

## Solar Development Capital: Lessons Learned in Financing Solar Home Systems

In the late 1990s the World Bank Group together with a number of US-based charitable foundations initiated an ambitious new financing and advisory services vehicle aimed at developing world solar photovoltaic (PV) businesses. Called Solar Development Group (SDG), it had two separate but interrelated components with common management oversight. SDG consisted of: (i) a not-for-profit Solar Development Foundation (SDF) funded by the Bank Group's Development Grant Facility and a number of charitable foundations; and (ii) a private equity fund investment vehicle called Solar Development Capital (SDC). The Global Environment Facility (GEF) was requested by IFC to contribute subordinated risk capital co-financing to SDC. Together the two components of SDG were expected to constitute a groundbreaking initiative to expand use of solar photovoltaic (PV) by rural people lacking electrical service in developing countries. The SDC private equity fund established in 2001 through this joint effort was ultimately terminated in 2004. Although the SDC portion of the SDG project failed to appreciably boost rural PV solar industry financing in emerging markets, the experiences gained generated many lessons that can help to inform future efforts. This issue of the Monitor presents findings and lessons learned from an April 2006 evaluation of the SDC initiative. The evaluation concluded that, in hindsight, lack of capital was only one of a myriad of barriers to the growth of PV in emerging markets. Innovative financing and grants from institutions such as GEF and IFC, however, will remain important in building the solar PV industry's capacity to absorb private capital that can propel the industry forward and meet the demand of millions of rural people living without electricity.

Anticipating a major technological breakthrough in solar PV, industry actors in the 1990s had begun to explore expansion of this technology to meet the energy needs of the nearly two billion people living without electricity in the developing world. These people live in areas too remote, poor, and sparsely populated to support the infrastructure investments needed to expand conventional electrical grids.

A joint initiative between the World Bank Group together with a number of US-based charitable foundations sought to catalyze an "order of magnitude" impact in the growth of PV businesses and dynamic PV

markets in developing countries through a unique new financing and technical assistance vehicle called SDG. The SDG initiative relied on IFC which mobilized GEF grant financing alongside private, government investment bodies, and institutional capital in SDG's Solar Development Capital (SDC) arm, a US\$32 million private equity fund. Several widely shared assumptions supported the approach behind this equity fund:

- PV performance and prices would improve as mass production of cells and modules expanded, increasing the competitiveness of the technology.

- The market for PV systems, including rural households, was a sufficient basis for a growing, profitable business in many parts of the world, thus, justifying a global approach.
- Potential returns on investment and scale of investments were sufficient to justify a professional fund manager and fund governance structure.

The IFC/GEF SDC portion of the SDG project had two primary objectives: accelerate use of PV solar home systems and contribute to lowering carbon dioxide emissions in regions for intended investments. SDC was specifically to (a) act as a showcase for the PV solar home system industry, (b) attract capital, and (c) demonstrate that un-electrified markets offered the potential for commercial investment, given that lack of capital is one of the main factors holding back massive growth. SDC was positioned to be at the forefront of building rural, off-grid PV solar home system markets by engaging commercial capital to play a catalytic role in growing the PV industry in emerging markets.

In 2006 Enterprising Solutions Global Consulting undertook an evaluation of SDC from startup through disbandment. Methodology consisted primarily of a desk audit and stakeholder interviews with one site visit to Kenya. Stakeholders included former Board members, investment officers, investees, and sector specialists. Review of key SDC documents ranged from Board minutes and IFC project records to annual and evaluation reports and publications on international PV experiences.

## EVALUATION FINDINGS

In the mid-1990s, PV market fundamentals seemed promising and industry experts discussed the potential “commoditization” of the industry, creating a market potential in the mind of SDC project formulators that was validated by an independent feasibility study based on limited market intelligence, much of it extrapolated from sales in industrialized countries. Market research for SDG that guided SDC’s establishment overestimated the growth potential and potential financial returns of the PV sector and underestimated the myriad factors required to achieve a market breakthrough and rapid scale-up. Furthermore, a project formulation process driven more by the needs of the project sponsors than those of potential recipient firms in the developing country market, coupled with an overly complicated implementation structure and poor market fundamentals contributed to less than desirable results.

However, the “disconnect” between project design and market reality ultimately led to disbursement of only US\$650,000 of SDC’s total committed capital of

US\$28.75 million to three companies in Kenya, Indonesia, and Bolivia between 2001 and 2004. The Kenyan investee declared bankruptcy in early 2005. The Indonesian investment was terminated prematurely due to cancellation of a parallel World Bank/GEF funded PV solar home systems subsidy program to Indonesia. The Bolivian venture continues to grow, although with somewhat limited impact to date on rural SHS delivery. Bolivia is also now being supported by a World Bank/GEF solar PV program which was not in place at the time that the SDC investment was made.

SDC’s investment guidelines were not always appropriate for the unique situation often faced by the small and medium enterprises (SMEs) characteristic of the rural, off-grid solar PV sector—frequently sole proprietorships lacking audited financial statements or considered too small for investment. In addition, limited sectoral expertise among SDC’s investment officers and their physical distance from the investments impacted the guidance that SDC could offer investees. Both factors limited SDC’s ability to identify deals and support investments once made. Overall, SDC’s achievements related to accelerating the use of PV solar home systems and indirect environmental results related to the reduction of carbon dioxide emissions were very disappointing compared with original expectations.

**Rural PV service providers.** These tend to be young, high-risk, low-margin firms needing patient capital with low-return expectations. They typically lack management expertise, systems for managing growth, market development capacity, and customer service focus and are sensitive to external factors, such as economic downturns, increased demand in other markets, and capacity of financing institutions to provide adequate liquidity to grow a market. Profitability is often elusive in the rural solar home system industry, due to high system prices in emerging markets and high distribution costs, given low population densities.

SDC’s private equity structure was also ill suited to addressing the needs of small low margin and inexperienced PV firms operating in rural settings. Sustainable delivery of PV services appears to require strong relationships among key stakeholders—government, multilateral agencies, local business networks, NGOs, and so on—to create an enabling environment for successful rural PV solar home systems delivery. 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. 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.

**Project formulation.** SDC's narrow focus on "PV solar home system electrification in rural, off-grid areas, targeting low-income people, with service provided through SMEs" and high expected rates of return was too ambitious, considering the resources ultimately available to the project, and more appropriate for a more mature or faster-growing market than PV solar. Few deals met both SDC's nonfinancial and financial criteria. SDC's ten-year fixed life required management to seek investments promising relatively rapid exits; whereas the PV solar home systems industry appears to require long-term patient capital. The family-owned nature of small businesses in emerging markets and low firm valuations made it similarly difficult to identify potential investees. Moreover, capital markets in emerging countries tend to be very small, minimizing the opportunities for exit. In addition, similar initiatives targeting solar PV in promising markets, also sponsored by IFC and GEF, and featuring more of a subsidized concessional finance approach and utilizing no IFC capital had already been launched (e.g., PVMTI). Pursuing the SDC project would have been more justifiable following a more extended trial period with such other complementary solar PV financing programs. Perhaps SDC then could have been justified or its financing structure modified on the basis of the success of a similar, smaller-scale initiative.

**Structure and implementation.** Although the project benefited from the diverse experience of the management team—consisting of a nonprofit U.S. environmental fund manager, a U.S. solar PV consulting firm, and a European fund management company—issues of distance, culture, organizational style, language, and ownership of SDC and of the managing company, overlaid by a complex staffing arrangement and fundamental questions concerning its relationship to SDF, complicated SDC operations. Nevertheless, considering its complex structure, the organization worked surprisingly well and operated frugally, demonstrating a high degree of commitment and professionalism.

Although SDC was very successful in mobilizing a substantial capital base from a range of investors—securing commitments totaling \$28.75 million of a targeted \$32 million—managing ten shareholders from across the development/finance spectrum also proved challenging. Disagreements among shareholders led to stalemate and ultimately early termination of SDC.

## LESSONS LEARNED

The SDC experiment offers many lessons related to development of the PV solar industry and to any project development process, including investment strategy and fund management:

## The PV Solar Home Systems Market

- For initiatives intended to meet standard commercial objectives, no substitute exists for rigorous market analysis. It allows for planning, enables the relevant entity to set realistic internal rates of return, determine appropriate payback periods, and estimate customer uptake and long-term sustainability. Although this kind of analysis will often be too expensive for use in small transactions, it would be invaluable for larger transactions or a portfolio of small transactions. Effective mechanisms ought to be established to implement this process.
- Profitability for the industry may take years to improve unless the challenges of distribution and client financing are resolved, even with technological breakthroughs and dramatic price declines in PV panel production. Considering the current state and cost of the technology which has been rising rather than falling, PV solar home system delivery can only be profitable given (a) sufficient population density and purchasing power, and little likelihood of medium term grid electrification, (b) a supportive tax regime (i.e., no excessive import duties or sales taxes), and (c) the presence of appropriate consumer financing options. In early stage market development, existence of efficient and appropriate subsidies (e.g., sustainable and performance based) 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 and pricing trends.
- Provision of efficient maintenance services is also critical to success. Profitable PV solar home systems 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 no longer function.
- End-user financing is, in many cases, the only way for low-income customers to pay for the often high upfront costs of PV systems. But customers must be able to afford monthly payments for two to three years—which is still not the case in many countries. Moreover, end-user financing cannot always help with low product demand and awareness or inadequate development of the financial sector. Credit schemes and collection methods must be flexible enough to allow access to credit for the poor and help ensure high repayment rates. The strong commitment of any end-user financier and its involvement with the vendor in program conception is essential. The number of parties involved should be limited to reduce the chances of failure.

- 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. End-user subsidies can help to grow markets quickly. 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 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 and the experience of other private equity funds strongly suggest that private equity in SMEs may not yet be the catalytic capital investment solution for developing countries. The family-owned character of many developing country businesses is not conducive to outside investment, and low valuations of firms often mean that any sizeable investment would reduce owner equity to levels unacceptable to them. Domestic capital markets also tend to be very small and the opportunities for exit are minimal.
- Diversification to renewable or clean energy using broader investment criteria allow a fund to be more flexible and finance projects that best fit each market's needs. Single-focus funds in contrast are high risk. A broader clean energy focus that is not restricted only to solar home system firms may provide the best flexibility to finance solar PV and other rural renewable energy projects.
- 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 and oversight of investment will ultimately be critical to successful investments in emerging market SMEs. Successful managers must have excellent sectoral and regional experience and will be better positioned to offer substantive support to investees.
- Streamlining processes is essential to increasing efficiency in high-risk, low-return markets, 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 among offices are key components of streamlining.

- Monitoring and follow-up to identify problems early and draw lessons are important for any organization investing in renewable energy in developing countries. The quality of management is often an issue in this high-risk, low-return industry. Part of an investor agreement may be conditioned on the investee fulfilling its information duty on a regular basis.

### CONCLUSION

SDC's experience showed that the rural, off-grid, solar PV industry in emerging markets is a low-margin, high-risk business requiring significant time and resources in which to build sustainable rural PV delivery networks crucial to gaining consumer confidence and market share.

SDC's original market analysis gave perhaps too much weight to capital as the key limiting factor necessary to catalyze rapid and effective growth of PV solar home systems delivery businesses in rural, off-grid areas in emerging markets. As in most industries and perhaps more so in such an immature sector, achieving commercial returns also requires strong business support mechanisms (e.g., market intelligence, stakeholder collaboration, and a supportive regulatory environment). SDC was exemplary in its cross-sectoral collaboration and innovative financing during start-up, but failed to come even close to achieving "order of magnitude" impacts on the rural, off-grid, PV solar industry in emerging markets.

SDC's experience suggests that innovative financing and grants from institutions such as GEF and IFC will remain important in helping build the solar PV industry's capacity to the point of absorbing the private capital necessary to propel the industry forward to meet the demand of millions of people in emerging markets living without electricity. In addition, 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 distant clients where service provision may never be profitable. SDC's experience suggests that IFC consider contracting established, regionally based, specialized fund management companies for any future similar initiative. It also underscores the need for making investments where a coordinated approach to industry building engages policy makers and financing organizations, as well as industry experts.