SOLAR DEVELOPMENT CAPITAL

The Private Equity Fund of the Solar Development Group

Final Independent Assessment

Lessons Learned in Financing Solar Home Systems

Final Report
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Abbreviations

CES	Environmental and Social Development Department, IFC
ERTIC	Decentralized Infrastructure for Rural Transformation Program
EBFP	IFC/GEF Environmental Business Financing Program
EEAF	Environmental Enterprise Assistance Fund
EFG	Environmental Finance Group, Part of CES
GEF	Global Environment Facility
IFC	International Finance Corporation
IO	Investment Officer
LDC	Lesser/Least Developed Countries
MFI	Microfinance Institution
MW	Megawatts
PE	Private Equity
PV	Photovoltaic
PVMTI	Photovoltaic Market Transformation Initiative
REEF	Renewable Energy and Energy Efficiency Fund
SDC	Solar Development Capital
SDF	Solar Development Foundation
SDG	Solar Development Group
Seco	Swiss State Secretariat for Economic Affairs
SELCO	Solar Electric Light Company
SHS	Solar Home Systems
SME	Small and Medium Enterprise
TIFM	Triodos International Fund Management
TPVP	Triodos PV Partners
TREDF	Triodos Renewable Energy for Development Fund
VC	Venture Capital
WBG	World Bank Group

Executive Summary

Introduction

During the late 1990s, the Global Environment Facility (GEF), through the International Finance Corporation's (IFC) Environmental and Social Department (CES) – the IFC group responsible for the management and oversight of the GEF funds – co-financed a groundbreaking, cross-sectoral initiative to provide electrical services to the rural poor by catalyzing an "order of magnitude" impact in the growth of photovoltaic (PV) businesses and dynamic PV markets in developing countries. Anticipating a major technological breakthrough, industry actors began to explore how the use of solar PV could be expanded to meet the energy needs of the close to two billion people living in areas that are difficult to reach, too poor, or too sparsely populated to support the infrastructure investments required to expand conventional electrical grids.

The initiative consisted of the establishment of Solar Development Capital (SDC or the Fund), a US$32 million private equity fund and Solar Development Foundation (SDF), what was to be a US$19.5 million non-profit technical assistance program to support earlier stage PV sector development. The Fund and the Foundation operated as part of the Solar Development Group (SDG), and were jointly managed by *Stichting* Triodos PV Partners (TPVP or the Advisor). SDC was to act as a showcase for the PV SHS industry, to attract capital and to demonstrate that unelectrified markets offered the potential for commercial investment, with the lack of capital being one of the main gaps holding back massive growth. It was positioned to be at the forefront of building rural, off-grid PV solar home system (SHS) markets by engaging commercial capital to play a catalytic role in growing the PV industry in emerging markets.

This report seeks to assess the achievements of the Solar Development Capital private equity fund from its start-up in March 2001 through its disbanding in June 2004, to determine how well the project met its goals of 1) accelerating the use of PV SHS and 2) contributing to lowering CO_2 emissions in the regions where investments were to have been made. The evaluation also draws out lessons for future programming by the GEF and the IFC.

Findings

SDC was formulated during the mid-1990s, at a time when PV market fundamentals seemed promising and industry experts discussed the potential "commoditization" of the industry, creating a market potential in the mind of the project formulators – and validated through an independent feasibility study – that in hindsight did not exist. Furthermore, a project formulation process that was driven more by the needs of the project sponsors than those of the developing country market, coupled with an overly complicated implementation structure and poor market fundamentals contributed to less than desirable results.

Market - Design Disconnect

The market research guiding SDC's establishment, and the greater SDG initiative, overestimated the growth potential of the PV sector and underestimated the myriad factors required to achieve market breakthrough. Projections from the aforementioned independent PricewaterhouseCoopers feasibility study were based on the limited market intelligence available at the time, much of which was extrapolated from sales in industrialized countries. The cautious go-ahead of the study was interpreted as a full green light, by the donor and investor who aspired to make an order of magnitude impact on sustainable energy options for rural electrification.

Unquestionably, *Stichting* Triodos PV Partners, Fund's Advisor worked diligently to develop and investigate a pipeline that would permit SDC to earn its targeted investment return. Unfortunately, the "disconnect" between the project design and market reality was such that the US$49 million deal pipeline anticipated by the business plan converted into just two deals valued at US$530,000, by the end of year two, when five deals worth $5,250,000 had been projected. Ultimately, US$650,000, of SDC's total committed capital of US$28.75 million, was disbursed to just three companies in Kenya, Indonesia and Bolivia between the Fund start-up in 2001 and its premature termination in 2004. The Kenyan investee declared bankruptcy in early 2005. The Indonesian investment was terminated prematurely as a result of the cancellation of the World Bank's GEF-funded PV SHS subsidy program to Indonesia. The Bolivian venture continues to grow, although it has had somewhat limited impact on rural SHS delivery to date.[1]

SDC's investment guidelines were not always appropriate for the unique situation of the small and medium enterprises (SMEs) characteristic of the rural, off-grid solar PV sector – often sole proprietorships, lacking audited financial statements, or considered too small for investment. Additionally, the limited sectoral expertise among SDC's Investment Officers and their physical distance from the investments also impacted the guidance the Fund could offer investees. Both limited SDC's ability to identify deals and support investments once made.

Overall, achievements related to accelerating the use of PV solar home systems and the indirect environmental results related to the reduction of CO_2 emissions were very disappointing compared to original expectations.

Rural PV Service Providers

The rural solar PV distributors interested in SDC tended to be characterized by young, high-risk, low-margin firms generally in need of patient capital with low return expectations. They typically lacked management expertise, systems for managing growth, and market development capacity. Additionally, many firms lacked a customer service focus, essential for developing successful delivery networks.

[1] Only half of the funds requested of SDC to carry out the firm's business plan were approved, and then, only half of that amount was disbursed. Nevertheless, the firm is currently participating in the World Bank/GEF SHS project in Bolivia (which incorporates the use of GEF-funded SHS subsidies), and therefore should increase its rural SHS delivery achievements.

Typical of the PV solar industry, they were also sensitive to external factors, ranging from general economic downturns which affect investment flows, to increased demand in other markets which can affect equipment availability and price, to the capacity of financing institutions to provide adequate liquidity to grow a market.

Profit is still the exception in the SHS industry. System prices in emerging markets are even higher than they were a decade ago due to the tight equipment supply resulting from SHS subsidy programs in Japan, Germany, and the United States. Distribution costs in regions with low population density also remain stubbornly high.

SDC's experience suggests that in most rural, off-grid markets, the sustainable delivery of PV services still appears to require strong relationships between key stakeholders – government, multilateral agencies, local business networks, NGOs, etc. – to create an enabling environment for successful, rural, PV SHS delivery. This environment ideally consists of a supportive policy and regulatory regime, available end-user financing to mitigate issues of affordability, strong management in firms looking to grow their delivery network, and access to sufficient patient capital to permit business expansion at the speed and volume demanded by the market. Many practitioners now believe that subsidies are necessary at an early stage to compensate for the high upfront costs of developing profitable distribution networks in rural areas. It appears that only a combination of these factors can result in a market that generates sufficient demand for PV services to support the growth of profitable PV businesses in rural areas.

SDC's market analysis failed to recognize that capital is just one of a number of factors necessary to effectively catalyze for the spread of PV solar technology.

Project Formulation

SDC's focus on "PV solar home system electrification in rural, off-grid areas, targeting low-income people, with service provided through SMEs" provided funding partners with a tangible goal, but narrowed the potential range of investment opportunities, especially when overlaid with the high expected rate of return demanded by a private equity fund. SDC's global scope reflected the funding partners' interests in making an "order of magnitude" impact on the sector, but was too ambitious considering the task of catalyzing the industry in any one given market and the resources ultimately available to the project.

SDC's private equity investment approach was part of a broad investment strategy being pursued by the IFC to help meet GEF objectives. While the approach might have been consistent with other GEF initiatives and the IFC's experience with emerging market private equity funds, in hindsight, it was more appropriate for a more mature or faster growing market than PV solar. In particular, we believe the Fund's greatest challenge stemmed from the "disconnect" between the low margin rural PV business and SDC's return expectations. Simply put, there were few deals meeting both the Fund's non-financial and financial criteria. The SDC experiment suggests that the PV SHS industry requires long-term patient capital whereas the Fund's ten year fixed life required management to seek investments promising relatively rapid exits. Similarly, the family-owned nature of small business in

emerging markets and low firm valuations made it difficult to identify potential investees. Moreover, capital markets in emerging countries tend to be very small, minimizing the opportunities for exit.

Finally, SDC was established despite the fact that other similar initiatives targeting solar PV in promising markets, also sponsored by the IFC/GEF, had already been launched.[2] Pursuing the SDC project would have been more justifiable on the basis of success of a similar, smaller-scale initiative

Structure and Implementation

SDC's structure proved complicated. Initially envisioned as a single entity with a financing and technical assistance component, SDC was ultimately established as two separate legal entities – the Fund and the Foundation – to best meet the needs of the funding partners. Consequently, the two institutions each had their own Boards of Directors, their own mandates, and their own priorities, though they shared staff. Nevertheless, the governance arrangement did not facilitate the interrelationship between the two organizations to achieve their mandate to move emerging market PV enterprises to commercial viability. Ultimately, SDF operated much more commercially than originally envisioned. It did not take on active networking and sectoral promotion role as originally planned, leaving an important gap in the SDG strategy.

Whereas the project benefited from the diverse experience of the Management Team, which was formed of three distinct organizations – a not-for-profit environmental fund manager based in the US, a US-based solar PV consulting firm specializing in developing country markets, and a European fund management company – issues of distance, culture, organizational style, language, ownership of SDC and of TPVP, overlaid by a complex staffing arrangement, complicated Fund operations. Essentially, the architecture was an additional complication to an already challenging initiative. The Fund's experience supports serious consideration for established, regionally-based, specialized fund management companies being contracted for similar initiatives in the future. Nevertheless, considering its complex structure, the organization worked surprisingly well and operated very frugally, demonstrating the commitment and professionalism of all involved.

Although SDC was very successful in mobilizing a substantial capital base from a range of investors, managing ten shareholders from across the development/finance spectrum proved to be a challenge. Disagreements among shareholders, primarily between the GEF (represented by the Environmental Finance Group of the IFC's Environment and Social Development Department) and Triodos Bank on the one hand, and the IFC Power Department on the other, led to a stalemate, and ultimately the early termination of the Fund.

Greater coherence and trust among investors may have allowed the Fund to have been restructured (which included reducing the investment return hurdles, broadening the investment criteria and considering new investment instruments) when it became clear that SDC's return expectations were out of line with the market reality.

[2] IFC/GEF SME Program. IFC/GEF PVMTI and IFC/GEF REEF Program.

Ratings

Due to the small number of deals and the installation of very few additional SHSs, SDC did not have a palpable impact on the PV industry. In terms of *sustainability*, the project is rated as *highly unsatisfactory* as none of the investments made by the Fund led directly to a long-term, sustainable development of solar energy in emerging markets, though two of the investees remain in business and are building on lessons learned from the SDC experience. Despite the significant effort invested by the Advisor and various project stakeholders to *achieve outcomes and objectives*, the result must be rated as *Highly Unsatisfactory*. Performance notwithstanding, funds were considered to have been very well managed, though *financial planning* is rated as *Unsatisfactory* as the original feasibility study was based on sparse information to support supply and demand assumptions which led to unrealistic financial projections. Moreover, financial planning remained hopeful even during project implementation.

It should be noted that the Environmental Finance Group of the IFC was also lauded by the majority of the stakeholders for its dedication to the project, from the start through to the challenges of the restructuring process.

Conclusion

The SDC experience has shown that the rural, off-grid, solar PV industry in emerging markets is a low margin, high risk business and requires significant investment of time and resources to build the sustainable rural PV delivery networks crucial to gaining consumer confidence and market share.

SDC's original market analysis perhaps gave too much weight to capital as the factor necessary to effectively catalyze the growth of solar PV SHS delivery in rural, off-grid areas in emerging markets. As in most industries, and perhaps more so in such an immature sector, achieving commercial returns requires strong business support mechanisms including, for example, market intelligence, stakeholder collaboration and a supportive regulatory environment, in addition to capital. Solar Development Capital was exemplar for its cross-sectoral collaboration and innovative financing during its start-up phase; unfortunately it was unsuccessful in even coming close to achieving the "order of magnitude" impact on the rural, off-grid, PV solar industry in emerging markets, sought by its creators.

SDC's experience suggests that innovative financing and grants from institutions such as the GEF and the IFC will remain important in helping build the solar PV industry's capacity to the point it can better absorb the private capital necessary to propel the industry forward to meet the market demand of the millions of people in emerging markets living without electrical services. Additionally, retail-level subsidies will likely continue to play a catalytic role in developing new markets, at least until businesses are able to reach sufficient scale to become profitable. In some cases, service providers may require ongoing subsidies to ensure service delivery to very distant clients where service provision may never be profitable.

SDC's experience suggests consideration for established, regionally-based, specialized fund management companies being contracted for future similar initiatives. It also underscores the need for making investments where there is a coordinated approach to industry building that engages policy makers and financing organizations, as well as industry experts.

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Part One – Introduction to the Report

1.1 Background

The Global Environment Facility (GEF) was established in 1991 to help developing countries fund projects and programs that protect the global environment. It operates as an innovative donor and financier, helping to catalyze important initiatives related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants.

During the late 1990s, the GEF, through the Environmental Finance Group (EFG), of the Environmental and Social Development Department (CES) of the International Finance Corporation (IFC) began to support a ground-breaking project to provide electrical services to the rural poor by catalyzing an "order of magnitude" impact in the growth of photovoltaic (PV) businesses and dynamic PV markets in developing countries. The initiative consisted of the establishment of Solar Development Capital (SDC), a private equity fund and the Solar Development Foundation, a non-profit foundation mandated to provide technical assistance which together constituted the Solar Development Group (SDG), an initiative of the World Bank Group and several leading US charitable foundations. SDG was managed by *Stichting* Triodos PV Partners (TPVP or the Advisor), and organization consisting of three distinct organizations – a not-for-profit environmental fund manager based in the US, a US-based solar PV consulting firm specializing in developing country markets, and a European fund management company – formed specifically to manage the initiative.

Not for lack of effort, SDC faced many challenges in achieving its goals. The Fund was disbanded in mid-2004, just three and a half years into what was to have been at least a ten year life.

Having been approved US$10 million from the GEF, of which US$1.27 million was disbursed, SDC was required to undergo a Terminal Evaluation upon completion of implementation.[3]

1.2 Scope

The goal of the SDC Terminal Evaluation is to determine if the project met its objectives as specified in the project approval documents. As per the GEF requirements, the evaluation reviews the implementation experience and achievement of results of SDC against the project's objectives (see Appendix 1 for the complete Terms of Reference). Specifically, the evaluation is meant to ascertain:

- If SDC accelerated the use of solar PV systems.
- If SDC contributed to lowering CO_2 emissions in the regions where investments were targeted to have been made.

This report seeks to assess the relevance, performance and success of the project. It also seeks to identify early signs of potential impact and sustainability of results, including the contribution to capacity development and the achievement of global environment goals. Finally, the evaluation

[3] All figures are stated in US dollars.

attempts to identify and document lessons learned and make recommendations that might improve the design and implementation of future IFC/GEF projects.

The evaluation covers the period 2001 through 2004 and is related to achievements of the GEF-funded Solar Development Capital fund, the private equity arm of the Solar Development Group. Reference is made to the Solar Development Foundation, SDG's non-profit technical assistance foundation where appropriate.[4]

1.3 Methodology

As detailed in Appendix 1, the methodology employed in this study consisted primarily of a desk audit and stakeholder interviews, with one site visit to Kenya. Stakeholders, including former Board members, investment officers, investees, and sector specialists, were interviewed in person or by phone. Responses were qualified by interviewees' knowledge of SDC's mission, mandate and operations. All interviews were confidential and findings are reported in summary or anonymous form. A full list of references and interviewees can be found in Appendix 2.

The assessment methodology included a review of key SDF and SDC documentation ranging from Board minutes, to annual reports to evaluation reports (see Appendix 3). Prior internal and external evaluations of the SDG and SDF provided an important source of information, as did IFC records regarding the project. The former Fund Managers' records were limited to those available from the IFC and in the possession of Enterprising Solutions from the two previous evaluations conducted by the firm. Other information was limited because Triodos International Fund Management did not provide access to project files or discuss the status of former SDC or SDF investments under management, though it shared a written and verbal assessment of the SDC experience. Finally, a number of publications on international PV experiences were reviewed.

1.4 Evaluation Team

The evaluation was undertaken by Enterprising Solutions Global Consulting (www.esglobal.com), a firm working in the areas of micro and small business finance, technical assistance, and institutional planning and evaluation, related to enterprise-led strategies for sustainable development. Enterprising Solutions conducted an in-depth mid-term assessment of the Solar Development Foundation, the SDC's non-profit business development sister agency, in early 2002. The evaluation made a number of key recommendations which contributed to changes in the Fund's and Foundation's structure and operations. In late 2004, Enterprising Solutions conducted the Independent Final Assessment of the Solar Development Foundation as part of the World Bank Grant Completion Report. The evaluation was managed by Triodos International Fund Management, which assumed the management of the SDC and SDF assets upon the disbanding of the two organizations. This Terminal Evaluation was managed by the IFC Environmental and Social Department, which acts as an Executing Agency for the World Bank Group which is one of three Implementing Agencies for the GEF.

[4] See Executive Summary of SDF Final Evaluation in Appendix 5.

1.5 Report Structure

The report is structured as outlined in the SDC Terminal Evaluation Terms of Reference (Appendix 1).

- Executive Summary
- Introduction
- SDC and its Development Context
- Findings and Conclusions
    - Project Formulation – Factors related to project formulation that influenced the subsequent development and impact of Solar Development Capital.
    - Implementation – An analysis of key aspects of how the project was implemented.
    - Results – Overview of the results, expected and unexpected, associated with the project.
- Lessons Learned
- Recommendations
- Appendices

Part Two – SDC and its Development Context

2.1 The Solar Development Group

The Solar Development Group (SDG) was envisioned to raise $50 million from a consortium of investors and donors to catalyze the emerging market solar photovoltaic industry in order to broaden and deepen market outreach, and ultimately grow the availability of electrical services to low-income people in off-grid areas. SDG was mandated to accelerate the development of viable private-sector business activity in the distribution, retail sales and financing of renewables-based off-grid electrification applications. It sought to increase the scale of enterprises using PV technology; lower transaction and finance costs for PV businesses; encourage new entrant to the industry; and encourage the growth of existing businesses. SDG's key indicators of success were the profitability of the SDC investment portfolio as a reflection of the growth potential, commercial sustainability and the value of the businesses supported by SDG and improvements in the economic status and quality of life of the communities served by these businesses.

SDG consisted of two separate legal entities:

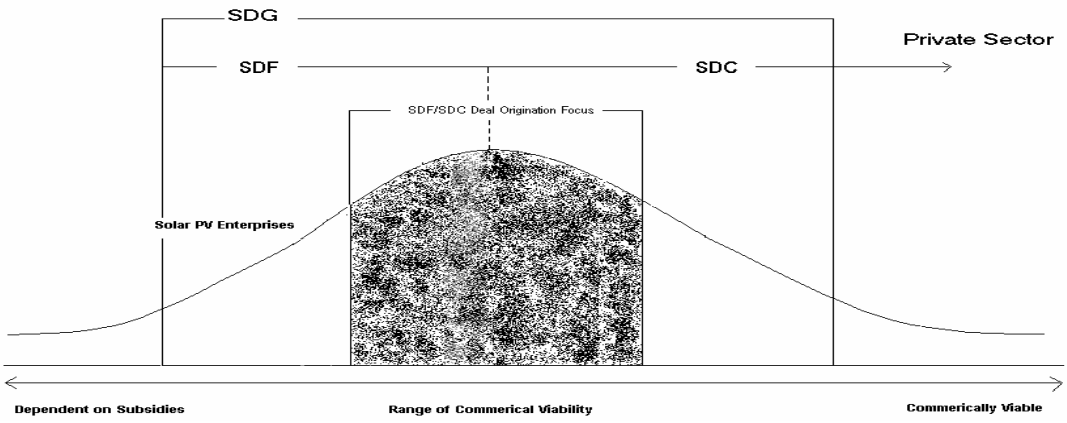
- Solar Development Capital ("SDC" or "the Fund") was to be a $32 million for-profit private equity fund established to take minority equity positions, provide debt or/and other forms of quasi-equity in established lower- and middle-tier PV companies overlooked by regional capital markets because of their size and industry. SDC could provide growth capital in the range of $100,000 to $2 million for private PV and PV-related business in developing countries. The Fund closed at $28.75 million of which only $650,000 was disbursed to three companies.

- The Solar Development Foundation (SDF or the Foundation) was proposed as a $19.5 million US non-profit entity mandated to provide technical assistance to the PV solar industry in emerging markets and to offer pipeline development support to SDC. It offered seed financing between $10,000 and $100,000 to help PV companies prepare for private investment. The Foundation ultimately raised $15.642 million in commitments of which $1.46 million was spent.

The SDC concept had a long gestation period, beginning before 1996. The idea originated from E+Co, a newly formed non-profit organization supported by the Rockefeller Foundation, to "bring together technology, people and funding to create viable local enterprises that deliver affordable and clean energy to those in need." Based on a concept outlined in a letter from the President of the Rockefeller Foundation to the President of the World Bank Group, SDC was to inject massive amounts of money to launch the emerging market PV industry – specifically to grow PV delivery networks in rural areas and increase the access of the poor to electrical services. The Fund was positioned to be at the forefront of meeting the rural PV market's needs through the provision of capital.

The Foundation and Fund, under the umbrella of SDG, were structured to operate on a continuum serving pre-commercial and commercial solar PV ventures (see Figure 1).

Figure 1
SDG Structure



During the mid-1990s, the PV sector was growing. Sales in industrialized countries were increasing and even a few emerging market PV ventures began showing promise. There was a great deal of exuberance and optimism related to the technology and telecom booms at the time. The technological leap experienced by the cellular telephone industry, in particular, was seen by some as offering the hope of a technological breakthrough that could similarly lower the cost of solar PV, and even commoditize the industry. The industry was characterized by broad-based belief that:

- The cost of PV solar was going to drop significantly, and that the trend of large price reductions experienced over previous decades would continue.
- Government policies beginning to encourage solar PV would reduce tariffs, making the technology more affordable.
- New emerging market entrepreneurs were entering the renewable energy market with good knowledge of their local markets, leading to increased competition (driving down prices) and allowing for better after-sales service.

Text Box 1
Some of the key companies working from OECD bases which become active in LDC solar PV activities in the mid-90s

- SELCO (Neville Williams, Harish Hande and investors);
- SOLUZ (Richard Hansen, John Rogers and financiers);
- Sunlight Power International (David Freeman, Jeff Serfass, Mark Opel with investments from EU and US investors);
- Golden Genesis/Golden Photon (Mike Davis, Ron Kenedi, & Pat D'Addario and the Coors Family VC funds);
- Total Energie/Solelec (Herve La Touche & Britta Scmidt);
- Anmoco/Enron Solar (Bob Kelly & Rich Barsky);
- Shell Solar;
- Siemens Solar (Peter McKenzie - who later went to work for AstroPower after Siemens merger with Shell Solar);
- Neste/NAPS (Finnish oil company with solar PV production group);
- BP Solar (Dipesh Shah);
- Electricte de France
- Nuon of the Netherlands.
- Swiss Re's private equity arm
- Gerling Insurance
- Gaia Capital,
- Canopus Foundation
- Bank Sarasin
- Solar Century in the UK

Source: Dana Younger, IFC, 2005.

- PV had the potential to be profitable in off-grid emerging markets as PV panels were beginning to be profitable in industrialized market off-grid areas for certain types of applications such as pipeline protection, rail road signaling, remote telephony, and off-shore installations.

Indeed, certain pockets of the industry, such as manufacturing and product development, were becoming very lucrative. Consequently, a number of influential actors, both individuals and companies, began entering the solar PV market. They ranged from start-ups able to secure commercial capital, to multinationals such as Shell and Siemens, to utilities and insurance companies such as Electricite de France and Gerling Insurance (see Text Box 1).

The solar PV industry was considered to be on the verge of profitability, although many challenges remained (see Text Box 2). Perhaps the greatest challenge was perceived to be the provision of PV service delivery to off-grid areas in the developing world.

2.2 SDC and the GEF

As private sector involvement in the PV solar grew in the mid- to late-1990s, the GEF began supporting a number of initiatives to specifically address the rural PV challenge. These included:

- **The IFC/GEF SME Program (now called the Environmental Business Finance Program)** which was established with $20 million in GEF funds to help improve access to finance, capacity building, and markets for small businesses active in renewable energy and energy efficiency; eco-tourism; sustainable agriculture and agro-forestry; and certified fishing. The fund held PV SHS investments in Bangladesh, Vietnam, the Dominican Republic and Honduras.

Text Box 2
Challenges Facing the PV Sector

Nature of the Economy
- Economic downturn limits purchasing capacity, even when credit is available.
- Financial crises in Argentina, Brazil and other countries have reduced the overall attractiveness of Southern markets.
- Northern PV markets are heating up, reducing the need for manufacturers and distributors to explore higher-risk Southern markets.
- As a result of the "hot" Northern PV markets, it is unlikely that component prices will not decrease for some time.
- Traditional international supporters of PV are reducing their commitments to Southern PV markets which have failed to demonstrate the capacity expected five years prior.

Nature of the Business model
- High risk, low-margin, slow growth industry.
- Limited institutional capacity. Will take time to mature.
- Need to explore productive use of PV in order for it to become a commercially viable industry.
- Dilemma: Cost too high for the majority of potential consumers but reduced costs will affect profitability of an already low-margin business.

Capital
- Lack of sufficient working capital.
- Desperate need for end-user financing.

Accessibility
- Need to lower the cost of the technology.
- Support for more in-country manufacturing needed.
- More cost-effective delivery to remote locations required.
- Technology needs to become more user-friendly.

Confidence in the Technology
- Need to build confidence in the technology as serious option: has been too much irresponsible use and installation, lack of sufficient follow-on service.
- Capacity to pay is higher than believed: will depend on quality products and being able to deliver more than simply basic services.

Politics and Policy
- Need to coordinate with rural electrification programs.
- Government must consider PV as a serious option in rural electrification policy frameworks.
- Reduce taxation barriers.

(Sources: Adapted from SDF Independent Review, 2002; Stakeholder Interviews 2005).

Notably, like SDC, the program sought to engage domestic financial intermediaries — commercial and retail banks, leasing companies and microfinance institutions — to allow environmental SMEs, including solar PV companies, to develop new business opportunities and build profitable new markets for domestic financial intermediaries.[5]

- **The IFC/GEF Photovoltaic Market Transformation Initiative (PVMTI)** which was a $25 million initiative to promote the sustainable commercialisation of PV technology in three selected countries in the developing world (India, Kenya and Morocco), by supporting examples of successful and replicable business models that can be financed on a commercial basis.[6]The program was co-financed between the GEF and the private sector

- **The IFC/GEF Renewable Energy and Energy Efficiency Fund (REEF**) which sought to provide investments in the $1 million to 100 million range in the areas of low-impact hydro, wind, biomass, geothermal, and small scale PV operations (which could include SHS distribution and marketing companies or grid-connected PV installations), targeting investees operating below 50 megawatts (MW). The main target groups were project developers and utilities involved in grid-connected renewable energy projects. Like SDC, the geographic focus comprised emerging market countries worldwide, eligible for IFC financing, including markets in Africa, Mexico and Latin America, the Caribbean, Asia, and Central and Eastern European.[7]

There were also a number of other World Bank/ GEF solar PV financing projects underway in Indonesia, Argentina, and India, among others.

As a result of a confluence of events beginning in 1995 and 1996, the SDC concept was presented by the President of the Rockefeller Foundation, Peter Goldmark, to the newly appointed President of the World Bank Group, James Wolfensohn, for consideration as a project on which the World Bank Group and leading US foundations could work together to promote shared interests and achieve "order of magnitude" development impact. The SDC concept was suggested as an attractive opportunity to offer early leadership to meet the rural, off-grid

Text Box 3
The SDC Concept in the Early Years

SDC was to act as a showcase for the PV SHS industry, to attract capital and to demonstrate that unelectrified markets offered the potential for commercial investment, with the lack of capital being one of the main gaps holding back massive growth.

Investing up to a billion dollars to catalyze the PV market was mentioned during the early stages of concept development.

Another early idea was to franchise PV solar delivery outlets, just as McDonald's had franchised hamburger sales – the "McSolar" concept. Though in hindsight some feel that operationalizing the McSolar model ultimately may have resulted in greater success, the franchising idea was deemed unfeasible to manage by the SDC funding partners and a focus on supporting existing private sector enterprises through a financing approach emerged – helping both start-ups and those enterprises needing the capital to go to scale.

During the early stages of conceptualization, SDC was also expected to play a networking and policy role, liaising with the World Bank and other major actors in the field.

[5] The concessional loan program ultimately made three PV investments, two of which failed. One investment, to Grameen Shakti in Bangladesh, became extremely successful, although its success cannot solely be attributed to the SME Fund subsidy.

[6] Since the launch of PVMTI in June 1998, the fund has committed more than US$19 million to nine projects in India, Kenya and Morocco and is in the process of finalizing additional projects for the remaining US$6 million available under the PVMTI fund. Ninety percent of disbursements were made in India.

[7] REEF was restructured after four years later, with just one investment, in a successful Thai biomass energy venture, in place.

challenge and help bring electrical services to the almost two billion people without access to electricity. Text Box 3 overviews the early discussions and concept.

Supported by the growth of the solar PV market and the large number of new entrants into the market, the concept began to be seriously considered, with the GEF taking the role as an innovative financier. Following extensive discussions and due diligence, including an independent feasibility study conducted by PricewaterhouseCoopers (PwC), SDC was established as a private equity capital fund in 2001. The Solar Development Foundation, SDG's technical assistance arm, began operations a year earlier to begin to prepare the market for SDC and develop a pipeline of possible investment deals for the Fund.

2.3 SDC Investors

SDC was expected to make 28 investments during a ten-year term, with typical investments to be made in PV solar home system-related SMEs, including manufacturers, distributors and retailers of PV systems, energy service companies, banks, microfinance institutions (MFIs) and leasing companies, that provided commercial credit and working capital, though priority was SHS distributors. SDC was to take minority equity positions and provide debt or/and other forms of quasi-equity to its clients, with most deals being finalized during the first five years of operation.

Share Offering

SDC was very successful with its share offering, securing investment commitments totaling $28.75 million, of a targeted $32 million, from a wide range of institutions. See Table 1 for complete list of investors and their investment commitments.

Table 1:
SDC Shareholders

Shareholders	Nature of Investor	Series A* (# of shares)	Series C** (# of shares)	Total Investment ($ 000s)	% Ownership
AstroPower	Private sector PV manufacturer	500		500	1.7%
Calvert World Values International Fund	SRI Fund	500		500	1.7%
Cordaid	NGO	850		850	3.0%
IFC on behalf of GEF	Multilateral		10,000	10,000	34.8%
IFC	Multilateral	3000	2,500	5,500	19.1%
Lambrechtsen	Individual Private investor	500		500	1.7%
Environmental Enterprise Assistance Fund (EEAF)	NGO		1,000	1,000	3.5%
Rabo Bank Sustainability Fund	SRI Fund	1,400		1,400	4.9%
Swiss State Secretariat for Economic Affairs (SECO)	Bilateral	2,250	750	3,000	10.4%
Triodos Bank Fund [89]	SRI Fund	5,500		5,500	19.1%
TOTAL		14,500	14,250	28,750	100.0%

** "A" shares were to receive a preferential payout from investments (capital +6%).*
*** "C" shares would only be paid after the "A" shares receive their preferential payment.*

[9] This included Triodos Groenfond NV, Triodos Deelnemingen BV, and the Wind Fund Plc.

To attract commercial capital, three classes of shares were established: Series "A" shares sought market-based returns. "B" shareholders were to accept lower than market return rates to further the developmental and environmental objectives of the Fund. Series "C" shares offered concessional funding, expecting to return only capital, and were subordinated to the "A" shares. Ultimately, investments were split equally between the "A" and "C" share classes, with the majority of the "C" shares being held by the IFC (19.1 percent) and GEF (34.8 percent). Triodos International Fund Management (TIFM) (19.1 percent) was the next largest shareholder, followed by the Swiss State Secretariat for Economic Affairs (SECO) (ten percent). The IFC Power Department, the GEF and SECO held the majority of the subordinated "C" shares.[10] No "B" shares, originally established to allow for program-related investments by private foundations, were sold.

Expected Return

The SDC business plan stated that PV Partners "hoped to achieve a 15 percent return for Series "A" investors" and that the Fund would "aim to achieve a return of at least 20 percent on its equity investments."[11] By early 2002, only two SDF business development services (BDS) interventions had qualified to become SDC investments. Management was already projecting a higher volume of deals with a lower average deal size to meet its targets. Two years later, by the time the Fund was closed, just one more investment had been made (although a fourth investment had been approved but was not disbursed with the early termination of the Fund).

Ultimately, SDC disbursed just three investments – one in Kenya, another in Bolivia and a third to a Singaporean company operating in Indonesia. Currently, only the Bolivian investment still has the potential of both expected impact and return, although it is possible that funds may still be recuperated from the Indonesian investee, as well, even though the project financed was prematurely terminated.

Table 2:
SDC Investments

	Investment 1	Investment 2	Investment 3
Country	Indonesia (Singaporean company)	Bolivia	Kenya
Objective	Develop new rural distribution network. Test prototype approach.	Diversify product range. Build rural network by identifying potential distribution outlets.	Expand retail outlets.
Amount Approved	$300,000 loan	$400,000 equity. ($100,000 loan from SDF to extend credit through Bolivian MFI)	$100,000 equity $50,000 loan
Amount Disbursed	$300,000	$200,000	$150,000
Year	2003	2002	2001

[10] The "C" shares were designed to take the first losses generated by businesses operations, allowing the "A" shareholders to obtain a relatively high rate of return.
[11] SDC Business Plan, 1999.

2.4 Termination

When it became clear that meeting the investment challenge was going to be much more difficult than expected, a restructuring proposal was presented to shareholders. The proposal included lowering return targets, which led to some small investors simply defaulting on their commitments. The larger investors, with more at stake, including the GEF, continued to search for options to restructure the Fund. Projects continued to be approved, although additional funds were not disbursed.

Discussions regarding SDC's future dragged on for one and a half years, with the remaining shareholders at a stalemate on 1) whether to terminate the Fund and 2) about the use of the "C" shares to guarantee the "A" shares, as had been the original intention.[12] Dissent continued and finally the decision was made to terminate the Fund and sell the SDC assets.

SDC was disbanded as a legal entity in June 2004, just three years into an expected minimum ten years of operations. It assets were sold to the Triodos Renewable Energy and Development Fund (TREDF) , managed by Triodos International Fund Management, one of the major investors in SDC and a member of TPVP, the former SDG Advisor. Upon liquidation, only 13 percent ($3.6 million) of funds had been approved and disbursed. US$2.1 million had been allocated to management fees, $330,000 to expenses, and $1.2 million allocated to deals and deal-related expenses. In all, three investments had been made, with just $650,000 of the $28.75 million Fund ultimately invested.

[12] The Fund by-laws clearly described the share subordination at the end of the investment term but no clause had been prepared to address the situation of an early closing of the Fund.

Part Three – Findings and Conclusions

3.1 Project Formulation

3.1.1 Market Fundamentals

As discussed in the previous section, the SDC concept was developed during the mid-1990s, at a time of exuberance and growth for the PV sector. The range of actors entering the field was notable. A major technological breakthrough was expected. Some emerging market PV ventures were showing promise. Sector experts even began to discuss the commoditization of the industry.

Ten years later, market fundamentals are such that:

- **System prices remain high**

  In recent years, major subsidy programs in Japan, Germany, and the US have boosted the growth of the PV market. Consequently, despite considerable expansion of manufacturing capacity, the global supply of panels has become tight, ironically increasing the cost and limiting the supply of solar panels in emerging markets.[13] In some cases, the price of panels increased by 20 percent, and more recently, delivery times have gone from two weeks to three months, causing additional cash flow problems for emerging market entrepreneurs.

- **Distribution and other costs also remain high**

  Distribution networks in emerging market rural areas remain expensive to build and maintain, even more so in regions with low population density. Notably, most rural PV success stories have taken place in Asia, partly because that continent has a higher population density than Latin America and Africa. Affordability remains the major challenge facing the industry, especially as practitioners estimate that the cost of PV systems themselves represents only one-fourth of the total purchase costs (other costs include wiring, distribution, etc.).

- **Subsidies seem to be necessary in new markets**

  High costs make systems unaffordable for most rural poor. Building a distribution network is also expensive for PV entrepreneurs. According to most practitioners interviewed, subsidies are still necessary to compensate for the high upfront costs of SHS. For example, in Sri Lanka, an initial subsidy program of $120 per system installed, introduced by the World Bank, boosted local market growth and motivated important actors such as Shell Solar to invest in the country (the market also benefited from a strong service-oriented foundation laid by early entrepreneurs, among other things). In 2004, a record 17,000 systems were sold in the country – Shell representing 30 to 40 percent of those sales. The number of subsidies to the country is now steadily decreasing as the distribution network becomes better established.

[13] The global supply of silicon is limited and its manufacturing is a difficult and costly process that requires heavy investment. Therefore, manufacturing is being challenged to adapt to meet demand.

It is important to mention that one interviewee did not share the widely held view of the need for subsidies. On the contrary, he believes that subsidies distort markets by getting clients accustomed to subsidised costs and may hinder market growth in the long run. Instead of using subsidies, the firm tries to provide excellent pre- and post-sale service, going as far as helping clients select the most appropriate appliances based on their SHS capacity, to develop client loyalty and win customers. The country's population density is an important factor contributing to the success of this strategy.

- **Industry capacity needs to be built**

Most PV companies are small family-owned businesses, which have grown without formal business or technological training or guidance. As a low margin industry, PV solar distribution enterprises have not attracted the most entrepreneurial participants. Additionally, local knowledge of renewable energy in general and of PV solar in particular, is limited. Consequently, during the early stages of industry development, technical assistance and support are needed. E+Co and UNEP have created a training tool to help entrepreneurs develop a business plan to grow and expand their businesses. In the case of Kenya, where PVMTI faced difficulties in finding potential investees, the fund recently recognized the need to support the development of an enabling environment, through grants and technical assistance, in order to build the market, as opposed to simply funding investments in specific firms.

- **Businesses are mostly family-owned and seem to prefer to stay that way**

Most PV companies are small family-owned businesses with limited barriers to entry, and a limited and widely disbursed customer base. Margins are small and growth capacity is often limited. Local entrepreneurs are often reluctant to sell a significant share of their capital to outsiders. They are also often unable to provide reliable, audited financial information. Consequently, making major investments is in SMEs is recognized to be both time consuming and expensive.

- **The financing of SHS remains a major issue for customers**

Financing PV solar continues to be a challenge. Fee-for-service financing has proven to be generally untenable over the long-term. Experience shows that partnerships between SHS distributors and MFIs are the most efficient way to provide financing to customers (e.g., Grameen Shakti in Bangladesh, SELCO in India). However, such partnerships also come with their challenges. Cooperation between two institutions can be difficult, and MFIs may consider the sale of PV systems as a secondary business, giving it less priority than is required, as was the case with SDC's Bolivian investment. The credit officers making the collections are not trained technicians, so they are unable to deal with technical problems faced by their clients. A new initiative in Sri Lanka is structured so that a PV firm works with a local MFI, but technicians from the PV firm collect payments and therefore address service problems at the same time. See Appendix 7 for more information on end-user financing.

- **A customer-orientation is necessary to proving the technology but is still not an industry norm**

  Successful companies such as SELCO India and Grameen Shakti strongly emphasize customer service in their business models and have thereby built customer confidence in the technology. SELCO India, for example, assists its clients in defining their exact needs, and in some instances go as far as to help clients choose the appliances that best fit their needs.

  Unfortunately, many companies in the industry seem to lack this customer and service focus. Historically, the development of PV systems in emerging markets was initiated by investors and practitioners from developed countries, who lacked a comprehensive understanding of client needs beyond the simple provision of equipment. In other cases, government subsidy programs attracted firms looking for a short-term, with little interest in system maintenance or long-term sector development.

  Best practices are still being conceived in this nascent industry, and a customer orientation is emerging as a critical component for success. At the end of the day, it is believed that the market will be developed by customer-driven entrepreneurs, not simply financial intermediaries. The comprehensive, long-term vision and commitment of these entrepreneurs is critical to building customer confidence in PV technology.

- **Quality of the systems and maintenance are key factors of success**

  As a subset of best practices, system quality is key for the credibility of PV technology in any given country. Unfortunately, quality systems and maintenance are often lacking. For example, in Kenya, poor quality products were commonly sold and as a consequence, many Kenyans are reluctant to use PV technology. Globally, out of two to three million solar home systems installed, practitioners estimate that less than two-thirds to three-quarters are still functioning.[14]

  One of the main industry factors of success is the availability of efficient maintenance services to customers. SELCO India and Grameen Shakti, two of the few profitable, rural PV solar ventures, have strongly emphasized maintenance in their business model as part of their customer focus.

- **"Grey markets" have grown**

  "Grey markets" have grown as equipment is increasingly being purchased in one country to take advantage of subsidized prices (e.g., bought

Text Box 4
The Future of PV Panels in Emerging Markets

Most of the practitioners and investors interviewed during this review do not foresee a drastic change in PV market fundamentals in the coming decade or so. They tend to believe that even if the current supply bottleneck of silicon used in manufacturing the most common types of cells and panels is resolved, the resulting price decrease would be insufficient to compensate for the remaining distribution and client financing issues.

Similarly, the experts interviewed do not believe that technological improvements (new, more efficient silicon cells and panels or new technology such as thin films) will have a significant impact in the short-term because 1) although these technology improvements have been discussed for years, they have never been mass produced and 2) the new technology will likely take time to reach emerging markets.

Over the longer term, interviewees believe that emerging markets do have the potential to become significant PV solar markets. Demand for electricity in off-grid areas is growing. One source of optimism is the fact that electric appliances are becoming cheaper and more energy efficient, thereby compensating for the energy supply limitations of PV systems.

[14] Source: K. Reiche, World Bank Group.

in India at a lower subsidized price and sold in Bangladesh). Such practices have affected the profitability of local industries, which had already been battered by price increases and supply shortages resulting from the PV booms in Japan, Germany and the US.

These and other tough challenges facing PV SHS providers in emerging markets, including the impact of the Asian financial crisis, led to an industry where profit is still the exception, not the rule. The SDC private equity model, promoting 15 to 20 percent returns, resulted in a mismatch between the market reality and the investment vehicle ultimately designed. This operational context consequently led to reduced investment opportunities for SDC.

3.1.2 High Level Sponsorship

SDC was formulated at a time when PV market fundamentals seemed promising, creating a market potential in the mind of the project formulators – and validated through an independent feasibility study – that in hindsight did not exist. The fact that the SDC initiative was personally spearheaded by Mr. James Wolfensohn and the presidents of a number of leading US foundations contributed to SDC happening at all. However, in many ways, the high level sponsorship skewed SDC to be more reflective of sponsors' needs and wishes than of market demand, as seen in aspects of the project's development, design and implementation.

- **Fund Scope**

Investment Criteria

The funding partners' goal was to finance PV solar home system electrification in rural, off-grid areas, targeting low-income people with service provided through small and medium enterprises (SMEs). While such a well-defined target made the initiative tangible and marketable for the funding partners, it narrowed the potential range of investment opportunities, particularly when combined with SDC's high expected rate of return. Additional social and environmental screens further narrowed the already limited range of potential investments within SDC's funding parameters.

Many alternative energy sector specialists suggest that a broader "renewables" scope would have had a greater chance of success and would have been more appropriate for addressing the challenge of sustainable rural electrification. Some believe that expanding the investment criteria beyond renewables to a "clean energy" scope would have helped, as market opportunities in renewable energy are too thin.[15] Additionally, an energy fund with a broad investment range would allow demand to determine the appropriate intervention, as opposed to pushing a single technology.

Global Scope

Whereas SDC began as a "billion dollar" concept with the potential for grand, "order of magnitude" impact to kick-start commercial financing of SHS, in its ultimate iteration, SDC did not have the resources – financial, human or time – or expertise to pursue a global strategy considering the nature of PV solar markets. PV markets demand targeted interventions to create the enabling environment in which SHS sales can thrive – a supportive policy and regulatory

[15] This approach was recently adopted by the Triodos Bank fund that purchased the SDC portfolio.

regime, the availability of end-user financing to mitigate issues of affordability, strong management, and access to sufficient patient capital to permit business expansion at the level of quality, speed and volume demanded. SDC's resources did not allow for the targeted, intense interventions required to achieve its goal.

Moreover, SDC's chance for success was narrowed because some of the most lucrative PV SHS markets were already being serviced by the GEF-sponsored Photovoltaic Market Transformation Initiative (PVMTI), a US$25 million initiative which was active in promoting the commercialization of PV technology in India, Morocco and Kenya (though ultimately, 90 percent of disbursements were made in India).

Timing

Relatively immature industries, such as solar PV, demand long-term, patient capital. SDC's ten-year term, in which most investments were expected to be made during the first five years and exits were to begin during the following five years, met investors' needs to foresee an exit, but required management to seek investments with the potential for relatively rapid exits. The nature of the SHS industry and SDC's mandate to work with SMEs made this a nearly impossible task as SHS growth in rural areas is slow during the start-up phase, and increases exponentially only after the market has proven and promoted the technology.

Some experts suggested that an open-ended fund could have better met market needs, allowing for SDC to better "accompany" the enterprises as they moved through the business cycle and giving management more flexibility in timing their exits.

- **Private Equity Investment Approach**

SDC was to act as a showcase for the PV SHS industry, to attract capital and to demonstrate that unelectrified markets offered the potential for commercial investment, with the lack of capital being one of the main gaps holding back massive growth. While it is clear that many PV SHS stakeholders believed a major price breakthrough was close at hand, and that sufficient capital was the major issue holding back the sector, the fact that SDC made only two equity investments suggests that its private equity investment approach did not coincide with the needs of the immature solar PV market.

SDC was one in a series of private equity funds supported by the GEF in an attempt to bridge the public/private capital gap. Some private equity experts suggest that SDC's failure to make equity investments is typical of other emerging market private equity fund experiences with SMEs. Very few of the GEF funds were successful for the many reasons highlighted in Text Box 5.

- **Return Expectations**

SDC's greatest challenge stemmed from the "disconnect" between its investment criteria and its return expectations. Returns were pegged at 15 to 20 percent – considered by the Advisor and investors as healthy yet achievable. Not for lack of trying, finding deals to meet this investment hurdle was more difficult than expected.

Less than one year after SDC was launched, many stakeholders believed that the economic environment had changed so significantly that average returns of 15 to 20 percent and five to seven year exits – which seemed possible when the project was designed five years earlier – were now "mission impossible," and that the situation was unlikely to improve any time soon. It should be noted, however, that other stakeholders stated that they always believed SDC's return and exit expectations were unrealistic.[16]

Today, most experts agree that start-up rural PV delivery enterprises are unlikely to be commercially viable until firms achieve economies of scale and are supported by an enabling environment that addresses regulatory issues, such as import taxes or the provision of subsidies for the purchase of equipment. Consequently, self-liquidating debt instruments with upside potential seem more appropriate than equity-like instruments over the short-term.

The PV SHS industry is a high-risk, low margin sector best served by patient capital with low return expectations. The failure to find an adequate number of investments suggests that SDC's return expectations were out of line with the reality of young, rural retail PV enterprises. Established firms, even those pursued by SDC, in some cases were able to secure less expensive financing from other sources. One of SDC's initial attempts to do a deal was rejected by the investee because of the high interest rate (approximately 30 per cent). Ultimately, the investee was able to secure a loan at less than five percent interest

[16] SDF Mid-Term Review, 2002.

Text Box 5
Private equity and venture capital limitations in emerging market SMEs

1. Character-lending
SME management and ownership usually relies on a single entrepreneur, as opposed to being able to count on a strong management team. Private equity (PE) and venture capital (VC) firms in developed markets prefer investments with strong teams as opposed to those run by a single person. The investors often play a large role in shaping and recruiting the senior management team.

2. Difficulty buying a significant amount of equity
SME entrepreneurs have usually grown their business on their own, maintaining full control. They are often reluctant to sell equity in their company. Consequently, it is difficult for investors to be influential in the management of the company and / or to share their know-how.

3. Market opportunities are often limited
In developed countries, successful PE firms target already existing and large markets. In developing countries, the renewable energy industry is still at an early stage which requires building an enabling environment before markets can grow.

4. Quality of information
In developed countries, venture capitalists expect a high level of reliability from the information they collect on which to base their investment decisions. Such information is difficult to obtain in emerging markets, whether it is market data or company information (e.g., financial statements of potential investments are frequently unaudited).

5. High monitoring costs
Successful PE firms closely monitor their investees. In emerging markets, the number of potential investees is generally limited and a fund often has investments spread over a region, rendering monitoring expensive and difficult to conduct.

6. Unclear exit strategies
Exits are often difficult to achieve in emerging markets because of the high level of risk involved and the scarcity of investors willing to accept these risks. Stock markets are often underdeveloped.

7. Unstable macroeconomic and political environments
The macroeconomic environment tends to be unstable (e.g., foreign exchange risk, economic crises, etc.) and political unrest is a concern in emerging markets.

8. Financial returns are low
Low financial returns tend to be a result of the above-mentioned points. An indirect consequence of low returns is that competent entrepreneurs prefer to focus on more lucrative investments.

Source: Information on VC / PE practices in developed markets is extracted from "How do venture capitalists choose investments" by Steven N. Kaplan and Per Stroemberg (2000).

Understandably, SDC sought relatively high returns from the sector to meet its own financial targets. Management repeatedly noted privately that the internal return on equity hurdle was ten percent, though publicly, the Fund's expected rate of return was promoted at 15 to 20 percent.[17] Surprisingly, some of the founding funding partners suggested that they never expected to meet even the internal return hurdle.[18]

This was the case with foundation partners. Although several foundations were initially excited about the commercial, venture capital nature of the Fund, only one foundation seriously investigated how it might make a contribution directly to SDC. That foundation was given approval by the IRS to make a donation to EEAF, a not-for-profit, which in turn invested in SDC. Many of the foundations reported being more interested in the experience of working with the World Bank Group than in the financial results of the Fund itself. Their lack of confidence in SDC's financial capacity is underscored in the fact that not a single series "B" share was sold, even though they were designed specifically to allow for PRIs to be made by foundations. Ultimately no class "B" shares were issued.

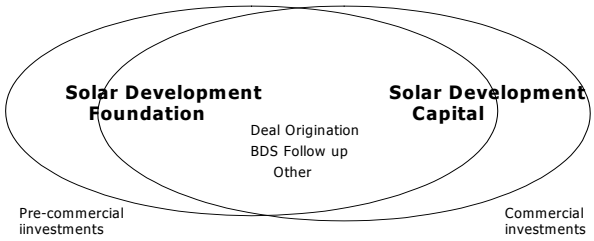
- **Structure**

SDC was conceived as a single entity with a financing and technical assistance component. Ultimately it was established as two separate organizations: SDC, a private equity fund, and SDF, a technical assistance foundation. Each organization had its own mission and objectives and was governed by an independent Board of Directors. Within the SDG structure, the non-profit SDF coordinated business development services and supported pipeline development for SDC. SDC was promoted as a commercial venture capital fund.[19] Figure 2 depicts the relationship between the two organizations.

The for-profit/not-for-profit structure helped to separate out the costly business development activities required to catalyze the emerging market PV industry by transferring those costs to SDF. It allowed SDC to offer better returns to investors as much of its market and pipeline development costs were absorbed by the Foundation, and costs only directly related to investment ready deals were assumed by the Fund.

The existence of a non-profit entity allowed the investor foundations to remain involved in the SDC initiative without having to risk even program related investment (PRI) funds and avoid Internal Revenue Service (IRS) concerns about foundation investment in for-profit ventures.

Figure 2
SDF and SDC Interrelationship



[17] SDG interviews 2002, 2004 and 2005.
[18] SDG interviews 2002, 2004 and 2005.
[19] SDC is actually a "quasi-commercial" fund, as it benefited from a number of subsidies: grants from SDF, pipeline support from SDF, as well as the class "C" shares to guarantee private sector investors against losses.

The separation of SDC's financing and technical assistance roles was expensive, complicated and bureaucratic. Paperwork and procedures were duplicated for investees working with both institutions. Although a single Management Team contracted to manage both SDC and SDF made the SDG initiative more coherent, the Management Team wore two hats and had to separate its activities, reporting and information management. Communication was complicated. Decision-making was complicated. The organizational architecture was an additional complication to an already challenging initiative.

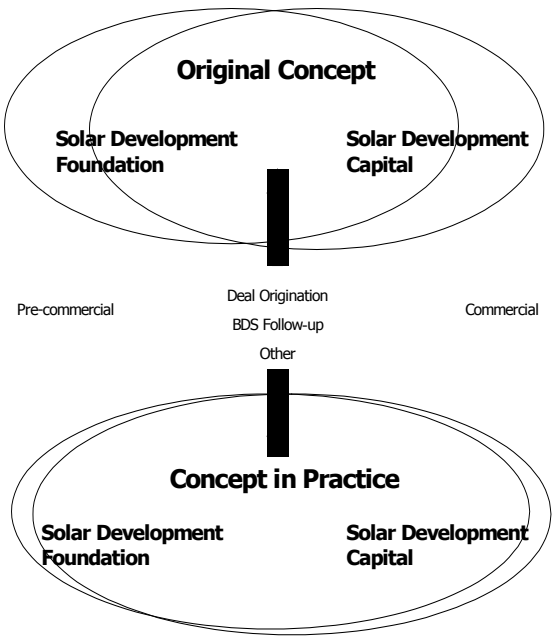
Mandates

SDG's dual structure and the differing expectations of the project stakeholders led to a certain degree of tension between the Fund and the Foundation, even though SDG's original intent was for SDC and SDF to operate in an integrated, coordinated way (see Figure 3). Accordingly, the Management Team placed the different SDF and SDC interventions along a continuum that began with early development support through SDF and ended with investment by SDC.

The two Boards, on the other hand, differed in their goals, priorities and processes. Initially both were return-oriented, seeking to support business that could absorb SDC investment. Over time, as the project pipeline became increasingly thin, the SDF Board began to define success independently of SDC as it was a bit more successful than the Fund as its return expectations were low. SDF was established by the Advisor, TPVP, to operate much more commercially than originally envisaged in the SDC feasibility study.

With the Advisor focused on achieving its deal targets, a highly commercial, return-oriented emphasis permeated the SDG structure. Positive in many ways, a consequence was that the sector promotion and policy work from the original SDC design was essentially dropped. Although management participated in some speaking engagements and a website was in place, TPVP did not assume the sector development role in a proactive active way. When asked about it, even some TPVP members deemed it outside of SDG's mandate.[20]

Figure 3
SDF and SDC Operational Structure Theory and Practice



Restructuring

Interviews suggest that it became more difficult for SDC to restructure precisely because SDF operated much more commercially than originally

[20] Interviews 2002, 2004 and 2005.

expected, providing many loans in addition to grants (see Figure 3). Therefore, restructuring SDC would have resulted in significant overlap in actual SDF operations. Disagreement within the SDC Board itself also contributed to the failure to approve the restructuring plan.

Although there are pros and cons to having a single or dual structure, we believe the ultimately greater coordination between the two institutions would have increased the likelihood of success. Although some say that operating as two separate entities was the only option, we believe that the final structure did not adequately consider the industry needs and was more reflective of the funding partner needs and interests.

Additionally, the high level sponsorship was such that:

- **"No-go" was not an option**

  According to some WBG staff, "in most projects there is a point at which a decision is taken whether a project is a `go' or a `no-go'. In the case of SDC, 'no-go' was not an option." "We were told to march, so we marched."[21] Mr. Wolfensohn's sponsorship sometimes made it difficult for IFC staff to raise their concerns related to SDC's size, structure, timing, due diligence, etc.

- **Similar projects already existed but were not yet proven**

  SDC was established despite the fact that the IFC/ GEF had only recently launched other similar initiatives. It certainly would have been advisable to wait for the results of related funds. It would have been particularly informative to review the results of PVMTI, which targeted some of the most promising PV SHS markets (India, Morocco, and Kenya), and to have incorporated the results into what was to be a geographically broader and higher-profile SDC.

- **Independent Feasibility Study noted a number of caveats**

  Finally, SDC's high level sponsorship allowed an independent feasibility study to be taken as green light for moving ahead with the SDC initiative with few modifications, although several important caveats were noted in the report:

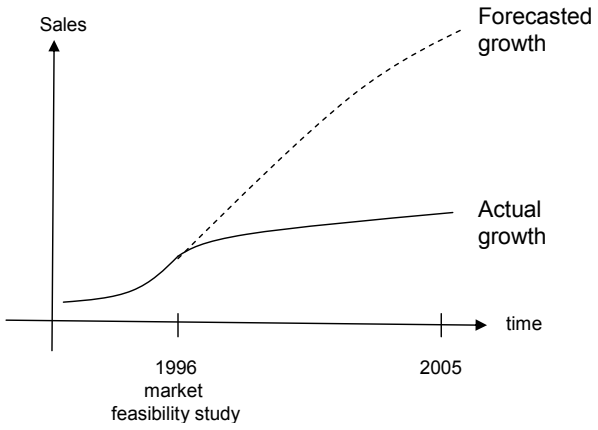
  - PV remains unaffordable for the majority of the target market.
  - The potential that beyond the $49 million pipeline identified, deal flow might not continue.
  - Lower returns, higher risks, hard currency risks, divestment and exit risks are possible.
  - Barriers to product acceptance, related to affordability, existed.
  - Potentially overly-optimistic expectations about grid connections existed.
  - Potential suppliers and consumers had a limited knowledge base.
  - A broader strategy focused on all renewable energy might be a more prudent approach.
  - Returns may not meet expectations.
  - Finding the adequate manager with the required skill set was of critical importance.
  - There are risks of a single versus a dual operational structure.

[21] Interviews with World Bank Group staff, 2005.

Notably, every one of the potential risks noted in the report became reality. This suggests that a more profound assessment of the risks was needed.

The feasibility study did have some methodological problems, including that the analysis of market growth in developing countries was weak. The market growth figures cited in the report were not specific to emerging markets and referenced to an individual PV expert, not a statistical institute. The assessment assumed that developing countries' growth would follow global growth, while in fact solar PV market growth in developed countries has *hindered* growth in emerging markets (see Figure 4). Finally, the feasibility study did not include a supply analysis, a basic part of any such study. It is therefore not surprising that the report overestimated the growth potential of the PV sector and underestimated the myriad factors required to achieve market breakthrough.

Figure 4
SDC Market Projections



3.2 Implementation

This section analyses the key aspects related to SDC's implementation – management, operations, governance, sponsorship and technical assistance – once the decision to move forward with the venture was made.

3.2.1 Fund Management and Operations

A single entity, Triodos Photovoltaic Partners (TPVP) was contracted to manage both SDF and SDC. TPVP's membership came from three distinct organizations: Environmental Enterprises Assistance Fund, a US-based NGO, Triodos International Fund Management, a Dutch-based fund management company, and Global Transitions Capital, a US-based emerging market PV sector consulting firm. Ownership of the partnership was shared, with and each EEAF and TIFM owning 40 percent and having two votes, and GTC holding 20 percent of shares and one vote. TIFM, while a Managing Partner in TPVP, also held a $5.5 million investment in SDC.[22] EEAF held $1 million of SDC shares, though the original capital had been provided by a private foundation, so the degree of ownership was less visceral than that of Triodos. GTC did not hold shares in SDC. While the three institutions worked jointly under the auspices of TPVP, each organization also managed their own projects and had their specific interests and objectives for participating in the SDC initiative.

The combination of culture, organizational styles, language, size of institutions, investment in SDC and ownership of TPVP made for a rich, yet complex management structure. The physical distance

[22] A portion of this investment represented the savings of 8,000 individuals invested in the Triodos Groenfond NV, a "green" fund.

between the different companies – Triodos is based in the Netherlands, EEAF in Arlington, Virginia, and GTC in Massachusetts – added further complexity to the relationship.

Additionally, each partner involved their own staff to different degrees and in different aspects of the initiative. Most staff reported to their primary supervisor at their institution as well as to their SDG supervisor, who may have been the same person or could have been a different person on a different continent. In some cases, staff had to allocate their time between their home organization, SDC and SDF. Local staff were also hired in the regions TPVP was active. African and Asian staff reported to a Team Leader in the Netherlands. The remainder of the Management Team, the Latin American investment team, the BDS Unit, and back office personnel all reported to the Arlington, Virginia office.

Considering its complexity, the arrangement worked surprisingly well, demonstrating the maturity and dedication of those involved. Whereas the structure resulted in only temporary tensions between the different management companies, several of the main actors reported that they would not recommend such a complicated structure for future endeavors.

Of final note, a number of the entrepreneurs involved with SDC and SDF reported a marked difference in sectoral knowledge and capacity between the GTC representatives working with the project and the investment officers responsible for follow up and ongoing support. This supports consideration for established, regionally-based, specialized fund management companies being contracted for future similar initiatives.

3.2.2 Governance

SDC was extremely successful in bringing together a diverse group of funding partners. As listed in Table 1, these ranged from multilateral agencies (e.g., the IFC and the GEF), bilateral agencies (e.g., the Swiss State Secretariat for Economic Affairs), a number of social investment funds, and one private sector PV enterprise.

While the number and range of investors was a great success, having ten shareholders from across the development-finance spectrum led to a complicated governance structure. Differing interests and needs, and diverging interests and priorities sometimes slowed the decision-making process. Initially, the differences were revealed during Investment Committee meetings, particularly in terms of comfort levels with technical information (e.g.., audited statements, sole proprietor businesses, etc.). Differences were underscored when some shareholders were unable or unwilling to accept lower return expectations, and pulled out after the presentation of the restructuring proposal. Others refused to consider investments in non-solar renewable energy because of other investments with a similar purpose. Still others were highly invested and argued to restructure the Fund.

Having a greater degree of coherence among investors, especially in the case of a social investment of the nature of SDC which a range of environmental, social and financial goals may have facilitated the restructuring process.

3.2.3 Project Sponsorship – GEF and IFC Power Department

The GEF (represented by the Environmental Finance Group of the Social and Environmental Development Department of the IFC) and the IFC Power Department, were majority shareholders of SDC, with 34.8 percent and 19.1 percent of SDC shares, respectively. The EFG acted as the Executing Agency for the US$10 million GEF funds allocated to SDC, while the IFC's own capital of US$6 million was invested by the IFC Power Department.[23] Together, they held the majority of SDC shares (54 percent) and were two of the more influential investors.

The GEF is an independent financial organization that provides grants and non-grant financing to developing countries for projects that benefit the global environment and promote sustainable livelihoods in local communities.[24] The IFC "promotes sustainable private sector investment in developing countries as a way to reduce poverty and improve people's lives." Not surprisingly, the Power Department and the EFG had diverging conceptions of SDC. It proved increasingly difficult to reconcile the two approaches, especially when the Fund began to face problems, and when it began to appear that the expected returns would not be met and that the investment pipeline was thin. The IFC's Power Department quickly concluded that the SDC had no future, and should be terminated early. The EFG, more focused on its innovative financier role, and maximizing impact on the solar PV industry in emerging markets argued to restructure the goals and operations. Tensions between the EFG and the Power Department lasted for one and a half years before the EFG reluctantly decided that the loss of time, energy, and money made withdrawal from the project the only logical decision.

The Power Department may have held its position because it became involved in SDC, like many others, only because Mr. Wolfensohn had sponsored it. Since the project was touted as commercial and related to energy, the Power Department had been essentially ordered to invest its funds and manage the project. Considering the Department's participation was not by choice, it is not surprising that it was keen to close the Fund when the investment failed to meet expectations.

According to a report written by Robert Ross of the EEAF management team, part of the rationale for closing SDC and three other funds managed by EEAF may be that the Environmental and Social Development Department which took the lead in promoting the concept did not manage the funds. "Once responsibility for the fund passed from the sponsoring department to the managing department, the commitment was lost as there was no departmental cohesion in the first place. The managing department interpreted its role as being one of institutional governance, rather than constructive support of the fund's mission. The managing department in all three cases took the early lead in criticizing fund management, but without offering constructive alternatives. They spearheaded and engineered the final shareholder decisions to shut down the funds. The managing department adopted a negative attitude to each fund and eventually took the lead in shutting it down, even though the sponsoring department originally created it."[25]

[23] Now referred to as the Infrastructure Department.
[24] GEF Web page.
[25] Robert Ross, EEAF Lessons Learned, January 2004.

All interviewees involved in the EFG/SDC relationship highlighted the EFG's strong support of SDC, both financially and philosophically. The EFG, particularly its representative, Louis Boorstin, continuously offered a creative and constructive approach to developing and growing the Fund and solving its problems.

The SDC project was experimental by nature. It could have benefited from the ongoing guidance and management of the EFG, which had helped to design and develop the initiative. The EFG recognized the experimental nature of the Fund and sought to make it work. The IFC should consider keeping the management of "alternative" projects with the sponsoring department, as such projects are not always as easily understood by more traditional IFC departments.

3.2.4 Technical Assistance

Interestingly, in the cases where SDC made or attempted to make equity investments, potential investees were generally as interested in the experience and contacts of an investor as in their financing. This made investing a greater challenge for SDC, as its investment officers were not PV experts, although some PV SHS expertise was available through SDF and GTC. Nevertheless, the SDC experiment suggests that the provision of funds alone does not adequately meet the needs of emerging market PV SMEs.

Venture capital financing usually comes with extensive assistance and monitoring from the VC firm. This assistance is especially important in emerging markets where there are many challenges. These can range from limited experience in a given area of expertise to limited experience with growing small firms. Within the SDG structure, technical assistance services were provided by SDF. It was assumed that the investees receiving financing directly from SDC were going to be relatively self-sufficient.
In the case of SDC's Kenyan investment, where the company ultimately went bankrupt, its General Manager was recognized as competent, but with limited experience. As his company grew quickly, he did not put in place a strong management structure or sufficient internal controls, resulting in significant embezzlement. Several local industry experts believe that closer monitoring and assistance from SDC, as a Board member, would have helped the general manager of the investee company put adequate internal controls in place and develop a solid management team, especially as SDC had encouraged the firm's rapid growth.

SDC also made an equity investment in a PV solar distributor active in the Santa Cruz region of Bolivia. In addition to capital, the entrepreneur was interested in gaining PV sector and small business management expertise through SDC membership on the firm's Board of Directors and ongoing association with the Fund. The entrepreneur reported that little support was provided, which may be explained as a result of SDC's early termination and the sale of assets to Triodos International Fund Management, which subsequently decided to eliminate its programming in Latin America. As of Fall 2005, the entrepreneur was still unable to close the firm's 2003 books because SDC was listed as a shareholder, even though the Fund had been formally terminated in June 2004. Triodos reported that is was doing its best to address the matter.

The Indonesian investee initially rejected SDC's equity investment offer because the owner did not believe SDC added value to the business, beyond providing capital, and ultimately what was

considered very expensive capital. Just months after rejecting SDC's offer, the same firm took a partner who in addition to investing capital, knew the PV industry, had excellent regional experience and contacts, and was actively engaged in the firm. The PV firm accepted a second offer of a SDC loan several years later.

The three investment experiences indicate that although SDC had available funds, the lack of in-depth knowledge of sectoral and regional issues, limited the guidance it could offer potential investees. Future initiatives might consider working with local investment teams or fund managers with proven regional and sectoral expertise and experience. Notably, the SDG's successor, the Triodos TRED Fund decided after one year of operations to begin working through local fund managers to identify and track investments.

3.2.5 Clarity of Investment Guidelines

Throughout this evaluation, interviewees communicated that investment guidelines of the Fund or the shareholders were ambiguous.

The most significant case of a lack of clarity in investment guidelines was the fact that neither the Private Placement Memorandum that served as the basis for fundraising, nor the organization's articles of incorporation or by-laws provided clear guidance about how the Fund's assets would be distributed in the event of dissolution before the Fund's anticipated ten-year life. The requirement of unanimity for critical decisions and the ambiguity in the governing documents combined to cause a critical loss of momentum for the Fund, ultimately leading to is early termination.

In other cases, criteria were applied to screen investments without being explicit. For example:

- A Mexican project for rechargeable phone batteries was refused consideration because guarantees regarding the working conditions of the employees were insufficient.
- A $2 million investment in a Mexican business was approved by the Board but ultimately rejected by the entrepreneur because the reporting requirements were too onerous and costly. Additionally, a commitment had to be made that the SDC funds would not be used to repay an outstanding loan.
- A number of investments were not considered by the IFC Power Department, because the companies were sole proprietorships, did not produce audited financial statements, or were small – all basic characteristics of SMEs.

In each of the cases, the investment criteria were ambiguous. As a consequence, time, funds, and arguably, goodwill, were wasted by presenting unsuitable projects for approval.

Notably, despite the large number of SDC shareholders, there was no emerging market SME representation. The SDF Board made efforts to recruit PV experts and entrepreneurs from developing countries. Because Board representation on SDC was a function of shares, it could not have done the same, but it could have established an advisory board or worked in closer conjunction with the SDC Board, management and staff sector experts. Experienced emerging market PV entrepreneurs may have brought a more realistic approach to the investment guidelines. Additionally, they would likely have helped conceive and grow a more market-driven project.

3.2.6 Coordination with other Sector Actors

Although SDC was successful during its project formulation phase in coordinating with and engaging many sector actors, its networking efforts were less aggressive during the implementation period. Although members of the Advisor participated in some speaking engagements, multiple stakeholders reported that SDC did not actively coordinate with important industry actors. The transactional nature of the venture capital deal-making, with its high levels of confidentiality, was not conducive to the more broad-based networking approach that sector-building requires and the emerging market PV solar needs.

3.3 Results

One of the main objectives of SDC was to demonstrate the commercial viability of investing in PV in rural, off-grid areas of emerging markets, specifically to accelerate the use of solar PV systems. SDC also sought to contribute to lowering CO_2 emissions in the regions where investments were made. Considering the small number of deals made, it is difficult to imagine that SDC had a large impact on promoting PV as a viable energy alternative for rural off-grid households and other applications, or that it had any real impact on emissions levels.

The SDC experience helped to demonstrate that the rural, off-grid, PV sector is much more challenging and complex than originally imagined and that innovative development financing and grants, such as those available from the GEF and the World Bank, are still necessary to help the sector reach the unelectrified in emerging markets.

This section discusses the impact and outcomes as can be assessed to date of the Solar Development Capital initiative. We begin by discussing what we believe is the critical challenge facing the solar PV industry. We then review the investments made, as well as other industry/environmental impact measures, and finally, the costs of the initiative. As required by the evaluation terms of reference, we end by attributing a rating to three key areas of assessment. In the following section, we look at the lessons learned.

3.3.1 The PV Challenge

Solar PV is one of the few sustainable energy alternatives for those living in rural, off-grid regions of the world. But a complex combination of factors for success make meeting market needs a challenge. The primary and underlying challenge is to find the elusive point at which the affordability of SHS and customers' perceived value of the technology meet. Customers must see value in the product – it must meet their needs in terms of an adequate and consistent level of energy production – and they must be able to afford to acquire the technology. To make solar PV a viable energy alternative, industry actors must work to 1) reduce costs and 2) increase the perceived value of solar PV technology.

Reducing costs can occur through:

- Major technological breakthroughs, although at this point in industry development, practitioners estimate the cost of a PV SHS system itself to represent just one- fourth of the

total purchase costs (other costs include wiring, distribution, etc.). Therefore, cost savings in other areas will also have to be found.

- Subsidies such that the product delivery to any given market becomes feasible. Subsidies may be up-front to end-users to facilitate the purchase of equipment. They may also be provided to the PV enterprises themselves to underwrite the start-up cost required to enter a new market – reaching potential clients, making sales, installing and maintaining equipment – until sufficient economies of scale are reached that make the market profitable. In some cases, extremely distant markets may never become commercially viable and may require ongoing subsidies to ensure service provision.

- Consumer financing which allows payments for a PV system to be made over an extended period of time, mitigating the affordability factor.

The perceived value of solar PV technology can only be satisfactory when service provision is satisfactory. This means addressing equipment quality, ensuring adequate PV systems to meet clients' needs, and providing the necessary after-sales service and system maintenance. The support of an enabling environment, engaging policy makers, finance providers, and coordinating with other donors active is also key to success. Finally, even when all of these criteria are met, the PV service provider's own capacity to grow its business – managerial, financial, planning capacity, etc. – are considerations.

Very few examples of PV SHS delivery firm profitability, such as Grameen Shakti in Bangladesh, SELCO India and Shell Sri Lanka, have been successful in finding the elusive point at which affordability and perceived value meet (see Figures 5 and 6). Neither Grameen Shakti nor SELCO India offers product subsidies, although both operations have benefited from substantial subsidies and both offer consumer financing. Shell Sri Lanka benefited from subsidies to end-users, provided by the World Bank and the ground work of early PV SHS firms in the region that have allowed the Sri Lanka PV industry achieve scale and for a number of firms to reach profitability. Nevertheless, the fact that even firms such as Shell Solar and BP Solar, which have been in business for 30 plus years, still find profitability elusive in some markets, illustrates the complexity of the challenge.

Figure 5
PV SHS Perceived Value / Cost Curve in New/Potential yet Unprofitable Markets

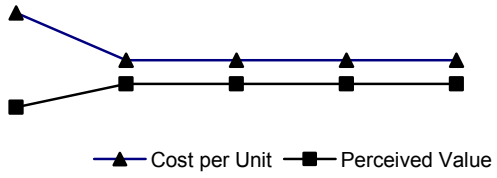
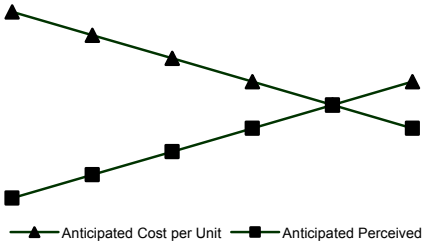


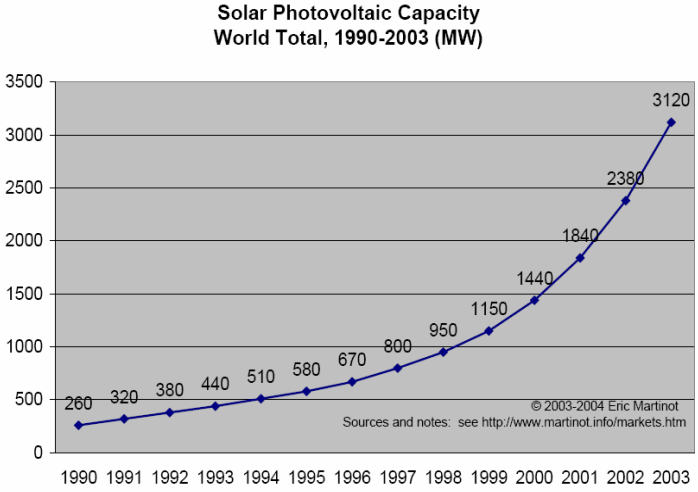
Figure 6
PV System: Perceived Value / Cost Curve in Profitable / Potentially Profitable Markets



Experience has shown that it takes significant capital, time, patience and discipline to build a strong rural delivery network where consumers themselves are demanding services. When evaluating the few solar PV success stories, we see either an unusual conglomeration of environmental factors including a supportive policy and regulatory regime, the availability of end-user financing to mitigate issues of affordability, strong management looking to grow their delivery network, access to sufficient patient capital to permit business expansion at the speed and volume demanded by the market, and strong relationships between key stakeholders – government, multilateral agencies, local business networks, NGOs, etc. – that are key to creating the supportive enabling environment required for successful, rural, SHS delivery (Sri Lanka and Grameen Shakti in Bangladesh) combined with extremely "deep pockets" or adequate working capital to stay in the market to the point where investments in market development are less necessary and customers are demanding the product themselves (Shell Renewables). Only then is it realistic to begin to see profitability. Of course, in the case of rural PV, it is critical that investments be made in an area that will likely never have grid access – areas where PV is the best alternative.

Global solar photovoltaic capacity has been growing exponentially in markets such as Germany and Japan as a result of major government subsidies (see Figure 7). In emerging markets it is likely that any significant industry growth will require the support of local authorities and governments as authorities can change legislation in favor of renewables as well as provide subsidies during start-up.

Figure 7: Global Solar Photovoltaic Capacity



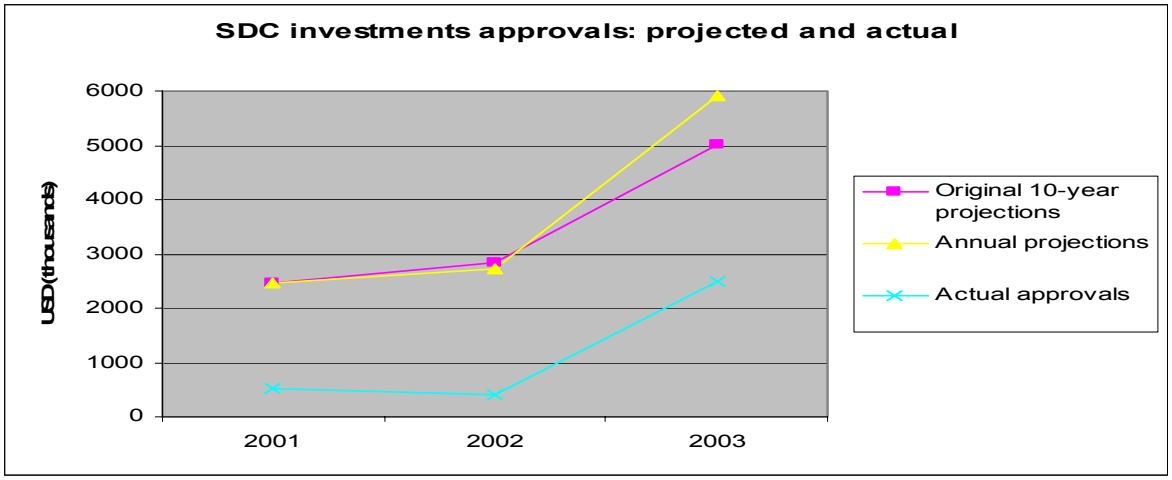
Initiatives such as the Decentralized Infrastructure for Rural Transformation Program (ERTIC), sponsored by the World Bank and the Bolivian Ministry of Public Works and Services provides an interesting example of programming which combines important factors for success such as cross-sectoral collaboration, policy and regulatory support, the recognized need for consumer financing, etc..

Essentially, successful solar PV delivery requires many factors to be in place. It is not surprising that SDC was not successful in finding appropriate investments. Even SDF, which had a more developmental mandate, was challenged to move firms along the pre-commercial/commercial spectrum. This seems to continue to be the case, even after the foundation ceased operations, based on the limited information available from Triodos International Fund Management, the new managers of the SDF and SDC assets.

3.3.2 SDC Investments

SDC was expected to make 28 equity investments in PV companies and financial institutions to facilitate end-user financing, and invest its total committed capital of $28.75 million during its lifetime. The SDC Board of Directors ultimately approved six investments, totaling $3.9 million, between 2001 and 2003 (see Figure 8 for a comparison of the budget vs. actual). One of the investments, for $2 million, was rejected by the Mexican entrepreneur. Another investment was passed on to another investment fund when SDC's future became uncertain. A third investment was cancelled upon the termination of the Fund. Ultimately only $650,000 was disbursed to three businesses. Not for lack of effort or resources, SDC clearly underperformed in all aspects of its investment approach.

Figure 8: SDC Investment Approvals



Interestingly, in correspondence as late as mid-2002, the IFC was worried that a core team of ten investment officers (IOs) might not be enough to satisfy the transaction needs.[26] The placement target was 12 or more transaction per year, with 50 relationships managed by nine investment officers at the peak. By December 2002, SDC still hoped to reach 50 percent of its 2003 objectives. Even approval projections as of May 13, 2003 continued to be optimistic (see Table 3).

SDC stopped investing two and a half years after it was started and was liquidated in 2004, just three years after program began. Of the investees, one went bankrupt in early 2005. As previously discussed, another

Table 3
SDC Approval Projections 2000-2003

Year	2003	2004	2005	Total
Original Business Plan 2000	10,300	7,300	10,600	28,200
Budget July 2002	8,533	6,700	3,700	18,933
Approvals as of May 2003	7,130	6,650	600	14,380
Projected Approvals as of May 2003	**2003**	**2004**	**2005**	**Total**
Asia	2,830	3,300	300	6,430
Africa	1,000	1,550	300	2,850
Latin America	3,300	1,800	0	5,100
Total				14,380

[26] Memos to TPVP, from IFC SDC archives.

investment was terminated by the investee shortly after it began as a result of changes in market conditions, specifically the cancellation of a World Bank subsidy program. The third venture continues to grow but has had relatively limited impact in terms of SHS delivery; only $200,000 was disbursed and the firm's original business plan was based on a $750,000 investment. Table 4 highlights the main points in the development of each investment. Other projects were in the pipeline but because of the institutional instability, little follow up was done during the last year of operations.

Table 4
SDC Investment Overview

	Investment 1	Investment 2	Investment 3
Country	Indonesia (Singaporean company)	Bolivia	Kenya
Objective	Develop new rural distribution network. Test prototype approach.	Diversify product range. Build rural network by identifying potential distribution outlets. Provide working capital to allow for adequate inventories in distribution outlets and allow for continuous product availability.	Expand retail outlets.
Amount Approved	$300,000 loan	$400,000 equity	$100,000 equity $50,000 loan
Amount Disbursed	$300,000	$200,000	$150,000
Year	2003	2002	2001
Outcome	Project stopped following withdrawal of World Bank SHS program in Indonesia and cancellation of subsidies. Number of SHS negligible as company withdrew delivery operations from region. Approximately half of overall investment recuperated. $270,000 still owed to Triodos. Only interest payment being made.	Company growing slowly but not as planned because business plan had requested $750,000 to expand product offering. Only $400,000 approved and of that only $200,000 advanced to the company. Expansion continuing slowly but more capital required.	Five new outlets were established within first year of investment as a result of the SDC investment. Bankruptcy in 2005.
Major events since disbursement	Firm opened seven rural delivery outlets in Indonesia, with varying degrees of success. Profitability was based on a franchising model in which consumers were provided both equipment and financing by the firm. Operations closed for a variety of reasons in each location, though withdrawal of World Bank subsidy was critical to the end to the investment. The investee is using the Indonesian experience to begin operations in Sri Lanka.	Firm purchased a vehicle to increase access to rural market and attempt to develop a series of distribution outlets in remote areas of the project region. Plan was to work through existing independent outlets to carry firm's products. Product range was to include non-PV equipment to increase operational sustainability by broadening product offering.	With the SDC investment, the investee rapidly opened five new locations. Several factors led the company to bankruptcy: ▪ Significant embezzlement from key staff ▪ Increased competition from companies offering a wider range of products ▪ Increased overhead costs due to fast growth ▪ Supplier's price increase

SDC's Role	SDC provided partial funds for the expansion strategy. The company provided the other half.	SDC provided partial funds for the expansion strategy. It was to provide technical assistance as well. Triodos has requested that the equity investment be converted into a loan as it has changed the way it operates. The PV operator questions the value to his company of such a decision. Relationship at a standstill as SDC is owner of enterprise on paper but SDC no longer exists and Triodos has not appointed a new director. Firm unable to close books for 2003 onwards or make other decisions requiring signature of shareholders. Additionally, an SDF loan was made to a local MFI to work with the firm to grow the market in certain rural areas by providing a subsidy to the end-user. Loan funds returned to Triodos, unused, without the approval or even the knowledge of the PV enterprise.	SDC approved an investment of $200,000 in the company and disbursed $150,000 ($100,000 equity and $50,000 loan). The objective of this investment was for the company to expand outside of Nairobi. SDC encouraged this expansion strategy, and put conditions on how it should take place. SDC's impact on the company was seen as negative by all interviewees. SDC was perceived to have encouraged the company's fast growth strategy but did not provide the management support and supervision it needed to implement that strategy.
Comments	Triodos was unwilling to comment.	Triodos was unwilling to comment beyond saying that it is trying to do its best to address the situation.	The company has gone bankrupt, making it impossible to discuss matters with former owners/ employees or collect first hand information on what happened exactly. For example, it is unclear which efforts were made to save the company. Some sources mentioned that Triodos got involved in the company's management while others mentioned Triodos tried to sell its shares. Triodos was unwilling to comment.

Some argue that the pipeline was finally beginning to develop in later years and that the Fund was closed too early. (See Table 5 for a summary of pipeline development.) This may have been the case, although upon following up with the Triodos Renewable Energy for Development Fund, the successor to SDF and SDC, few if any of the SDF investments or SDC pipeline have shown any indication of becoming investment quality projects. Text Box 6 summarizes the arguments for closing the Fund and for restructuring.

Table 5 Growth in SDC Pipeline over the Fund Life					
		3-Aug-01	Dec-01	Dec-02	31-Jul-03
Number of Projects		6	14	23	26
Capital Needs		$2,430,000	$5,230,000	$ 14,280,000	$ 14,033,000
Type of Projects	Distributor	2	3	7	6
	Distributor/retailer	1	6	4	0
	Retailer	0	2	0	12
	Manufacturer / distributor	2	1	3	4
	MFI/financing	0	0	4	3
	Other	1	2	5	1
Status	Closing in process/ first disbursement completed	0	2	2	3
	Due diligence in process / approval pending	3	0	2	3
	Positive preliminary contacts made / business plan received	3	12	19	19
	Rejected	0	0	0	1
In June 2002 – a broader list was sent to the IFC upon request: 299 companies were in the pipeline, but most had been rejected or not contacted seriously yet.					

Text Box 6
Did the Fund Close Down too Early?

Some stakeholders believe SDC closed too early, arguing that a downscaling would have been more appropriate at the time. Others believe it should have been closed earlier to have minimized losses.

Early Close

- Limited losses.
- It was clear the concept itself was wrong and returns would not be achieved.
- Even with lower return expectations, investees proved very difficult to identify.
- As of late 2005, SDF investments, which were initially foreseen as the future SDC investments, were still posting disappointing results.
- All other solar/renewable energy funds faced or are facing at best low returns and at worst significant losses (REEF, PVMTI, Terra, the solar portion of E+Co's portfolio, GEF-SME). They have also had difficulties finding potential investees and disbursing their commitments.
- No early stage VC fund investing in SMEs in emerging markets seems to be successful.
- No changes in the market conditions are in sight.

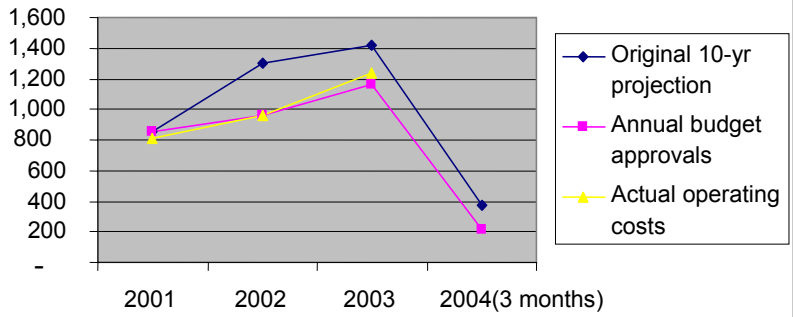
Restructuring

- Toward the end of the Fund's life, management thought they had a promising pipeline which had grown from six companies in August 2001 to 26 in July 2003 (see Table 5), with potential investments opportunities in sight.
- Management suggested that the Fund be downsized from $29 million to $15 million and the operating costs reduced, which would have limited losses.
- Could have applied the lessons learned during the three first years of the Fund.

3.3.2 Cost

Upon the termination of the Fund in mid-2004, $3.6 million had been called and disbursed. Out of this amount, approximately $2.1 million (58 percent) had been allocated to management fees, $330,000 to expenses, and $1.2 million to deals and deal-related expenses. Operating costs were consistently less than the original ten-year projections but approximately equal to the yearly projections (see Figure 9). All together, the Fund spent $3.6 million to disburse $650,000, a ratio of 5.5:1. This does not include the cost of the BDS and pipeline services provided by SDF, nor the IFC or World Bank costs related to the project. IFC costs related to the project were unavailable but if a conservative estimate considers them to be half of the GEF costs, the expense to disbursement ratio increases to 6.75:1. Oversight costs incurred by the various shareholders would increase the ratio.

Figure 9: SDC Operating Budget vs Actual
USD (thousands)



An internal IFC review of management fees and expenses found that the fund managers "operated very frugally and were at best covering, costs, particularly given the wide reach of the operations and the rigorous due diligence conducted."[27]

The cost of the SDC venture to the GEF is estimated to approximately $1.79 million (see Table 6). Out of this, $1.27 million was disbursed to SDC, and $0.52 million was used for operational costs (e.g., time of investments officers, transportation costs) linked to the SDC investment.[28] See Table 7 for details on planned and actual co-financing.

Table 6	
SDC-Related GEF Costs	
	Amount (in USD)
Disbursed by the GEF	1,267,391
GEF Operational Costs	525,559
Sales Proceeds	0
Total costs to the GEF	1,792,950

Project start-up was clearly a very expensive endeavour as two new institutions were created. Something that could be considered in the future for similar projects is to disburse funds through already established investment institutions, in order to avoid expensive start-up costs. The funds would then be invested and managed by each of the institutions based on established criteria. The likelihood of success of such a model might be greater than that of SDC as various funds specialize in particular markets

[27] OEG Initial Project Evaluation Summary, 2005.
[28] Source: Financial analysis team of the CES-Environment & Social Development Department, IFC, September 2005.

Table 7: Co-Financing										
Co financing (Type/Source)	GEF own Financing (mill US$)		Government (mill US$)		Other* (mill US$)		Total Approved (mill US$)		Total Disbursed (mill US$)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Grants	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Loans/Concessional (compared to market rate)	$ 3,478,261	$ 121,800	$ -	$ -	$ 6,521,739	$ 228,200	$10,000,000	$2,300,000	$ 10,000,000	$ 350,000
Credits	$ -	$ -	$ -	$ -	$ -		$ -			
Equity investments	$ 6,521,739	$ 104,400	$ -	$ -	$12,228,261	$ 195,600	$18,750,000	$1,633,000	$ 18,750,000	$ 300,000
In-kind support	$ -	$ -	$ -	$ -	$ -	$ -	$ -			
Other	$ -	$ 1,041,191	$ -	$ -	$ -	$1,908,809	$ -			
Totals	$ 10,000,000	$ 1,267,391	$ -	$ -	$18,750,000	$2,332,609	$28,750,000	$3,933,000	$ 28,750,000	$ 650,000

3.3.3 SDC Compared to its Peers

Financing of PV SHS has shown itself to be challenging. While certain aspects of the industry can be lucrative, the financing of rural SHS has proven to be a challenge globally. Table 8 compares some features of the main global investors in solar energy (investment funds and distributors). An analysis follows.

- **Nature of Investors**

Funds

Based on an informal survey, corroborated by Phil LaRocco of E+Co (which tracks much of this information and was itself involved in a number of the funds), six global investment funds invested in solar energy in LDCs in the last decade. Three were dedicated to solar energy specifically, and three were dedicated to renewable and/or clean energy, including PV solar. The World Bank Group (through GEF and IFC) was involved as a lead investor in all but one. Notably, none of these investors were purely commercial, although SDC had a clear for-profit objective. Each of the funds started between 1994 and 2001. SDC and SDF were the last to begin. SDC was closed just two years after it began. REEF was restructured.

Distributors

Only two distributors are present on a global scale – BP Solar and Shell Solar – although BP Solar focuses more on manufacturing than on distribution. Both benefited from the significant investment potential of their parent companies and have been working in the sector for over 30 years. A third distributor, SELCO, has developed a distribution network in three countries (India,

Vietnam, and Sri Lanka).[29] Each of these companies have only begun to become profitable in recent years, although their profitability has been affected by Northern growth in demand for PV that has resulted in supply shortages and price increases in emerging markets. Shell Solar reports that it its operations are just breaking even. Considering the relatively "deep pockets" and the long experience of both BP and Shell Solar, in particular, and the fact that neither works exclusively in off-grid rural areas, their experiences underscore the complex challenge of achieving profitability in the PV solar sector.

- **Other investors**

Interestingly, although regional development banks were not active in financing solar energy projects during the last decade, they now seem to have developed some interest in the industry. In 2005, each announced that it would finance one solar project in their respective region:

- The Asian Development Bank announced that it will help develop solar energy technologies in isolated rural areas of Afghanistan, through a technical assistance grant approved for US$750,000. The grant is from the Poverty Reduction Cooperation Fund, financed by the UK government. [30]

- The Inter-American Development Bank announced the approval of $700,000 in financing to support a project that will provide solar-powered electricity systems to isolated rural communities in Nicaragua. The financing includes a $520,000 loan and an $180,000 grant to TECNOSOL, a Nicaraguan firm specializing in electricity generation systems powered by wind, water and solar energy.[31]

- The African Development Bank announced the financing of a Solar Thermal Power Station Project. It seeks to extend electric power generation facilities and develop renewable forms of energy in Morocco. The project is co financed by the GEF.[32]

In some cases, local and national authorities also helped finance solar energy projects.

- **Investments**

As shown in Table 8, the amount committed for the PV solar funds ranged from $13 to $65 million, and the total amounts invested were between $650,000 (SDC) and $5 million. Notably, all funds had difficulty identifying potential investments, and therefore were able to disburse only a small percentage of their total committed capital. The number of solar energy companies financed by each Fund ranged from one (REEF) to ten (E+Co), with the exception of SDF which was a technical assistance fund and not commercial in nature, which financed 46.

[29] Information on SELCO, Shell Solar, and BP Solar were provided by the practitioners interviewed.
[30] Source: Asian Development Bank website.
[31] Source: Inter-American Development Bank website.
[32] Source: African Development Bank website.

Table 8
Investors in Solar Energy in Emerging Markets

	INVESTMENT FUNDS						DISTRIBUTORS / MANUFACTURERS		
	Sponsored by the World Bank Group (IFC and GEF)								
	GEF-SME (now EBFP)	PVMTI	REEF	SDC	SDF	E+Co	SELCO	Shell Solar	BP Solar
Mission	Low interest rate loans to intermediaries in renewable energy, including solar, and biodiversity	Investments in solar energy (PV) Minimum: $500,000 per investment	Investments in renewable energy	Investments in solar (PV) energy	Investments in solar (PV) energy (grants and small loans)	Investments in clean energy, including solar	Distribution of solar electric systems	Manufacturing and distribution of solar electric systems	Primarily manufacturing, but also design, marketing and installation of solar electric systems
Year started	1995	1998	2000	2001	2001	1994	1994 in India, 1997 in the US, Vietnam, and Sri Lanka (US was the mother company; now each company is independent)	More than 30 years old	1973 (Solarex, which merged with BP Solar in 1999)
Year closed	-	Restructured in 2004	Restructured in 2005	2004 purchased by the Triodos Renewable Energy for Development Fund	Assets transferred to the Triodos Renewable Energy for Development Fund in 2004	-	-	-	-
Investors and sponsors	Lead sponsor and investor: GEF	IFC / GEF	Lead sponsor and investor: IFC / GEF	Lead investor: GEF / IFC, Triodos International Fund Management, range of private	Lead investor: World Bank Development Grant Facility, range of US foundations	Lead sponsor and investor: Rockefeller Foundation	India: No majority investor but many different ones (e.g. E+Co, SwissRe, Enova)	Subsidiary of Shell	Subsidiary of BP

Table 8
Investors in Solar Energy in Emerging Markets

	INVESTMENT FUNDS						DISTRIBUTORS / MANUFACTURERS		
	Sponsored by the World Bank Group (IFC and GEF)					E+Co	SELCO	Shell Solar	BP Solar
	GEF-SME (now EBFP)	PVMTI	REEF	SDC	SDF				
				sector investors					
Management	IFC	IFC	Lead Advisor: EIF. Sub-advisors: EEAF and E+Co.	Lead Advisor: Triodos PVP Partners (EEAF, GTC, Triodos International Fund Management)	Lead advisor: Triodos PVP Partners (EEAF, GTC, Triodos International Fund Management)	E+Co	Co-Founder, Harish Hande	Shell	BP
Committed capital	$20.8 million in total	$30,000,000 ($25 m for projects and $5 m for implementation)	$65,000,000	$28,750,000	$13,400,000	Ongoing	n.a.	n.a.	n.a.
Drawn down	-	$19,000,000	-	$3,600,000	$ 6,940,000	$11,000,000	n.a.	n.a.	n.a.
Amount invested / Revenue	$1,850,000 in solar ($17 m in total)	$11,600,000	$840,000	$650,000	$3,200,000	$3,000,000 ($11,000,000+ in total)	SELCO India's revenue in 2005: $3.1 millions (55,000 clients)	Unknown	Unknown
# of projects financed	3 in solar (22 in total)	11-12	1 (agro-waste)	3	60 (46 companies)	10+ in solar (114 in total)	25 service centers in India	Unknown	Unknown
Region(s)	Bangladesh (Grameen Shakti), Vietnam (SELCO), Honduras (Soluz)	Kenya, Morocco, India	Global	Bolivia, Kenya, Indonesia	Global (24 countries)	Global: Africa RAPS Mona** Latin America Soluz DR Soluz Honduras	India, Vietnam, Sri Lanka	Marketing in 75 countries through a global network of professional distributors and sales partners. manufacturing	20 offices and manufacturing plants located around the world (Production facilities in the U.S., Spain, Australia, and India)

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	Sponsored by the World Bank Group (IFC and GEF)								
	GEF-SME (now EBFP)	PVMTI	REEF	SDC	SDF	E+Co	SELCO	Shell Solar	BP Solar
						Tecnosol** Asia SELCO (India)** **operating		facilities in the United States, Germany, and Portugal.	
Return on invest	Default on two out of three investments	Not available (seems mitigated at best)	No recovery	Depends on the investors (from limited losses –A shares- to no recovery – C shares).	Disappointing to this point (exact figures not available – defaults have been numerous)	IRR: Just above break even. Rate of return ranges from between recovery of just 50% of principal in some cases to an 11% return on the Tecnosol investment – all together E+Co management estimates its IRR on solar investments to be slightly positive (compared to 8.4% on all clean energy investments)**	SELCO India broke even between 2001 and 2004. Will make losses in 2005 because of supply issues (price of equipment and delivery delays from suppliers) SELCO Vietnam is not profitable (business infrastructure is bad, lack of financing institutions with proper network)	Breaks even (Source: Damien Miller)	In 2004 BP Solar made a profit for the first time. It increased its megawatt sales by more than 30% globally (Source: BP Solar website),
Comments	Only the Grameen Shakti investment -	Have had difficulty identifying suitable	GEF portion of REEF re-constituted in December		Triodos has now decided to enlarge its investment criteria to clean	According to E+Co, solar projects with potential decent	The business model of SELCO India focuses on customers'	Fee-for-service model is seen as not	BP Solar seems to be mainly active in developed markets, where its profits are

Table 8
Investors in Solar Energy in Emerging Markets

	INVESTMENT FUNDS						DISTRIBUTORS / MANUFACTURERS		
	Sponsored by the World Bank Group (IFC and GEF)								
	GEF-SME (now EBFP)	PVMTI	REEF	SDC	SDF	E+Co	SELCO	Shell Solar	BP Solar
	which benefits from grants and an existing microfinance distribution network - has proven successful	projects. Offers a combination of loans, guarantees and grants.	2005 as $18 million commitment to E+Co (sustainable energy facility)		energy as a whole and to invest in local funds investing in local companies	returns are limited to cash, and cash + short term credit models, especially involving MFIs. Fee-for-service model is too difficult.	assistance in finding the best products for their needs and on offering maintenance services.	profitable.	likely to be made.

** E+Co's IRR calculations exclude E+Co's operating and enterprise development service costs. E+Co covers a large portion of these costs through contract revenues and grants and not through the proceeds of its investments. Current estimate for E+Co indicates that for each $1.00 invested approximately $0.22 worth of services are provided. In addition it requires about $0.13 for each $1.00 invested to operate this global non-profit organization.

- **Profitability**

SDC was not the only fund that suffered significant losses. Most of the other World Bank Group investment funds did as well. All together, the solar energy investments were at best recovering their funds:

- All investment funds except one (E+Co) had significant losses. E+Co experienced a wide range of returns from one investment to another, from loss of 50 percent of capital to a peak of an 11 percent return on one investment.
- Shell in Asia and BP Solar globally were just breaking even after 30 years of existence and heavy investments.
- SELCO India was profitable from 2001 to 2004 and will make losses in 2005 because of supply delays that resulted in cash flow issues and price increases (the price of their systems increased by 20 percent in recent years).

It seems that the longer the investor was in business, the more successful it was (Shell, BP, and E+Co are the most successful and the oldest investors). Both E+Co and Shell emphasized the importance of learning by doing as a key factor of success in this still nascent industry. But as we have seen, none have been overwhelmingly successful.

3.3.4 Assessment against Other Criteria

The SDC Terminal Evaluation TOR requires that the Fund be assessed based on the following criteria:

- **Information Dissemination and Awareness**

The most positive outcome of SDC may be that it provided important lessons for the industry and for stakeholders. For example, taking the lessons learned from its SDG experience, the Triodos Renewable Energy for Development Fund, which took over SDG's portfolio, decided to drastically change its investment strategy. The fund's new strategy is defined as a "fund-in-local fund" strategy which focuses on investing in new or existing local financial intermediaries in clean energy finance. Some aspects of this strategy shared by the Triodos management team include:

- PV SHS investment criteria are too narrow a focus for a single investment fund. In the case of alternative energy, a broad interpretation is required, including energy efficiency or clean energy (even certain non-renewables such as small diesel, hybrid, and LPG). This allows for more diversity in investment portfolios.
- Investment structures should be locally/regionally-based. Only local fund managers can provide the labor intensive, day-to-day management of investee companies. Local fund managers need financial incentives to target the smaller segment of the SME market
- Initially, return expectations in local dedicated clean energy SME funds will be moderate. Patient, socially responsible investors are needed. Local fund return can be higher when

funds have a broader investment scope, perhaps beyond energy (e.g., sustainable infrastructure).

- Capacity building, creating awareness, and risk mitigation instruments are required to catalyze and mobilize co-financing to local funds by the existing financial institutions in those local markets.
- Creative self-liquidating mezzanine instruments with a commercial approach should improve return rates.
- The fund-in-fund approach should offer support in setting up and supervising local financing vehicles.
- A fund-in-fund can be a channel for donors to professionally catalyze and grow local funds.

- **Use of PV Systems and Growth of the Sector**

SDC had a very limited impact on the level of use of PV technology, and especially of off-grid solar home systems in developing countries. We come to this conclusion simply because few systems were installed as only three SDC investments were made. The number of systems installed was negligible in Indonesia as the project was shut down shortly after start-up. Because the Kenyan investee is bankrupt, documentation on how the number of systems installed or maintained by other firms subsequent to the bankruptcy is unavailable. The Bolivian company continues to install SHS but in recent years, with only part of the SDC investment to help build the firm's SHS market. Close to 80 percent of the firm's income has come from installations in businesses in the technology field.

For the most part, SDC's work with individual businesses met with limited success. In the case of Indonesia, SDC took a more comprehensive strategic approach, working with two PV manufacturers, supporting financing system through a local bank, as well as working with a local alternative energy consultancy. Unfortunately, the Fund was closed before the results of the regional sector-building strategy could show results.

- **Availability of Consumer Finance for PV**

SDC did not affect the general availability of financing for PV systems in developing countries simply because no SDC funds were invested in finance institutions. It should be noted, however, that SDF did make such investments in two of the three SDC investment countries. In the case of the Bolivian investment, the subsidy program sponsored by SDF was never implemented as it was made somewhat irrelevant by a World Bank sector development program, which offered even better subsidies for the same region as the SDF loan. The PV firm tried to change the regional focus of the SDF grant but found only limited interest from the MFI. The loan funds were held in a bank account for over two years. Enterprising Solutions discovered that the TRED Fund had negotiated with the MFI to return the loan funds in mid-2005, without the PV firm's knowledge.

- **Connection to the World Bank Group**

  SDC does not appear to have exploited its connection with the World Bank Group as fully as it might have. Closer coordination with WBG alternative energy experts would have allowed for better use of Bank-sponsored programs and subsidies. Better coordination with the Bank would also have helped in terms of building the deal pipeline, sharing risks and building business support networks.

- **Development of Business Enterprise Support**

  Business enterprise support activities were undertaken by SDF, but not SDC. SDC participated actively only on the Board of the Kenyan company but ultimately was unable to help the firm to address its growth challenges. As mentioned, the firm declared bankruptcy in early 2005.

- **CO_2 Emissions**

  The effect of SDC's investment activities on CO_2 emissions was negligible as few unit sales were attributable to SDC investments. It is important to note, however, that the use of PV technology in rural off-grid households is not an effective way to combat CO_2 emissions, given that such populations are low-level producers of CO_2 in the first place.

- **Sustainability**

  SDC investments have not created lines of business that are sustainable to date, although the Bolivian investee would roll out his PV SHS growth plan, if the remainder of his SDC investment funds were available and the plan operationalized together with the SDF financing. The investee is pursing growth in its rural off-grid market through participation in the Decentralized Infrastructure for Rural Transformation Program (ERTIC) Program sponsored by the World Bank. It is assumed that the Kenyan firm's customers have been picked up by other PV operators. Finally in Indonesia, although the program was halted, the entrepreneur is now considering the SDC investment as R&D for a similar distribution network that he is launching in Sri Lanka.

The TRED Fund will be able to apply the proceeds of the repayment of the Indonesian investment to other clean energy projects. The Kenyan investment is lost and the Bolivian investment remains uncertain.

3.4 Ratings

Project results are very disappointing considering the commitment and dedication of those involved in the project. We must, however, rate SDC's performance on three dimensions: sustainability, financial planning, and outcome based on the original expectations. .

- **Sustainability: Highly Unsatisfactory**

  None of the investments made by the Fund led directly to a long-term, sustainable development of solar energy in emerging markets. Perhaps only the lessons learned may be sustainable.

- **Financial Planning: Unsatisfactory**

  The original feasibility study was based on a relatively weak market assessment. It was based upon sparse information to support supply and demand assumptions for industrialized country PV sector growth rates, which led to unrealistic financial projections. Even during the project implementation phase, financial planning remained hopeful. In this difficult environment, the Advisor did maximize the resources available. According to stakeholders, funds were managed wisely and the involvement of the management teams was laudable.

- **Outcome/ Achievements of Objectives: Highly Unsatisfactory**

  The achievements of the Fund were very limited. The Fund invested only US$650,000, which has resulted in the installation of very few additional SHS, if any, compared to the number that would have been installed without the Fund. Consequently, it had very little impact on the development of local businesses and on the environment (CO_2 emissions and other pollutants). Further, it did not contribute to building an enabling environment.

The evaluation terms of reference, requires that we comment on what would have occurred had SDC not taken place.

With the amount disbursed to SDC, the GEF could have subsidized the installation of approximately 12,500 solar home systems at $100 per installation. With the $10 million it committed to SDC, the GEF could have subsidized the installation of 100,000 systems at $100 each. While this would have had an immediate impact, it would not have helped to understand some of the broad challenges facing the industry.

It is unclear how relevant any comparisons might be because of the unique nature of SDC's mandate.

Part Four – Lessons Learned

The SDC experiment offers many lessons specifically related to the development of the PV solar industry as well as more generally applicable to any project development process.

The PV SHS Market[33]

- **Profitability**

  According to practitioners and industry investors, even if a technological breakthrough in PV panel production occurs, profitability perspectives for the industry may take years to improve unless the challenges of distribution and client financing are resolved. Considering the current state and cost of the technology, PV SHS delivery can be profitable only if several conditions are met in any given market:

  - Existence of a potential market (sufficient population density, sufficient purchasing power, little likelihood of grid electrification).
  - A supportive tax regime (no excessive import duties nor sales tax).
  - Presence of appropriate consumer financing options.

  In cases of early stage market development, the existence of efficient and appropriate subsidies (e.g. sustainable, performance-based, etc.) generally contributes to an initially acceptable level of profitability. A stable economic environment (limited business, political, and currency risk) supports long-term profitability. Nevertheless, PV firms are quite vulnerable to external factors such as equipment supply.

- **A Coordinated Approach**

  A coordinated approach to building a sector in a given region – engaging policy makers and financing organizations, and coordinating with other donors active in the area – is key to addressing the PV challenge. A good example is the current World Bank "Decentralized Infrastructure for Rural Transformation Program" (ERTIC) which works with governments and local and international service providers. The program provides investments, in infrastructure and training, as well as requiring a financing capacity from participating firms.

- **Customer Orientation**

  A customer-orientation is critical to successful PV SHS service delivery. Distributors must become more customer-driven (e.g., know each customer's lighting/energy needs, learn how to adapt and finance products, etc.). Customers must see value in the product – that means it must meet their needs in terms of an adequate and consistent level of energy production.

[33] Managers from EBFP, PVMTI, SDC, E+Co, SELCO, and Shell Solar were interviewed, among other sector specialists.

- **Maintenance**

  The provision of efficient maintenance services is also critical to success. Profitable PV SHS retailers such as SELCO India and Grameen Shakti have emphasized maintenance in their business model. PV practitioners estimate that one-fourth to one-third of the two to three million solar home systems installed in the world, are no longer functioning.[34]

- **Affordability**

  Affordability is considered the main issue limiting the massive use of solar PV in off-grid, rural areas. It should be noted, however, that practitioners estimate the cost of a PV SHS system itself to represent just one-fourth of the total purchase costs (other costs include wiring, distribution, etc.).

  Although cost is clearly a deterrent to market expansion, affordability alone is not the solution. A combination of affordability and perceived value are the keys to success. Financing, of any kind, mitigates the affordability issue only to a degree.

- **Financing**

  Upfront costs of PV systems are such that in many cases the only way for low-income customers to acquire them is with financing. End-user financing is key to the successful delivery of PV to low-income rural communities in developing countries. But even where financing is available, customers have to be able to afford at least monthly payments over a two to three year time period. This is still not the case in many countries. Moreover, end-user financing has its limitations. It cannot always help if the demand and awareness of the product are low or if the financial sector is not developed enough.

  Credit schemes and collection methods must be flexible enough to allow access to credit to the poor and to help ensure high repayment rates. For example, credit schemes with low down payments (e.g., 15-20 percent) and weekly collection methods have proven successful in some instances. The fee-for-service – periodic payment of a fixed amount by the buyer for use of the product – proved too difficult to implement and is generally now abandoned. Therefore, the purchase of the whole system needs to be financed by the end-user, who often cannot pay cash.

  If end-user financing is provided by a third party, commitment of that organization is necessary for the success of the scheme. The strong involvement of the end-user financier and the vendor in the conception of the program is essential. The number of parties involved should be limited in order to limit the chances of failure.

- **Subsidies**

  Retail level subsidies will likely continue to play a catalytic role in the growth of solar PV in emerging markets, until enterprises are able to reach sufficient scale to become profitable.

[34] Source: K. Reiche, World Bank Group.

End-user subsidies can help to quickly grow markets. Subsidies in which part of a loan is forgiven if a break-even point is reached within a certain timeframe can motivate entrepreneurs to create sustainable businesses. In some cases, service providers may require ongoing subsidies to ensure service delivery to very distant clients, where service provision may never be profitable.

Investment Strategy

- **The potential for equity investments in SMEs may be limited in developing countries**

  The failure to make equity investments through SDC, as well as the experience of other private equity funds, strongly suggests that private equity in SMEs may not yet be the catalytic capital solution for developing countries. The family-owned character of many developing country businesses is not conducive to outside investment, and the low valuations of firms often means that any sizeable investment would reduce owners' equity beyond what would be acceptable to them. Finally, capital markets tend to be very small and the opportunities for exit are minimal.

- **Diversification to renewable or clean energy**

  Single focus funds are high risk investments. Broader investment criteria allows a fund to be more flexible and to finance the types of projects which best fit the needs of each market. A clean energy focus may provide the best flexibility to finance the solar PV projects.

- **Focusing on a given region is more efficient**

  Targeting financing on one country or region is a more efficient way to develop a PV solar market than pursuing a global focus. By increasing general awareness, decreasing production and delivery costs, and concentrating know-how, economies of scale and synergies can develop, in both customers' perceived value and cost reductions.

Fund Management

- **Local management**

  Ultimately, local management and oversight of investment will be critical to successful investments in emerging market SMEs. Successful managers will have excellent sectoral and regional experience and will offer substantive support to investees.

- **Streamline processes**

  In order to increase efficiency in high risk, low return markets, it is essential to streamline processes, thereby limiting time and costs associated with each deal. A national or regional focus, short and simple approval and disbursement processes, and institutionalized sharing of know-how between offices are key components of streamlining.

- **Monitor and follow-up projects to identify problems early and draw lessons**

  Monitoring and follow-up should be an important part of the mission for any organization investing in renewable energy in developing countries. It is all the more important that quality of management is often an issue in this high risk, low return industry, which has difficulty attracting the most entrepreneurial business people. A standardized follow-up process should be put in place. Part of an investor agreement may be conditioned on the investee fulfilling its information duty on a regular basis (e.g., every three months).

Part Five – Recommendations to the GEF/ IFC

5.1 Overall

The GEF/ IFC have the unique ability to provide innovative financing in large amounts to groundbreaking initiatives. They can offer important seed capital to mobilize and leverage significant resources from a range of funding partners. Pursuing a coordinated approach to building a sector in a given region – engaging policy makers and financing organizations, and coordinating with other donors active in the area – is particularly effective. A thorough due diligence process is key to the success of any investment vehicle. An efficient due diligence process focuses on understanding the market needs and ensuring that the investment vehicle is designed to effectively meet them.

Not all investments will pay for themselves but important lessons can be learned from the investment experiences and disseminated broadly. Where investments are successful, they can lead to major breakthroughs that improve the environment and the lives of many.

5.2 Solar PV

In the case of solar PV, innovative financiers such as the GEF and IFC are still required to address the price/ perceived value dilemma facing the PV industry. Significant resources will have to be invested to achieve the technological breakthroughs that can meet the market demand of the millions of people living without electrical services. Support will also be needed to build the capacity of PV enterprises to a point where they can better absorb the private capital necessary to propel the industry forward.

The Right Kind of Capital

In most developing countries, the market for PV still has to be created. Subsidies, grants, and public procurement can play an important first step in building markets. They increase the availability of technology and raise public awareness. The second stage of financing consists of the development by private companies of a service infrastructure to directly access end-users. At this high investment/ low return stage, seed capital is most appropriate. Loans should come as a third step to support growing and established companies. A handful of companies in developing countries have reached this stage. Equity investments follow but are only occasionally of interest to SMEs in emerging markets.

Targeted Investments

At least in the case of solar PV, targeting financing in various countries or in region is a more efficient way to develop a market than focusing globally. Besides allowing for greater coordination, targeted investments can increase general awareness, help to grow markets and lead to decreased production and delivery costs.

5.3 Project Formulation

- Ensure the coherence of donor objectives and market needs.
- Conduct a thorough market needs assessment when designing and structuring projects.
- Update market intelligence and adjust project design and implementation as required.
- Align a project's scope with the available resources.

5.4 Project Implementation

- Use the simplest structure to implement projects.
- Maintain the sponsoring agencies' involvement in project implementation.
- Invest in coordination among the various PV initiatives supported in any given region.
- Make appropriate investments based on an enterprises' stage of growth.
- Consider, when possible, disbursing funds through already established investment institutions, in order to avoid expensive start-up costs.
- Work closely with important stakeholders in any given region, preferably involving them early on in the planning process.

Appendices

Appendix 1: Terms of Reference

TERMS OF REFERENCE FOR THE TERMINAL EVALUATION OF THE SOLAR DEVELOPMENT CAPITAL Ltd

Projects supported by the Global Environment Facility (GEF) are required to undergo a terminal evaluation upon completion of implementation. Terminal evaluations review the implementation experience and achievement of results of the project against the objectives set at the beginning of the project and any changes agreed to during the course of implementation. They are intended to assess the relevance, performance and success of the project. This exercise seeks to identify early signs of potential impact and sustainability of results, including the contribution to capacity development and the achievement of global environment goals. It will also identify/document lessons learned and make recommendations that might improve design and implementation of the IFC/GEF projects.

The International Finance Corporation ("IFC") closed the Solar Development Capital Ltd ("SDC") in April 2004. This project is part of a larger entity called the Solar Development Group (SDG) which raised $50 million from a consortium of investors and donors to provide technical assistance, equity and debt financing for photovoltaic companies focused on off-grid locations in developing countries. SDC was the private equity arm of this company and was intended to take minority equity positions, provide debt or/and other forms of quasi-equity to its clients.

In order to perform an independent final evaluation as required by the GEF, IFC shall need the services of a consulting firm knowledgeable about (a) solar energy sales and services in developing countries and (b) the private equity financing structure. In terms of scope, the evaluation shall cover the period 2001 through 2004 and shall be a desk audit of prior internal evaluations of this project, review IFC records regarding the project and Private equity managers' records. It is also expected that former and current personnel of the Private equity firm will be interviewed if they can be readily located. The evaluations will not involve travel or work in the countries where these investments may have been made. This evaluation exercise is expected to be undertaken between July 25, 2005 and September 5, 2005.

The Consultant will carry out a final evaluation to determine if the project accelerated the use of solar photovoltaic (PV) systems and contributed to lowering CO_2 emissions in the regions where investments were supposed to have been made. In this regard, the Consultant will, in so far as possible, also be expected to opine on the counter-factual, i.e., what would have happened had the project not been established. With the project log frame as a guide, the consultant shall analyze the project's environmental objective, delivery and completion of outputs/ activities against appropriate indicators.

The expected product from this evaluation will be a final completion report. The report may not exceed 50 pages including any appendixes and the draft should be submitted to IFC at the end of the second month of the contract. A copy of the draft report should be shared with Environmental Enterprises Assistance Fund of Arlington, VA, Triodos International Funds Management of Zeist (the Netherlands), and Global Transition Consulting of Chelmsford, MA (US). The report should be structured along the following lines

- Executive Summary
- Introduction
- SDC and its Development Context
- Findings and Conclusions
    - Project Formulation
    - Implementation
    - Results
- Recommendations
- Lessons Learned

Methodology

The approach to be employed in this study will primarily be a desk audit and the use of interviews and limited field visits (to management team). To establish if the project accelerated the use of PV systems in target developing countries, the evaluators shall review the project's deal process to ascertain the number of deals completed, interview PV experts and marketers to target markets to gather information about the prevalence of these systems in target market before and after the intervention. (Note: Only 3 projects were actually financed.) To determine the overall success of the private equity effort, the evaluators will focus on internal evaluations and project implementation reports created during the course of this project and other documents that capture the project objectives and processes. They will also interview appropriate IFC staff, SDC Fund managers and SDC investees where practical. If data is available, the evaluators will calculate the direct environmental impact of this project by identifying the reduction in CO_2emissions generated through the substitution of kerosene lamps with PV powered sources of electric lighting.

The evaluation shall complete an assessment of the following items.

- **Sustainability** (e.g., the extent to which project benefits persist after GEF assistance has come to an end---including financial resources available to project when GEF assistance ends, stakeholder perception of continuing benefits and legal frameworks, governance or public administration structure that will support the project objectives post GEF intervention).
- **Monitoring and evaluation** (e.g., Did the project establish an appropriate M&E system for tracking progress towards program objectives? Was the M&E system used for project management?)
- The evaluators shall also ensure that the terminal evaluation provide a breakdown of information on the final actual costs and co-financing for the project.

- Also the evaluators shall consider such climate change questions as (a) how effective is the project at transforming the market place in terms of (i) the availability of finance (ii) business enterprise support and (iii) information dissemination and awareness.

Findings/ conclusions

The terminal evaluation will include ratings on (1) sustainability, (2) financial planning and (3) outcome/ achievement of objectives (the extent to which the project's development objectives were achieved). The ratings will be: Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory (MU), Unsatisfactory (U) and Highly Unsatisfactory (HU).

Appendix 2: List of Interviewees

SDC Board of Directors

- Brooks Browne, former head of EEAF. President SDC
- Liliana de Sá, Executive Assistant, Swiss State Secretariat of Economic Affairs, SDC Board of Directors (currently employed in the SME Department of the IFC).
- Louis Boorstin, IFC, SDF & SDC Investment Committee, SDC Board of Directors

TPVP Management Team and Staff

- Hans Schut, Managing Director – Netherlands TPVP Investment team; Vice President, SDF
- Phil Covell, Managing Director TPVP BDS Services, Secretary/Treasurer, SDF
- Candace Smith, Former, CEO SDG, USA
- Robert Ross, Former, CEO SDC, USA
- Rene Magermanns, Investment Officer, TPVP Investment Team, The Netherlands

Energy Sector Specialists

- Mark Hankins, Energy Alternatives Africa, Kenya
- Phil LaRocco, E+Co, USA
- Damian Miller, Shell Solar Pte Ltd., Manager Rural Operations Asia,
- Killian Reiche, Alternative Energy Specialist, Latin America, World Bank,
- Chris Soper, CEO, Sollatek, Kenya
- Guy Jack, CEO, Chlorideexide, Kenya
- Lalith Gunaratne, former member of the Board of SDF, Sri Lanka

Donor & Investor Community

- Sandeep Kohli, IFC, in charge of PVMTI
- Maurice Biron, IFC, in charge of GEF-SME
- Peter Cook, Power Department, IFC, Investment Officer
- Alexandre Leite, Environmental and Social Development Department, IFC, Investment Officer,

- Dana Younger, Senior Adviser, Renewable Energy and Sustainability, Infrastructure Department, IFC (was involved in the design of SDC while serving as the IFC/GEF Coordinator for the EFG)
- Richard Spencer, Energy Sector Specialist, World Bank (former Board member SDF)

Enterprises

- Eduardo Lozada, Owner, Enersol, Bolivia
- Maurice Adema, Managing Director, Sundaya, Indonesia
- Marcelo Mallea, PRODEM, Bolivia
- Mickey Hehuwat, Mambruk, Indonesia
- Jon Respati, CEO, Mambruk, Indonesia

Appendix 3: Key Documents Consulted

- SDC Business Plan, 1999
- Coopers & Lybrand Feasibility Study of SDC, 1997
- SDF Organizational and Program Description – For PV Acceleration in Emerging Countries, October 1999
- SDG Brochure, August, 2001
- SDG Deal origination strategy document, 2001
- SDF Operating Guidelines and Policies, 2000
- Original SDC Concept paper, 1997
- SDG Organizational Diagram, January, 2001
- All SDC Board & Shareholder minutes from May 2002 onward, with sample SDC restructuring scenarios
- Proposals from EEAF/GTC and Triodos to manage SDF , September, 2003
- Loan/Grant/Guarantee agreements for selected companies
- *Aide-memoire*, draft recommendations, and data collected, Fanny Misfeldt-Ringius
- External Evaluation of SDG by the management team, December, 2004
- Internal Evaluation of SDG by the management team, September, 2004
- Memo to SDF BOD on progress toward implementing recommendations of the 2002 evaluation, January, 2003
- SDG client data
- SDG performance analyses
- Baseline client impact information, 2002 and 2003

Appendix 4: SDG Timeline

Source: SDG Internal Evaluation Report – September 2004

Solar Development Foundation began its operations in March 2000 and set the stage with BDS support to synergize various enterprises. Its operations continue under new management as the Triodos Renewable Energy for Development Fund, after a restructuring that occurred on March 30, 2004. All independent members of SDF's Board of Directors now constitute the Board of Supervisors of the new entity.

Solar Development Capital began operating in April of 2001. It operated for two-and-a-half years before effectively ceasing operations late in 2003, and then by selling its assets to Triodos Renewable Energy for Development Fund in May 2004.

Almost as many years were spent developing the concept for Solar Development Group as were spent actually implementing it, as indicated in the timeline below:

3/96 James Wolfensohn of the World Bank and Peter Goldmark of the Rockefeller Foundation agree to pursue an investment vehicle to promote the use of solar energy to meet rural needs in developing countries, based on a proposal by E+Co to dramatically expand funding for companies that appeared capable of providing rural energy services in a commercial way using relatively new technologies.

7/96 Consultative meetings are held to develop the concept.

11/96 A concept paper for "Solar Development Corporation" is circulated.

7/97 PricewaterhouseCoopers, IT Power Ltd, Enterplan International and Siparex are appointed to develop a feasibility study and business plan for the initiative.

12/97 The final draft of the PricewaterhouseCoopers study is delivered, outlining recommendations for the launch of Solar Development Corporation.

98 GEF funding application and initial private sector fund raising

8/98 Bids are solicited for management.

3/99 Triodos PV Partners is appointed as Advisor, and begins development of the managers' business plan and continues fundraising.

3/00 SDF commences operations with $12 million in commitments and approves its first transactions.

4/01 SDC closes at $29 million and begins operations.

9/01 SDC approves its first investment.

5/02 The Advisor signals the need for flexibility in SDC investment instruments and lower SDC return expectations. SDC investors agree on new investment guidelines allowing for more straight debt transactions, with less risk and less aggressive return expectations. Discussions to restructure share ownership in the fund begin.

7/02 SDC shareholders deadlock on the definition of supermajority required to shut down the fund in restructuring proposals. Negotiations continue.

5/02 Robert Ross replaces Brooks Browne as CEO of EEAF and TPVP.

12/02 SDF completes its strongest year in terms of volume of approvals: 26 projects totalling approximately $1.7 million.

1/03 SDC investors agree to postpone restructuring negotiations, allowing the manager to focus on pipeline development and deal origination, until September 2003.

9/03 SDC fails to meet transaction targets; shareholders discuss options for scaling back or shutting down. SDF Board of Directors solicits proposals from EEAF and Triodos to manage the non-profit in the event SDC fails.

1/04 SDF Board elects to continue operations, selects Triodos International Fund Management as the new manager.

3/04 SDF transfers operations to Triodos Renewable Energy for Development Fund. IFC and Seco cancel their investment commitments to SDC.

4/04 Remaining SDC shareholders vote to sell the fund's assets to Triodos Renewable Energy for Development Fund, thereby liquidating the fund. Triodos Renewable Energy for Development fund begins operations.

Appendix 5: Executive Summary, Final Evaluation Solar Development Foundation December 2004

Introduction

Electricity is taken for granted in most parts of the world. Nevertheless, over 1.5 billion people – one-quarter of the world's population – live in areas that are difficult to reach, too poor, or too sparsely populated to support the necessary infrastructure investments required to expand electrical grids. The Solar Development Foundation (SDF) was an innovative initiative of the Solar Development Group (SDG), which sought to help foster the development of PV businesses and dynamic PV markets by offering support to private sector companies in developing countries. SDF, a US$19.5 million not-for-profit organization, offered business development and seed financing to help PV companies prepare for private investment. It sought to complement the activities of Solar Development Capital (SDC), a US$29 million for-profit private equity fund for private PV and PV-related business in developing countries.

The objective of this End-of-Grant Independent Review is to assess the progress made by the Solar Development Foundation against six core evaluation questions: relevancy, efficacy, efficiency, sustainability, institutional development impact, and planning and implementation. The report seeks to assess achievements from the start-up of the Foundation in March 2000 through to March 2004 when SDF's assets were transferred to the Triodos Renewable Energy for Development Fund (TRED Fund) managed by Triodos International Fund Management BV, part of the European Triodos Bank Group out of its offices in Zeist, the Netherlands, in March 2004. This report was prepared for the TRED Fund Management for submission to the World Bank Development Grant Facility (DGF).

The Solar Development Foundation was unique in its support of private sector businesses – specifically, helping PV companies prepare for private investment. This report highlights SDF's challenges and achievements and seeks to draw out lessons for future programming. Although our assessment focuses on the Foundation, the analysis should be understood within the broader SDG framework and market challenges encountered by SDC in achieving its objectives.

This evaluation was undertaken by Enterprising Solutions Global Consulting, an international development firm specializing in enterprise-led strategies for micro, small and medium enterprises. Enterprising Solutions also conducted the 2002 mid-term evaluation of SDF, which led to a number of changes in SDF and SDC operations.

The Challenges of Placing Private Capital

Without a doubt, the rural PV market proved itself to be much more challenging than ever imaged when SDF and the broader SDG initiative were conceived and established. The Solar Development Group positioned Solar Development Capital at the forefront of meeting the rural PV market's needs through the provision of capital. The Foundation was initially positioned to provide technical assistance to support enterprises in receiving private capital. The SDG experiment illustrates that although the basic premise of the need for capital to build rural delivery networks was not incorrect, subsidies and grants will likely continue to play an important role in rural electrification, especially where rural delivery networks are in their early stages of development. Commercial returns are generally only possible where subsidies have allowed businesses to reach a sufficiently large market – which requires a relatively significant initial investment of time and resources in building an adequate service network and a sufficient level of consumer confidence in the technology to generate demand.

Hindsight shows us that market research guiding the establishment of SDG overestimated the growth potential of the PV sector and underestimated the myriad of factors required to achieve market breakthrough. In the context of the technology-driven venture capital (VC) boom of the '90s, well-intentioned project founders sought to transfer a traditional financing model to the rural PV sector. Four years of operations in markets around the globe, however, have shown rural PV providers to be characterized by young, high-risk, low-margin firms generally in need of "patient" capital with very low return expectations. The firms typically lack management expertise, systems for managing growth, and market development capacity.

Over Fifty Small Businesses Assisted

Despite the challenges, over 50 small businesses were assisted in some way – more than in any single World Bank PV solar intervention – during the Foundation's relatively short life. In some cases there were significant improvements on companies' revenues, and profits and jobs were created. Even in the cases where interventions did not completely achieve their original objectives, the participating entrepreneurs generally appreciated them and their enterprises benefited from a matured understanding of their business and market. *Although SDF's rural, poverty alleviation focus made its task extremely challenging, the Foundation's experience offers numerous important insights into the rural PV market and of working with small, rural, private PV businesses in developing countries.*

Key Findings

Our assessment indicates that SDF was clearly ***relevant*** in terms of meeting a certain need of the rural electrification market. The Foundation's mandate of supporting the growth of the PV industry in rural areas, while also improving social, economic and environmental impact, meant that efforts focused on the very challenging development of solar home system service networks. Programming was quite ***effective*** in terms of *reaching out* to numerous rural PV businesses around the world. Unfortunately, although measures of success were established in the form of a balanced scorecard, *the lack of adequate data collection does not permit a thorough assessment of outcomes or impacts.* Through the combination of a survey of participating firms and in-depth interviews with entrepreneurs conducted within the budget limitations of this assessment, it appears that participating businesses generally found SDF support to be useful. In one instance, a 15 times increase in sales and six times increase in employment was attributed to an SDF loan. In other cases SDF is said to have doubled sales, and in another raised them by 40%. In some cases

financial impact was negligible although almost all participating businesses noted maturation of their planning and negotiation skills as an indirect result of working with SDF. ***Efficiency*** was rated relatively high in terms of staff support to businesses although the length and nature of the loan approval process was a source of frustration. How sustainable the Foundation and its impact will be remains in question.

In cases of businesses supported, sustainability depends on a number of factors. Early results suggest a reasonable degree of impact. Applying a better monitoring process will be critical to properly assessing this and other factors. The transfer of assets to the Triodos Renewable Energy for Development Fund provides a stable infrastructure, although it's important to ensure that the TRED Fund is able to offer or leverage some of the grants or subsidies that the rural PV sector continues to require at its early stages of development.

From the perspective of institutional development impact, the SDF and SDG experiences are extremely rich in lessons learned for its various stakeholders in the PV industry, the investment sector and to donor agencies. Adequate resources should be invested in documenting in detail the many lessons identified in this report. Finally, although process and implementation was relatively efficient yet complicated as a result of the numerous stakeholders involved in the project, it also offers numerous lessons for future experiences in terms of structuring and implementing similar initiatives.

Lessons Learned

The SDF experience offers a stepping stone towards helping the PV industry to reach deep into rural off-grid markets. These are just a few of the many challenges highlighted by the Foundation's experience: public-private sector collaborations, direct interventions with small businesses in developing countries, the use of a variety of investment instruments, approaches to support businesses, and the challenges of jointly managing social and environmental goals.

The SDF experience teaches us the importance and impact of project design: the benefits and challenges of a management by consortium, of working through interrelated but independent organizations, and of pursuing a global versus a more narrowly defined local or regional strategy.

We also learn the importance of matching financial support to a business' particular stage of development. Specifically, the rural PV market may require a flexible and dynamic financing model, demand-driven in terms of the nature and volume of interventions, decentralized to ensure a good understanding of market needs, and in tune with the psyche of the dynamic, fast-changing, relatively informal, world of small business – particularly the pioneering world of PV solar entrepreneurs.

Most significantly, the SDF experience shows us that financing and capacity building support to PV suppliers on their own may not yet be enough to achieve widespread rural electrification. In most off-grid markets, the sustainable delivery of PV services still appears to require strong relationships between various participants in the rural markets to create an "enabling environment for rural electrification." This environment consists of a supportive policy and regulatory regime, the availability of end-user financing to mitigate issues of affordability, strong management in firms looking to grow their delivery network, as well as access to sufficient patient capital to permit

business expansion at the speed and volume demanded by the market. It appears that only a combination of these factors can result in a market that generates sufficient demand for PV services to support the growth of profitable PV businesses in rural areas, and vice versa.

An efficient, demand-driven SDF-type organization clearly has a strong role to play in meeting the financing and capacity building needs of the rural PV market, while doubling as a catalyst in the Northern and Southern PV industries. An efficient investment model would have enough criteria to allow a pipeline of reasonable breadth. It would be a single structure managed by a single management organization with a reasonably good understanding of the subject matter. Additional expert personnel would be hired as needed. Resources would be focused on specific regions in order to build up adequate knowledge and understanding of the business environment. This knowledge would be used to collaborate and build partnerships with key stakeholders in the region as well as to inform investment decisions. Finally, financing would be flexible and tailored to the specific stage of a business' development.

With the transfer of SDF assets to the Triodos Renewable Energy for Development Fund, the Advisory Board and the Fund manager have integrated the many lessons from the SDG experience to better position the TRED Fund for success. Our main recommendations to the TRED Fund are to clearly recognize the unique nature of the rural PV sector and to make adequate modifications to the traditional Triodos fund model to specifically address these factors – most importantly the need to offer a range of financial instruments, including grants and subsidies as necessary, the critical importance of building partnerships with other actors in the markets they invest in, and finally, recognizing the value of tracking and measuring impact to improve investment decision-making and PV best practice.

The SDG experiment illustrates that at this point in the development of PV for rural electrification, an SDF-type organization can play an important role in catalyzing the PV industry to provide services to the millions of people in off-grid areas who currently depend on piece-meal sources of electricity. SDF, in its new form as the TRED Fund, can also help keep the role of the private sector at the forefront of service provision, no matter how challenging the rural PV market is at the current time. While developing rural markets on a purely commercial basis remains a challenge, the role of the private sector in rural electrification will be increasingly important. As an SDF Board member notes, the millions of people without electrical services cannot be left behind.

Recommendations

World Bank

- Ensure that programs are demand-driven.
- Reconsider consortium requirements on requests for proposals. Managing partnerships between groups with similar yet distinct interests, objectives and institutional needs, though very valuable, can divert significant resources and energy.
- Invest in greater coordination among the various PV initiatives supported.
- Continue to recognize and cultivate the critical role of the private sector in meeting demand for PV in rural off-grid areas.

- Recognize that venture capital may not necessarily be an appropriate financing vehicle for investing in developing country SMEs, which tend to be closely held family-based operations.

TRED Fund

- In addition to broadening the investment criteria to include non-solar renewables and significantly lowering the expected rate of return, the TRED Fund should:
- Undertake investments where an enabling environment exists or is emerging.
- Monitor investments regularly, including in-depth conversations with investees at least twice per year to better understand investment progress and challenges.
- Provide financing primarily to entrepreneurs with a strong customer focus and high quality management.
- Actively cultivate partnerships and seek collaboration particularly in order to access or leverage grants or subsidies that play an all-important role in the early stages of developing a rural PV delivery network.
- Measure impact when applying and disseminating important lessons and best practices for the sector.

PV Sector

- Continue to recognize and cultivate the critical role of the private sector in meeting demand for PV in rural off-grid areas.
- Design distribution and service programs based on client needs.
- Make appropriate investments based on an enterprise's stage of growth.
- Work closely with important stakeholders in any given region, preferably involving them early on in the planning process.
- Study in detail the SDG experience and apply lessons learned.
- Measure impact when applying and disseminating important lessons and best practices for the sector.

Appendix 6: SDC 2003 and 2004 Financial Statements

ASSETS
Statement of assets, liabilities, and net assets
Expressed in US$

ASSETS	as of June 22, 2004	as of Dec. 31, 2003
Cash	0	$ 594,415
Due from related party	0	$ 5,599
Investments in securities (cost $304,905)	0	$ 130,000
Investments in loan receivables (cost $352,453)	0	$ 120,000
Prepaid insurance	0	$ 3,051
Interest receivable	0	$ 1,469
Total assets	0	$ 854,534
Liabilities, accrued expenses	0	$ 30,806
Net assets	0	$ 823,728

Statement of changes in net assets
Expressed in US$
For the period January 1, 2004 through June 22, 2004

	Class A	Class C	Total
Net assets, beginning of period	$ 407,472	$ 416,256	$ 823,728
Transfer of class C net assets to class A	$ 416,256	$ 416,256)	$ -
Redemption of shares	$ (578,981)	$ -	$ (578,981)
Excess of expenses over revenues	$ (244,747)	$ -	$ (244,747)
Net assets, end of period	$ -	$ -	$ -

STATEMENT OF REVENUES AND EXPENSES
Expressed in US$

	2004	2003
Revenues		
Interest income	7355	22373

Expenses		
Advisory fees	208637	718800
Additional advisory fee	6900	216958
Bad debt expense	15191	232453
Professional fees and other	21374	83676
Total expenses	252102	1251887
Net investment income (loss)	-244747	-1229514
Unrealized appreciation or depreciation on investment		-174905
Grant income		216958
Excess of expenses over revenues		-1187461
Accumulated deficit, beginning of the year		-1580822
Accumulated deficit, end of the year		-2768283

Appendix 7: End-user Financing / Microfinance

End-user financing is a key success factor

One of the major hindrances to the growth of PV systems in rural areas in developing countries is the high upfront cost of PV SHS. For low-income rural populations, SHSs, if paid for in cash, are not affordable. End-user financing is key to the success of PV systems in developing countries.

The potential effect of end-user financing on PV systems sales is widely recognized by experts. SEEDS, a local MFI in Sri Lanka, finances the installation of 20,000 systems annually. Nevertheless, the Sri Lanka market is experiencing a bottleneck. Sales could increase by 30 percent if more end-user financing was available.

End-user financing has its limits. It cannot help if the demand and awareness of the product are not sufficient, or if the financial sector is not sufficiently developed.

Types of financial tools

Many types of tools are available to provide financing to end-users of PV solar home systems other than cash, grants, and subsidies:

- Commercial consumer loans
- Instigate purchase / salary withholding schemes
- Loans through MFIs
- Fee-for-service (the consumer =pays a monthly fee to use the system, but does not own it)
- Dealer credit

No one end-user financing tool is the answer for all situations. On the contrary, the range of tools available provides an opportunity to adapt to the local realities of each market. For example, partnerships between microfinance institutions and PV systems retailers have proven successful in some instances, but they require a well-developed, sustainable MFI to be active in the market.

End-user financing is expensive and difficult to put in place. For example, retailers providing financing must acquire financing knowledge by hiring experts, and training staff and customers, and have the appropriate funds to meet the resulting working capital needs.

If financing is provided through a partnership with an external financing institution, the institution has to develop a new product and train its credit officers. This means the institution needs to be sustainable and sophisticated enough to handle these types of operations. It also needs to be strongly committed to PV systems and to collaborate closely with retailers on an ongoing basis. Additionally, marketing expenses to launch the operation add to high upfront costs. Finally, ongoing administration costs can be high.

Key success factors for end-user financing include:

- **Customer Satisfaction**
  Customer satisfaction is key to ensure high repayment rates. Customers will be motivated to repay their debts if their PV system fits their expectations.

  The most important aspect of customer satisfaction is that the SHS functions properly. Therefore, maintenance is the key factor to ensure high repayment rates. Technicians should be based near their customers to be able to act quickly on maintenance issues. A service fee may also include regular system checks. Providing basic training to the customer on how to use the product is also important.

  Any business model should emphasize these points. Grameen Shakti, a successful Bangladeshi PV retailer or manufacturer providing consumer finance, has conceived its business model around this principle of customer satisfaction.

- **Flexible Credit Schemes and Collection Methods**
  Credit schemes must be flexible in order to reach the poor. Successful organizations such as Grameen Shakti, SELCO Sri Lanka, and E+Co in India, and their partners, offer several schemes. Some require low down-payments (15 to 20 percent), thereby allowing customers in the lower income category to buy the systems. A common reimbursement period is two to three years. Grameen Shakti offers a 4 percent discount for cash payments.

  Flexible collection methods help to ensure high repayment rates. For example, SELCO India collects payments weekly in order to attract new clients and be paid by customers in the lower income category, who normally could not afford monthly installments. In the case of Grameen Shakti, which has an estimated repayment rate of 98 percent, installments are collected monthly (but contact to the customer is often more frequent).[35] Collection is difficult in rural Bangladesh due to poor or no roads, hot temperatures in summer, monsoon, floods, etc. Hence, Grameen Shakti often collects at times favorable to its customers (e.g., during fishing or harvesting season). Grameen Shakti engineers also encourage customers to make some payments in advance to cover disaster periods. During floods, customers often make separate arrangements with Grameen Shakti.

- **Full Commitment of the Financing Partner**
  When end-user financing is provided by a third party, such as an MFI, its full commitment to the credit product is a key factor of success. This commitment can prove difficult to secure because the financing partner does not always believe or understand PV systems and may decide to get into the business for the wrong reasons (subsidies, prestigious partner, etc.). This was the case of the Bolivian investee and its microfinance partner.

[35] Source: Nancy Wimmer

The MFI or bank should be sophisticated enough to be able to deal with a new product and to train its loan officers. One way to do this may be for the institutions to deal with PV systems loans as part of housing loans, avoiding the need to develop a new product.

The MFI or bank partner should be heavily involved early in the conception of the project. Then, throughout the development, implementation, and life of the project, cooperation between the vendors and the financing institution(s) should be formalized. From the inception of the project, focus should be put on making the institution(s) understand the PV market.

Regardless, the number of parties involved should be kept at a minimum in order to limit the chances of failure. Two to three partners seem to be a maximum for success. A project involving five parties in Morocco failed because of the difficulties in coordinating the work of several organizations.

Sri Lanka's SEEDS has been very successful in providing end-user financing for PV systems. To tackle the PV system market, they created a whole new division and hired credit officers with prior PV knowledge. Now, one-third of SEEDS' portfolio is PV-related.

Adapted from Annex 8 End-user Financing / Microfinance, SDF Final Evaluation, 2004.