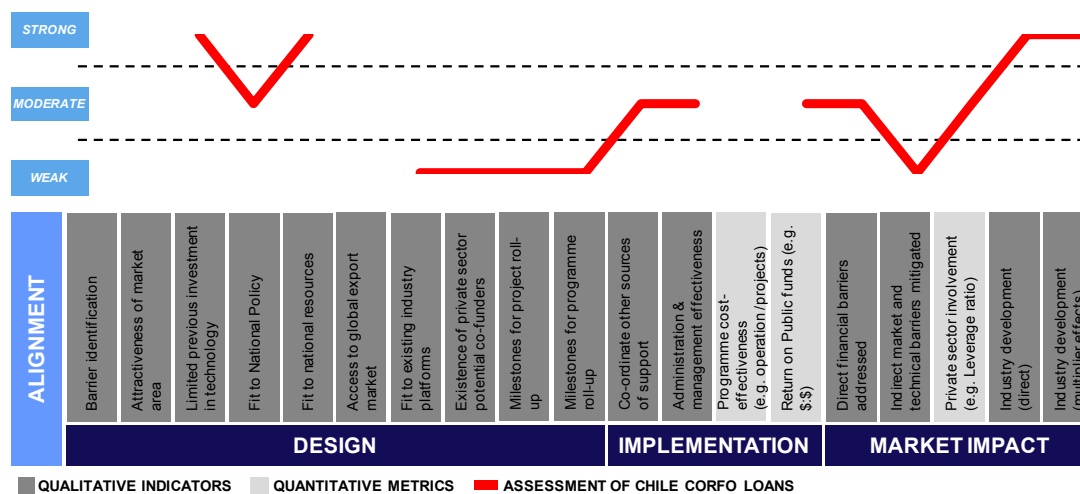
However, the direct effect of the programme in the finance sector was limited due to heavy reliance on one local bank, which still requested project analysis from the programme unit.

The Non-Conventional Renewable Energy CORFO Loans scheme²⁵

| Overview | | |
|---|---|--|
| Name of PFM: Non-conventional Renewable Energy CORFO Loans Scheme | | Target phase(s) of development: Targeted Deployment/Untargeted Diffusion |
| Start: 2008 | Finish: Ongoing | Evaluation period: 2008-2011 |
| PFM Description: A credit line for clean energy loans granted through commercial banks with better interest rates and a longer pay back period for projects. EUR80m or \$113m have been provided by German development bank KfW to CORFO, the Chilean Economic Development Agency, through an agreement between the Chilean and German governments. | | |
| Country context: The national renewable energy law 20.257 makes it mandatory for electricity companies selling directly to final customers to incorporate a certain percentage of non-conventional renewable energy (NCRE) into the electricity they provide. NCRE includes small-scale hydro, wind, solar, biomass and geothermal plants. Large-scale hydro already accounts for approximately 4.5GW of 15GW national installed capacity. Between 2010 and 2014 the obligation to supply energy from non-conventional renewable generators will be 5%. As from 2015, this percentage will increase gradually by 0.5% annually, to reach 10% in 2024. | | |
| Key performance metrics: | | |
| Direct investment: \$106.5m | Leverage ratio: 1:1 | |
| Direct deployment: 82.7 MW | Return on public funds: | |
| No. of companies: 14 | \$1.2m of public funds per MW installed | |

²⁵ Evaluation based on CRE (2011) and a semi-structured interview and questionnaire with programme managers

Figure 10: Alignment of NCRE CORFO Loans scheme to evaluation indicators



Key findings

The CORFO loans scheme for non-conventional renewable energy (i.e., excluding large hydro) aligns moderately to strongly on many indicators including attractive market opportunity, administrative effectiveness, and reducing financial barriers for projects. However, in terms of design, the programme lacked an overarching development strategy. Co-ordination with the private sector or other co-funding was limited. Key findings include:

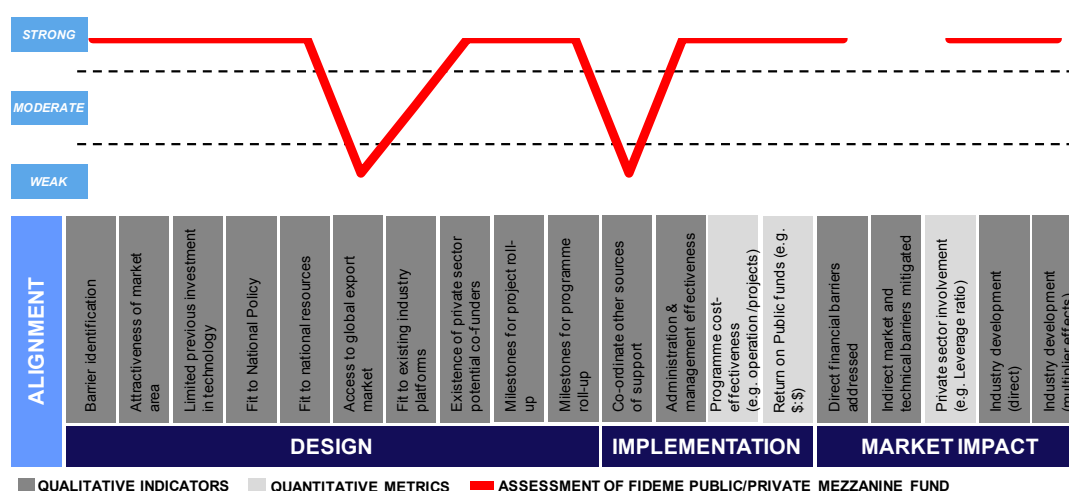
- Credit lines must be integrated with capacity building or technical assistance activities** to stimulate market adoption for clean energy projects. Local banks can benefit from high quality feasibility and pre-investment studies subsidised by a partner CORFO scheme. The provision of these studies is a prerequisite for loan applications and allows a relatively timely response. This has been an important factor in the success of the PFM in deploying capital to projects. However, local banks indicated that the impact of the loans can be enhanced by further technical assistance.
- Effective monitoring, reporting and evaluation procedures** can enhance impact. In many regards, the programme is successful in providing investment and deployment of clean energy technologies. However, it is unclear if such capital has stimulated extra investment. Current reporting requirements include a biannual qualitative report to KfW, although this does not include any reference to an overarching strategy, removal of identified barriers, or indicators of market maturity. This means that assessing whether value for money is achieved in comparison to other potential PFM interventions is difficult and does not allow for other options to be explored.

The loans scheme has directly contributed to the deployment of 82.7MW of NCRE through supporting 14 companies. These loans are typically offered at favourable 2.6% interest rates over longer terms and with a repayment grace period of 2-3 years. The wider industry development has seen the proportion of NCRE in Chilean's electricity generation growing 295MW from 2.6% to 4.1% (640MW) of total installed capacity since the programme began.

FIDEME public/private mezzanine fund²⁶

| Overview | | |
|--|--|--|
| Name of PFM: FIDEME public/private mezzanine fund | | Target phase(s) of development: Targeted deployment/Untargeted diffusion |
| Start: 2003 | Finish: 2008 | Evaluation period: 2003-2008 |
| PFM Description: FIDEME (Investment fund for renewable energy) was a €45m fund aimed at addressing debt-equity gap limiting the growth of the wind and other RE (Renewable Energy) sectors in France. A non-repayable amount of €15m was provided by ADEME (the French environment and energy management agency) as a subordinated tranche. €30m was invested from large investors such as Caisse des Depots. The fund provided subordinated debt or convertible bonds to projects in France to a maximum level of 5% of the fund (€2.25m) and 25% of project costs. Project sponsors were also required to take 10%-20% equity stakes. The fund was managed by the private sector firm, CDC-IXIS with ADEME experts participating in project evaluations. | | |
| Country context: In 2000, the French Government mandated purchase of electricity from RE sources and followed this in 2001 with the introduction of a Feed-in-Tariff scheme. For wind, this included regressionary tariffs over the years of the scheme with annual reduction of 3.3% and a one-off 10% once 1500MW was achieved. However, it was found that French companies seeking to kick-start the renewable sector in France had a financing gap between private equity and debt. Companies were unable to access sufficient cheap equity or debt from commercial finance institutions to finance projects. | | |
| Key performance metrics: | | |
| Direct investment: £15m approx. | Total leverage ratio (fund + projects): 1:20 | |
| No. of projects: 27 | Operation costs as % of fund: 2.5% | |
| Direct deployment: 300MW | Return on public funds: 40% internal return (on the 50% repayable amount of public funds) | |
| Emission reductions: 560,000 tCO ₂ by the end of the fund period. | Return on public funds: €50k of public funds per MW installed | |
| Primary leverage ratio (fund): 1:2 | Return on public funds: €0.03 of public funds per tCO ₂ reduced | |

Figure 11: Alignment of FIDEME public/private mezzanine fund to evaluation indicators



²⁶ Evaluation based on ADEME (2003), FIDEME (2008), Giessel, van J.F. & Veen, van der G. (2004) and a semi-structured interview with programme managers.

Key findings

The FIDEME public/private mezzanine fund is often cited as an example of successful public finance intervention. The existence of a commercial successor fund as well as multiple competitors in the market since its closure is indicative of targeted financial barriers addressed. Key findings include:

- **Leverage can be optimised through structured use of public funds at different levels.** FIDEME had a double leverage structure firstly through the fund itself where €30m of private investment was pooled with €15m of ADEME investment. At the project-level, 10%-20% of equity was required from project sponsors and no project could receive more than 25% of investment or 5% of the fund (€2.25m). This led to the public fund achieving a total leverage factor of 1:20.
- **Adopting no return and first loss positions in funds provides flexibility in structuring finances for deployment.** Although focusing on deployment and diffusion of proven RE technologies in France, the fund is characterised as a venture capital fund given the status of the RE sector at that time. With 50% or €7.5m of the ADEME investment non-repayable, the fund to offer lower coupon interest rates on convertible bonds typically for a VC fund from a 10% market rate to 6.5%-8%. ADEME also adopted the subordinated position for the other 50%. In total, this led to a €15m guarantee provision for the private sector investors.
- **Privately run public/private funds can cooperate given suitable division of responsibilities.** The CDC-IXIS team had a dedicated staff of 3 to 4 people per project with a general support team in the front and middle office. Due diligence was firstly performed by the management team before forwarding to ADEME for approval. Response times for straightforward cases were two months. The public sector partner was allocated a 33% voting share on the Board in accordance with its share of the fund. Any project application which proved contentious between public and private sector managers had to receive 66% approval at the Board level. Allowing initial due diligence by the private sector managers ensured that commercially viable projects were prioritised. The one project loss made in the fund derived from a referral by public sector officials.

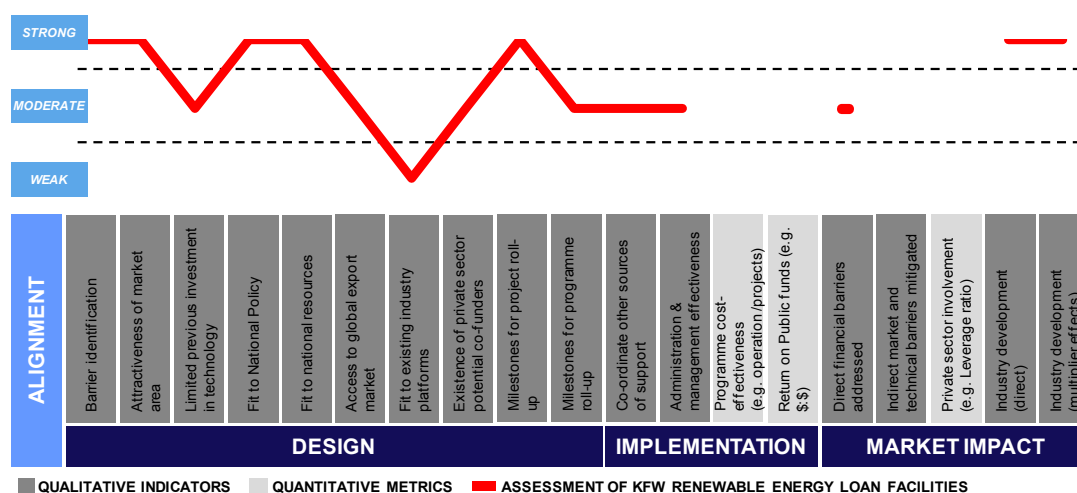
The fund financed a portfolio of 27 projects with a total capacity of 300MW. The projects included 23 wind farms, a hydro plant, a biofuel plant, a waste-to-energy plant, and a clean-tech fund). The capacity of the wind projects accounted for 1/3 of France's new wind capacity additions between 2004 and 2006. The total wind sector in France grew from 148MW installed to 3.4GW at the close of the fund. The projects will collectively reduce up to 560,000 tCO₂.

Financial returns in the fund outperformed expectations. The return on fund investments was 9.4%, ahead of the original 7% target. Private investors will recoup all investments and interest in 2013 while ADEME will close in 2015. While the ADEME-funded 33% share of the fund had a subordinated first-loss position in relation to its private sector partners, this was only the case up until the 7% return target was achieved. Thereafter, ADEME had a 50% position on capital gains beyond the 7% target. This means that of the original €7.5m repayment expected, ADEME is set to earn approximately €10m.

KfW Renewable Energy Loan Facilities²⁷

| Overview | | |
|---|------------------------|--|
| Name of PFM: KfW Renewable Energy Loan Facilities | | Target phase(s) of development: Targeted deployment/Untargeted diffusion |
| Start: 1990 | Finish: Ongoing | Evaluation period: 2007-2009 |
| PFM Description: KfW have been providing loan facilities for renewable energy since 1990 through the ERP-Environment and Energy-saving Programme (ERP-Umwelt). This programme was later complemented with the KfW-Umwelt programme, the KfW-Solar power programme (KfW-Solarstrom Erzeugen), and the KfW-RE programme (KfW-Erneuerbare Energien). These programmes offered lower than market interest rates, initial grace periods for repayment and differing co-funding and loans amounts dependent on small or large-scale projects. In 2009, KfW's different renewable energy loan facilities were consolidated and simplified to reduce confusion among consumers. The result is a KfW-RE Standard and RE Premium programme. The 'Standard' programme targets renewable electricity generation and combined heat and power plants, while the 'Premium' programme targets renewable heat plants. Both schemes offer 100% investment costs with a €10m cap through domestic retail banks. This evaluation will cover the years 2007-2009 for the six schemes above where the most relevant data is available. | | |
| Country context: The German Government adopted an Integrated Energy and Climate Programme in 2007 with subsequent legislation setting renewable energy targets in electricity (30%) and heat (14%) by 2020. A FiT support system has been in place since 1991 with a recent update in 2009 and is widely recognised as one of the successful policy frameworks for clean energy deployment globally. | | |
| Key performance metrics (2007-2009): | | |
| Direct investment: €17.2bn | | Emission savings: 11.3m tCO ₂ equivalent per annum |

Figure 12: Alignment of KfW Renewable Energy Loan Facilities to evaluation indicators



Key findings

Of the case studies presented in this study, KfW Bankengruppe is the only public finance institution with the ability to operate as a rated financial institution in the market. There are

²⁷ Evaluation based on ZSW (2010, 2009, 2008), www.kfw.de and interview with staff

several findings related to the benefit of focusing public funds through a financial institution such as a green investment bank. These include:

- **State-backed financial institutions can provide stable and long-term low-interest finance to support market growth through volatility.** As KfW is state-backed, it receives part of its budget from the Federal Ministry of Economics and Technology and, along with a AAA credit rating, allows it to offer low interest loans to market participants. This was particularly important during times of market volatility in 2007 and 2008 when the commercial finance sector experienced the credit crunch and KfW loan programmes through domestic banks were able to fill a project financing gap. It can also cover technology specific market disruptions such as the silicon bottleneck contributing to prohibitive solar PV costs in 2008 (when PV installations in Germany were able to steadily increase).
- **Absolute caps on public finance are most effective for programmes that wish to target SMEs.** SMEs have specific commercial financing constraints in implementing RE projects such as access to capital and increased credit risks. By offering a 100% project loan up to €10m at favourable conditions, KfW were able to attract market interest from prospective developers while ensuring a wide distribution of public funds. This offering recognises the potential in small-scale clean energy and emission reduction projects particular in the residential sector which can often be overlooked as too small by commercial project finance institutions.
- **Aligning public finance impacts with public policy goals** can be effective in communicating successful performance. Evaluations on KfW renewable energy lending facilities in 2007, 2008, and 2009 were effective in communicating programme impacts to policy-makers. Carbon emission savings were communicated as a percentage of the savings required to meet 2020 targets. The impacts of electricity and heat generation were communicated in terms of reduced energy imports on an annual and lifetime basis pointing to spending otherwise retained in the domestic economy; in addition, job creation through investments were estimated for each year.

The three years under evaluation in this case study resulted in a total of €17.2bn investment volume through the KfW programmes which represents 40% of total investment in renewable electricity and heat generation during the period. The cost of energy imports was reduced by between €244-€310m per annum and €16.1bn over the lifetime of the investments. Seventeen percent of Germany's 2020 targets in electricity and heat was met through the projects financed in the three-year period and between 43,000 and 45,000 jobs were created in the manufacturing, construction, and O&M of the renewable sector.

6 CONCLUSIONS: KEY SUCCESS FACTORS FOR REPLICATION OF PUBLIC FINANCE MECHANISMS

In conclusion, we consider key success factors for the replication of different PFMs in context-specific environments, their appropriate design and implementation and discuss how to understand and evaluate their impact.

Choosing effective PFMs

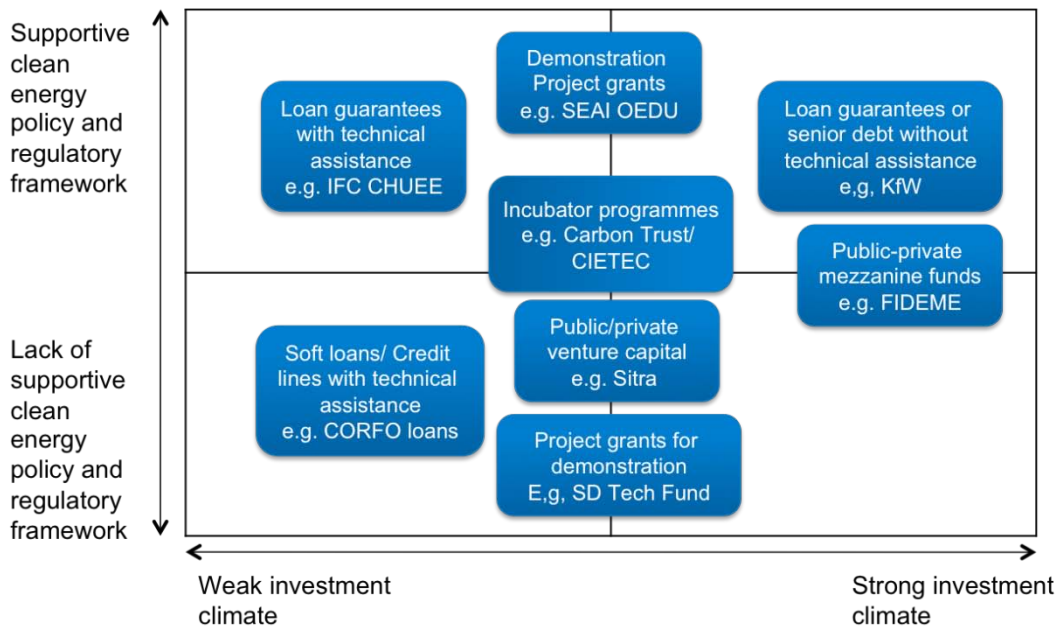
There are two key dimensions that set the country context for applying the most efficient PFM and use of public funds:

1. **The clean energy policy and regulatory framework:** A country's clean energy policies, such as Feed-in-Tariffs or Renewable Portfolio Standards, are driven by issues such as national energy security, commitments to combat climate change and the natural resources available to the country. This drives enabling factors such as planning processes and infrastructure (e.g., grid development) which also affect the relative support for clean energy. Clean energy policies are also influenced by the current and projected importance of clean energy in the overall national energy mix.
2. **The investment climate:** The general market conditions for investment are important if new financial flows into clean energy are to be attracted through a PFM. In most cases this will refer to the capacity of local banks, it can also refer to the extent to which international finance can be accessed.

Whether private sector finance is leveraged at the same time (e.g., direct joint finance of projects) or after public sector investment (e.g., support for research and innovation programmes), factors such as political risk, currency risk and the track record of international investment in the country impact on the effectiveness of the PFM.

Public finance agencies must therefore take such context-specific factors into account when considering PFM replication. Based on the analysis of case studies presented in Chapter 5, Figure 13 illustrates the relevance of certain PFMs to different contextual environments. The illustration does not definitively limit the application of different PFMs in different context, but rather illustrates where some PFMs may be or have been deployed to maximum effect.

Figure 13: Replication potential of different PFMs in similar clean energy markets



The chart summarises a number of conclusions drawn from the case studies:

- Loan guarantees in partnership with local banks can deliver efficient outcomes in both strong and weak investment climates if they operate within a supportive policy context. For weak investment climates, it is important that programmes are accompanied by adequate, strategic and time-limited technical assistance to ensure the local financial sector builds the requisite in-house capacities.
- Grant schemes for demonstration projects and incubator programmes may operate effectively irrespective of the capacity of local banks. However to have greatest impact, it is important they are aligned with national clean energy policy.
- In countries with no or limited supportive clean energy policy framework, more direct public finance support is required to drive the deployment of proven clean energy technologies, for example through soft loans or credit lines. These actions can then enable a supportive policy environment to eventually emerge whereby other PFMs such as guarantees may achieve greater impact.
- Venture capital equity and subordinated mezzanine debt may operate most effectively where weak policy signals and lack of familiarity with clean energy holds back investment from an otherwise strong investment climate.

Designing and implementing PFMs effectively

The qualitative and quantitative indicators listed in the evaluation methodology form a common approach to inform the design and implementation of a PFM. Although the case studies presented in Chapter 5 represent only a high-level evaluation of each PFM and the data available, they reveal a significant variance in the extent of current reporting and evaluation practices.

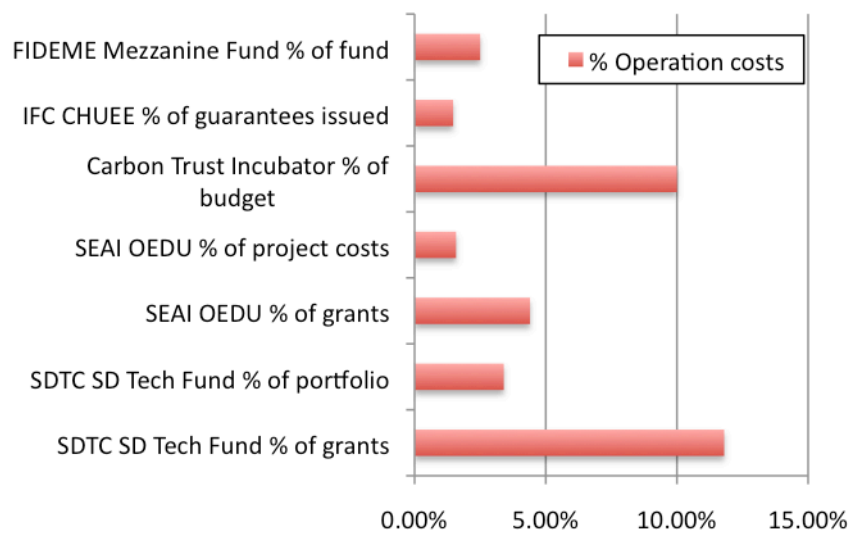
Derived from the indicators and case study analysis, some essential factors and opportunities for cross-fertilisation among PFM agencies include:

- The design of a PFM benefits from a comprehensive analysis of barriers to be mitigated or reduced to inform specific programme activities (e.g., Carbon Trust);
- This assessment of barriers should consider the capabilities of implementing agencies, local banks, and programme beneficiaries to ensure the PFM is fit for purpose. In some cases (e.g. CHUEE), programmes have demonstrated the benefit of adapting the design of the PFM when underlying assumptions change;
- Many of the case studies demonstrate the benefits of building extensive networks with large corporations, SMEs, and investors to ensure the PFM is well received and leveraged effectively (e.g., SD Tech Fund);
- It is important that a conditions-based limit is placed on the programme to adequately communicate expectations of success and to prepare the private sector for eventual withdrawal of public support. This includes identifying milestones for project/programme level roll-up where it is clear public funds are no longer required.

The implementation of PFMs requires addressing a trade-off between keeping operating costs low while also maximising the ability of the PFM to add value. While operating costs vary according to each case study as shown in Figure 14, direct comparisons can be misleading:

- Some organisations include technical assistance under operating costs (e.g., SEAI).
- Efforts to specifically target successful companies to support may increase operating costs but can avoid investment in unsuccessful enterprises (e.g., Carbon Trust).
- Allocating dedicated staff with requisite capacity to implement the programme and do so with efficient time responsiveness can reduce costs for beneficiaries. (e.g., SEAI, SDTC) However, the need for large or small staff units differ significantly depending on the type of PFM.
- For some PFMs such as grant schemes, it makes more sense to measure cost-effectiveness against eventual private sector leverage rather than use of public funds.

Figure 14: High-Low ranges of PFM operation cost-effectiveness



Metrics for cost-effectiveness

PFMs apply a range of different metrics for cost-effectiveness that make it difficult to compare PFMs. They fall in two categories:

- *% of operation costs*: expressed either as % of total funds dispersed; total portfolio worth; annual programme expenditure; or annual budget
- *Return on public funds*: expressed either as the rate of monetary return from public investment, the return for \$1 on MW deployed or tCO₂ saved or KWh saved

Integrating monitoring and reporting procedures to track and complement the necessity of the intervention is essential. Some of the most significant impacts of PFMs are indirect and easily overlooked. Reporting can go beyond output indicators (e.g., projects implemented) and basic outcome indicators (GW deployed or CO₂ saved) to consider, for example:

- Cost-benefit analysis on programme returns
- Percentage proportion of expenditure on programme overheads compared to investment
- Additionality of public finance intervention in the market through discounting or probability analysis
- Jobs created directly or indirectly by the programme
- Global value added or net economic benefit from programme spend.

Understanding PFM impact

Comparison of the performance between PFMs is extremely difficult. The analysis confirms the importance and difficulty in arriving at a comparative assessment tool for different PFMs, operating with differing objectives and contexts. Any fair evaluation must be context-

driven. PFMs should be evaluated in terms of their ability to meet specific industry needs including:

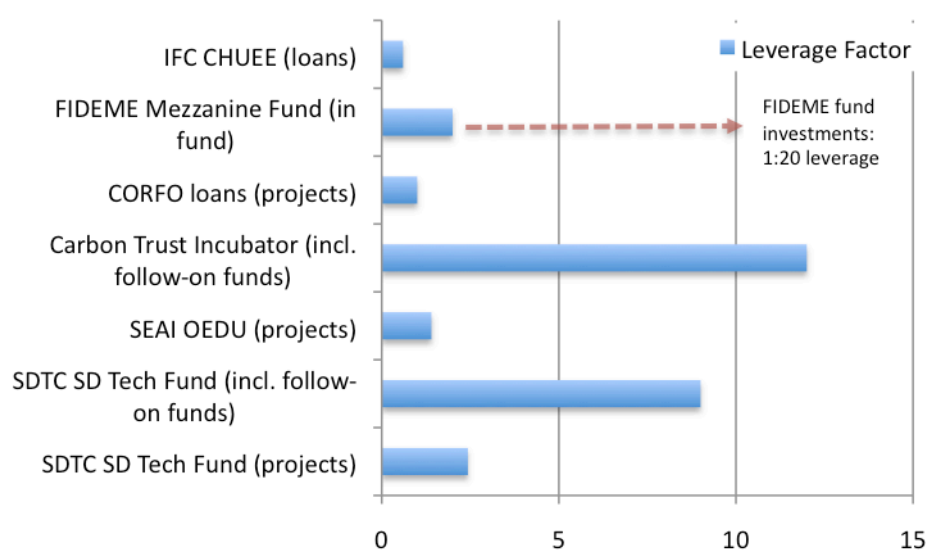
- Specific requirements of the clean energy sector reflected by their position in the clean energy continuum;
- The requirements to ensure orderly transitions by industries between different stages in the continuum;
- The specific needs determined by the country context in which they operate including national resources, barriers and the market driving policies context.

There are, however, a number of metrics commonly used to describe achievements of PFMs. The most commonly listed metric to describe PFM impact is the leverage factor – or the amount of private finance raised per investment through the PFM. Figure 15 below presents the different leverage factors quoted by the case studies.

This is useful in that it shows the level of connectedness to the wider private market. However it is not an accurate indicator of performance across all PFMs, particularly those where leverage may not be a stated aim (e.g., project demonstration grants). Further factors which influence the range presented in the figure include:

- The attractiveness of different sectors, and positions along the clean energy continuum for private sector investment.
- Variability in the way in which “leverage” is assessed. In some cases this is against guarantee positions taken on bank loans; direct side-by-side use of public/private funds in demonstration projects or funds; or follow-on private financing secured post-PFM intervention.
- As discussed above, each country varies according to the strength of the local banks. This will affect the ability of a PFM to leverage further finance.

Figure 15: Range of leverage factors reported in case studies



Metrics for market impact

Leverage factors: expressed either as private finance leverage side-by-side with public funds, e.g., project costs co-funding or equity stakes; leverage of follow-on funding in next stages of development post public funds; leverage of implicit public funds, e.g., guarantees.

The case studies also illustrate other means of describing the impact of a PFM; these depend on the purpose of the PFM and its contribution to wider national policy. They include CO₂ savings, MW installed among others.

For many PFMs, there is evidence to suggest their absence would mean clean energy companies would develop much more slowly or never progress at all. The metrics used to describe impact are limited in their ability to address the question: “what would happen if the PFM did not exist?” In each case study it is possible to identify a link between a PFM activity and a particular barrier being addressed. However this differs in terms of barriers being addressed at a market level and at a project level.

A key aspect of measuring market impact should therefore be to actively monitor and report on particular financial, market or technology barriers being addressed by the PFM as a whole, so that the need for continuity in public funds can be objectively and periodically reviewed.

For the long-term growth of clean energy, it is important that PFMs do not distort the market. In each of the case studies, the intervention existed in an underserved market and there was no evidence identified of crowding out private sector markets.

PFMs which are market facing have a better ability to engage the private sector; they are able to work with the right private finance entities. Mechanisms for private sector feedback are essential for ensuring the PFM can adapt to changing market conditions.

PFMs can play a role of stimulating whole industries provided there is joined-up support to help industries transition through the clean energy continuum. The indirect economic effect of growth of specific clean energy markets is well documented (e.g., development of wind industry in Denmark; PV industry in Germany). While it is difficult to attribute growth of an industry to specific initiatives at different stages in the clean energy continuum, collectively they play an important role in creating an environment for substantial growth.

PFMs which avoid unnecessary uncertainty as to the provision of follow-on support beyond that specific industry stage in the clean energy continuum are critical for ensuring wider industry growth is achieved. A disjointed system can result in disconnects along the clean-energy continuum, or the effects of interventions negated by other barriers remaining in place.

Therefore, understanding the role of the PFM in the wider market needs to be understood from the outset. Effective monitoring, reporting and evaluation procedures can enhance impact. These should not just include direct measures, but also assess the extent to which the PFM supports the wider industry growth and maintains national competitiveness.

Final Recommendations

Based on the methodology development and analysis of case studies, we have identified six key priorities for action by public finance agencies that are common to effective PFM interventions. This can strengthen the case of intervention in prospective host countries, as well as add to international discussions around climate finance:

1. Get the context right. Not only does policy alignment and the capacity of the financial sector need to be taken into account, but also the relevant stage of the industry and the need for its transition along the clean energy continuum.
2. Integrate the removal or reduction of identified barriers into every level of PFM actions. This includes a top-down overview of assessing market needs and reviewing programme impact, to bottom-up evaluations of individual project applications and project impact. This is required to provide a comprehensive evaluation and confidence that public finance is still required.
3. Integrate data requirements to communicate the direct and indirect benefits of public finance intervention from the level of each individual project to the programme level.
4. Demonstrate private sector appetite for public finance intervention through industry platforms and consortium development.
5. Communicate clear conditions-based indicators of success that can signal eventual removal of public funds.
6. Stress the indirect benefits of PFM aside from leverage factors such as job creation, net economic benefit and health costs reduction.
7. Construct a continuum of PFMs to support the transition of clean energy industries through the clean energy continuum.

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