



SUSTAINABLE  
ENERGY  
FINANCE  
INITIATIVE

# PUBLIC FINANCE MECHANISMS TO CATALYZE SUSTAINABLE ENERGY SECTOR GROWTH

UNITED NATIONS ENVIRONMENT PROGRAMME



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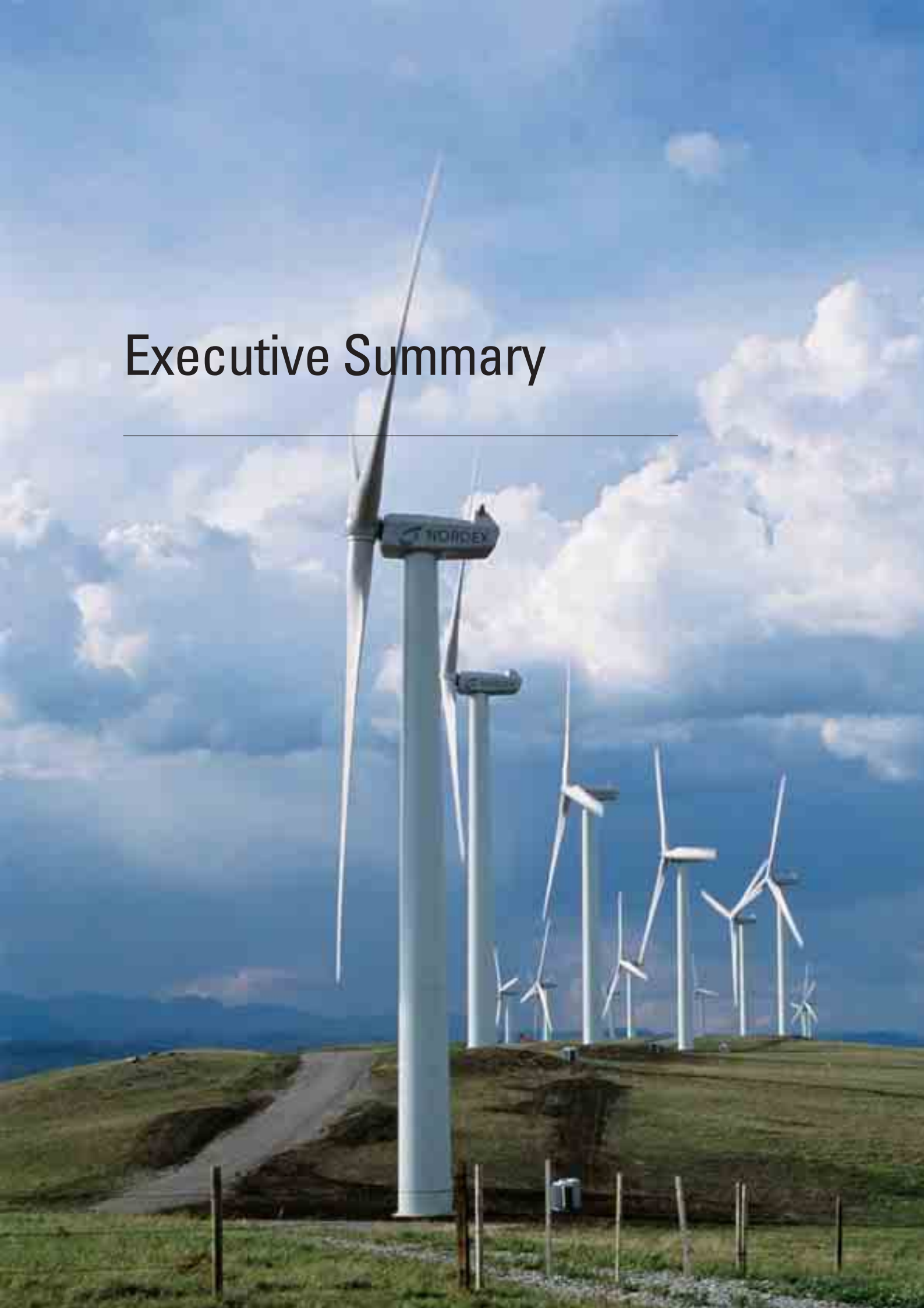
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# Executive Summary

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This Sustainable Energy Finance Initiative (SEFI) report was prepared by BASE and UNEP in collaboration with the US Clean Energy Group, and with the financial support of the United Nations Foundation. Its objective is to provide policy-makers and public finance agencies with a guide that traces the investment stages of sustainable energy technology innovation and project development and highlights how public mechanisms can help address the financing barriers that hinder capital formation in the sector. The report describes public interventions along the continuum of financing instruments that a developer must secure to take a technology or project forward – a continuum that today is incomplete due to various imperfections in the energy markets.

Policies are needed that create markets, reduce risk, provide acceptable rates of return for investments and create conditions for a sustainable and profitable SE industry. This entails long-term regulatory frameworks that create the overall market conditions for investment, supported by niche public finance mechanisms that address specific barriers and gaps to technology or project development. Significant analysis has been carried out previously on the most appropriate regulatory frameworks for supporting clean energy sector growth. Little attention, however, has been given to the role of public mechanisms in filling the finance gaps that still remain, even once regulatory instruments such as feed-in tariffs or portfolio obligations are in place. This, therefore, is the exclusive focus of the present report, which looks at the different stages of technology and project development, and assesses the sort of public finance instruments that are being used today and others that could be developed to further catalyze sector growth.

### TECHNOLOGY INNOVATION

Technology innovation is the fundamental driver of transformation in the sustainable energy markets. The technology-innovation process is influenced at its different stages by technology-push and market-pull forces that need to be managed and balanced by technology innovators, governments, financiers and eventually end-users. To lead technology innovation towards the market and to engage commercial investment in the clean energy sector, governments are starting to implement a range of new financial mechanisms capitalized by public sources. These mechanisms mostly target the pre-commercialization financing gap, or 'valley of death', which today plagues new technology developments.

Mechanisms such as contingent grants, technology incubators, convertible loans and public/private venture capital are being used to help get SE technologies from the R&D and demonstration phases through to full-scale commercialization.

### PROJECT DEVELOPMENT

Once a technology reaches commercialization, development shifts from a technology to a project focus. Facilities that can share the costs of project development on a grant, contingent grant or soft-loan basis can help move a project from the pre-feasibility stage through to financial closure. Grant programs are increasingly being combined with loan instruments to shift the focus from early-stage 'prospecting' to later-stage project engineering and development.


The financial structure for larger sustainable energy projects involves a range of equity, debt, insurance and other risk-transfer instruments. Some public instruments are being used in different countries to bridge specific gaps, particularly the widening debt-equity gap.

Public institutions exist that provide straight equity, others are taking quasi-equity positions. Some aim at facilitating corporate and/or project financing to the SE sector through public sector debt instruments.

Significant innovation in public support mechanisms is also taking place in the emerging markets, where a lack of supportive regulatory instruments makes financing SE projects particularly challenging.







A key to improving project bankability is risk management and transfer. The public sector can play an important role in sponsoring and testing new risk-management products and also in supporting activities to improve the availability of data needed for actuarial studies and the development of new underwriting / rating methodologies.

### SUSTAINABLE ENERGY SMEs

Small and Medium-Sized Enterprises (SMEs) are key players in the deployment of sustainable energy technology and in providing services that support both industry and consumers. Government-supported enterprise development and business-support programs currently exist in most countries, although few address the critical financing gaps SE business start-ups encounter. Supportive regulatory/fiscal frameworks and financial support mechanisms are needed for those SE enterprises experiencing capital constraints and difficulties in making it from the early business-planning stages through to operations and commercial sustainability. Financing mechanisms that provide grant support or provision of debt or equity at the seed, start-up and growth stages are crucial to develop the small-scale niche of the SE market.

### END-USER FINANCE

Given the high capital costs of most SE technologies, the availability of affordable end-user financing is critical for accelerating market uptake, particularly in the developing world. For household scale SE systems, end-user financing comes in various forms, ranging from retailer financing to consumer credit, leasing or fee for service. Helping shift cash-based SE markets to credit and other financing options can significantly increase the market for clean energy technologies. To ensure the success of such instruments, carefully designed public support initiatives are needed that support new markets without overly distorting them.

### INSTITUTIONAL MODELS

A number of national and local governments have adopted innovative institutional models to drive through the implementation and coordination of energy policy measures, while ensuring the long-term development of the sustainable energy sector. In Europe there are a number of national agencies worth studying, while in the United States the majority of public funding efforts for the sustainable energy sector are to be found at sub-national or state level.

The results of this report permit several observations:

Understanding financing gaps that exist in the various market stages of SE market development is a complex task. They may vary depending on the applicable regulatory environment, on developed or developing contexts and on current financing and clean energy market trends.

Effective financing mechanisms should *fill an existing investment gap, increase private sector involvement and awareness* and have the *ability to be phased out over time*, leaving a long-term *private sector financing solution in place*. The most effective finance mechanisms do not distort the market, but rather help to build it into a financially viable alternative to conventional energy.

Where possible, finance mechanisms should be *designed in an integrated manner* that allows financing gaps to be addressed at the different stages of product development. This avoids a “quick fix” approach. An example of this is a program that provides financing mechanisms from the pure R&D stage, then business incubators and technology accelerators, followed by VC investment.

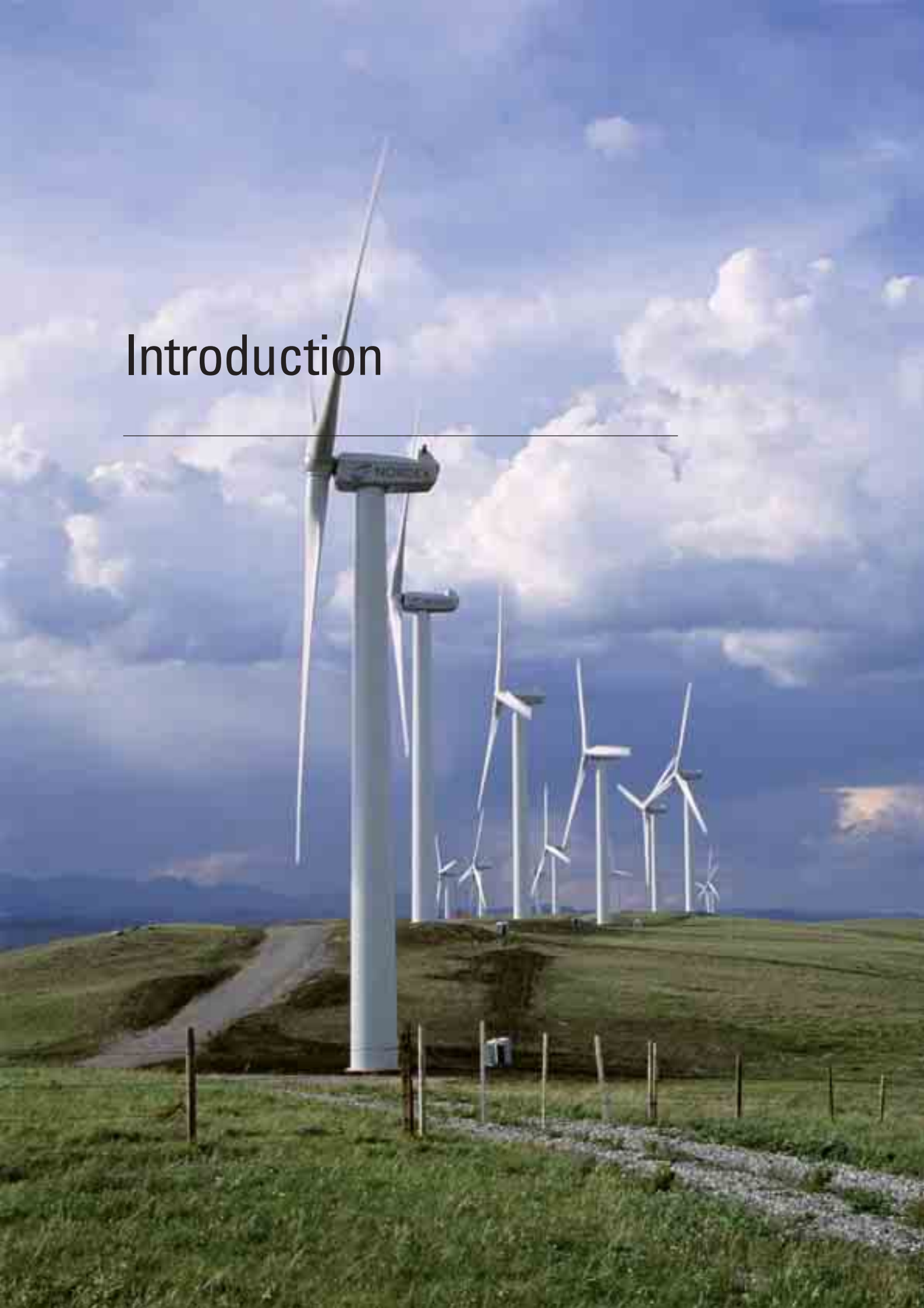
Financing gaps are most frequently encountered during the pre-commercialization stage of technology innovation and the project-planning stage for project deployment (particularly for small project proponents). *Financing options are lacking for these segments of SE market development.*

One key to improving project finance availability for all developers is *risk management and transfer*. Lenders and investors would be more willing to engage capital if more comprehensive insurance coverage were available to the sector. Public authorities have a role to play in resolving this issue.

Sustainable energy market development requires an *integrated strategy that aims to develop all aspects of the sector* including technology innovation, project development, (SME) business and industry support, consumer awareness and end-user finance. Regardless of structure and management methods, *pro-active communication with the private sector* remains crucial to implementing successful public sector financing mechanisms.

# Introduction

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Rising oil prices, growing energy security concerns and the human and environmental devastation caused by adverse weather events that might be attributed to climate change are increasing the attractiveness of alternatives to conventional fossil-fuel based energy sources and adding more reason to rethink the world's energy future. Investment is at the core of the transition to a sustainable energy future, as massive amounts of new capital will be required to cover the world's growing energy demand and to meet commitments to deep carbon emissions reductions.

A number of barriers exist that are impeding scaled-up investment in the sustainable energy sector, an area that includes both renewable energy and energy efficiency technologies and systems. Financiers regard the cost and long-term performance risks of clean energy technologies as being higher than with conventional systems – a perception which often results from a lack of timely and accurate information. The typically small size of sustainable energy projects makes transaction costs disproportionately high. The market distortion caused by the pricing of high-carbon fuels, which does not reflect the environmental and social costs they impose, puts most sustainable energy technologies at a competitive disadvantage and makes them dependent on supportive policy and regulatory frameworks to be financially viable.

## THE ROLE OF THE PUBLIC SECTOR

Both international agreements and self-imposed targets are leading government policy-makers to consider and act on the wider impacts of energy production and consumption. Given today's rapidly changing markets, however, governments increasingly have to find smarter and more effective ways to intervene.

Effective government intervention catalyzes sustainable energy technology innovation and provides the operating frameworks that financiers need to take long-term investment decisions. Policies are needed that help create markets, reduce risk, provide acceptable rates of return for investments and create conditions for a sustainable and profitable sustainable energy industry. This entails long-term regulatory frameworks supported by finance mechanisms that address barriers and gaps to financing sustainable energy solutions.

## PUBLIC FINANCING MECHANISMS

Supportive regulatory and tax environments are key drivers of the development and financing of new technologies, however, these macro approaches are not always enough to create the true enabling environment needed for large-scale investment in sustainable energy systems. This report focuses on public finance mechanisms that support the sustainable energy industry by filling the financing gaps a technology encounters as it proceeds from R&D through to commercialization and full-scale deployment. Understanding the financing gaps that exist in the various stages of sustainable energy market development is a complex task. The gaps may vary, depending on the applicable regulatory environment, on developed or developing country contexts, as well as on current financing and clean energy market trends. To avoid a "quick fix" approach, public finance mechanisms need to be designed in an integrated manner that allows barriers and gaps to be addressed at various stages of market development.

## STRUCTURE AND CONTENT

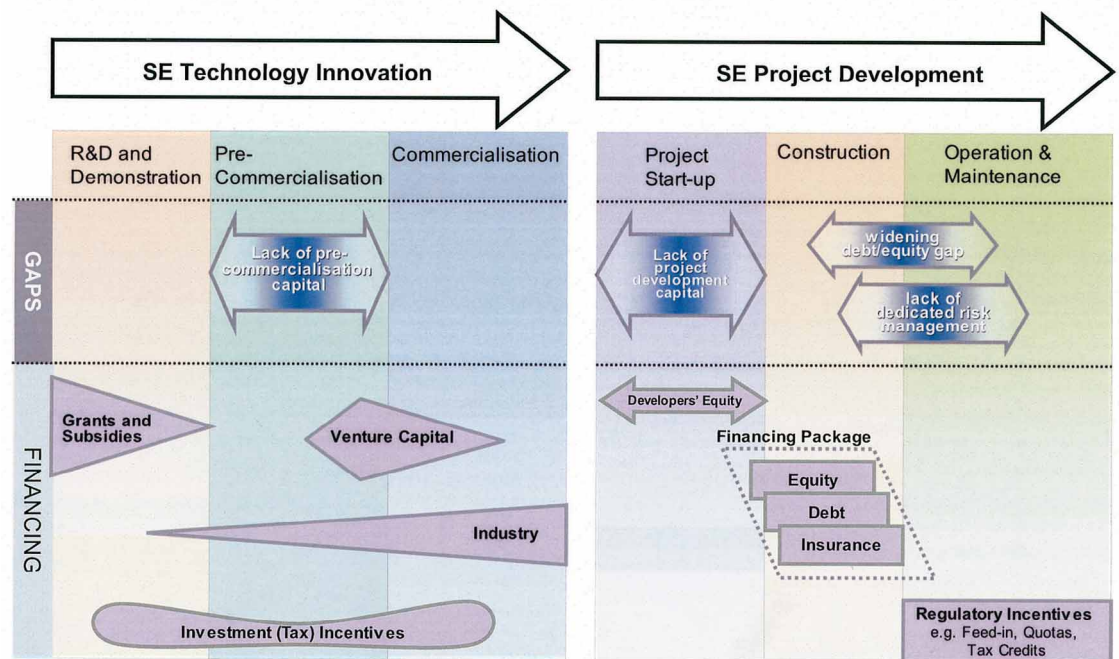
This publication serves to guide policy-makers and public finance agencies through the gaps in financing sustainable energy and provides examples of existing support mechanisms that are designed to close those



gaps. It is not meant as a complete inventory of existing mechanisms. Though it deals mainly with domestic public policy and mechanisms in OECD country contexts, the report also highlights some examples from economies in transition and developing countries.

The *Sustainable Energy Finance Continuum* (Figure 1), which will be discussed in Sections 1 and 2, covers two key areas of SE sector growth – *Technology Innovation* and *Project Development* – and highlights the existing financing gaps, along with government interventions currently available.

Figure 1 Sustainable Energy Finance Continuum



Sections 4 and 5 assess the gaps and mechanisms in the Small and Medium-Sized Enterprises (SME) sector and in the area of End-User Finance. Finally, Section 6 presents some examples from different countries of institutional approaches that have effectively overseen the development and execution of a range of sustainable energy public finance mechanisms.







Financing Sustainable  
Energy Technology  
Innovation

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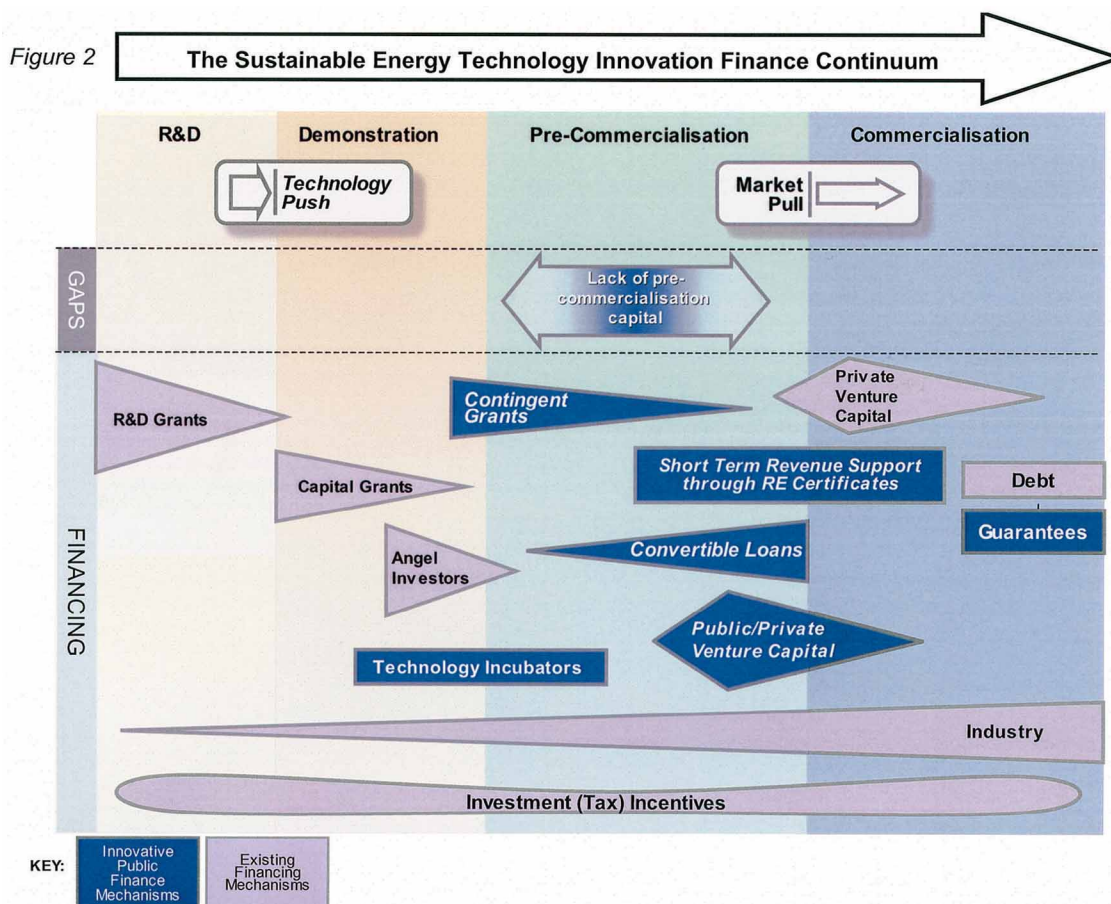
## 2. Financing Sustainable Energy Technology Innovation

Technology innovation is one of the key catalysts behind sustainable energy market growth. The technology-innovation process progresses from research and development (R&D) to demonstration, pre-commercialization through to commercialization. Each stage is influenced by *technology-push* and *market-pull* forces that need to be managed and balanced by technology innovators, governments, financiers and eventually end-users.

Supportive regulatory and tax environments are key to driving the development and financing of new technologies. In most parts of the industrialized world fiscal incentives, regulatory frameworks and market mechanisms underlie most decisions to invest in energy, both conventional fossil-fuel, as well as newer clean technology. Section 3 presents a brief discussion of the relationship between these broader policy measures and the finance community's interest to invest in sustainable energy. In many contexts, however, it has become clear that these more macro approaches are not always enough to create the true enabling environment needed for investment in new energy options.

### THE TECHNOLOGY INNOVATION FINANCING CONTINUUM

A financing "continuum" conceptual analysis illustrates the stages of investment needed to bring a technology forward to commercialization and where there are gaps in this process. The Sustainable Energy Technology Finance Continuum below shows that the financing gap typically begins in the mid-demonstration stage and continues through to the early commercialization phase. The gap is caused by systemic market failures encountered as technologies move along the innovation process, and public financing mechanisms demonstrate options to close existing financing gaps.







Grant funding, which can often be accessed for technology R&D, is seldom available for demonstration activities, particularly in those sustainable energy sectors where demonstration can involve high capital costs. This financing gap becomes more pronounced as technology development moves into the pre-commercialization stage. Figure 2 demonstrates the “weaning-off” of grant support and entry into one large post R&D, pre-commercial financing gap. This phase is often characterized by high-cost activities such as initial and secondary prototype development and testing, site development, supply chain formulation, construction, and grid interconnection. The skills and capital needed for large-scale demonstration and early commercialization are different from those required for R&D. During demonstration, financial concerns become a greater priority. To convince investors, developers must prove that their technology will be able to perform in real-market conditions and be commercially viable. This process, which may involve a number of trials and prototype retooling, is time and capital-intensive. Larger players from industry, represented at the bottom of the continuum, play an important role in developing and commercializing SE technologies. Often they are able to cover significant portions of these costs from their internal R&D and product-development budgets. Smaller technology innovators can try to raise capital from business angel investors, however, this often proves to be difficult. Also, handing over equity stakes and a certain amount of control of the company to investors so early in the innovation process is not always the most attractive option for technology developers. This stage has been referred to as the technology innovator’s “Valley of Death” because of the difficulty in securing the financing needed to reach commercialization.

#### CONVENTIONAL OPERATING AND CAPITAL GRANTS

Research and development has traditionally been the principal focus of government support in industrial and innovation policy. R&D is supported by government grants and subsidies and is driven by academia, government research laboratories, SMEs and research units of large corporations. Allocating capital effectively, in other words, picking winners, has always been a challenge for managers of public R&D programs. Technology developers often complain that grant programs can be restrictive in terms of flexibility and continuity. Still, in sectors with strong societal externalities, such as those with environmental or health benefits, government R&D grants remain the main financing source in the early phases of technology innovation. There is agreement that direct subsidies and competitive grants for R&D must be maintained due to the reluctance of the private sector to invest during this early stage.<sup>1</sup>

As important as grants are, the capital required at the R&D stage is relatively small compared with the level of investment necessary at the prototype testing and construction phases. When technologies move out of pure research to the true technology “innovation” stages of the process, business-development support and venture capital come into play. When developing grant programs appropriate for a local context, investment culture and technology type, governments should focus on ‘smart subsidy’-style grants that do not create dependence, i.e. a tendency to remain in a research slump that keeps technologies at the R&D and first demonstration stages, where grants are available. Smart subsidies attempt to grow a new technology area, while minimizing long-term market distortions. They are meant to lead technology innovators toward commercialization and help attract early and later risk capital investment that otherwise would not be available because investors see high risk and protracted investment horizons. Grant-support models that are linked to performance can allow developers to build a track record, which developers receiving only traditional up-front grants cannot. It is also crucial that grant support remain as consistent as possible to avoid increased risk aversion in the event of public-funding cuts. At the same time, R&D subsidies remain “smart” when they have an ‘exit-strategy’ as the technology reaches pre-commercialization that will leave a functioning and sustainable sector in place upon their removal.<sup>2</sup>

1. Deloitte and Touche, 2003.

2. ICCEPT, 2003.

## 2. Financing Sustainable Energy Technology Innovation

Interesting public finance mechanisms currently in use in this area include integrated grants that link technology innovation stages and needs along the innovation chain, including pure and applied research, feasibility studies and demonstration. Examples include *SenterNovem's* grant programs in the Netherlands (DEN and EOS) and the *Austrian Technologies for Sustainable Development* programs, which apply to a broad range of SE sectors.<sup>3</sup> This approach helps to ensure that financial instruments merge within and across the different stages to commercialization.<sup>4</sup> Such grant programs should be replicated and expanded across all SE technology sectors. Innovative institutional structures can also enhance this integrated approach. These will be discussed in Section 6.

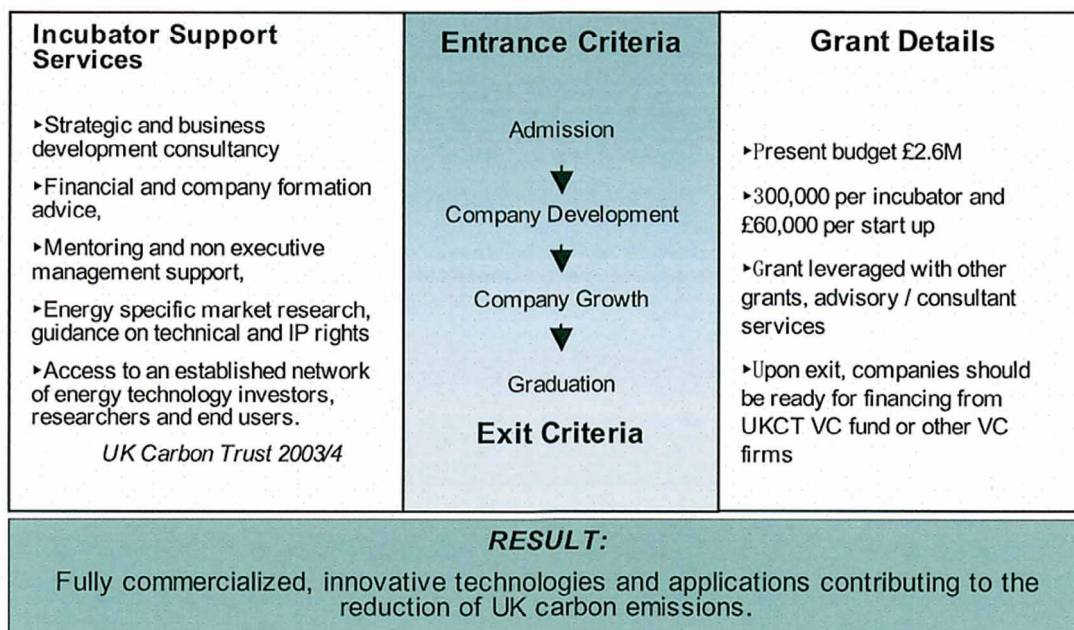
### FILLING THE GAP

To lead technology innovation towards the market and to engage commercial investment in the SE sector, governments are starting to implement a range of new financing mechanisms capitalized by public sources. These include technology and business incubators, contingent grants, convertible loans and public-backed venture capital. A new UK-driven concept of revenue support to fill the pre-commercial gap is also worth examining.

### INCUBATORS AND ACCELERATORS

Technology incubators can assist developers in covering operating costs, provide advice on business development and raising capital, help to create and mentor management teams, and provide energy-related market research. They provide for an interesting instrument to policy-makers, due to their overall local and regional economic-development contributions. Such is the case of the UK *Carbon Trust Incubator Programme*, which furnishes an important stepping-stone to commercialization for new sustainable energy and "low carbon" technologies.

Figure 3 UK Carbon Trust Incubator Programme



3. See reference in overview at the end of this document.

4. The specific 'stages' depend on the sustainable energy technology and economic and regulatory contexts.



Sustainable Energy incubators are vital instruments in transforming scientists and academics (crucial for technology development) into accomplished entrepreneurs, often complemented by professional managers. They can also assist in creating a high-quality investment pipeline of new companies by integrating R&D into business-process strategies and assisting with business-plan development and costly patent applications, which are both key to preparing businesses for venture capital.<sup>5</sup> Although incubators are not direct financial mechanisms, they play a key role in fostering the transition from technology focus to market focus, which is crucial to reducing the impacts of financing gaps.<sup>6</sup> Technology accelerators play a similar role and provide the funding, coordination and expertise needed to further lead promising technologies to commercialization. They can work together or independently with business incubators, ensuring both the technical and commercial assistance needed to support the business case to the investor.

### CONTINGENT GRANTS

Contingent grants are grants that are 'loaned' without interest or repayment requirements until technologies and intellectual property (IP) have been successfully exploited.<sup>7</sup> They can serve to cover some of the costs during the highest-risk development stages and in some cases increase investor confidence and, in so doing, leverage highly needed risk capital. Successful repayment of contingent grants can permit public subsidies to be recommitted to emerging technologies. The UK Carbon Trust's R&D *Open Call Scheme* for research, pre-commercial development and demonstration offers contingent grants of up to £250,000. Technologies such as photo catalytic conversion of sunlight to hydrogen, wave and tidal energy, energy efficiency technologies and various industrial processes that reduce CO<sub>2</sub> and energy use have been supported.<sup>8</sup>

### SOFT AND CONVERTIBLE LOANS

Loans from the banking sector are rarely accessible at the pre-commercial stage because of the high technology development risk, the lack of immediate revenue-generation potential to repay the loan and because a small developer's balance sheet generally does not provide sufficient collateral. The public sector can provide soft loans and convertible loans that offer short-term interest deferral periods and payback grace periods. There are also cases of innovative mechanisms using convertible loans for technology innovation. The Massachusetts Sustainable Energy Economic Development (SEED) Initiative, for example, provides loans from \$50,000 to \$500,000 for companies undergoing new product development (between R&D and commercialization). The loan offers deferred debt service during the first two years. Matching funds are required, but there is no collateral requirement. During year three to four, quarterly payments on interest are due and during year five, remaining interest is amortized quarterly through due dates, at which time principal is also payable. The loan is convertible to equity and automatically converts at a variable 25% discount during a qualified financing round.<sup>9</sup>

The state of Connecticut offers a range of financing instruments to promote and commercialize clean renewable technologies through the Connecticut Clean Energy Fund (CCEF). An example is a financing scheme that combines grant support for a demonstration project with a soft loan that is repayable if the technology reaches commercialization. The fund is designed to work with companies at any stage and can often use soft loans, debt and equity within funding guidelines and at CCEF's discretion to devise an optimal financing package for early state technologies and companies. As a quasi-public state agency with a history of equity

5. UK Carbon Trust; SEFI, June 2004.

6. Murphy and Edwards, 2003.

7. In some UK and US contexts, these 'repayable grants' may be referred to as soft loans.

8. Technologies supported include Focus and Consider categories on the UKCT the *Low Carbon Technology Assessment* at [http://www.thecarbontrust.co.uk/carbontrust/about/publications/Low\\_Carbon\\_Technology\\_Assessment.pdf](http://www.thecarbontrust.co.uk/carbontrust/about/publications/Low_Carbon_Technology_Assessment.pdf).

9. Qualified round refers to an equity raise of at least \$2 million with institutional investors.



## 2. Financing Sustainable Energy Technology Innovation

investments in technology, CCEF is well positioned to understand the challenges of early stage and start-up companies and provides capital support not readily available in the private equity markets.

As previously mentioned, debt financing is generally not accessible or practical as a solution during the intense period of the pre-commercialization gap, because lack of cash flow means insufficient revenues are available to service the debt.<sup>10</sup> If, however, technology innovation is supported by innovative and smart subsidies and / or risk capital, this might reduce risks for bankers and may open opportunities for debt financing at the beginning of the commercialization stage. Further government support here could include fall-away loan guarantees that disappear once the technology has successfully reached commercialization.<sup>11</sup>

### VENTURE CAPITAL

#### Venture Capital

New trends in sustainable energy venture capital funds are those launched or leveraged with public funds in order to increase the flow of capital into the market.

The main private equity investment option for technology innovation is venture capital.<sup>12</sup> The investment typically carries a high level of risk, but also provides an above-average return on investment due to the company's growth and success potential. Venture capital investors obtain equity shares in the start-up company and generally play a significant role in the management and technical aspects of the company, including obtaining a seat on the board. VC has been a driver for technology start-ups in many innovation sectors. VC investments in technology innovation must meet

investment exit expectations. Without clear exit paths, typically through re-sale or initial public offerings (IPOs), VC investors cannot easily commit to the deal, even when they are convinced of the investment potential.

Studies show that although clean tech's share of total venture capital continues to grow, clean energy technologies are lagging behind other clean technology sectors and the absolute amounts of investment are decreasing, which may increase the funding gap at the pre-commercialization stage.<sup>13</sup> Governments' understanding of venture capital as a market-growth catalyst is important in the long-term development of the SE sector. Government institutions need to support efforts that increasingly engage private investment in sustainable energy ventures. Various government agencies have been experimenting with venture capital mechanisms as part of their overall industrial and economic development policy aimed at turning promising research into new products and services. A new innovative example is the capitalization of venture funds with public resources leveraged by energy taxes, systems benefit charges or ministry budgets earmarked for the SE industry. Public investment has recently been committed in venture capital for sustainable energy, in some cases with the involvement (investment and fund management) of the private sector. Publicly driven venture capital funds have emerged in the United States, Australia and the UK. These funds can be launched with

- Government capital only
- Government capital with a matching, separate private VC requirement
- Pooled government and private capital.

10. One of the principle criteria a banker will evaluate when assessing a loan request is the Debt Service Coverage Ratio (DSCR), the ratio of free cash flow to loan repayments. The higher the DSCR the lower the risk of loan default.

11. Goldman, McKenna and Murphy, 2004.

12. Venture Capital is generally understood as being a subset of private equity investment, although the terms are often used interchangeably. For the purposes of this report, venture capital is a specific sub-segment of private equity investment, which entails investing in start-up companies with strong growth potential, and private equity entails investment in the expansion and growth of any company that is not listed on a public stock exchange. In the sustainable energy sector VC is most often used to finance new technology development and private equity is used to finance company growth or project development (e.g., wind farms).

13. Moore and Wuestenhagen, 2004; Sonntag-O'Brien and Usher, 2004. Note that in some national markets the relative decline in investment may be attributed to overall increases in total VC activity.





In most cases public sector VC is either invested independently or it requires a matching commitment from commercial VC investors. The UK Carbon Trust VC Fund has been capitalized by government funds, leverages private sector VC funds and highlights the potential of clean tech investments through the “demonstration effect”. This strategy can deliver a powerful message to private sector VC investors.

Private funds seeded with State Government funds like the CEGT (Centre for Energy & Greenhouse Technologies) in Victoria, Australia can also aim to leverage private risk capital into the clean tech arena more directly through immediate co-investment opportunities. The case of the CEGT is seen as particularly innovative, as it funds technology developers at different stages across the innovation spectrum. Private/public capital can be offered to developers not only at the early commercialization stage (where most VC takes place), but also between the development and demonstration stages (i.e. the “pre-seed” phase), where standard commercial capital would not normally venture.

Public risk capital funds can be pooled with private capital. This model usually involves a quasi-equity characteristic, whereby once all public and private investors have received an equal share of a pre-determined profit (i.e. 8% IRR), the public sector investors take a subordinate position on further profits (i.e. 30% compared with 70% taken by private investors). This provides further incentive for private investors to join the fund, and is the case with the Australian CVC REEF (Renewable Energy Equity Fund). Unlike the pure mezzanine model (described later in Section 3), however, public and private investors take the same losses in the event of failure. Although most of the examples are recent, success has already been demonstrated in terms of private capital leveraged, deal-flow and in some cases, return on investment. In the long term, emissions reduction impacts will also be demonstrated.

### **The California Clean Energy Fund (CalCEF)**

CalCEF is a non-profit public benefit corporation dedicated to making equity investments in clean energy technology and service companies. Its mission is to create a series of private sector investment vehicles that serve as catalysts for advancing California’s clean energy economy. CalCEF partners with three VC firms (Nth Power, Draper Fisher Jurvetson and VantagePoint Venture Partners) to leverage matching investment and reinvests profits in the US \$30 million fund. The fund’s initial endowment comes from utility bankruptcy settlement with Pacific Gas & Electric (PG&E, a California utility company); each CalCEF investment is matched by a larger VC capital investment.

- VC partners make equity investments in clean energy companies on behalf of CalCEF, using VC partner criteria. (For example, Nth Power typically likes to own 10-15% of a company and aims for 5-10 times or even greater return on its investment from a company with a technology proven at the lab level and ready to turn into a product or to launch.)
- Funds are invested in private companies creating technologies or products that will lead directly or indirectly to decreased reliance on non-renewable fuels.
- Both early and late stage equity investment opportunities are eligible.
- CalCEF is also working to establish the CalCEF Clean Energy Angel Fund with a network of angel investors to fund promising companies that might need additional support before they can meet criteria for investment from CalCEF.
- CalCEF launched an RFP in summer 2005 to partner with a California university to create and sustain a Center of Excellence in Energy Efficiency. The center will advance innovation and accelerate commercialization of energy efficient products, services and practices.

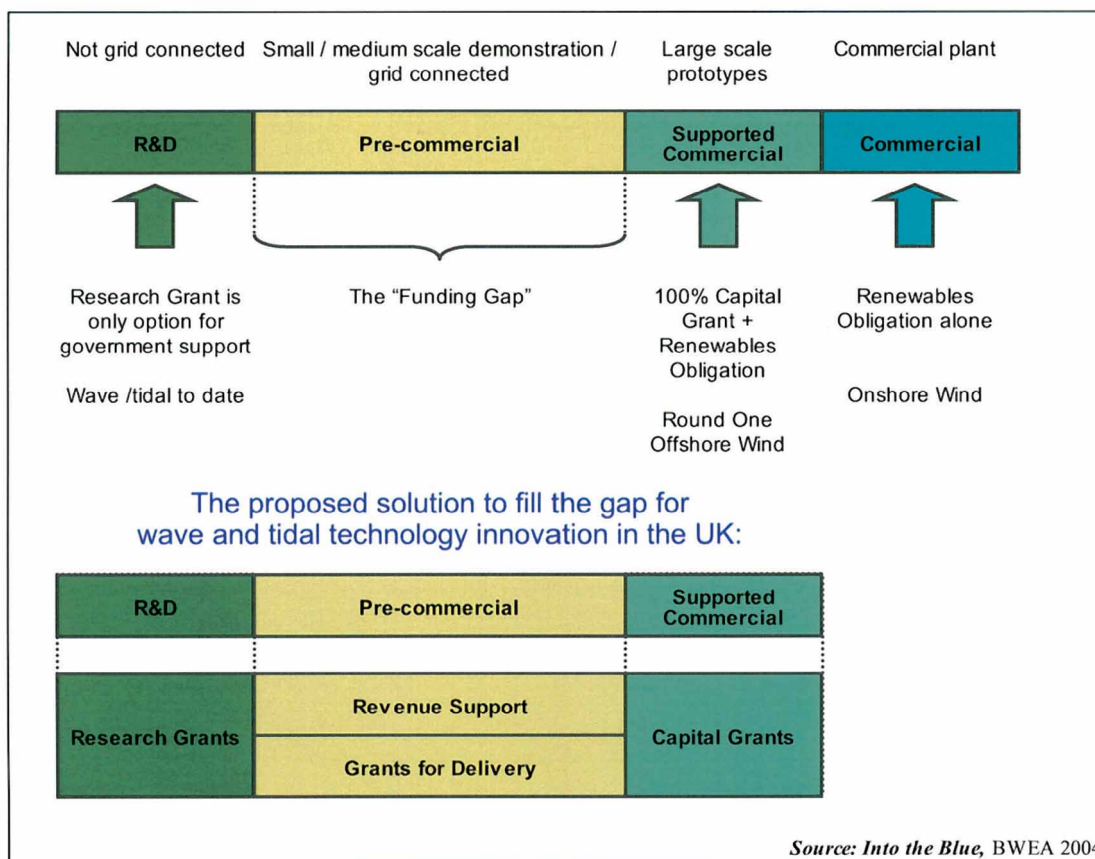
CalCEF is an example of a U.S. trend to use utility settlement of compliance payments to create new funding mechanisms for clean energy.

## 2. Financing Sustainable Energy Technology Innovation

### REVENUE SUPPORT

To complement strategic grants, the UK Department of Trade and Industry is also examining forms of revenue support to fill the pre-commercial gap for wave and tidal technology innovation. An intervention has been proposed which integrates research grants in the early R&D stages, grants for delivery (grid inter-connection and decommissioning) and revenue support based on successful production in order to gradually move innovation toward commercialization. Revenue support would be linked to ROCs (Renewables Obligation Certificates – similar to RECs). Once production begins at the early pre-commercialization stages, ‘photocopied ROCs’ with a proposed value of £100 per MWh will be given to the producer in addition to normal ROC benefits.<sup>14</sup> This proposal would address cash-flow issues of concern to investors and debt providers financing the commercialization stages. This revenue support could be compared with a fixed premium ‘mini feed-in tariff’ and could be the most cost-effective means to filling the gap and developing the wave and tidal market<sup>15</sup>

**Figure 4 The Wave / Tidal Financing Gap – UK**



14. Specific to tidal example. For further information on this proposed instrument consult 'Into the Blue' available at <http://www.bwea.com/marine/intotheblue.pdf> Status of this mechanism is as follows: There is no specific amount allocated for this instrument but, each project has a funding cap of £9m with the revenue support part of this amount lasting for a maximum of 7 years. The revenue support will come into effect when the DTI scheme has been given European Union State Aid approval.

15. ICCEPT; British Wind Association and Climate Change Capital.

A large-scale sustainable energy project featuring a wind turbine in a field at sunset. The background is a warm, orange-hued sky with a soft glow from the setting sun. A single wind turbine is visible in the center, its three blades extending outwards. The overall scene is serene and emphasizes clean, renewable energy.

# Large-scale Sustainable Energy Project Development

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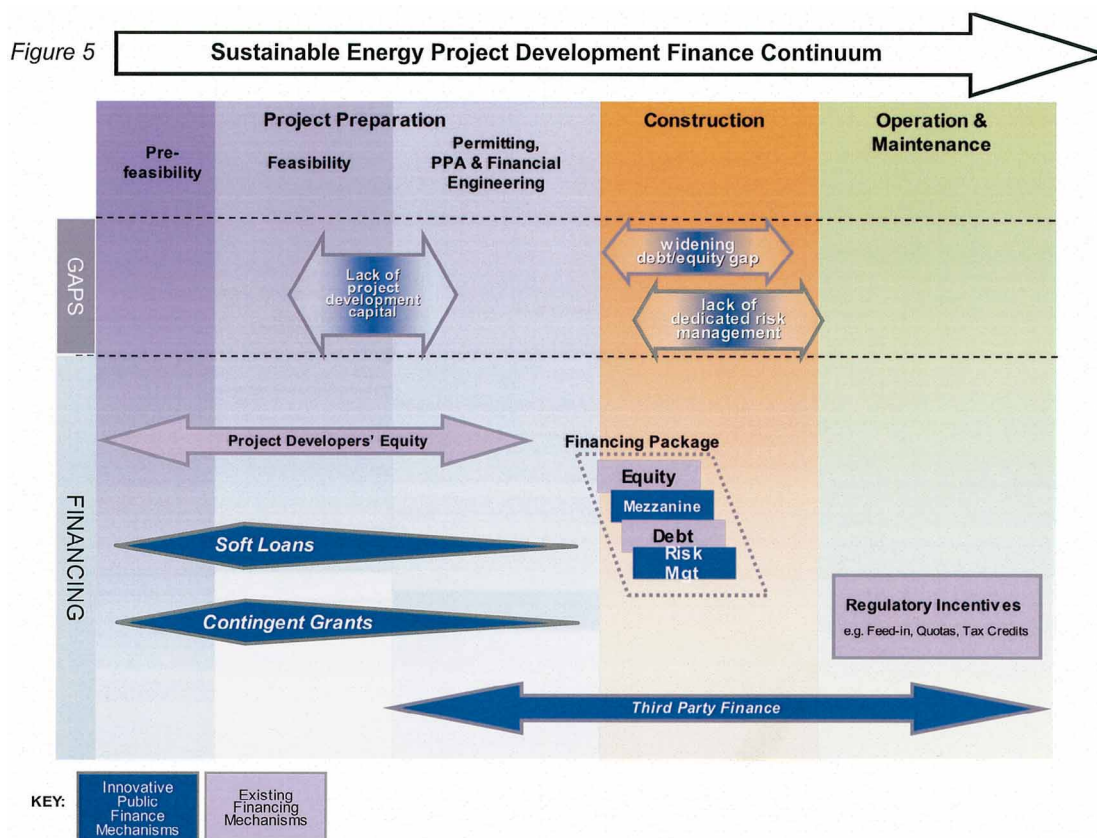
3

### 3. Large-scale Sustainable Energy Project Development

The previous section focused on the SE technology innovation process. Once a large-scale technology (e.g., one used for grid connected RE plants) reaches the commercialization stage, development shifts from a technology focus to a project focus.

Figure 5 shows the SE Project Development Continuum which begins with project preparatory activities, then construction and finally the operations and maintenance phase. There are two major areas where financing gaps occur in this continuum, the first involving a lack of project development capital in the preparatory stages, and the second involving a range of issues such as the debt-equity gap<sup>1</sup> and the lack of risk management instruments that impede the financial structuring of the full project. The specific challenges that contribute to the financing gaps vary somewhat according to local financial, regulatory, and technology contexts. They do, however, share some general characteristics such as the high up-front capital costs and therefore long-term financing requirements, small overall project size as compared to conventional power projects, high transaction costs and a general lack of familiarity on the part of investors and lenders.

Project preparation for on-grid SE projects is generally carried out either by large energy companies (IPPs or utilities) or specialized project-development companies (as is the usual case in Germany). Energy companies finance project preparation from operational budgets. Specialized companies finance project development work through private finance, capital markets, or with risk capital from venture capitalists, private equity funds, or strategic investors (e.g. equipment manufacturers).



Once a project developer has prospected out a site and has assessed the resource potential, the access to the grid, and the expected power purchase price, they will prepare a pre-feasibility analysis. If the analysis is promising, the developer will then undertake project feasibility tasks, including full-scale technical and

1. The intensity of the debt-equity gap can vary depending on sustainable energy technology, market structure, stability of the regulatory environment, the size and volume of project, and other factors.



financial modeling, business plan preparation, resource<sup>2</sup> and environmental assessments, and stakeholder consultations. The developer will then work their way through the permitting process, the grid-interconnection and off-take agreements, the financial engineering<sup>3</sup> and fundraising.

The final stages of project preparation are unpredictable: the permitting process can last for years, *power-purchase agreements*, grid inter-connection and transmission agreements can also be time consuming and costly to negotiate. Before the business plan has even been completed with all the necessary data and permitting requirements, the project developer has to begin marketing the project to investors. It is most often the smaller developers, working independently, who do not have sufficient capital reserves to carry them through this time and capital-consuming phase and have difficulty making it to financial closure.

## FINANCIAL INSTRUMENTS FOR PROJECT START-UP

Facilities that can share some of the costs of project development, on a grant, contingent grant, or soft loan basis, can play an important role in helping many developers take a project from pre-feasibility stage through to financial closure. These facilities need to be carefully structured to target the right projects and align interests on project development. Public sector contingent grants can be targeted at various preparatory activities and then repaid in part or in full when the project has reached the operation and revenue-generating stages. As with technology innovation, soft loans that offer deferred debt service and interest-free grace periods are also useful. Grant programs are increasingly being combined with loan instruments to shift the focus from early stage 'prospecting' to later stage project engineering and development. In some cases this transition to 'smarter subsidies' is occurring at the request of project developers.<sup>4</sup>

### The Canadian Green Municipal Funds

The Federation of Canadian Municipalities runs the Green Municipal Enabling Fund (GMEF) that offers grants of up to CDN\$ 350,000 to municipalities and their private sector partners for cost-shared planning initiatives, feasibility studies and field tests for the pre-feasibility and feasibility stages. GMEF's sister fund, the Green Municipal Investment Fund (GMIF), provides soft loans (4-10 years) for capital costs, consultant fees, construction costs, and the renovation of facilities and structures essential to implement SE projects. Loans and loan guarantees cover 15% of all capital costs (more in exceptional cases) to a maximum of CDN\$ 20 million for municipalities and CDN\$ 10 million for private sector partners.

*The Funds were capitalized with CDN\$ 250 million in 2000. The success of this model has led to another commitment of CDN\$ 300m in the 2005 Canadian federal budget.*

The Connecticut Clean Energy Fund Pre-Development Program (CCEF) is a soft loan facility designed to help move large early-stage SE projects through the project development pipeline. The program extends loans at 'reasonable' interest rates to RE projects that have yet to begin siting, permitting, or feasibility analyses. Funding is typically offered as unsecured debt on ranges of up to \$250,000 for projects  $\leq 5$  MW and up to \$500,000 for projects  $\geq 5$  MW. A cash cost share of 25% is required from project developers or sponsors. Debt is repayable at time of project construction financing and is forgiven if the project does not mature to a point where repayment is possible. Since the overall aim of the fund's project-bound financing is to help developers

2. I.e. one to two years of site wind data, fuel supply studies (biomass), geological studies (geothermal), etc.

3. Where the financial structure is defined and the risks and returns allocated to the different parties.

4. Bollinger and Wiser, 2002

#### Massachusetts Pre-Development Financing Initiative

The Pre-Development Financing Initiative offers funding to project developers and public entities in the form of grants and loans in an effort to support the development of RE grid-connected generating facilities in New England of 1 MW or larger (3 MW for wind facilities). The scheme is split into two main support areas:

Feasibility studies can be funded up to \$50,000, in the form of grants for public entities and loans for private (i.e., project developers) and select not-for-profit corporations (e.g., community associations, private universities, membership organizations).

Pre-development Finance can be provided to cover costs related to siting, environmental analysis and assessment, permitting, facility design, financial and legal analysis, and marketing activities. The maximum available for wind project development and other RETs is \$250,000 and \$150,000 respectively. These are generally given out as grants to public entities like municipalities, MA public authorities, federal and state government, and schools, and as loans to project developers and select non-profits.

through the project development process towards full operation and revenue generation, the CCEF also runs "Project 100", a market supply initiative with funding for long-term power-purchase agreements (discussed below under *Regulatory Mechanisms*). The Pre-Development program is therefore partly aimed at seeding a pipeline of projects for the "Project 100" power purchase agreements. Other US federal and state level financial mechanisms in this area of activity include the USDA (United States Department of Agriculture) RE grant program, Wisconsin Focus on Energy's grants and loans to SME projects and the Massachusetts' Pre-Development Financing Initiative (see box).

#### FINANCIAL INSTRUMENTS FOR PROJECT CONSTRUCTION, OPERATION, AND MAINTENANCE

Generally, larger sustainable energy projects are financially structured in the same way as any large-scale energy project. The conventional power-sector financial structure generally includes the following:

- Equity provided by the companies involved in the project, as well by institutional and strategic investors or the capital markets;
- Debt provided through corporate or project-financed loans from commercial banks or, for larger projects, through bond offerings underwritten by investment banks and institutional investors;
- Insurance of specific operational risks provided by an insurer or insurance broker; and perhaps
- Guarantees provided by an export credit agency to cover specific cross-border risks.

After the operational costs are covered, the projects' pay-out hierarchy generally takes the reverse order to this list, with the equity investors paid out last. For on-grid SE projects it can be difficult to pull this financial package together, and the gaps can often only be filled with niche financial products, some of which already exist and some of which need to be created.

#### EQUITY FINANCING MECHANISMS

Equity is normally sourced from corporate treasuries, strategic<sup>5</sup> investors, private equity funds, or the capital markets (i.e., public equities). Each type of investor will have their own reasons to invest, usually based on

5. Those that invest for reasons linked to their own business activities, for example to increase the market share for their products or to provide them with privileged access to a specific technology.

their estimation of the risk-adjusted return of the project and the options they see for eventually exiting the investment. Exits are generally made through IPOs, management buyouts or industrial sales.

Although there definitely is a gap between risk capital at the technology innovation stage and the project financing stage, some VC investors may have interest in providing later-stage equity for the first commercial applications of technologies they've financed. Follow-on equity investments at this stage allow for lower risk (as the technology is more proven) although more modest returns.

After a few years of post tech-boom lull, in 2004/5 an increasing number of sustainable energy companies are raising project equity through the stock markets<sup>6</sup>.

Public agencies can also provide equity needed at this stage. One institution that offers some equity instruments for renewable energy technologies is the Connecticut Clean Energy Fund (CCEF). As a quasi-public state agency with a history of equity investments in technology, CCEF provides capital support that is not readily available in the private equity markets. The early stage of their participation in a project specifically aims at catalyzing later-round commercial financing. The fund negotiates terms on a case-by-case basis using any type of equity, debt, convertible debt, or other financial instrument.<sup>7</sup>

Besides CCEF, there are few examples of publicly driven financing mechanisms that provide equity for project financing, perhaps because the private sector is able to fill most of this need. Another reason is that private equity investors must often take an active part in company governance, a role that public institutions are not always comfortable with given the associated time commitments and liabilities that this can entail.

It is important to remember that the cost of debt financing is lower than the cost of equity, therefore increasing the share of debt in a project leverages the returns to equity shareholders.<sup>8</sup> Most project developers therefore seek as much debt as possible to finance their projects. Increased debt, however, means increased risk of loan default. Debt-to-equity ratios in stable energy markets with long-term off-take agreements can range up to 4:1 (80% debt: 20% equity). In general, the higher the risk (real or perceived), the higher the amount of equity required. In the nascent SE sector lenders tend to require the project sponsor to provide more equity (up to 50%) to demonstrate creditworthiness and cover risk to debt servicing.<sup>9</sup> The creditworthiness of both the off-take agreements and the buyer utility can heavily influence how much debt a project is allowed to take on.

In summary, although some equity investment is now available in the SE sector, public intervention is often needed as it is not enough to cover the required equity share that banks usually expect in a project, particularly in uncertain markets with high equity requirements.

## MEZZANINE FINANCE MECHANISMS

Mezzanine finance groups together a variety of structures positioned in the financial structure somewhere between the high risk / high upside pure equity position and the lower risk / fixed returns senior debt position. Typically it comes in the form of quasi (or convertible) equity which can combine some form of preferred shares with subordinated debt and the option to later be bought out, either progressively or in one

6. The LSE's Alternative Investments Market has seen the largest number of SE IPOs, but listings are also up on the Frankfurt, Paris and NASDAQ exchanges.

7. CCEF targets projects in Connecticut, but can make investments outside the state providing that they provide benefits to Connecticut ratepayers.

8. In some contexts, the returns on equity are not dissimilar to debt returns. An example is wind-sector investment in the US where project owners are reportedly seeking unleveraged, after-tax returns of as low as 8%, compared with ~7% for debt.

9. Higher amounts of equity can also be driven by tax credits that can provide a substantial share of after-tax IRR, but don't contribute to debt service. Again, such is the case with wind in the US where many projects have been able to monetize the production tax credit for additional leverage.

### 3. Large-scale Sustainable Energy Project Development

bullet payment (called 'put options'). Quasi-equity is most useful in illiquid markets where a lack of exit options makes pure-equity investments less attractive.

For sustainable energy project developers, this form of finance is cheaper than would be available on the equity market, does not usually involve sacrificing any control of the company and can allow them to raise sufficient capital to meet the debt-equity requirements of senior lenders. Mezzanine finance instruments can be extended out 8-12 years, providing a more 'patient' capital investment option. It has proved to be most successful when operating in mid-to well-developed capital markets where equity and debt instruments are well established.<sup>10</sup>

Mezzanine finance is an attractive option for public sector participation. Public funds can buy down the risks for commercial investors and/or lenders and, by helping close the debt-equity gap, buy up returns for project developers. The potential to leverage private capital is also significant.

The French FIDEME (Fonds d'Investissements de l'Environnement et de la Maîtrise de l'Énergie) is a public-private mezzanine fund aimed at helping developers bridge the debt-equity gap. Within the fund structure ADEME, the French Environment and Energy Management Agency, has invested € 15 million in subordinated debt that effectively provides a first loss guarantee to senior lenders in the fund. By taking a mezzanine position within a mezzanine fund, ADEME has positioned its capital to be double leveraged, once by the other lenders in the fund, and a second time by the equity and senior lenders within the projects that the fund finances. The fund is open to French SMEs who face debt/equity gaps on their balance sheets, and is based on the concept of non-additionality, meaning that if FIDEME did not finance the project, it would not be implemented. ADEME estimates that the FIDEME will provide € 300 million in leverage to their capital in investments in renewable energy projects. This will still take time to bear out, since the main targeted sector is wind, a market that is still struggling to get going in France.

Some of the US state clean energy funds (discussed in section 2) provide mezzanine-type investment in sustainable energy power projects. For example, the Sustainable Development Fund of Pennsylvania (SDF) offers junior debt<sup>11</sup> to projects not easily financed on a purely commercial basis.

Another mezzanine financing instrument similar to FIDEME is being considered within the proposed European Commission's Patient Capital Initiative (PCI). The concept is a Global Renewable Energy Fund of Funds (GREFF) that would provide subordinated non-commercial capital to a number of investor-financed funds. Each fund would invest some form of patient equity or quasi-equity into renewable energy businesses/projects in developing countries and economies in transition. The capitalization target is € 75 million of public/donor funding, which it is expected could leverage € 300 million of investor capital in the individual funds.

#### DEBT MECHANISMS

The bulk of the financing provided to a project is usually in the form of senior debt, which can be structured as on-balance sheet corporate finance or off-balance sheet project finance. There do exist some public sector loan instruments aimed at facilitating corporate and/or project financing to the SE sector, however, these are mostly limited to small to mid-size projects (loans from \$5 to 20 million).

KfW (the German bank for reconstruction and development) has designed a series of soft loan credit lines for renewable energy projects within its Programme for the Promotion of Renewable Energies. Partner banks on-lend the financing provided by KfW and assume the credit risk in return for risk-adjusted margins. Loans can be granted for up to € 5 million with a maximum 3-year interest-free grace period and partial debt relief provided by the German Federal Ministry for the Environment (BMU). Successful implementation of this kind

10. da Sola Pool, 2004.

11. SDF financing can range up to \$5 million for maximum 10 year terms at a fixed per annum interest rate of 5%.

On or off the balance sheet?

**Corporate Finance** involves debt provided by banks to companies that have a proven track record, using 'on-balance sheet' assets as collateral. Most mature companies have access to corporate finance, but have limited total debt loads and therefore must rationalise each additional loan with other capital needs. Corporate finance is the preferred financing approach for small projects (e.g. less than \$15 million), since the financing can be executed more quickly and project revenues may be inadequate to support the transaction costs associated with other financing methods. Costs of legal and arrangement fees can be kept low. With a single sponsor accepting the majority of the project risk, technical and financial due diligence will typically be accomplished more quickly. Tax incentives (e.g., accelerated depreciation) and leasing structures can help improve the financials of RE projects for corporate sponsors.

**Project Finance** involves debt provided by banks to distinct, single-purpose companies, whose energy sales are sometimes guaranteed by power purchase agreements (PPA). Often known as off-balance sheet or non-recourse finance, since the financiers rely mostly on the certainty of project cash flows to pay back the loan, not the creditworthiness of the project sponsors. It is most practical for mid to larger scale projects above 20 MW.

of soft loan programme may be inhibited if the permitted margins are insufficient to motivate the partner bank to market the product to its customer base. This can be avoided if the bank has a strong corporate commitment to the SE sector, as is the case with Banque Populaire d'Alsace mentioned in Section 4.

Lines of credit are actually more common in emerging markets, capitalized mostly by international financial institutions and bilateral donor agencies. For instance, the Bulgarian Energy Efficiency and Renewable Energy Credit Line (BEERECL) offers loans, technical assistance and grant support to Bulgarian SE projects. The facility is financed with € 50 million from the EBRD (European Bank for Reconstruction and Development) into which is blended a € 10 million grant facility from the Kozloduy International Decommissioning Support Fund (KIDSF). Participating private sector banks on-lend to Bulgarian projects in the range of € 50,000 to € 2 million. As an added incentive, loan recipients also receive grant support towards the principle of the loan, 7.5% for energy efficiency projects and up to 20% for renewable energy projects.

### The Netherlands-Green Funds

Individuals in the Netherlands can receive a tax incentive of 2.5% and an earned interest of 1-1.5% on green savings accounts. Participating Banks (ABN AMRO, ING, RABO, Triodos, Fortis and ASN) use these savings to offer soft loans to environmental projects that include clean energy technology and project developers (in particular for wind).

As of year-end 2004, 188,000 investors had invested € 4.1 billion, € 3.55 billion of which has been on-lent to 6,500 projects. Projects require Dutch government certification to be eligible for the reduced interest loan.

*The innovation and success of the green fund model is the incredible amount of leveraged capital introduced to the marketplace. The Green Fund model has led the Netherlands to a supply-oriented market. Now the banks ask developers to consider sustainable energy financing, rather than the other way round.*

SenterNovem

### 3. Large-scale Sustainable Energy Project Development

A lot of innovation in public support instruments for debt financing is actually happening in the developing world, driven in part by a lack of supportive regulatory instruments and therefore the need to boost the financials of clean energy projects to directly compete with conventional energy systems. To improve access to long-term financing, a variety of instruments are being used, including currency swaps to reduce foreign exchange risk<sup>12</sup>, two-step bridging mechanisms to allow project refinancing<sup>13</sup>, lease-financing arrangements to reduce off-take risk, and various other approaches<sup>14</sup>.

#### RAISING BANKER AWARENESS

One of the principle barriers from the project developer's perspective is not necessarily the nature of the SE project itself, but the lack of understanding and experience that exists among commercial lenders. The extra costs associated with satisfying the higher 'burden of proof' that a bank's loan committee would normally apply to their first few SE loan requests usually falls on the project developer. These learning curve issues can be remedied somewhat through public sector facilities. Such mechanisms can include institutional strengthening interventions, such as training and technical assistance to banks for putting in place appropriate credit rating and due diligence procedures, or project specific support facilities that share some of the elevated transaction costs. Raising awareness is crucial within smaller commercial lending institutions, particularly in emerging markets, but also in larger institutions where educating management and board members can help raise the profile of SE investing as well as improve the general understanding of sector trends and market opportunities.

For example, SEFI has been developing a Transaction Support Facility<sup>15</sup> for helping financiers evaluate and transact first time loans/investments in the renewable energy and energy efficiency sectors. SEFI support comes in the form of direct or contingent grants to investors/lenders evaluating RE or EE transactions, usually to cost-share project assessment and advisory work undertaken by third party experts. Another example is the Bulgarian Energy Efficiency and Renewable Energy Credit Line (BEERECL) that besides on-lending through local banks, also helps these partner banks in developing and managing a clean energy loan portfolio.

#### ALTERNATIVES TO BANK FINANCING

Third-Party Financing (TPF) is another form of off-balance sheet financing that can be used in place of debt financing. It is best known for energy efficiency and energy performance contracting via energy service companies (ESCOs), but can also be a source of finance for renewable energy projects. TPF leasing arrangements can also provide the purchaser/lessor with tax advantages (i.e. accelerated depreciation) while transferring all operating costs and responsibilities to the lessee.

An example of government-led third party financing is the Spanish IDAE model, which has been financing renewable projects in Spain since the late-1980s. IDAE identifies a project, provides the capital to a developer to construct it (or install the new energy consuming or producing equipment), and recovers its investment plus the cost of its services out of the energy production or savings. In other words, IDAE finances

12. For example DEG, the private sector arm of KfW, has put in place a cross currency swap to finance a windfarm in China.

13. The World Bank has offered a liquidity stand-by guarantee to banks providing term loans to mini-hydro plants in Uganda. Although banking regulations limit loan maturities to 8, this form of put option (the banks can sell the loan to the World Bank after 8 years) allows banks to stitch together two loans into a 15 year financing package, a term more appropriate for RE infrastructure financing.

14. An in-depth review of this mechanism is in "Financing Instruments for Renewable Energy", P. Lindlein, W. Mostert, Final Draft, KfW (2005).

15. Initially this facility is being run through a number of banks in North Africa.

all the costs and assumes the technical responsibility of the investment. At the end of the contract, all capital assets are owned by the project developer and user of the installation. IDAE plays the role of an ESCO and has invested € 95m and leveraged another € 104m in 144 sustainable energy projects<sup>16</sup> under the third-party finance mechanism. In the case of investments where the scale of the project requires additional finance partners IDAE has experimented with other approaches, including taking direct equity investments. The percentage ownership held by IDAE in the different companies varies between 6.7% and 40% and never exceeds 49%.

In the OECD markets the largest RE projects are starting to access the bond markets as a means of raising capital. The first known examples of this approach occurred in summer 2003 when FPL Energy in the US and Britain's ScottishPower raised \$380 million and \$700 million, respectively, through new bond issues for wind park financing. The scale of these offerings is indicative of the level of maturity of the wind sector, and also the limited role that public support programs can play in these commercial markets. The recently passed US Energy Policy Act of 2005<sup>17</sup> permits for *Clean Renewable Energy Bonds* allowing municipal utilities, rural cooperatives and governments to issue clean renewable energy bonds, with a national cap of up to \$800 million (of which a maximum of \$500 million is available to governments). The Federal government will give the bondholder a tax credit for what they would usually receive from the issuer in the way of interest.

## RISK MANAGEMENT MECHANISMS

An integral element of deal structuring, particularly for off-balance sheet projects, is financial risk management. This process entails using financial instruments to transfer specific risks away from the project sponsors and lenders to insurers and other parties better able to underwrite or manage the risk exposure. Among other important factors, financial risk management is one of the keys to deployment of sustainable energy technologies. Applied correctly, certain financial risk management instruments can help mitigate the perceived risks associated with RE and affect the degree and terms of investment into such projects. However, there are currently constraints on the availability of such risk management instruments, which relate to factors such as the willingness and capacity of insurance and capital markets to respond.

There has been some development of dedicated insurance products that provide financial protection to SE projects. However, there are still considerable gaps in providing insurance products for the broad array of sustainable technologies on the market, as seen in Figure 6, the *RET Risk Transfer Heat Map*<sup>18</sup>.

The successful development of new insurance and Alternative Risk Transfer<sup>19</sup> (ART) products for the SE sector will require the development of specialist insurance underwriting practices and other emerging financial risk management instruments such as weather derivatives, credit derivatives<sup>20</sup> and political risk insurance. The public sector can fill a role by sponsoring and testing new risk management products and supporting the financial industry with the information and data needed to accurately underwrite risk management products for SE projects. Support can also be provided to financial innovators who wish to take the leading role in developing new risk management products, most likely small to medium-sized specialist risk/finance companies, and assist them in bridging risk management activities with the major financial institutions. Governments can reinforce and assist a 'learning by doing approach' where new SE financial risk management

16. Biomass, district heating grids, solar thermal, small hydropower, wind, pv solar and energy efficiency projects.

17. July/August 2005

18. *Financial Risk Management Instruments for Renewable Energy Projects*, UNEP, 2004

19. Alternative risk transfer involves non-traditional forms of re/insurance and techniques where risk is transferred to the capital markets.

20. Derivative: A financial contract whose value is derived from another (underlying) asset, such as an equity, bond or commodity.



### 3. Large-scale Sustainable Energy Project Development

Risk Categories	Construction All Risks	Resource Supply / Exploration	Property Damage	Machinery Breakdown	Business Interruption	Delay in Start Up / Advanced Loss Of Profits	Defective part / Technology risk	Contractors overall risk	General / Third Party Liabilities
Wind Onshore	Red	Blue	Red	Orange	Orange	Red	Blue	Red	Red
Wind Offshore	Red	Blue	Red	Orange	Orange	Red	Blue	Red	Red
Solar PV	Orange	Blue	Yellow	n / a	Orange	Blue	Yellow	Orange	Yellow
Wave / Tidal	Orange	Blue	Yellow	Yellow	Orange	Blue	Blue	Orange	Yellow
Geothermal	Orange	Blue	Orange	Orange	Yellow	Blue	Blue	Orange	Orange
Biogas	Orange	Blue	Yellow	Yellow	Yellow	Blue	Blue	Orange	Orange
Small Hydro	Yellow	Blue	Yellow	n / a	Yellow	Blue	Blue	Yellow	Yellow
Biomass	Yellow	Blue	Blue	Blue	Blue	Blue	Blue	Blue	Yellow

#### Availability of cover

Red	Increasingly comprehensive and competitive cover - rates going down, cover being extended
Orange	Broad cover - leading markets available, standard rating available, possible high premiums / deductibles
Yellow	Partial cover - Growing market interest, some gaps in cover, limited capacity, high premiums / deductibles,
Blue	Very limited cover - Few markets, restrictive terms and conditions, many exclusions
Dark Blue	No cover available from traditional insurance markets

projects are tested and can be adopted by financial organizations and institutions.<sup>21</sup> In 2005 UNEP will begin a multi-year analysis and development effort on new risk management instruments and specifically those that could be developed through public private risk sharing partnerships.

The flow of private capital to the SE sector is dependent upon investor confidence. This means that minimizing any potential negative financial impacts on a project caused by unanticipated events is key to ensuring capital inflows to the sector.

#### GUARANTEES


One form of risk mitigation instrument is the public sector loan guarantee, implemented where possible in conjunction with private financial institutions. Partial risk guarantees ensure debt-servicing payments to selected lenders or other investors in a project, usually for specific time periods or exposure levels. Partial credit guarantees act to extend loan repayment periods, thus improving the project's cash flows. Both forms of guarantee can motivate banks to lend for projects they perceive as risky. Buying down the risk can mean lower costs of financing for the borrower or decreased security requirements. Guarantees are most effective at addressing elevated banker perceptions of risk; once a bank has gained experience managing a portfolio of SE loans, they are in a better position to evaluate true project risks.

Guarantee schemes for larger-scale projects in OECD countries are uncommon, however there are examples of small to mid-size guarantee instruments including the French FOGIME (see section 4), the Canadian GMIF, and the USDA (United States Department of Agriculture) RE and EE Program. In 2005, the USDA set aside 11.4 million for SE loan guarantees<sup>22</sup> (out of a total \$22.8 million, where the remainder 11.4 million was allocated for grants) The US Agency for International Development (USAID) also offers loans to private sector SE project investments. The new US Energy Policy Act mentioned above also has provisions for energy and fuels derived from municipal waste and cellulosic biomass as well as a specific loan guarantee program for sugar ethanol.

21. Elaboration of insurance, reinsurance and other risk management found in UNEP's *Financial Risk Management Instruments for Renewable Energy Projects* available at [www.sefi.unep.org](http://www.sefi.unep.org). In 2005 UNEP will begin a two year targeted research effort through the GEF to identify promising areas where public mechanisms can effectively support innovation in the RE risk management markets.

22. The exact criteria for loan funds under this program (financed as part of "Farm Bill Section 9006") were not established at time of publication; however, by law, guaranteed loans cannot exceed 50% of project costs. Any funds of the \$22.8 million not earmarked for loan guarantees by August 31, 2005 will revert to additional grant funding under this program.





On the state level in the US, Pennsylvania offers a new financial assistance program for renewable energy projects including loan guarantees and straight loans through the Pennsylvania Economic Development Authority (PEDA). Loan guarantees under this program are offered for a maximum of \$500,000 with terms set by PEDA's affiliated lending institutions. Loans are offered for maximum 10-year periods, with an interest rate of 50% of the prime rate (no less than 3.25%).

In developing countries, the World Bank has been offering some guarantee facilities, through the Global Environment Facility for geothermal project exploration risks, and through MIGA for other projects and risk types.



# Financing Mechanisms for Sustainable Energy SMEs

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# 4



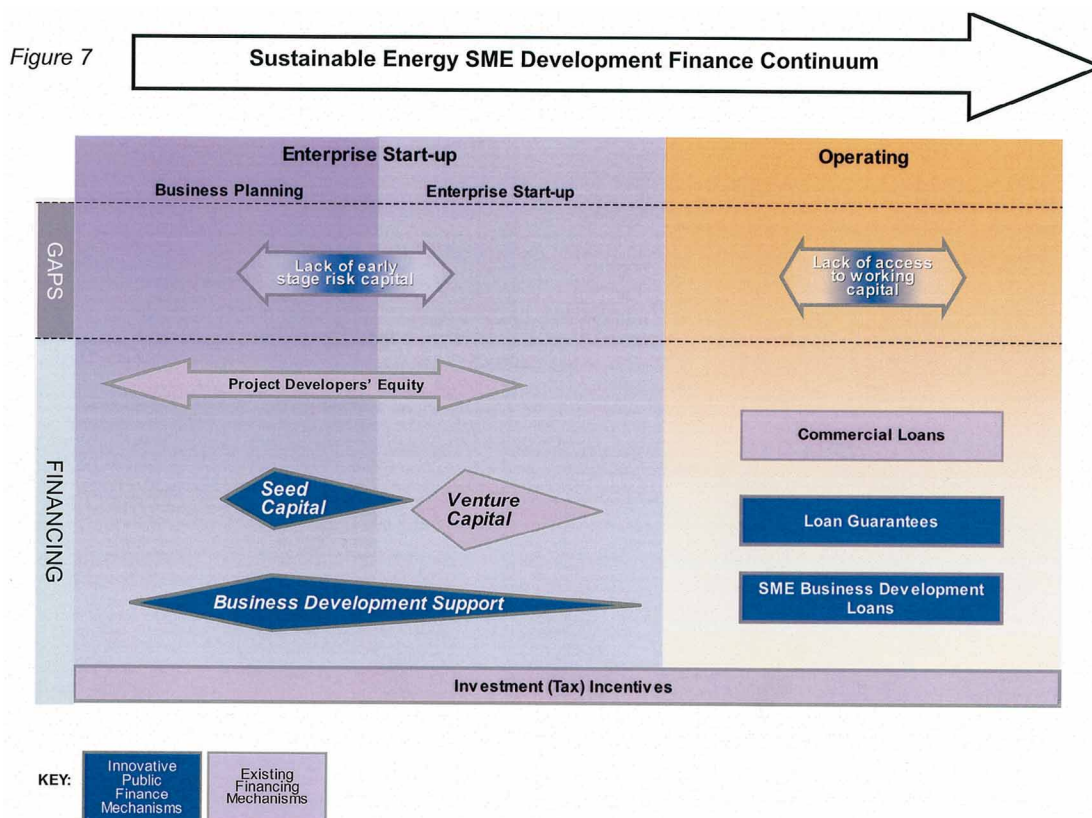
## 4. Financing Mechanisms for Sustainable Energy SMEs

Small and Medium-Sized Enterprises (SMEs) are key players in the deployment of sustainable energy technology and in providing services that support both industry and consumers. They can help to ensure continued growth of the sustainable energy industry and impact CO<sub>2</sub> emissions on a large scale. The majority of all clean tech and environmental businesses responsible for technology innovation and sustainable energy product and service delivery are SMEs. These enterprises have a very broad-based profile. Sustainable energy SME business activities range from energy consultancy services to small-scale RE manufacturing and assembling, wholesaling, distribution and installation, small-scale RE sales and servicing and ESCOs (Energy Service Companies). SE SMEs are generally able to offer efficiently packaged small-scale energy services to a variety of energy users. They are often locally based, which can be an added value when trying to convince consumers and other companies to choose sustainable energy. The flexibility of SMEs makes them well positioned to work with larger SE companies to support their business activities.


Government-supported enterprise development and business support programs currently exist in most countries, however, few address the critical financing gaps experienced by SE business start-ups. Investors tend to consider SE SMEs high risk and high cost, and they tend to be the least served by the financial services industry.<sup>1</sup> Supportive regulatory/fiscal frameworks and financial support mechanisms are needed for those SE enterprises experiencing capital constraints and difficulties in achieving sufficient profit margins from the concept and early business planning stages through to operation.

### ENTERPRISE START-UP AND OPERATING GAPS

Figure 7 demonstrates some of the financing gaps faced by sustainable energy SMEs – gaps that vary in size, depending on the local context.



1. Miller, A, IFC, SEFI Sustainable Energy Finance Roundtable, Bonn, June 2004.



To ensure the necessary cumulative impacts of small-scale business on the growth of the sustainable energy sector, large-scale deployment of small-scale business activities must be reached. Governments can bridge some of the financing gaps through specialized support programs, including business development services (preparation of business plan, market information, etc.), technology and business incubators/accelerators, networking activities and direct finance mechanisms for filling equity and debt-related gaps. Public sector support for knowledge exchange between the SE business sector and financiers can address information gaps that create barriers to financing.

## FILLING THE SME GAPS

Finance mechanisms that provide grant support or debt or equity at the seed, start-up and growth stages are crucial to the development of the small-scale niche of the SE market.

### GRANTS

Contingent grants are useful mechanisms that can help the SME address specific aspects of business development, especially in the early stages before any revenue streams have been established. This option permits the public sector actor to provide incremental funds without directly subsidizing commercially viable activities, since the support is repaid once the business activity has started providing returns. In the event that the contingent grant is repaid, then the repayment history is useful for demonstration to future investors. The New Jersey Office of Clean Energy's Renewable Energy Economic Development (REED) program provides competitive contingent grants of up to \$500,000. The grants seek to assist businesses of less than 500 employees in leveraging other private sector funding, and are repaid depending upon the revenue success of the company. This flexibility allows a company to initiate ventures much earlier than would be possible using conventional business financing programs. It also allows for more capital to cycle into the company, transferring the repayment period to a time when the company is financially capable of meeting debt-service obligations.

### EQUITY

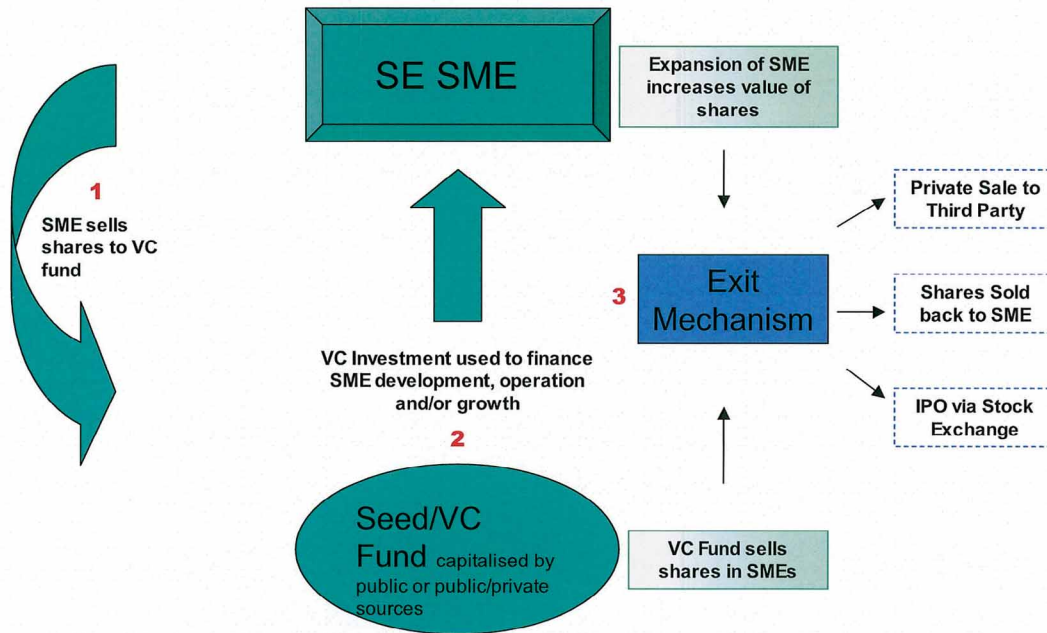
The newly launched public sector-supported venture capital programs mentioned in Sections 2 and 3 focus largely on risk capital investment in new SE technologies. Investment in technology innovation is crucial, but it is also equally important to ensure that the SMEs deploying the new technologies and services to the end consumer can access the capital needed to launch and operate their businesses. SMEs generally carry further risk due to their weak balance sheets and/or track records and limited market presence. Lack of investor familiarity with the sector makes the seed/equity gap even more pronounced and calls for appropriate government responses through education, demonstration and financing mechanisms. An approach to public sector participation in providing seed and growth equity to SE SMEs can be seen in Figure 8.

Public sector-capitalized funds can take different legal and public/private partnership-based forms. SMEs that require equity for business development during the technology commercialization stage have access to many of the VC funds mentioned in Section 2. Unfortunately, there are few public sector-supported VC funds that invest in SMEs beyond the technology development stage. The Sustainable Development Fund (SDF) in Pennsylvania is one example of a state financing instrument that provides not only VC, but also business grants and loans for early-stage SE companies across the small-scale tech deployment and innovation spectrums (see box next page). The SDF also extends subordinated debt to larger project developers. The UK Carbon Trust's line of business support for UK SMEs is also an example of public sector financing mechanisms that fill this niche.



Figure 8

Public sector supported solution for equity gap for SE SME unable to obtain financing (or acceptable financing) for seed or growth capital



Adapted from European Commission Guide to Risk Capital Financing in Regional Policy, 2002

### Pennsylvania Sustainable Development Fund

Created out of the restructuring proceedings of the state utility, PECO Energy, the SDF is capitalised at around \$32m. The Fund provides a wide range of support to companies that design, manufacture, sell, install, operate or service SE products, technologies and services:

- **Business Planning Grants** are available up to 75% of the total costs. The average grant is \$25,000.
- **Business Start-up Grants** are available for product/tech prototypes, demonstrations, measurement and metering costs, marketing efforts and other business expansion/start-up costs. The same terms as Business Planning Grants apply.
- **Venture Capital** is offered through the Pennsylvania Advanced Industrial Technology Fund (PA-AIT), created with Blue Hill Partners (a US private VC firm.) The fund stands at \$1.5m with typical investments between \$300-500,000.
- **Commercial loans** are also extended to SE companies and commercial end-users wishing to finance or purchase clean energy equipment or upgrades. Loans can also be made to start-ups and expansions of SE companies (described above). Loans range from \$25,000 to \$250,000, and carry a 5% to 6.5% fixed interest rate.
- **Subordinated debt** can be extended to SE project developers, occupying a junior position next to an institutional senior lender. Up to \$5m is available per project for a 12-year term at 5% interest rate.

### DEBT

Even if a SE SME can raise the equity needed to start a business, accessing debt capital can be challenging, even after the company is operational. SMEs face typical obstacles such as weak balance sheets and small transaction size when they are seeking working capital for operations and growth capital loans to expand.



Mezzanine financing models can sometimes address SME financing gaps. The FIDEME fund mentioned in Section 3 targets this niche need and was created specifically to fill the “weak balance-sheet gap” faced by French SMEs involved in large-scale project developments.

In the US context SE SMEs are being supported through many of the broader funding initiatives and programs of the state clean energy funds. While most of these programs are not specifically categorized or tailored to them, SMEs are often eligible for support by nature of where on the deployment or commercialization continuum their business activities fall. Most North American SE SMEs can also seek support through general small business loan programs that are not specific to sustainable energy technologies at the state or provincial and federal level.

## GUARANTEES

Despite the fact that many sustainable energy technologies are commercially proven, lenders still often perceive SE businesses as non-conventional and therefore risky. Financial risk management and transfer mechanisms are also part of the debt/equity gap mitigation package. As mentioned in the Section 3 discussion on risk management, government-sponsored guarantees can cover some commercial risks associated with borrowers who have inadequate balance sheets or credit histories. They can also cover other non-commercial risks associated with the economic and financial stability of the country of project implementation. Guarantee schemes, when successful, increase bank involvement in financing SE SMEs and can reduce the real and perceived SME and SE technology risks, as well as credit risks linked to long amortization periods.<sup>2</sup> When targeting perceived risks, pricing the guarantee correctly is particularly important. The correct price needs to be both low enough to make the guaranteed loan affordable to borrowers, and high enough to incentivize banks to eventually drop the guarantee if and when their perceptions of the technology or business activity have improved and they realize that the guarantee costs more than it is really worth. Without an appropriate pricing strategy, a guarantee mechanism can create dependence and become difficult to remove.

### FOGIME

#### *A public-private loan guarantee mechanism*

**FOGIME provides guarantees of up to 70% of loan amounts granted for implementing sustainable energy business activities for SMEs, to a maximum of 750,000.**

**OSEO-BDPME** (SME Development Bank) through its subsidiary **OSEO-SOFARIS** finances 40 to 50% of the guarantee from its small business guarantee fund.

**ADEME**, French Environment and Energy Management Agency covers the remaining portion of the guarantee

**L'Électricité de France (EDF)** and **Charbonnages de France** have recently joined the partnership.

The FOGIME is an interesting example of an SME guarantee product. Spearheaded by the French ADEME, FOGIME provides SMEs with guarantees for working capital loans through a division of the French SME development bank (the “BDPME”), a co-sponsor and administrator of the guarantee fund. The capital available in the fund is €17.8m and leverages up to €242m in loans from the private sector. To date, 50 French SMEs have benefited from the guarantees. FOGIME learned some valuable lessons along the way and had to

2. Technopolis, 2004.

## 4. Financing Mechanisms for Sustainable Energy SMEs

respond to SME feedback that the guarantees offered were not accessible or affordable. SMEs were unable to access the guarantee because of the annual service charge of 0.85% of the total loan. In response to this, the fee was modified and brought in line with other French small business bank guarantee products in the range of 0.45% to 0.6%.

### DEVELOPING COUNTRIES

SMEs also play an important role in developing countries by providing technologies and services to niche energy markets that are either poorly served by, or complement, the centralized utility approach. For example, technologies and services such as solar crop drying, sawmill waste charcoal production, wind pumps, solar home systems, biogas digestors and different energy efficiency technologies are being commercialized in various countries through the SME sector. Conventional bank financing is even less likely to be made available to SE SMEs in emerging and developing economies, especially in the early innovation stages when risk capital is needed to develop a new product or service offering. In these contexts, new finance intermediaries are needed that can provide appropriate forms of capital and the management support that small enterprises need to develop and grow a new business activity. Essentially these intermediaries employ a venture capital approach, although in markets that seldom can provide venture capital returns. Public support mechanisms can therefore play an important role in bridging gaps and helping SMEs access appropriate forms of financing.

#### The challenge of supplying rural energy services

- is NOT a lack of technology, business models, capital or the ability to pay;
- it is the MISMATCH between the needs of the enterprise and the types of financing currently available.

P. Larocco, Executive Director, E+Co

One interesting example of this SME finance intermediary is E+Co, a 'public purpose' investment company that provides seed and growth capital to clean energy enterprises in developing country markets. The seed capital provided, usually in the form of debt, can range from several thousand dollars for a new enterprise to simply pilot a new business activity, to a few hundred thousand dollars to take a new enterprise from a tested approach to a proven commercial business. The willingness to take more risk than with conventional sources, combined with the provision of enterprise-development services, constitute the main concessional aspects of their seed financing approach. UNEP has since 2000 operated Rural Energy Enterprise Development programmes in various regions in partnership with E+Co and a number of local enterprise development partners.<sup>3</sup> These REED programmes are capitalized by donor funding from the UN Foundation.

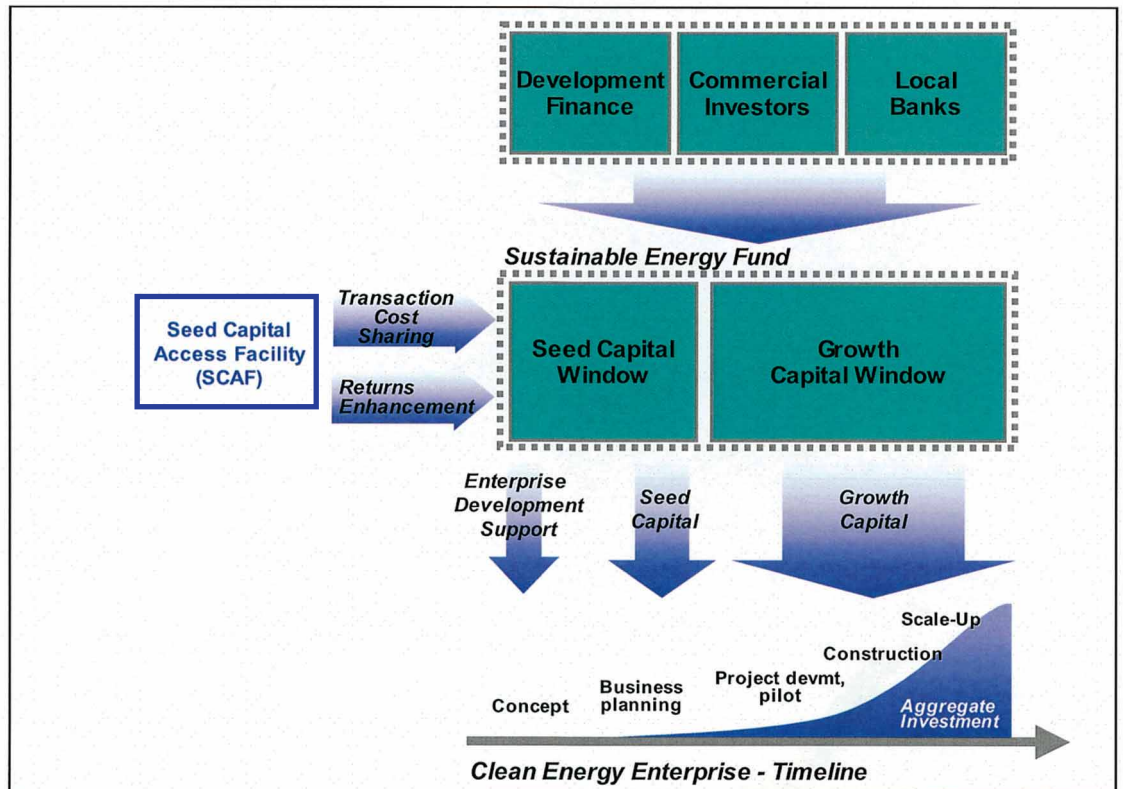
While there is increasing interest in the seed and early stage capital sub-sector, much of the support to date has come from foundations and donors, sources that are able to underwrite the broader developmental returns of seed capital investing. Although these sources have been critical to the early development of the seed finance model, attracting more mainstream capital to seed stage investing will be needed to realize the full potential of this area of investment activity.

The Shell Foundation has been working in this area. In Africa the Foundation has been supporting the specialist financier GroFin to develop and capitalize a series of SME funds, the first of which is the South African focused \$6 million *Empowerment Through Energy Fund*. A second \$22 million East Africa Energy Fund has been capitalized to being operations in late 2005. For these funds Shell Foundation provides an operating grant to cover initial fund management costs and some soft capital to help lever commercial investment from African banking institutions.

3. Information on UNEP's rural energy enterprise development programmes can be found at <http://www.ared.org/> (Africa), <http://www.b-reed.org/> (Brazil), and <http://www.c-reed.org/> (China).



Figure 9 The UNEP - Seed Capital Access Facility



Using a somewhat similar approach, UNEP has been developing a Seed Capital Access Facility (SCAF) that will help SE investment fund managers to provide Seed Capital to early stage SME's as the first step in a multi-step investment strategy. By sharing transaction costs and buying-up investment returns, the SCAF will help close the gap between what local sustainable energy SMEs are able to offer in terms of returns on investment, and the requirements of the investment community (see figure 9). By bridging this gap the facility will help provide entrepreneurs with the enterprise development services and early stage risk capital they need to develop sustainable energy projects. By growing the pipeline of SE projects in development, it should also help increase the scale and scope of SE Investment opportunities available to commercial energy investors.

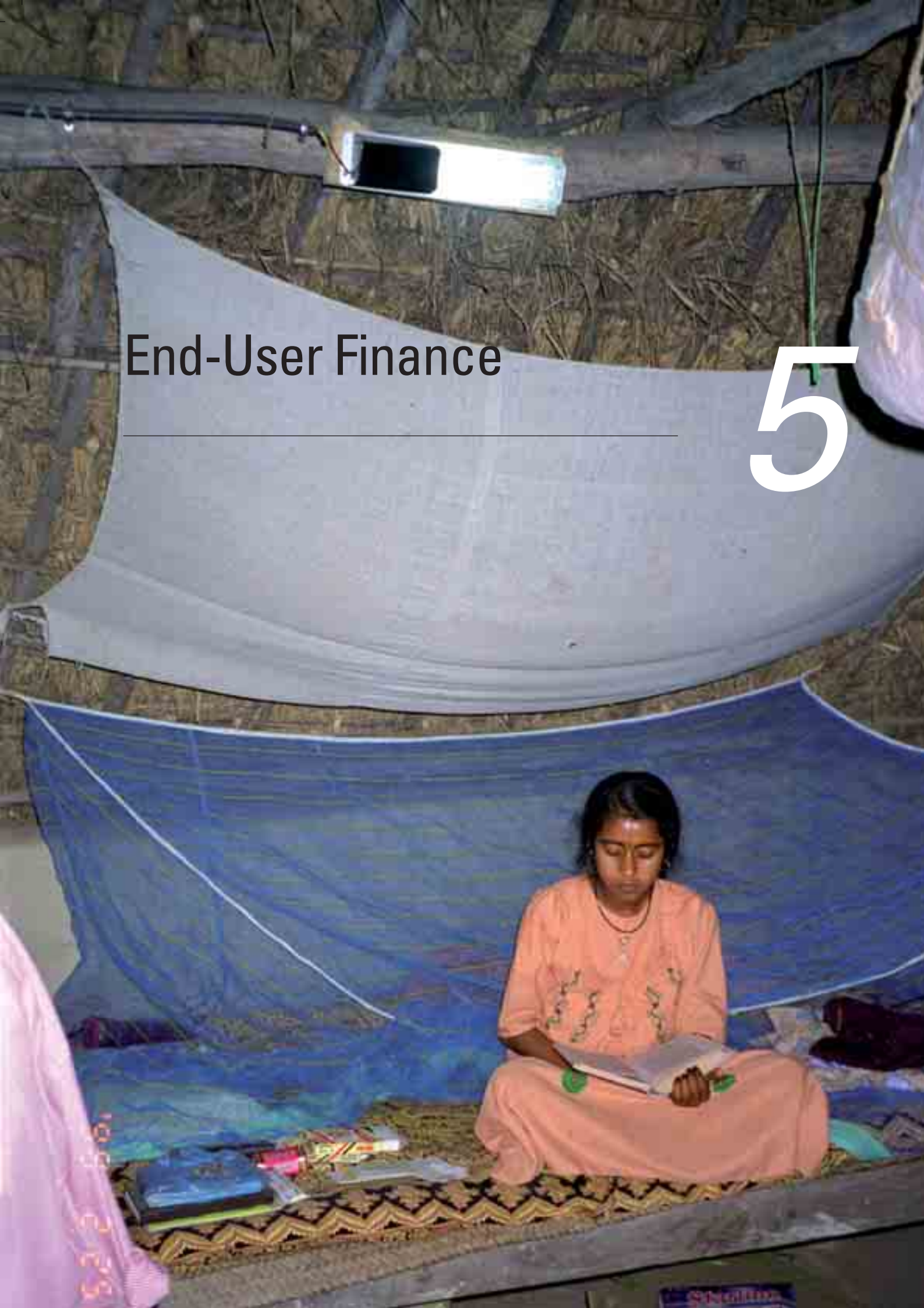
Many more such enterprise support programs will be needed if the SME sector in the developing world is to play an increasing role in delivering clean energy products and services to those currently without access to a safe and affordable supply.



# End-User Finance

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# 5





## 5. End-User Finance

Since most sustainable energy technologies are highly capital cost intensive, their successful scale-up is largely dependent upon the customer's ability to access financing for their purchase. The availability of low-cost end-user finance can therefore be the catalyst for accelerating market adoption of renewable energy or energy efficiency systems, particularly in the developing world. This is true both for large scale project developments, but also for smaller consumer-oriented SE technologies such as solar home systems, domestic biomass heating systems or geothermal heat pumps. For these consumer-oriented systems, end-user finance comes in various forms, ranging from retailer financing (i.e. the customer pays the vendor in monthly installments), to commercial bank loans, microcredit and third-party financing such as leasing or performance contracting.

### GAPS TO DELIVERING SUSTAINABLE ENERGY PRODUCTS AND SERVICES TO THE CONSUMER

Financed sales include both retailer financing and bank financing, either in the form of personal or consumer credit. For short-term financing, SE retailers might find it most appropriate to provide their own financing options, for example, offering customers the opportunity to pay for systems in monthly or quarterly installments, usually for periods of 3 to 12 months. Managing a credit operation, however, is in no way similar to installing and servicing SE systems, and therefore, retailers who want to build a large-scale credit-backed sales operation will usually look to a banking institution to manage the credit delivery. Furthermore, financing end-user transactions is generally a poor use of a retailer's working capital, given the high cost of this capital and the propensity for this approach to very quickly consume large quantities of working capital.<sup>1</sup> For moderate risk customers, financial institutions should generally be able to provide more competitive end-user financing terms. The barriers that hinder bank financing of consumer-oriented SE systems include an increased real and/or perceived risk of customer default, which leads to higher-cost financing,<sup>2</sup> the small initial demand for SE financing that fails to capture the attention of banks, and a general lack of access<sup>3</sup> to financing options that might be available within existing banking operations.

As with retailer financing approaches, the fee-for-service and third-party/leasing models are also very costly from a working capital perspective and thus will only usually work for companies that have access to some form of low-cost financing. In developing countries fee-for-service contracts can also require an upfront installation cost component beyond the financial means of lower-income customers. This can also be the case for rental or leasing arrangements (or lease to own), where a more significant initial upfront payment is required.

### FILLING THE GAPS

#### FINANCED SALES

Government support programs can play a catalytic role in helping mainstream end-user financing for consumer-based SE systems. These are usually in the form of credit enhancements, either interest subsidies (also referred to as "softening" of loans) or loan guarantees. Many governments have experimented with various approaches.

1. e.g. Inventory increasing 4 to 8 times, from 6 weeks supply of systems, to 6 or 12 months.

2. In some markets this is aggravated by a lack of sufficient collateral to secure the loans.

3. SE loan options may not receive the exposure they need within banking institutions to receive a strong customer uptake.



“One of the key factors to sustainable energy market growth is the development of green financial services such as soft loans. They need to target local actors, small businesses, the self-employed and individuals. The goal is to support them in this new market with a medium to long-term investment policy.”

**Arnaud Berger,**  
**Banque Populaire d’Alsace**

One notable program is PreVAIR, which was launched in France by the Banque Populaire d’Alsace in partnership with the French Environment and Energy Management Agency (ADEME). The Banque Populaire has a long-standing sustainability policy, which has been the driving force behind the creation of a PPP-supported investment subsidy and complementary savings instrument. The Banque Populaire markets a savings product, called Codevair,<sup>4</sup> which guarantees an annual interest rate of 2% (variable - unlimited savings balance) and carries the ‘Finansol’ label from the French Social Investment network. Codevair deposits

fund a line of PreVAIR soft loan products that support sustainable energy improvement and construction projects for SMEs, self-employed entrepreneurs and private customers. Standard PreVAIR loans are presently available at 3% and ‘softened’ loans at a reduced interest rate of 1.75%. The interest subsidy is partially covered by ADEME and partially by the Banque Populaire. The Regional Government has recently joined the partnership. The Bank assumes the full default risk while both parties work together with a multi-sector network of partners to review the technical feasibility of loan requests. The loans are small in nature (limited to €25,000 per loan) and are used for energy efficiency and small renewable energy home and building improvements.

### *Financed Sales in Developing Countries*

In developing countries there are many specific obstacles still to be overcome in scaling up end-user financing options for sustainable energy systems, such as the overall weaker financial markets, the lack of familiarity among banks with sustainable energy technologies, poor client creditworthiness and a lack of useful collateral options. Since, however, the costs of SE systems are much higher in relation to income levels having effective, available and affordable end-user financing mechanisms in place are critical for SE market growth.

Specific financial support mechanisms can be introduced to reduce risk for the local lending institutions or to facilitate increased demand for their loans. Interest rate subsidies, collateral support, loan duration extensions and guarantees can all be useful support mechanisms, depending on the context. Special collateral arrangements can be made between the renewable energy dealer and the bank, whereby the system (solar panels or other) can be used as collateral for the loan. In the event of default, the bank acquires the system and it is resold by the dealer, with the non-amortized portion of the system going back to the bank.<sup>5</sup> Debt extended directly to dealers is another form of support that can permit them to offer credit for system sales, with the inherent costs and limitations that this involves, as was discussed earlier in the section.

For SE sectors that are already commercialized on a cash-sales basis, but where growth is constrained by a lack of end-user finance, UNEP has been implementing credit enhancement programs that help local banks build new consumer loan portfolios.

In 2003, such a program was launched in southern India to accelerate the market for financing solar home systems. The program is a partnership between UNEP and two of India’s largest banking groups – Canara Bank and Syndicate Bank. An interest rate subsidy helps the banks to build solar financing portfolios without distorting the credit risk or the existing cash market for solar home systems. The loan programs are currently offered through over 2,000 branches of both banks and seven regional Grameen banking networks. To date, over 15,000 systems have been financed, with loan activity growing even as the subsidy is phased-out.

4. Similar in principle to the Dutch green fund savings programmes.

5. Lindlein, P and W. Mostert, 2005.

## 5. End-User Finance

Similar approaches are being supported through the Mediterranean Renewable Energy Programme (MEDREP) for solar water heating (SWH) systems. The Prosol loan facility has recently been launched for domestic solar water heaters in Tunisia, involving the national energy management agency (ANME), the national utility (STEG) and the local banking community. An interesting aspect of the initiative is that the loan repayments are channeled through customer utility bills, which lowers the credit risk for the banks and therefore the cost of financing. Over 5,000 systems have been financed in the first six months of the program. In Morocco a facility is being prepared along similar lines with the state utility for the financing of larger solar water heating systems on hotels.

Financial mechanisms that engage micro-credit providers in renewable energy financing can also be effective. In Sri Lanka and Bangladesh the World Bank and the GEF have been working with microfinance institutions, commercial banks and leasing companies to provide end-user financing for solar home systems, and have seen both markets scale up quickly. For example, 43,000 SHS have been sold in Bangladesh in under 30 months<sup>6</sup>.

The overall success of financing mechanisms will be enhanced with carefully designed initiatives that support new markets and do not distort them. This includes the participation of intermediaries that provide local financing and technical/business support to both SE product and service providers and to the paying consumer.

### FEE-FOR-SERVICE, LEASING AND OTHER THIRD PARTY FINANCE

Consumers usually prefer fee-for-service and leasing options due to the lack of upfront costs, collateral requirements and the inclusion of maintenance costs within the service or lease contract. These transaction finance arrangements pose a lower risk to the consumer and, if not they are not too costly, can provide a boost in adoption rates for consumer-scale renewable energy systems.

There are some cases of public and privately owned utilities that provide fee-for-service and leasing of RE systems. Examples are largely found at the municipal and state level in the US. One notable example is in Lakeland, Florida, where the municipal utility installs and maintains SWH systems, charging customers only for the hot water used. The Lakeland program offers homeowners an approximate 15% savings in hot water bills, reducing electricity use on average by 1,500 kWh and CO<sub>2</sub> by 1.4 tons annually. This program has seen financial returns to the utility in the 7% range. Most recently, Lakeland Electric sold 50MWh of 'green tags' and claims to be the first utility ever to produce and trade renewable energy credits derived from solar water heaters.

Energy Performance Contracting (EPC) is a form of third-party financing for consumers that has proven to be an effective, high-impact and low-cost end-user financing mechanism. EPC features a process where, after a competitive tendering process, a contracted company is responsible for project feasibility, design, equipment purchase, installation, maintenance and operation plus, most importantly, a guaranteed amount of savings. The management of the project development and tender procedure can be hired out to an external facilitator, as in the case of the Berlin Energy Saving Partnership (see box). The main attractions of this form of end-user finance for the customer are the reduced risk when making a technology upgrade and the opportunity to finance the equipment through energy savings. Since an ESCO or a third party finances the investments, this is an efficient way of reducing energy usage in many sectors. The technical and economic risks are held entirely by the ESCO and payments are based on a share of the savings achieved. The finance required for the investment can come from the ESCO's own capital, but in most cases a third party is involved, which might be a bank. Smaller-scale ESCOs, however, have encountered difficulty in raising significant debt financing for EPC projects, which is one of the issues currently hindering swift market uptake.

6. J. Saghir, World Bank, The Global Investment Challenge - Financing the growth of Renewable energy in developing countries. Renewable Energy World, July-August 2005.



### The Energy Saving Partnership, Berlin

Since 1996:

- 19 Building Pools (groupings of several building complexes to mix unprofitable and profitable buildings into the contract), comprised of over 1,300 buildings
- Total initial investments by contractors valued at over € 40m
- Average guaranteed savings per Building Pool of over 25% or € 9.5m
- 58,000 tonnes of CO<sub>2</sub> saved p.a.

Berliner Energie Agentur

SE companies, usually ESCOs, that provide fee-for-service or leasing options to consumers require upfront capital to finance their inventory of systems. This can lead to an overall small asset base and a weak cash-flow position, particularly for small and mid-size operations, and is why they are considered high-risk and have difficulty accessing bank financing. Small business development support via seed capital, loans and small business guarantee programs can sometimes help fee-for-service or ESCO operations achieve critical mass and financial sustainability.<sup>7</sup>

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7. Specific examples of finance mechanisms that support sustainable energy SMEs such as ESCOs are presented in Section 4.





# Successful approaches to developing the sustainable energy sector

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# 6



## 6. Successful approaches to developing the sustainable energy sector

Regional, national, state and local governments are taking up the challenge of addressing gaps and barriers in the sustainable energy market by implementing the various financing mechanisms and regulatory incentives presented in this report. Given today's rapidly changing clean energy marketplace, governments increasingly have to find smarter and more effective ways to intervene. Both international agreements and self-imposed targets are leading government policy-makers to consider and act on the wider impacts of energy production and consumption. A "quick fix" approach that creates single solutions for individual needs is no longer justifiable.

This section will look at some of the innovative institutional models and approaches to financing that a number of national and local governments have adopted to drive through the implementation and coordination of energy policy measures, while ensuring the long-term development of the sustainable energy sector.

### PUBLIC-PRIVATE SECTOR RELATIONSHIP BUILDING: THE KEY FOR EUROPEAN GOVERNMENTS

A recent trend in some European countries is to improve the relationship between governments, government agencies and the business sector. In countries such as the UK, the Netherlands and France, a newfound confidence and improvement in public-private interaction have fostered sustainable energy market growth. These approaches are different in nature, and are typically sparked by organizational change at government or agency level, or simply by more attention given to private sector needs. The examples below illustrate new experiences in developing innovative finance mechanisms and vehicles for managing them.

#### THE INDEPENDENT APPROACH TO SUSTAINABLE ENERGY SECTOR GROWTH: THE UK CARBON TRUST

The Carbon Trust was created in 2001 as part of the UK government's drive to accelerate clean energy sector growth. At a time when government subsidies were the main form of clean energy finance, the UK decided that a new comprehensive approach that engaged the private sector should be initiated to improve the efficiency and effectiveness of government intervention in the SE sector.

The Carbon Trust is an independent, not-for-profit, fully private sector company, which is funded by revenues from the Climate Change Levy, an energy tax imposed on business energy consumption. The government granted it independence through the *Grant Offer Letter*<sup>1</sup> with the Department for Environment, Food and Rural Affairs (DEFRA), which binds the Trust to deliver specific outputs against the sum of funding received.<sup>2</sup> Although there are some conditions to this arrangement (e.g. a DEFRA representative occupying a seat on the board), the Trust has almost total autonomy over investment strategy through its own dedicated committee.

"Seeing the world from the view of the investor; that's the innovation that is the Carbon Trust"

The Trust was given a mandate to help UK business and the public sector meet goals for reducing greenhouse gas emissions and to help create a low-carbon technology sector in the UK. To achieve those aims effectively with the resources available, the Carbon Trust believes in focusing

on "the technologies that offer the greatest carbon-saving potential and where [their] investment can make a material difference to the development and commercialization of that technology."<sup>3</sup> To date, the Trust has spurred significant sustainable energy technology growth through a dedicated "pillar" of activities designed

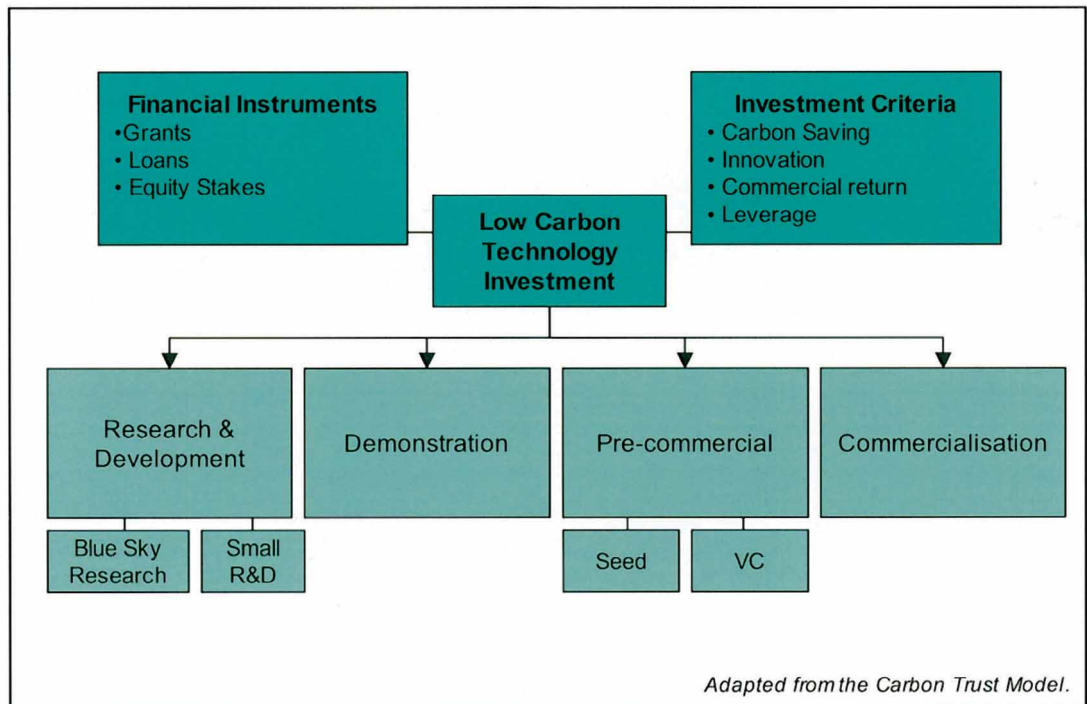
1. A *Grant Offer Letter* (GOL) is a contract between two parties – i.e. between DEFRA and the Carbon Trust – that sets out the terms and conditions that apply to the extension of the grant.

2. The annual budget for 2003/2004 was £60m, but varies from year to year.

3. The Low Carbon Technology Assessment 2002: Making our Investment Count (Carbon Trust).



Figure 10 The Carbon Trust Model (I)



to develop new low-carbon technologies. This area of the Carbon Trust’s business operations provides a comprehensive, early-stage investment vehicle to help SE technologies develop from conception through to the later stages of market readiness (see figure 10).

#### THE CARBON TRUST’S LOW CARBON TECHNOLOGY FINANCING PROGRAMMES: AN INTEGRATED APPROACH TO INVESTING IN SUSTAINABLE ENERGY

To help identify where it should concentrate its investments, the Carbon Trust drafted and graded a list of clean energy technologies according to ‘impact vs. cost’ criteria, and prioritized it. The result was the *Low Carbon Technology Assessment Matrix*,<sup>4</sup> a tool to help the Trust decide in which technologies it should, or should not, invest. It soon became apparent that selected technologies were at different stages of market readiness and thus required different types of support. Some technologies, for example, were market-ready, but needed assistance to enter the market; others were not market-ready at all. From this analysis the Carbon Trust devised the most appropriate programs and mechanisms within their flexible budget to maximize the effectiveness of their intervention. In the fulfillment of its mission, the Trust also supports these efforts with activities such as networking, awareness and information campaigns, “blue sky” research, and training delivered to the business sector and other government departments<sup>5</sup>.

The Carbon Trust model has been successful (see figure 11) at supporting the development of the SE market by leveraging private sector capital and involvement, as sought by the UK government. According to the Trust, transferring investment decision-making capacity from the Ministries to a separate, external entity has achieved better results (CO<sub>2</sub> reduced vs. money invested) and has increased private sector confidence. This also made it possible to overcome legal public sector constraints linked to unfair competition and political concerns that commercialization should remain a private sector affair. As the Trust is not-for-profit and has no vested business interest, the government’s confidence in the Trust to deliver success in terms of the public good is also secured.

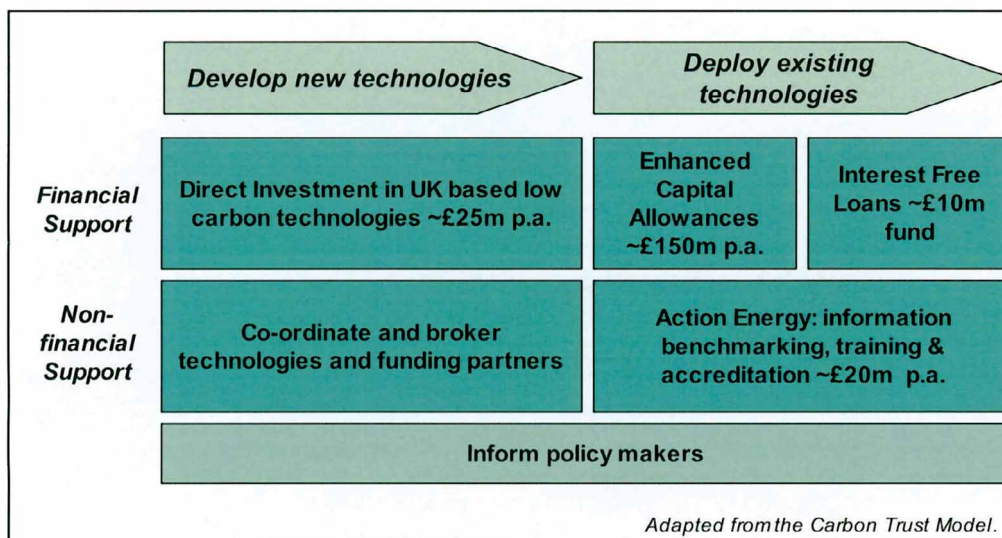
4. [http://www.thecarbontrust.co.uk/carbontrust/about/publications/Low\\_Carbon\\_Technology\\_Assessment.pdf](http://www.thecarbontrust.co.uk/carbontrust/about/publications/Low_Carbon_Technology_Assessment.pdf).

5. The Carbon Trust recently advised the UK DTI (Department of Trade & Industry) as part of their Renewables Innovation Review.



## 6. Successful approaches to developing the sustainable energy sector

Figure 11 The Carbon Trust Model (II)



Over and above the *approach* to clean energy investing, it is also the *complementarity* of the Trust's suite of financial mechanisms that makes it an interesting approach to monitor for potential replication; a range of instruments that leverages private sector capital into the SE market not only at one stage, but also across several stages of the finance continuum. Finally, the Trust actively studies other SE funding approaches and seeks out innovative practices and emerging SE finance instruments through international exchanges with other clean energy funds, such as the Massachusetts Renewable Energy Trust, the Connecticut Clean Energy Fund and the Sustainable Development Fund.

### REORGANIZATION THE KEY TO DUTCH SE DEVELOPMENT: SENTERNOVEM

*"We went a step further than the usual PPP relationship; we gave the steering wheel to the private sector and asked them to drive."*


SenterNovem is the Dutch government agency for innovation and sustainable development, which was created in May 2004 as the result of a merger between Senter and Novem, two former agencies of the Dutch Ministry of Economic Affairs. Senter was previously mandated by government to coordinate innovation, Novem was in charge of energy and the environment. This newly formed agency is an attempt to bridge the gap between government policy and market practices in the pursuit of cleaner energy systems.

SenterNovem offers a wide range of support to businesses, institutions and local authorities interested in initiatives that encourage sustainability and innovation. In essence, it is a clearinghouse for sustainability issues including financing mechanisms, energy policy, technology development and demonstration.

*"We link the policy of national and regional government to market practice; and vice versa."*

SenterNovem plays an important intermediary role between government and business. On the one hand, it is a government partner for the implementation of government's energy policy on industry. On the other hand, SenterNovem aims to give industry a platform to provide input to government on energy policy. This type of flexibility was one of the goals of the 2004 merger and the subsequent restructuring that took place, which supports SenterNovem's efforts to be business focused, streamlined and one single point of contact (where previously there were several) for industry. More recently,





the agency's front-office staff was also reorganized along business sector lines to make the transfer of knowledge and advice on government policies to defined areas of industry more efficient.<sup>6</sup> This structure encourages open dialogue and a forward-reaching dynamic that helps the Dutch government in its drive towards a more sustainable energy system in partnership with the private sector.

The conception of one of the OTC programs (Support to Coalitions in Energy Transition) illustrates this flexible approach. After identifying the need to make a permanent transition to cleaner energy systems, the government invited the private sector to take the lead in establishing priorities. Industry duly came up with five key 'directions', which now have public-private steering groups and dedicated funding from the OTC program to cover initial sustainable energy and other RD&D activities.

### TRADITIONAL STRUCTURE, FLEXIBLE APPROACH: ADEME

ADEME<sup>7</sup> (French Environment and Energy Management Agency) is the French government agency that deals with energy issues in industry for the Ministries of Environment, Industry and Research. Its main aim is to help companies optimize energy management, minimize their impact on the environment and commit to a sustainable development approach.

Following its creation in 1992, ADEME concentrated largely on financial assistance via grants. Since 2000, however, ADEME has diversified its financial instruments to encourage commercial finance in sectors where there was insufficient debt and equity capital, where costs were high or the return on investment was low. This decision was also influenced by new trends that recommend "public-private partnerships" to diversify financial instruments supporting sustainable development.

Although ADEME is a decade older than either the Carbon Trust or SenterNovem, and was conceived with a different original strategic direction, it demonstrates that a public sector vehicle does not have to be created from scratch (like the Carbon Trust), or re-structured (like SenterNovem) to launch new and innovative finance mechanisms. ADEME has provided a successful model for leveraging private sector capital in the SE market through the creation of innovative mechanisms that respond to real market needs.

The proactive nature of this intervention is evident in the creation of FIDEME (see Section 3) and FOGIME (see Section 4), two funds that have successfully attracted private capital to the renewable energy sector, especially at the SME level. ADEME is currently preparing a new initiative designed to reduce the administrative costs involved with sourcing private sector finance. The "Contrat de Développement Durable" (sustainable development contract) is presently being developed with OSEO (see Section 4) to fill a recently identified financing gap in the SE financing market and facilitate an increase in SE projects in France.

### INNOVATIVE FUND CREATION AND MANAGEMENT: THE UNITED STATES

Unlike in Europe, in the United States the majority of public funding efforts for the sustainable energy sector are to be found at *sub-national* or *state* level. The US sustainable energy financing vehicles address similar gaps and barriers to those targeted by European mechanisms, however, they are somewhat different in terms of their conception, structure and mode of operation.

6. Back office staff work in streams organised along instrument lines (e.g. OTC, DEN, etc.) and front-line staff are organised according to sector, increasing SenterNovem's ability to add value to specific sectors.

7. L'Agence de l'Environnement et de la Maîtrise de l'Énergie.

## 6. Successful approaches to developing the sustainable energy sector

### Connecticut Clean Energy Fund

- Managed by *Connecticut Innovations Inc.*, a quasi-public investment agency
- Charged with making equity and other investments in the high-tech sector
- Funding of \$100m over 5 years

### Sustainable Development Fund

- Part of The Reinvestment Fund (TRF)
- TRF builds wealth and opportunity for low- and moderate-income individuals
- Invests through loans, equity and grants.
- SDF funding was \$27.5 million in 2004

Clean energy funds at state level are generally financed in one of two ways. Many funds are sourced through the systems benefit charge (SBC),<sup>8</sup> as is the case with the Connecticut Clean Energy Fund (CCEF) and the Massachusetts Renewable Energy Trust (MRET). Other SE funds are capitalized using money that becomes available after state utility settlements, e.g. the Pennsylvania-based Sustainable Development Fund (SDF). Funds capitalized through financial settlements usually occur after a state has deregulated its electricity market and a bloc of money has been put aside to form a dedicated clean energy fund. There are other creative means, however, to capitalize public funds. The Xcel Energy Renewable Development Fund in Minnesota was initially capitalized in return for dry cask storage of spent nuclear fuel at Xcel's Prairie Island

nuclear facility.<sup>9</sup> This fund currently stands at US \$16 million per year based on the number of dry casks in storage.<sup>10</sup> In other examples, the California Clean Energy Fund (CalCEF) was initially endowed as part of a bankruptcy settlement following the California energy crisis involving a state utility, Public Gas & Electric (PG&E). Similarly, the Illinois Clean Energy Community Foundation was created through a settlement where Commonwealth Edison in Illinois provided the foundation with a \$225 million endowment to support clean energy projects. The broad models for creating SE funds discussed above are different, but equally efficient ways for states to maximize public capital when looking to (re)invest in clean energy activities in a way that benefits the taxpayer and supports SE market growth.

### Energy Savings Fund Canton Basel-Stadt, Switzerland

After 10 years of strict regulations governing power plant efficiency and building standards in reaction to the local resistance to nuclear energy, the Canton administration realised that you could achieve more with incentives and positive motivation than with command and control. In 1998, Basel passed a law to put a small systems benefit charge on each consumer's electricity bill. The revenues generated are used to leverage investments in energy efficiency and renewable energy measures. In 2000, Basel introduced a feed-in law for solar PV.

In addition to finding innovative ways of *creating* funds, several US states are also discovering new and highly effective ways of *managing* their SE dollars. Instead of trying to self-manage investments (as is often the case with federal/national-level governmental intervention), states are increasingly housing such funds within other existing public institutions such as economic development agencies. These organizations typically possess the required specialist expertise, sector experience and professional networks in technical innovation

8. The systems benefit charge (SBC) is a small electricity ratepayer surcharge that is collected and then administered by a public benefits fund or state clean energy fund. The SBC has traditionally been used to pay for EE programs, R&D for RE technologies, buy-downs (rebates) for RE installations, demonstration projects, increasing peak electricity reductions, and providing assistance to low-income utility customers. Their use varies according to the objectives and regulations of each state. It is expected that of the 15 existing state funds, \$4.37 billion will be raised via the SBC between 1998 and 2012.

9. As proposals for a permanent repository for spent nuclear fuel in the US have not been successful to date, many plants are storing spent nuclear fuel on site in dry cask storage.

10. The State of Vermont recently followed Minnesota's model in May 2005 when the VT legislature required Entergy, the utility operator of the Vermont Yankee nuclear power plant, to support a clean energy fund with payments based on the number of dry casks of spent nuclear fuel that Entergy stores at the nuclear facility.





and / or economic and social development, and are often better placed to make successful investments, leverage private sector capital, implement SE projects and support SE companies. The CCEF and the SDF are excellent illustrations of how this approach can work.

The partnership approach can also be applied at the *sub-fund* level. The Massachusetts Green Energy Fund, for instance, is a subset of the MRET,<sup>11</sup> which invests venture capital in RE companies throughout the state. MRET decided to go one step further and partner with a private VC investor, Commons Capital, whom it selected to manage the \$15 million fund. The twofold advantage of Commons' involvement in the fund is that it has a proven track record in VC investing and the experience that goes with it, and is in the position to leverage further private sector capital through its existing networks and working relationships. This and the examples mentioned above clearly show that the US states are leading the way in terms of fund management, as well as ability to leverage private sector capital.

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11. Massachusetts Technology Collaborative (Renewable Energy Trust).

## KEY LESSONS

### ▶ **Achieving private sector commitment is ESSENTIAL to long-term sustainable energy sector growth**

#### **Institutional Lessons**

- ▶ Institutional independence from central government – including investment decision-making capacity – can be an important market driver due to the increased confidence it gives to the private sector.
- ▶ Increased and better quality communication between government and the business sector is needed to engage private sector time and capital.
- ▶ Governments should be reactive to the opinions and needs of the private sector.
- ▶ Implementing agencies should be able to mediate efficiently between government policy makers and private sector decision makers.
- ▶ The ‘single agency’ approach means easier, more effective communication between all parties, externally and internally, as well as better organisational visibility and transparency.
- ▶ Learn from the lessons of other organisations
- ▶ Secure strong company leadership and high-level political commitment

#### **Investment Lessons**

- ▶ Investments should be made on a technology’s / project’s ability to reduce GHG emissions against a defined financial projection. The ability to **PRIORITISE** and **FOCUS** is key to an efficient investment strategy, as is the ability to say **NO** to bad financing propositions.
- ▶ Build and stick to a clear strategy that has stakeholder buy-in
- ▶ An integrated and focused approach to SE investing is needed to fill financing gaps across the various spectrums.
- ▶ Funds and *sub-funds* can often be more effectively managed through established, experienced partners whether in the public or private domain.



# Conclusions

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## Conclusions

Current levels of investment in the sustainable energy sector are inadequate to reduce the increasingly harmful environmental impacts of today's energy mix, particularly climate change. Public intervention is necessary to catalyze sustainable energy market growth. Around the world, a growing number of governments have recognized the economic and environmental benefits of sustainable energy, and are enacting policy measures and launching finance mechanisms to address and break down the barriers affecting investment in the sector.

This report is intended to serve as a guide to the public finance mechanisms available today and to show the link to the financing gaps they have been designed to close.

Many of the mechanisms presented are new and have just recently been launched. SEFI will continue to monitor their results and assess possibilities for appropriate replication in other regional, national and sub-national contexts.

The results of this report permit several observations.

Understanding financing gaps that exist in the various market stages of SE market development is a complex task. They may vary depending on the applicable regulatory environment, on developed or developing contexts and on current financing and clean energy market trends.

Effective financing mechanisms should *fill an existing investment gap, increase private sector involvement and awareness* and have the *ability to be phased out over time*, leaving a long-term *private sector financing solution in place*. The most effective financing mechanisms do not distort the market.

Where possible, financing mechanisms should be *designed in an integrated manner* that allows financing gaps to be addressed at the different stages of product development. This avoids a "quick fix" approach. An example of this is a program that provides financing mechanisms from the pure R&D stage, then business incubators and technology accelerators, followed by VC investment.

Financing gaps are most frequently encountered during the pre-commercialization stage during technology innovation and the project start-up for project development (particularly for small project proponents). Financing options are lacking for these segments of SE market development.

The key to improving project finance availability for all developers is *risk management and transfer*. Debt (and other finance types) would be more readily available if more suitable risk management and risk transfer tools existed.

Sustainable energy market development requires an *integrated strategy that aims to develop all aspects of the sector* including technology innovation, project development, (SME) business and industry support, consumer awareness and end-user finance. Regardless of structure and management methods, *pro-active communication with the private sector* remains crucial to implementing successful public sector financing mechanisms.

# Overview

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Organisation	Programme / Mechanism Name if applicable	Mechanism Type	Financing Stage	Geographical Coverage	Website
L'Agence de l'Energie et de la Maitrise de l'Energie (ADEME)	FIDEME	Mezzanine Fund	Construction, Operating	France	<a href="http://www.ademe.fr">http://www.ademe.fr</a> (French only)
	FIDEME	Mezzanine Fund	Construction, Operating	France	<a href="http://www.ademe.fr">http://www.ademe.fr</a> (French only)
	FOGIME	Loan Guarantee	Operating	France	<a href="http://www.ademe.fr">http://www.ademe.fr</a> (French only)
	FOGIME	Loan Guarantee	Operating	France	<a href="http://www.ademe.fr">http://www.ademe.fr</a> (French only)
	PreVAIR	Soft Loans	End-user Finance	France	<a href="http://www.ademe.fr">http://www.ademe.fr</a> (French only)
Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT)	Technologies for Sustainable Development	Grants	RD&D	Austria	<a href="http://www.nachhaltigwirtschaften.at">http://www.nachhaltigwirtschaften.at</a>
Berlin Energy Agency	Berlin Energy Saving Partnership	Third Party Finance	End-user Finance	Berlin, Germany	<a href="http://www.berliner-e-agentur.de/pdf_files/ESP_Broschuere.pdf">http://www.berliner-e-agentur.de/pdf_files/ESP_Broschuere.pdf</a>
California Clean Energy Fund (CalCEF)	n/a	Seed / Venture Capital	Pre-Commercial	California, USA	<a href="http://www.calcef.org">http://www.calcef.org</a>
Carbon Trust	Low Carbon Technology Programme	Technology Incubator, Seed / Venture Capital	Pre-Commercial	UK	<a href="http://www.thecarbontrust.co.uk/carbontrust">http://www.thecarbontrust.co.uk/carbontrust</a>
	Low Carbon Technology Programme	Grants	RD&D	UK	<a href="http://www.thecarbontrust.co.uk/carbontrust">http://www.thecarbontrust.co.uk/carbontrust</a>
	Action Energy Loans	Soft Loans	End-user Finance	UK	<a href="http://www.thecarbontrust.co.uk/carbontrust">http://www.thecarbontrust.co.uk/carbontrust</a>
Centre for Energy & Greenhouse Technologies (CEGT)	n/a	Pre-seed / Seed / Venture Capital	RD&D, Pre-Commercial	Australia	<a href="http://www.cegt.com.au">http://www.cegt.com.au</a>
	n/a	Demonstration Grants	RD&D	Connecticut, USA	<a href="http://www.ctcleanenergy.com">http://www.ctcleanenergy.com</a>
	n/a	Seed / Venture Capital	Pre-Commercial	Connecticut, USA	<a href="http://www.ctcleanenergy.com">http://www.ctcleanenergy.com</a>
Connecticut Clean Energy Fund	Pre-Development Program	Soft Loans	Feasibility, Permitting, PPA & Financial Engineering	Connecticut, USA	<a href="http://www.ctcleanenergy.com">http://www.ctcleanenergy.com</a>
	n/a	Private Equity	Construction	Connecticut, USA	<a href="http://www.ctcleanenergy.com">http://www.ctcleanenergy.com</a>
	n/a	Consumer Rebates	End-user Finance	Connecticut, USA	<a href="http://www.ctcleanenergy.com/renewable/solar_tech.html#solarprogram">http://www.ctcleanenergy.com/renewable/solar_tech.html#solarprogram</a>
CVC REEF	n/a	Venture Capital	Pre-Commercial	Australia	<a href="http://www.cvcreef.com.au">http://www.cvcreef.com.au</a>
E+Co	n/a	Business Development Support, Seed Capital	Seed	Developing Countries	<a href="http://www.energyhouse.com">http://www.energyhouse.com</a>
European Bank for Reconstruction and Development	Bulgarian Energy Efficiency and Renewable Energy Credit Line (BEEREL)	Soft Loans	Construction	Bulgaria	<a href="http://www.beerecl.com">http://www.beerecl.com</a>

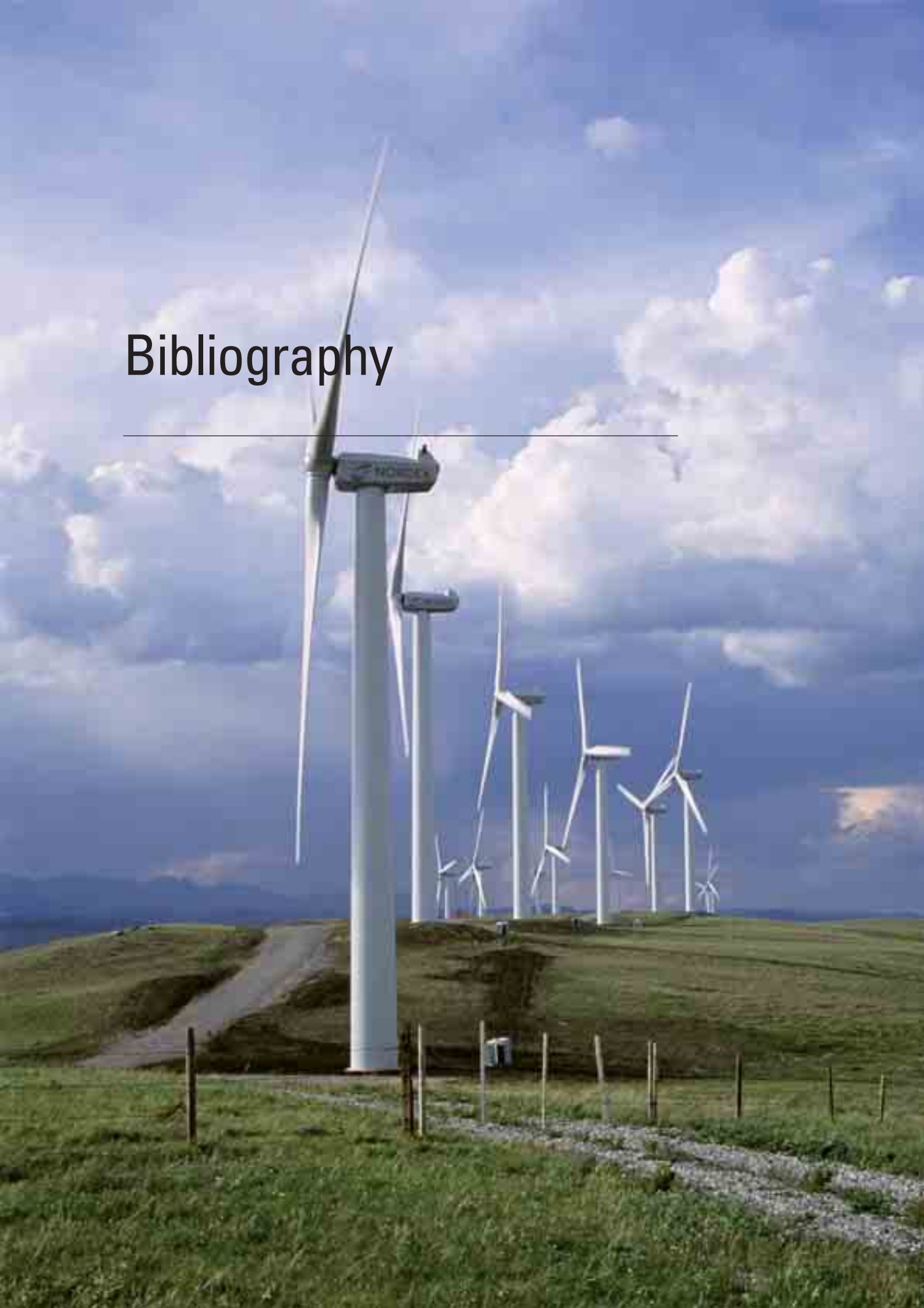
Organisation	Programme / Mechanism Name if applicable	Mechanism Type	Financing Stage	Geographical Coverage	Website
Federation of Canadian Municipalities	Green Municipal Enabling Fund (GMEF)	Grants	Pre-feasibility, Feasibility	Canada	<a href="http://www.fcm.ca">http://www.fcm.ca</a>
	Green Municipal Investment Fund (GMIF)	Soft Loans	Feasibility, Permitting, PPA & Financial Engineering	Canada	<a href="http://www.fcm.ca">http://www.fcm.ca</a>
	Green Municipal Investment Fund (GMIF)	Loan Guarantee	Construction	Canada	<a href="http://www.fcm.ca">http://www.fcm.ca</a>
Instituto para la Diversificación y Ahorro de la Energía (IDAE)	n/a	Third Party Finance, Equity	All	Spain	<a href="http://www.idae.es">http://www.idae.es</a> (Spanish only)
Kredit für Wiederaufbau (KfW) Foerderbank	RE Programm	Soft Loans	Construction	Germany	<a href="http://www.kfw-foerderbank.de/EN/Umweltschutz/RenewableE.jsp">http://www.kfw-foerderbank.de/EN/Umweltschutz/RenewableE.jsp</a>
	Solar Power Generation and CO2 Reduction Programmes	Soft Loans	End-user Finance	Germany	<a href="http://www.kfw-foerderbank.de/EN/Umweltschutz/RenewableE.jsp">http://www.kfw-foerderbank.de/EN/Umweltschutz/RenewableE.jsp</a>
Lakeland Electric Solar Water Heating	Florida Sunshine Programme	Fee for Service supported program	End-user Finance	Florida, US	<a href="http://www.nrel.gov/docs/fy04osti/36054.pdf">http://www.nrel.gov/docs/fy04osti/36054.pdf</a>
	Green Energy Fund	Seed / Venture Capital	Pre-Commercial	Massachusetts, USA	<a href="http://www.masstech.org/renewableenergy/index.htm">http://www.masstech.org/renewableenergy/index.htm</a>
Massachusetts Technology Collaborative (Renewable Energy Trust)	Sustainable Energy Economic Development (SEED) Initiative	Soft and Convertible Loans	Pre-Commercial	Massachusetts, USA	<a href="http://www.masstech.org/renewableenergy/index.htm">http://www.masstech.org/renewableenergy/index.htm</a>
	Commercial, Industrial and Institutional Initiative	Grants	Feasibility, Permitting, PPA, & Financial Engineering, Construction	Massachusetts, USA	<a href="http://www.masstech.org/renewableenergy/index.htm">http://www.masstech.org/renewableenergy/index.htm</a>
	Pre-development Financing Initiative	Grants, Soft Loans	Feasibility	Massachusetts, USA	<a href="http://www.masstech.org/renewableenergy/index.htm">http://www.masstech.org/renewableenergy/index.htm</a>
Netherlands Green Funds	n/a	Soft Loans	Varies	Netherlands	<a href="http://www.novem.nl/default.asp?documentId=135003">http://www.novem.nl/default.asp?documentId=135003</a>
	Renewable Energy Economic Development (REED) Program	Soft and Convertible Loans	Pre-Commercial	New Jersey, USA	<a href="http://www.njcleanenergy.com/html/Combined/cleanenergy_financing.html">http://www.njcleanenergy.com/html/Combined/cleanenergy_financing.html</a>
New Jersey Clean Energy Program	Renewable Energy Economic Development (REED) Program	Seed Capital	Enterprise Start-up	New Jersey, USA	<a href="http://www.njcep.com">http://www.njcep.com</a>
	Renewable Energy Economic Development (REED) Program	Loans / Subordinated Debt, Contingent Grants	Operating	New Jersey, USA	<a href="http://www.njcep.com">http://www.njcep.com</a>
Pennsylvania Economic Development Agency (PEDA)	n/a	Research Grants	RD&D	Pennsylvania, USA	<a href="http://www.peda.org">http://www.peda.org</a>
	n/a	Construction Loans and Guarantees	Construction	Pennsylvania, USA	<a href="http://www.peda.org">http://www.peda.org</a>
SenterNovem	OTC	Grants/Capital Subsidy	Feasibility	Netherlands	<a href="http://www.senternovem.nl">http://www.senternovem.nl</a> (Dutch only)
	EOS, DEN	RD&D Grant	RD&D	Netherlands	<a href="http://www.senternovem.nl">http://www.senternovem.nl</a> (Dutch only)

Organisation	Programme / Mechanism Name if applicable	Mechanism Type	Financing Stage	Geographical Coverage	Website	
<b>The Reinvestment Fund (TRF)</b>	Sustainable Development Fund (SDF)	Grants	RD&D	Pennsylvania, USA	<a href="http://www.trfund.com/sdf/index.htm">http://www.trfund.com/sdf/index.htm</a>	
	Pennsylvania Advanced Industrial Technology (PA-AIT) Fund	Seed and Venture Capital	Pre-Commercial	Pennsylvania, USA	<a href="http://www.trfund.com/sdf/index.htm">http://www.trfund.com/sdf/index.htm</a>	
	Sustainable Development Fund (SDF)	Soft Loans	Construction	Pennsylvania, USA	<a href="http://www.trfund.com/sdf/index.htm">http://www.trfund.com/sdf/index.htm</a>	
	Sustainable Development Fund (SDF)	Venture Capital	Enterprise Start-up	Pennsylvania, USA	<a href="http://www.trfund.com/sdf/index.htm">http://www.trfund.com/sdf/index.htm</a>	
	Sustainable Development Fund (SDF)	Grants	Business Planning, Business Development Support, End-User Finance	Pennsylvania, USA	<a href="http://www.trfund.com/sdf/index.htm">http://www.trfund.com/sdf/index.htm</a>	
	Sustainable Development Fund (SDF)	Commercial Loans	Enterprise Start-up / End-user Finance	Pennsylvania, USA	<a href="http://www.trfund.com/sdf/index.htm">http://www.trfund.com/sdf/index.htm</a>	
	Sustainable Development Fund (SDF)	Third Party Finance	End-user Finance	Pennsylvania, USA	<a href="http://www.trfund.com/sdf/index.htm">http://www.trfund.com/sdf/index.htm</a>	
	Pennsylvania Advanced Industrial Technology (PA-AIT) Fund	Growth Capital	Operating	Pennsylvania, USA	<a href="http://www.trfund.com/sdf/index.htm">http://www.trfund.com/sdf/index.htm</a>	
	<b>UK Department of Trade and Industry (DTI)</b>	Wave and Tidal Programme	Revenue Support	Pre-Commercial	UK	<a href="http://www.dti.gov.uk/renewables/renew_4_3.htm">http://www.dti.gov.uk/renewables/renew_4_3.htm</a> <a href="http://www.dti.gov.uk/renewables/business_pdfs/waveandtidalstreamdemonstrationscheme.pdf">http://www.dti.gov.uk/renewables/business_pdfs/waveandtidalstreamdemonstrationscheme.pdf</a> <a href="http://www.bwea.com/marine/intotheblue.pdf">http://www.bwea.com/marine/intotheblue.pdf</a>
		Indian Solar Loan Programme	Soft Loans	End-user Finance	India	<a href="http://www.unep.fr/energy/finance">http://www.unep.fr/energy/finance</a>
<b>UNEP</b>	Tunisian Solar Interest Rate Subsidy	Soft Loans	End-user Finance	Tunisia	<a href="http://www.unep.fr/energy/finance">http://www.unep.fr/energy/finance</a>	
	African Rural Energy Enterprise Development (AREED)	Business Development / Seed Capital	Business Planning / Enterprise Start-up	Ghana, Mali, Senegal, Tanzania, Zambia	<a href="http://www.areed.org">http://www.areed.org</a>	
	Brazil Rural Energy Enterprise Development (B-REED)	Business Development / Seed Capital	Business Planning / Enterprise Start-up	Brazil	<a href="http://www.b-reed.org">http://www.b-reed.org</a>	
	China Rural Energy Enterprise Development (C-REED)	Business Development / Seed Capital / Microcredit	Business Planning / Enterprise Start-up	Yunnan Province, China	<a href="http://www.c-reed.org">http://www.c-reed.org</a>	
	Farm Bill Section 9006	Grants, Loan Guarantee	Construction	USA	<a href="http://www.usda.gov">http://www.usda.gov</a>	
<b>United States Department of Agriculture (USDA)</b>	n/a	Grants	RD&D	Wisconsin, USA	<a href="http://www.focusenergy.com/portal.jsp?pagelid=11">http://www.focusenergy.com/portal.jsp?pagelid=11</a>	
	n/a	Grants	Feasibility / Construction	Wisconsin, USA	<a href="http://www.focusenergy.com/portal.jsp?pagelid=11">http://www.focusenergy.com/portal.jsp?pagelid=11</a>	
	n/a	Soft Loans / Consumer Rebates	End-user Finance	Wisconsin, USA	<a href="http://www.focusenergy.com/portal.jsp?pagelid=11">http://www.focusenergy.com/portal.jsp?pagelid=11</a>	



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UNEP is working to create the policy and economic framework where sustainable energy can increasingly meet the global energy challenge. Changing attitudes and helping mainstream financiers to consider sustainable energy investments are key components of the energy work within UNEP and the starting point for the UNEP Sustainable Energy Finance Initiative.

SEFI provides current and targeted information to financiers and facilitates new economic tools that combine social and environmental factors – both risks and returns – as integral measures of economic performance.

SEFI is modelled as a platform to provide financiers with the tools, support and networks to drive financial innovation that improves the environmental performance of the energy mix. The overall strategy is to use this platform and modest amounts of capital to convene financiers, engage them to do jointly what they may have been reluctant to do individually, and to catalyze public-private alliances that together share the costs and lower the barriers to sustainable energy investment.

SEFI is managed jointly by the UNEP Energy Branch in Paris, the UNEP Finance Initiative in Geneva and BASE, a UNEP Collaborating Centre located in Basel.



In March 2001, the Canton of Basel-Stadt and the United Nations Environment Programme (UNEP) established BASE as a UNEP Collaborating Centre with the function of supporting UNEP's energy programme, particularly in the area of promoting new approaches to financing sustainable energy in developing countries. BASE's mission is to promote and facilitate investment in energy efficiency and renewable energy to accelerate worldwide commercialization of sustainable energy and to contribute to global climate protection, poverty mitigation, and conflict prevention.



Clean Energy Group is a non-profit, 501 (c)(3) organization dedicated to greater use of cleaner energy technologies, such as fuel cells and solar, in newly restructured energy markets. CEG operates as a “market assist” non-profit catalyst to build a clean energy marketplace. We work with engineers, policy analysts and economists, and other energy consultants to provide information, advocacy and analysis to develop market opportunities for clean energy. CEG works with nonprofit officials from around the U.S. that are responsible for over \$3.5 billion in new clean energy funds. CEG now manages the Clean Energy States Alliance (CESA).

## About the UNEP Division of Technology, Industry and Economics

The UNEP Division of Technology, Industry and Economics (DTIE) helps governments, local authorities and decision-makers in business and industry to develop and implement policies and practices focusing on sustainable development.

The Division works to promote:

- > sustainable consumption and production,
- > the efficient use of renewable energy,
- adequate management of chemicals
- and the integration of environmental costs in development policies.

### **The Office of the Director, located in Paris, coordinates activities through:**

- > **The International Environmental Technology Centre** - IETC (Osaka, Shiga), which implements integrated waste, water and disaster management programmes, focusing in particular on Asia.
- > **Production and Consumption** (Paris), which promotes sustainable consumption and production patterns as a contribution to human development through global markets.
- > **Chemicals** (Geneva), which catalyzes global actions to bring about the sound management of chemicals and the improvement of chemical safety worldwide.
- > **Energy** (Paris), which fosters energy and transport policies for sustainable development and encourages investment in renewable energy and energy efficiency.
- > **OzonAction** (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition to ensure implementation of the Montreal Protocol.
- > **Economics and Trade** (Geneva), which helps countries to integrate environmental considerations into economic and trade policies, and works with the finance sector to incorporate sustainable development policies.

*UNEP DTIE activities focus on raising awareness, improving the transfer of knowledge and information, fostering technological cooperation and partnerships, and implementing international conventions and agreements.*

For more information,  
see [www.unep.fr](http://www.unep.fr)



**Both international agreements and self-imposed targets are leading government policymakers to consider and act on the wider impacts of energy production and consumption. Given today's rapidly changing markets, governments increasingly have to find smarter and more effective ways to intervene.**

**Policies are needed that create markets, reduce risk and provide acceptable rates of return for investments in the renewable energy and energy efficiency industries. This entails long-term regulatory frameworks that create the overall market conditions for investment, supported by niche public finance mechanisms that address specific barriers and gaps to technology or project development. Significant analysis has been carried out previously on the most appropriate regulatory frameworks for supporting clean energy sector growth.**

**Little attention, however, has been given to the role of public mechanisms in filling the finance gaps that still remain, even once regulatory instruments such as feed-in tariffs or portfolio obligations are in place. This, therefore, is the exclusive focus of the present report, which looks at the different stages of technology and project development, and assesses the sort of public finance instruments that are being used today and others that could be developed to further catalyze sustainable energy sector growth.**

[www.unep.org](http://www.unep.org)

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